JÖNKÖPING UNIVERSITY
Jönköping International Business School

Doctoral Thesis

Managing contexts for innovation and renewal

Strategies of incumbent firms in traditional manufacturing industries

Shanyun Sam Lu

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Glory to the Lord Jesus Christ – my ultimate source of hope and strength!

Shanyun Sam Lu
August 6, 2021

Abstract

This dissertation aims to advance understanding of the strategies of incumbent firms in traditional manufacturing industries (TMIs) regarding managing contexts for innovation and renewal. It offers nuanced explanations of how and why incumbent firms in TMIs handle enablers and barriers from the outer contexts of firms.

The analytical framework is anchored in a set of different yet related theoretical notions from the literature on strategic renewal, contextualising entrepreneurship, institutional theory and sustainability transitions studies. Empirically, this dissertation investigates three cases revolving around the innovation and renewal processes of five firms in different TMIs, namely mining, steel production, manufacturing metal products, energy production, and manufacturing electrical products in Sweden. The findings reveal that a firm leverages, shapes and fosters the alignment of elements from different forms of contexts – such as institutional, network, technological and local-spatial contexts – in order to protect and empower innovations associated with firm renewal. A firm's contextual strategies not only matter for innovation and change, but also for accomplishing persistence that drives innovation. The heterogeneity of contextual strategies employed by firms can be explained by the firm's endowment of resources and power, the extent to which contexts enable/hinder innovation, and managerial aspirations.

This dissertation contributes to innovation studies by contextualising the strategies of incumbent firms in TMIs. More specifically, it offers novel insights into two theoretical debates: 1) the co-alignment vs. co-creation views of strategic renewal; and 2) the role of incumbents in sustainability transitions. It also makes empirical and methodological contributions, and has managerial and policy implications.

Keywords

incumbent firms, traditional manufacturing industries (TMIs), strategy, contexts, innovation, renewal

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1 Introduction

Innovation is an important means for incumbent firms to achieve renewal, and renewal is essential for firms to survive and thrive over time. Innovation-based renewal therefore needs to be well managed to secure the longevity and successful prospects of firms. Innovation and renewal do not occur in a vacuum, meaning that they unfold in specific contexts (Agarwal & Helfat, 2009; Dodgson, Gann, & Phillips, 2014b). Contexts can enable or impede innovation and renewal, and outcomes depend on how well contexts are managed (Phillips, 2014). This implies that firms need to manage relevant contexts in order to exploit favourable conditions and grapple with unfavourable ones during their innovation and renewal journeys (Garud, Jain, & Kumaraswamy, 2002; Lawrence, 1999; Phillips, 2014; Schmitt, Raisch, & Volberda, 2018). In other words, obtaining a better understanding of how innovation is managed by firms to secure long-term prospects requires a better understanding of the mechanisms and rationales employed by firms to manage their contexts.

Incumbent firms, regardless of size, refer to "*profit-seeking actors that are 'established' and 'positioned' in markets",* and *"have vested interests, historically accumulated capabilities, established supply chain linkages and institutionalisd ways of operating*" (Steen & Weaver, 2017, p. 1073). These firms in traditional manufacturing industries (TMIs) have been rather neglected in recent innovation studies (Bathelt, Munro, & Spigel, 2013; Radicic, Pugh, & Douglas, 2020), although they still matter for economic development and are concerned about by policymakers in post-industrial economies (Radicic, Pugh, Hollanders, Wintjes, & Fairburn, 2016). According to Radicic et al. (2020, p. 259), a TMI can be defined as an industry with most of the following characteristics: "*long-established, once a main source of employment, at least at the sub-regional level; in the mature or declining phase of their industry life cycle, with recent decline typically associated with globalisation; relatively labour intensive, hence vulnerable to out-sourcing to other countries; but retaining a capacity for innovation, through which they continue to be important source of wealth creation and employment*". Typical examples of TMIs are industries manufacturing raw metals, fabricated metal products, basic chemicals, rubber and plastic products, pulp and papers, automotive, electrical products, energy, wood, leather, textiles, food and beverages (Amara, Landry, Becheikh, & Ouimet, 2008; Bathelt et al., 2013).

Incumbent firms in TMIs tend to face significant challenges in order to innovate and renew themselves, due to large sunk investments, and established organisational and institutional structures both within and outside the firms (Bergek, Berggren, Magnusson, & Hobday, 2013; Christensen, 2013; Hansen & Coenen, 2017). For example, most incumbent firms in the steel industry have built up internal organisational routines and procedures revolving around either iron-

ore-based or scrap-based steelmaking, which are closely linked to their respective supply chains. They are also subject to widely adopted industrial standards and largely price-based competition (Christensen, 2013; Karltorp, Bergek, Fahnestock, Hellsmark, & Ulmanen, 2019). Such conditions seem to leave little room for incumbent firms to innovate, which hampers their renewal and long-term survival.

Along this line of argument, newcomers or start-ups are often perceived as the source of innovation, disrupting incumbent firms with radical innovations (e.g., radically new technologies or new business model), and changing the competitive landscape of a mature industry. It is argued that these disruptive newcomers and start-ups are generally more risk-taking and not constrained by stranded assets or organisational and institutional structures built up over time either internally or externally to the firms (Christensen, 2013; Schumpeter, 1934). The downfall of Kodak is a typical example of an incumbent firm being disrupted by innovative newcomers, however, there is historical evidence showing that incumbent firms in TMIs can also be innovative and find means for renewal (Agarwal & Helfat, 2009; Onufrey, 2017; Sjöö, 2016; Taalbi, 2014). For example, Sjöö's (Sjöö, 2016) historical study of innovation in the Swedish manufacturing industries between 1970 and 2007 shows that incumbent firms were inclined to be serial innovators, while start-ups mostly launched one-off innovations. The study further reveals that some innovative start-ups are actually spin-offs from incumbent firms, which implies that they were the same innovators, simply under different roofs.

In many post-industrialised countries, firms in TMIs still account for a significant share of economic activities and contribute to the creation of social welfare. They also appear to have potential for innovation and renewal (Bathelt et al., 2013; Radicic et al., 2020). It is thus a pity that recent scholarly focus in innovation studies has been skewed towards start-ups and firms in high-tech and/or the service sectors (e.g. Auerswald, 2008; Eisenmann, Parker, & Van Alstyne, 2011; Ghezzi & Cavallo, 2020; McDonald & Eisenhardt, 2020; Xing & Sharif, 2020), whereas innovation by, and the renewal of incumbent firms in TMIs have received much less attention. Although start-ups and firms in high-tech and the service sectors have infused fresh blood into economic development, incumbent firms in TMIs which bring forth innovation and pursue renewal are just as important to economic development and vitality (Bathelt et al., 2013; Radicic et al., 2020). Against this background, this dissertation examines the innovation and renewal journeys of incumbent firms in TMIs.

The literature offers different suggestions about how firms may facilitate innovation and renewal: some suggest that firms need to break from their old path and develop new knowledge and competence to avoid being locked-in by existing structure that hampers innovation and renewal (Leonard-Barton, 1992; Utterback & Abernathy, 1975; Vergne & Durand, 2010). Others argue that firms do not necessarily need to forsake their current path and abandon the knowledge and competence they have accumulated in order to foster innovation and renewal. Instead, they can leverage and draw on previous knowledge and competences to develop new ones, and (re)deploy resources to innovate and renew themselves

(Bergek et al., 2013; Berggren, Magnusson, & Sushandoyo, 2015). This is particularly salient among firms in mature industries (Onufrey, 2017; Onufrey & Bergek, 2020). Essentially, those two opposing views reflect the dialectic tensions between change and persistence related to innovation and firm renewal. Regardless of which suggestion a firm subscribes to regarding the ways of pursuing innovation and renewal, contexts always matter.

External contextual changes such as regulatory and demographic changes, increasing social and policy expectations of sustainable production and consumption, and intensifying global competition also present both opportunities and challenges in order for incumbent firms to innovate and renew themselves (Bathelt et al., 2013). While the inner and outer contexts of firms are both important for innovation and renewal (Pettigrew, 1987), this dissertation focuses on the strategic actions of incumbent firms in relation to a firm's outer contexts, because we still lack nuanced explanations of this phenomenon.

The outer contexts are often treated as antecedents triggering innovation and change inside firms, and their role after the commencement of innovation and renewal processes is largely backgrounded in extant studies. This is surprising given that innovation and renewal processes do not occur in vacuum once they have begun (Agarwal & Helfat, 2009; Schmitt et al., 2018). As such, research into innovation and renewal on incumbent behaviours tends to take an outside-in approach, focusing on how firms internally adapt to changes in their outer contexts (e.g. Gulati & Puranam, 2009; Volberda, Baden-Fuller, & Van Den Bosch, 2001a; Warner & Wäger, 2019). Exactly how incumbent firms in TMIs strategically manage their outer contexts for and along their journeys of innovation and renewal, and why they act in the way they do, remain unclear.

This area of knowledge deserves research attention for at least two reasons. First, addressing it helps to advance innovation studies in terms of contextualising the innovation strategies of firms. Secondly, it is useful for generating practical insights for innovation managers and policymakers who seek to facilitate innovation and renewal. This dissertation is therefore motivated to study the strategies by incumbent firms in TMIs with regards to managing their outer contexts for innovation and renewal. In the remainder of this dissertation, 'contexts' and 'outer contexts' are used interchangeably, referring to the environments external to firms, unless specified otherwise.

1.1 Aim and research question

The aim of this dissertation is *to advance understanding of the strategies of incumbent firms in traditional manufacturing industries regarding managing contexts for innovation and renewal*. In line with this aim, the dissertation addresses the following **overarching research question**:

> *How and why do incumbent firms in traditional manufacturing industries strategically manage contexts in their innovation and renewal journeys?*

Answering the research question means that this dissertation contributes to innovation studies by offering nuanced explanations of firm strategies regarding multiple external factors for the creation and realisation of novel products and processes. The focus on firms in TMIs supplements recent innovation studies where most scholarly attention is skewed towards firms and start-ups in the high-tech and service sectors. More specifically, the explanations offered here speak to and advance knowledge in *two unresolved theoretical debates*: the first concerns the approach of either co-alignment or co-creation to strategic renewal (Schmitt et al., 2018), and the other concerns the role of incumbents in sustainability transitions (Turnheim & Sovacool, 2020).

Beyond offering theoretical insights, these explanations have high *empirical relevance* because many firms in TMIs strive for innovation yet lament the difficulties of innovating and securing future prospects.

This dissertation also offers a *methodological contribution* by proposing a framework that facilitates systematic and rigorous analysis of the interplay between institutional influence and actor strategies in unfolding innovation processes.

To these ends, I provide four individual papers and an overall synthesis of findings from the papers in this kappa. I next present an overview of the four individual papers.

1.2 Overview of the papers

This section briefly outlines the four individual papers (Table 1 provides an overview). Each paper offers insights that together answer the thesis's overarching research question and speak to the two targeted theoretical debates. *The logic of ordering* the papers is as follows: Paper 1 zooms out with a longer time horizon, and probes the strategic renewal of a rural industrial SME, which explains how the firm's strategies to manage three different forms of contexts (i.e., institutional, network and local-spatial contexts) matter for the firm's innovation and continuous survival. Paper 2 and Paper 3 respectively zoom into specific innovation processes that lead the focal firms onto promising development trajectories. Both Paper 2 and Paper 3 explain firm strategies towards socio-technical contexts underpinned by institutions, although Paper 3 and Paper 4 examine firm strategies regarding the institutional context in more depth. Paper 2 focuses on large and powerful firms, and Paper 3 supplement the insights of Paper 2 by focusing on their less powerful and resource-equipped counterparts. In addition to a reflection on current conceptualisations and proposing a reconceptualisation of innovation process, Paper 4 offers a methodological contribution to research, geared towards analysing institutional influence on (path-breaking) innovation processes while taking into account innovator responses.

Paper 1 *Strategic renewal as a duality of deliberate change hinging on persistence: How contextual strategies matter – The case of a rural industrial SME*

This paper aims to explain the strategies employed by rural industrial SMEs in and towards a firm's outer contexts for strategic renewal. Adopting a duality view, strategic renewal is reconceptualised as the simultaneous endeavours of deliberate change hinging on persistence with the firm's attributes to secure its long-term prospects. The firm's outer contexts are understood as consisting of different forms, which managers engage with (i.e., connecting to, leveraging and shaping) rather than passively receive or experience. An in-depth longitudinal (1988-2019) analysis of the revelatory case of a metal product manufacturing SME in the Gnosjö rural industrial district finds that the firm's managers employed four contextual strategies targeting the institutional, network and local-spatial contexts. These strategies include *1) defying and 2) changing hindering institutions* (such as local gender norms, societal bias against industrial jobs and educations, and industrial expectations for such firms to succumb to price-based competition and to relocate to low-cost countries); *3) creating local support infrastructure* (such as establishing local private schools customised to the needs of local firms for competence, and forming alliance organisations to support collective competitiveness); and *4) leveraging enablers to reach wider networks* (such as leveraging place-based reputation to reach a wider market, and leveraging networks outside the rural district to change institutions and to obtain various cutting-edge competence that is lacking in the local district). These strategies matter for resolving the tensions that arise between the outer contexts and the endeavours by managers to change some of the firm's attributes while persisting with other attributes (i.e., the duality of strategic renewal). In doing so, they strive to create and exploit favourable contextual conditions, while grappling with those that are unfavourable to ensure the firm's survival and long-term prospects. The findings also show that to continuously innovate and survive is not just about change, but also about persistence regarding the firm's direction and how it moves in that direction.

Paper 2 *Instigating regime change: Incumbent reorientation with radical innovation and strategies to mitigate innovation barriers*

This paper aims to explain how and why incumbents facilitate change in socio-technical regimes wherein they could otherwise benefit by defending the status quo. Theoretical explanations are built by combining the literature on the role of incumbents in sustainability transitions and on regime structuration: incumbents instigate regime change by reorienting themselves with radical and sustainable technology, and then by restructuring the regime (the socio-technical context) – namely, by (re)shaping the regime elements of actors, institutions and materiality, and fostering the alignment of regime elements towards a rationality that favours the incumbents' radical technology. Incumbent re-orientation is motivated by both exogenous pressure and endogenous aspirations to reposition themselves for the long-term future. Capable incumbents strive to be the frontrunners of radical

and sustainable technology development, because they regard it as an important way to achieve long-term prospects and competitive advantages. Incumbents need to mitigate barriers to their innovation during the radical innovation journey, and thus restructure the regime whose dominant rationality still revolves around the old and unsustainable technology. As they do so, incumbents draw on their enabling characteristics as large and powerful firms, including their wealth of accumulated knowledge and resources, strong position established in the industry, and superior relational access to policy arenas. Such enabling characteristics are much less likely to be enjoyed by new entrants. The theoretical explanations are illustrated by analysing the ongoing Hydrogen Breakthrough Ironmaking Technology (HYBRIT) initiative championed by three large incumbents in the steel, mining and energy industries. The empirical case also reveals the importance of a firm's core-fixed assets reaching the end of their lifecycle, as a great window of opportunity for incumbents to reorient themselves onto a novel technological trajectory in light of increasing regulatory pressure. The regime restructuring mechanisms employed by the three incumbents in HYBRIT can be detailed into restructuring actors; restructuring technological knowledge, financial resources, and physical infrastructure (i.e., materiality); restructuring policies and regulations, and market rules (i.e., institutions), fostering their alignment towards a rationality favouring the HDR technology for iron-ore steelmaking in the steel regime.

Paper 3 *Strategic navigation: An innovative incumbent straddling multiple socio-technical regimes*

This paper aims to explain how and why innovative incumbents strategically navigate the institutional context permeating the socio-technical systems of which they are a part. The focus is on a specific under-explored type of incumbent, characterised by resource and power constraints while straddling multiple regimes when developing niche innovation and pursuing firm renewal. Theoretically, the paper builds on the recent debate about the role of incumbents in sustainability transitions, while drawing on the multi-level perspective (MLP) to understand the contexts, and synthesising existing concepts denoting actor strategies towards institutions to understand incumbents' navigation behaviours. Empirically, the paper longitudinally examines a Swedish firm's journey in developing electric vehicle (EV) chargers during 2007-2018. The findings reveal that firms with aspirations to enter a nascent field and to develop a sustainable trajectory leverage room afforded by the multiple regimes they straddle to innovate and manoeuvre forward, identifying promising areas in which to innovate and reorient towards, exercising legitimacy work in niche and regimes to protect and empower innovation, and collaborating with powerful actors in different regimes to handle constraints vis-à-vis institutional enablers and barriers. The seemingly passive and risk-minimising approach of such firms are both reflexive and transient, contingent upon factors such as their perceptions of their own power position, latitude in manoeuvring, change of industry directionality, and the stake they have in a particular institution.

Paper 4 *Institutional influence on the innovation process – Developing an operational framework for institutional analysis*
This paper aims to develop an operational framework to facilitate a systematic and rigorous analysis of institutional influence on the innovation process, accounting for the interplay between institutions and the responses of innovating actors throughout the innovation process. As such, this paper is largely conceptual, with an extensive review of the elusive notion of institutions and existing conceptualisations of the innovation process which motivates and sets the stage for the operational framework development. The innovation process is reconceptualised to elevate the role of institutions. In this reconceptualisation, the innovation process is understood as the three iterative and interconnected subprocesses of shielding, nurturing and empowering. These three subprocesses subsequently emerge and unfold over time, and they share temporal overlaps with each other on a timeline. In this regard, innovating actors (e.g., incumbent firms) create 'protective space' for the innovation during the innovation process, against the adverse selection environment or context, which is argued to be essentially institutional in nature. This is particularly so when it comes to path-breaking innovation processes. An operational framework is developed by incorporating the reconceptualisation and the three elements of institutions (i.e., regulative, normative and cultural-cognitive) into a matrix, and by adding coding schemes into the matrix. This framework provides an overview of the innovation process in light of institutional influence. It allows researchers 1) to analyse how regulative, normative and cultural-cognitive institutions respectively influence the innovation process, and the actors' responses to those influences; 2) to analyse, within each subprocess of the entire innovation process, how the three types of institutions interact to affect innovation endeavours, and how actors configure their behaviours to respond to those effects as they strive to shield, nurture and empower innovation; and 3) to analyse how institutions in one of the regulative, normative and cultural-cognitive realms during a subprocess of innovation may be reinforced or cancelled out by the effect of other institutions in the same or a different realm in a later subprocess of innovation. When a researcher fills the framework with data from one innovation process, they can juxtapose multiple such frameworks concerning different innovation cases, and conduct a systematic cross-case comparison. The framework is thus useful for both within-case and cross-case analysis.

In order to demonstrate the analytical power of the framework, this paper also provides an illustration of framework application by drawing on an empirical case of three incumbent firms handling institutional enablers and barriers throughout the subprocesses of shielding, nurturing and empowering the HDR technology for iron ore steelmaking in the HYBRIT initiative. Connecting the reconceptualisation of the innovation process with the research question of this dissertation, 'shielding', 'nurturing' and 'empowering' address the 'how', and creating protective space for the path-breaking innovation against adverse selections in contexts addresses the 'why' in the research question.

Table 1. Overview of the individual papers

	Paper 1	Paper 2	Paper 3	Paper 4
Objective	To explain how SME managers engage with different forms of contexts as they seek to change some while hinging on persistence with other attributes of the firm in the course of strategic renewal.	To explain how and why incumbents facilitate change in socio-technical regimes wherein they could otherwise benefit by defending the status quo.	To explain how and why incumbents straddling multiple socio-technical regimes navigate institutions when developing niche innovation, despite resource and power constraints.	To develop an operational framework for analysing institutional influence on the innovation process in a systematic manner.
Theory/Literature	Strategic renewal: - Duality of persistence and change; Contextualisation: - Engagement with contexts.	The literature on the role of incumbents in sustainability transitions; Regime structuration.	The literature on the role of incumbents in sustainability transitions; The Multi-level perspective (MLP); Legitimacy work; Strategic response	Institutional theory (Scott's three pillars); Existing conceptualisations of innovation process; Strategic niche management ('shielding', 'nurturing', 'empowering').
Design	Empirical; Single case study; Longitudinal analysis of SME managers in a rural industrial setting regarding how they strategically engage with contexts for strategic renewal.	Empirical; Single case study; Longitudinal analysis of three firms: motivations for reorientation with radical innovation; strategic actions to mitigate innovation barriers in socio-technical context; implications for regime change.	Empirical; Single case study (analysis of one firm) Longitudinal analysis, with focus on strategic actions in relation to the institutional context.	Mainly conceptual, with empirical case illustration.

Findings	Managers of rural industrial SMEs engage with contexts (i.e., the institutional, network and local-spatial contexts) through four contextual strategies: 1) defying and 2) changing hindering institutions, 3) creating local support infrastructure, and 4) leveraging enablers to reach wider networks. These strategies matter for resolving tensions that arise from the collision between contexts and managers' endeavours to change some while persisting with other attributes of the firms.	Exogenous pressure and endogenous aspirations to reposition triggered incumbent reorientation (timing of replacing core fixed assets, and positioning for long term are crucial). Three main restructuring mechanisms: (re)shaping and fostering alignment of actors, institutions and materiality in socio-technical regime to mitigate innovation barriers and instigate regime change by drawing on three advantageous characteristics.	Less powerful and resource-equipped incumbents leverage the room afforded by the multiple regimes they straddle to innovate and reorient themselves; legitimacy work to protect and empower innovation; collaborating with powerful regime actors to handle their own resource and power constraints; seemingly passive responses to institutions are actually reflexive and transient, contingent upon perceptions of own power position, latitude in manoeuvring, change of industry directionality and stake in a specific institution.	Reconceptualisation of innovation process by elevating the role of institutions. An operational framework developed by matrixing institutions (i.e., regulative, normative and cultural-cognitive institutions) and the three subprocesses of shielding, nurturing and empowering.
Status	In preparation for journal submission. Previous versions submitted to a special issue in an Entrepreneurship journal, presented at the JIBS boot camp, CeFEO seminar, at RATIO symposium 2019 and NORSI Workshop 2021 .	In preparation for journal submission. Previous versions presented at EGOS 2020 conference. Also accepted for full paper presentation for IST 2020 conference.	In preparation for journal submission. Previous versions presented at DRUID summer conference 2019; PROS 2019. Also accepted for full paper presentation at IST 2019 conference; roundtable discussion at AMJ Paper Development Workshop 2020.	Work in progress. Previous version presented at AOM Conference 2019 (Technology and Innovation Management division) Abstract published online in Academy of Management Proceedings, 2019 (1).

1.3 Structure of the dissertation

This dissertation includes a 'kappa' (i.e., cover chapters or a comprehensive summary) and four individual papers. The 'kappa' consists of six chapters: *Chapter 1* – as presented above, gives an introduction to the dissertation. *Chapter 2* provides the theoretical background, including the research positioning of the dissertation, the research frontier and knowledge gaps this dissertation seeks to address, as well as an elaboration of the two vibrant theoretical debates to which this dissertation offers novel insights. It also presents the analytical framework employed in this dissertation. *Chapter 3* presents the methodology, encompassing my philosophical stance and the research design in line with the research aim and research question. *Chapter 4* provides a summary of empirical findings. *Chapter 5* discusses the findings from the papers by first answering the dissertation's research question, and by highlighting the theoretical, empirical and methodological contributions. *Chapter 6* concludes the dissertation, outlining managerial and policy implications, its limitations and the research outlook. The four individual papers are attached after the 'kappa'.

2 Theoretical background

2.1 Positioning in innovation studies

This dissertation is primarily positioned in the interdisciplinary field of innovation studies. The field of innovation studies may be defined as the "scholarly study of how innovation takes place, what the important explanatory factors and economic and social consequences are" (Fagerberg, Fosaas, & Sapprasert, 2012a, p. 1133). In the early days the main focus of this field concerned economic and policy studies of science, technology and innovation. Over time, it has developed into an interdisciplinary field that also encompasses the management and organisation of innovation (Dodgson, Gann, & Phillips, 2014a; Fagerberg, Landström, & Martin, 2012b; Fagerberg, Mowery, & Nelson, 2005). There has recently been an increasing demand for better understanding of the innovation process for management and policy purposes, which used to be largely black-boxed (Coyne & Van de Ven, 2021; Martin, 2016). The focus of the field seems to be increasingly on innovation for environmental sustainability and societal benefits rather than largely innovation for economic growth (Martin, 2016). Generally speaking, innovation scholars acknowledge that innovation takes place in specific contexts, and the broader contextual factors affect how innovation occurs and is managed (Dodgson et al., 2014b; Kline & Rosenberg, 1986).

This dissertation is tied closely to the core of innovation studies in explaining how innovation takes place in contexts. The basic assumption of this dissertation is that innovating actors are not passive recipients of contextual influence, but that they strategically (i.e., intentionally act with a goal in mind) - albeit not freely - manage contexts and surroundings as they pursue innovation. In other words, this dissertation assumes neither determinism nor voluntarism, but it assumes that innovating actors influence and are influenced by specific contexts. The innovating actors of interest in this dissertation are incumbent firms in TMIs. This dissertation also connects innovation with firm renewal, as innovations are seen here as an important means by which to achieve renewal.

Much research in innovation studies addressing established firms in relation to their outer contexts tends to look inward, and focus on explaining how firms adapt to various external changes and pressures (Geels, 2014), although more recent literature on open innovation and innovation (eco)system considers how firms behave outwardly. This represents only half-completed endeavours, because firms cannot be assumed to be passive actors operating in the changing environments. In order to achieve a more well-rounded understandings of firm behaviours - including those related to innovation and renewal, an 'inside-out' approach is therefore much needed (Geels, 2014). An 'inside-out' approach addresses the strategic actions of firms towards their outer contexts. It casts light

on the attempts of firms to strategically manage and shape their contexts in the course of innovation (Geels, 2014). In line with this, the main purpose of the dissertation is to advance understanding of the strategies of incumbent firms in traditional manufacturing industries (TMIs) regarding managing contexts for innovation and renewal. The major focus of enquiry in this dissertation is 'how' contexts are managed and 'why' contexts are managed in particular ways by incumbent firms in TMIs.

In the spirit of interdisciplinarity of innovation studies, this dissertation speaks to several scholarly subfields including innovation and sustainability transitions (especially the literature on the role of incumbents), and strategic entrepreneurship (especially the literature on strategic renewal). Next, I elaborate on the conceptualisations of innovation and renewal, and their relationship.

2.2 Innovation and renewal

Innovation, "the carrying out of new combinations", differs from invention. Innovation is more than invention, as it involves the utilisation or commercialisation of new ideas and practices (Schumpeter, 1934). However, there is no universal definition of innovation. This dissertation takes a broad view on the concept of innovation, and adopts Schumpeter's definition, as commonly shared by innovation scholars (Fagerberg et al., 2012a). According to Schumpeter, innovation encompasses one or more of the following five types: 1) new products, 2) new methods or processes of production and commercialisation, 3) new markets, 4) new source of supplies of (material) inputs, and 5) new ways of organising (Schumpeter, 1934, p. 66). While 'newness' or novelty characterises innovation, the question is 'new to who'? In this dissertation, innovation is first and foremost new to the focal incumbent firms in TMIs, but this does not exclude it being new to the industry or even to the world. Depending on the pace and scale of novelty, innovation can be situated anywhere on a spectrum from incremental to radical. Incremental innovation generally refers to minor improvements to what already exists, whereas radical innovation refers to drastic changes to, or deviations from, what already exists, which generally entails new development trajectories for the focal firms and often even transformation of the entire industry (Fagerberg, 2018; Markard & Truffer, 2006; Tushman & Anderson, 1986). Although profit-seeking incumbent firms engage in innovation activities primarily to gain competitive advantages (Teece, 1986), there seems to be an emerging trend wherein incumbent firms are pressured and/or show interest in innovating to tackle grand challenges such as sustainability transitions (Berkhout, 2014; Steen & Weaver, 2017).

In this dissertation, innovation is treated as a process that occurs over time, and thus not just as an artefact or outcome of the endeavours of innovating actors (Pavitt, 2005). The innovation process tends to be black-boxed by economists in innovation studies, but it receives more attention from management scholars who are interested in explaining how innovating actors manage the development and

commercialisation of innovation over time (Fagerberg et al., 2012b; Van de Ven, Polley, Garud, & Venkataraman, 1999). Contexts matter in the unfolding of the innovation process because contexts affect the strategies deployed by innovating actors who strive to push their novelty forward (Kline & Rosenberg, 1986; Phillips, 2014). The management of innovation therefore inherently involves the management of contexts.

Innovation is often associated with renewal, in the sense that it is considered an important means to achieving renewal (Agarwal & Helfat, 2009; Corbett, Covin, O'Connor, & Tucci, 2013; Sharma & Chrisman, 1999). The strategic renewal of firms involves the refreshing or replacing of their strategic attributes (e.g., core capabilities, technologies, products or processes), which have the potential to secure the firm's long-term prospect (Agarwal & Helfat, 2009). Strategic renewal is anchored in the intentionality of managers who seek to build new and promising development trajectories for firms (Flier, Van Den Bosch, & Volberda, 2003; Schmitt et al., 2018). Incumbent firms refresh or replace strategic attributes through innovation. In doing so, they maintain their relevance to ever-changing contexts, gain competitive advantages and even enter new development trajectories that are important for their long-term prospects (Agarwal & Helfat, 2009). Innovation is therefore an important means for incumbent firms in the pursuit of strategic renewal, and renewal generally involves some kind of innovation (Sharma & Chrisman, 1999). Just like innovation, renewal is also a process that unfolds over time (Schmitt et al., 2018).

The renewal process encompasses the process(es) of innovation. Put differently, the renewal process of an incumbent firm may involve one or more innovation process(es). For example, an incumbent firm may renew themselves by developing a new product over time which allows them to enter a nascent business area that will later become a thriving one (e.g., the 'EPBA' case in Paper 3). It may also be the case that an incumbent firm is continuously developing and/or adopting new technologies, new processes, and new ways of organising, which over time contribute to the firm staying relevant to the changing environment, gaining competitive advantages and enjoying long-term prospects (e.g., the 'Gnosjö Automatsvarvning' case in Paper 1, and the 'HYBRIT' case in Paper 2 and Paper 4). Whether a renewal process consists of one or multiple innovation processes is an empirical question, but also contingent on the analytical choice of the researcher who selects the timespan for analysis.

Although innovation is arguably an important means to renewal, not all innovations lead to renewal. Recent research in innovation studies has pointed out there could be a 'dark side to innovation' (Biggi & Giuliani, 2021; Gardner & Bryson, 2021; Hansen, Nygaard, & Dal Maso, 2021). This new argument challenges an optimistic assumption widely shared among innovation studies scholars that innovation is something good and positive for firm development, as well as for economic and social development. Coad, Nightingale, Stilgoe, and Vezzani (2021) argue that some innovations may cause harm such as public health risks, environmental degradation, and damage to society and the economy. It should be noted that these harmful innovations are not the types included in this

dissertation. Instead, the innovations on which this dissertation is focused are those which are not only conducive to firm renewal, but also contribute to (or at least do not cause harm to) mitigating climate change, and to economic and societal goods – at least as far as one can anticipate at the point of writing this dissertation. Nevertheless, firms pursuing such 'good' innovations in the course of their renewal are not necessarily exempt from the conflicts and barriers inside or outside the firms.

Since innovation (process) is a means to renewal and a part of renewal process, and the management of innovation involves the management of contexts that enable or hinder innovation, it is logical to argue that incumbent firms need to manage their contexts in strategic ways in the course of innovation-based renewal. Innovation-based renewal is particularly important for incumbent firms in TMIs because these incumbents generally face fierce price-based competition, and may be replaced by disruptive newcomers (Christensen, 2013). Paradoxically, these incumbents generally encounter barriers which impede their innovation, and thus renewal. The barriers could be factors internal to the firm, such as established routines, procedures, competences, managerial mindsets, or sunk investments that create inertia and lock the firms into their existing trajectories (Leonard-Barton, 1992). Barriers may also be factors outside the firm, however, such as developed relationships with suppliers and customers, as well as well-established industry- and/or societal institutions (e.g., technological standards, user practices and societal expectations) which make it difficult for incumbent firms in TMIs to take risks and innovate to the extent and/or direction that brings renewal (Christensen, 2013). Hindering factors or conditions such as those mentioned above need to be managed and overcome in order for incumbent firms in TMIs to successfully innovate and renew themselves. Although this dissertation does not exclude consideration of a firm's internal contexts, the main analytical focus is given to the outer contexts of firms, and the strategies of firms in and towards their outer contexts. This directs us to the role of contexts and strategies by incumbent firms for innovation and renewal.

2.3 Contexts and strategies for innovation and renewal

2.3.1 What is meant by 'contexts'?

In this dissertation, the concept of 'contexts' is delimited and primarily operationalised as the environment or structure external to incumbent firms in TMIs. In another word, 'contexts' are understood in this dissertation as 'the outer context of the firm', referring to the environment in which the firm operates (Pettigrew, 1987, p. 657; 2012), and comprising different forms such as technological, institutional, social, network, economic, competitive and so forth. The plural form of the word 'context' (i.e. contexts) is used to acknowledge the different forms into which a firm's external environment can be analytically

dissected, for the purpose of nuancing the strategic actions by firms to manage contexts for innovation and renewal.

This is not to deny the role that the internal environment of the firm plays in innovation and renewal (Corbett et al., 2013), and nor does it ignore the debate about treating context and environment as the same. This dissertation operationalises 'contexts' as the environment or structures external to the firm, because it focuses on understanding how firms strategically deal with what is external to them as they develop innovations associated with renewal. It is a deliberate choice I made as a researcher based on my research interest, in alignment with the gaps in the literature. On the other hand, while it is relatively common within strategic renewal research to refer to the external environment – the changes of which prompt innovation and renewal endeavours by firms, it is also opposed by recent contextualising entrepreneurship research, which suggests that contexts should not be treated as something just 'objectively out there' and thus against the use of the term 'environment' when referring to context (Baker & Welter, 2020). However, no explicit definition of context seem to have been proposed by these opponents and gained consensus within or across scholarly communities, which gives ample room to operationalise 'context' in a variety of ways that are appropriate for the research at hand.

This dissertation does subscribe to the view that contexts are not just something given that determine a firm's behaviours related to innovation and renewal. This is because contexts – delimited as the external environment or structures outside a firm – *can influence but not determine* a firm's behaviours. Meanwhile, contexts can also be shaped by intentional and strategic actors such as incumbent firms seeking innovation and renewal. Nevertheless, this dissertation *does not subscribe to the volunteristic view* that actors can entirely create contexts via social construction or freely shape their contexts without limitations. This is because actors have, to various degrees, 'partial autonomy' with which to shape structure (Battilana, 2006; Lawrence, 1999).

In summary, contexts exert influence via enabling and constraining behaviours (Johns, 2006). Contexts therefore matter because they influence the behaviours of those involved in the innovation and renewal processes, which consequently affects the outcome of innovation and renewal endeavours (Coenen, Moodysson, & Martin, 2015; Kline & Rosenberg, 1986; Van de Ven et al., 1999). Innovating actors such as innovative firms may exercise their 'partial autonomy' to influence and shape their contexts (Van de Ven et al., 1999). It is therefore important to foreground both contexts and the actions of innovative firms in and towards contexts when studying innovation and renewal journeys.

2.3.2 Multiplicity of contexts

Innovation scholars acknowledge the multiplicity of contexts in the sense that contexts can be analytically divided into different forms, such as spatial, institutional, social, technological, and economical contexts (Kline & Rosenberg,

1986; Van de Ven et al., 1999). However, there is no consensus on how contexts should be typologised in terms of their analytical form (e.g. Welter, 2011; Zahra, Wright, & Abdelgawad, 2014).

While the multiplicity of contexts is acknowledged among innovation scholars, it is usually backgrounded in the analysis and theorising of innovation (processes) in empirical studies. More recently, there has been a contextual turn in innovation studies, particularly in the study of innovation systems, which emphasises the importance of accounting for different forms of contexts (e.g., actor-network/social, institutional, and spatial) in explaining where, how and why innovation takes place (Asheim, 2020; Binz, Truffer, & Coenen, 2016). Despite this, we still rarely see innovation studies include the (strategic) actions of innovating actors in multiple forms of contexts simultaneously when explaining how and why innovation happens.

Why does it matter? First, different forms of contexts, while analytically distinct, are inter-related, and interact to affect how innovation occurs (Van de Ven et al., 1999). If we only focus on one form of context while obscuring the others, we may thus risk over-weighing the effect of that particular form of context on innovation because other forms of contexts may mitigate or reinforce the effect of that particular form of context. Second, the way that innovative firms respond to and shape different forms of contexts in turn moderate the effects of contexts on innovation processes. In other words, to better understand and explain how innovation takes place, we need to explicitly account for multiple forms of contexts on the one hand, and consider the actions of innovating actors (e.g., innovative firms') in and towards multiple forms of contexts on the other hand. This dissertation makes an attempt to incorporate multiple forms of contexts and the strategic actions of innovative firms when studying the innovation and renewal journeys of incumbent firms in TMIs.

After establishing this premise, we may ask the questions: what are the current research frontiers and what research opportunities can we move forward with regarding incumbent firms managing contexts for innovation and renewal? This brings us to the next section on the current research frontier, research gaps and two unresolved theoretical debates related to incumbent firm behaviours in innovation and renewal.

2.3.3 Contexts, innovation and renewal – research frontiers and gaps

What are the current research frontiers and what opportunities can we move forward with regarding incumbent firms managing contexts for innovation and renewal? A systematic literature search (see Appendix 1) reveals that extant research addressing incumbent firm behaviours in innovation and renewal mainly cluster into four bodies of literature: 1) strategic renewal (including corporate entrepreneurship); 2) disruptive innovation (including incumbent-challenger dynamics, discontinuous innovation); and 3) incumbent behaviours in sustainability transitions. There is also 4) a rather limited strand on innovation-

based renewal aggregated to regional and industry levels. In this section, I first offer a brief review of these clusters of literature, and then elaborate on two unresolved theoretical debates to which this dissertation particularly relates and speaks to. Table 2 provides an overview of these four clusters of reviewed literature.

Table 2. Overview of four clusters of literature reviewed on the innovation and renewal behaviours of incumbent firms

Literature cluster	Dominant theme	Opposing observation/ argument	Industry and firm studied	Gaps	Synthesis of gaps addressed in this dissertation
Strategic renewal	Co-alignment view: Renewal (process) as firms, triggered by changes in external contexts, make changes and innovate internally to 'fit' with external contexts. This is usually a discontinuous process rife with breaking path-dependence and inertia.	Co-creation view: Renewal (process) as a constant process wherein firms proactively create opportunities in markets and shape industry evolution to their advantage.	Various types: Biomedicine, electric utility, image sensors, computers; marketing, advertising, music, financing services etc.	• A blind spot on how firms manage multiple forms of outer contexts simultaneously in renewal journey. • Unresolved debate: co-alignment vs co-creation view. • General lack of interest in firms in TMIs.	• Theoretical: How and why incumbents firm in TMIs *manage different forms of contexts* in their innovation and renewal journeys? Speaking to two unresolved debates: 1) Co-alignment vs co-creation view of firm strategic renewal; 2) The role of incumbent firms in innovation and sustainability transitions. • Empirical: Lack of insights on the strategies of firms *in TMIs* that are in need of innovation and renewal.
Disruptive innovation (incumbent-challenger dynamics; discontinuous innovation)	New entrants/challengers are the innovators: they use radical innovation to disrupt incumbent firms that used to be large and powerful. Incumbent firms initially overlook and later try to fight back, but often lose the battle to new entrants (typical 'David vs. Goliath' story).	Incumbents may strategically respond to disruption bought about by new entrants under certain conditions and through mechanisms such as investing in, cooperating with and acquiring innovative start-ups, yet, incumbents mostly adapt rather than being the de novo innovators. 'Creative accumulation' may enable incumbent firms to pursue discontinuous innovation.	High-tech and service sectors (including semiconductors, digital platform services, other services, biotechnology, automation, fin-tech etc.)	• The context incumbent firms manage is characterised by competitive and disruptive forces. Little attentions to multiple forms of contexts. • Focus on incumbent-challenger dynamics obscure incumbent firms proactively initiate and develop (radical) innovation and seek renewal. • Overly focus on high-tech and service sectors (except early works on hard disk, steel etc.), rarely attending to incumbent firms in TMIs.	

Incumbent behaviours in sustainability transitions	Incumbent firms, operating in socio-technical regimes, lack motivations and abilities to reorient and pursue sustainable and radical innovation. Such innovations are brought forth by new entrants operating in socio-technical niches. Incumbent firms suppress innovations by new entrants, and obstruct a socio-technical system transitions towards sustainability (especially sustainable production and consumption).	Incumbent firms may strategically reorient and diversify with sustainable innovation due to opportunities to redeploy existing resources and/or subject to serve regulatory pressure. They may thus play a positive role in driving sustainability transitions.	Energy, agro-food, mobility, housing industries etc.	• Unresolved debate: the role of incumbent firms in sustainability transitions (and the innovative capacity of incumbents) • Unclear how and why innovative incumbent firms manage the socio-technical contexts (including regime) underpinned by institutions during innovation journeys.	• Methodological: Lack of an operational framework to systematically and rigorously analyse institutional influence on the innovation process, while accounting for the strategic behaviours of firms.
Innovation-based renewal at industry and/or regional levels	The institutional contexts – 'the rules of the game' –affect innovation processes and thus the renewal of industries and regional economies. Firms play a part in the innovation-based renewal processes, while subject to the influence of the institutional contexts. The spatial, institutional, industry and network contexts are often accounted for.	-	Various types including TMIs.	• Mostly focus on analysing structural influence and give little attention to a firm's strategic agency. • Operationalisation of institutional analysis on the innovation process represents a challenge: current solutions appear ad-hoc and lack rigour, leading to knowledge fragmentation.	

The general theme in *the cluster of strategic renewal literature* echoes what Schmitt et al. (2018) call the 'co-alignment' view. This view contends that changes in the external environment of incumbent firms necessitate those firms innovating and adapting in order to stay competitive and survive in the long term (Agarwal & Helfat, 2009; Schmitt et al., 2018). As such, contexts serve as antecedents or triggers of incumbent firms embarking on processes of developing new products, technologies, business models and so forth, which are vital for renewal. It seems relatively common in the strategic renewal literature dominated by the co-alignment view to look inward by focusing on organisational processes, capability building and battling inertia and rigidity inside firms (An, Zhao, Cao, Zhang, & Liu, 2018; Eggers & Kaplan, 2009; Roy, Lampert, & Stoyneva, 2018; Sosa, 2011; Warner & Wäger, 2019). In other words, the strategic renewal literature tends to pay less attention to the way incumbent firms manage their external environments or outer contexts in their innovation and renewal journeys.

Contrary to the co-alignment view, a handful of studies argue for a 'co-creation' view (Schmitt et al., 2018) which suggests that firms constantly work on strategic renewal, and during this process proactively influence and shape their external environments to the firm's advantage in terms of opportunity creation and industry evolution. However, the limited articles that take the co-creation view on strategic renewal mostly focus on activities by incumbent firms to form strategic alliances, catering to customer needs or influencing industry standard settings (e.g. Eklund & Kapoor, 2019; Kim & Pennings, 2009; Peltola, 2012). There is basically a blind spot in terms of understanding and theorising about incumbent firms managing different and multiple forms of contexts simultaneously for innovation and renewal. These represent interesting and valuable research opportunities, since different forms of contexts matter not just at the outset but also throughout a firm's innovation and renewal journeys. This dissertation addresses this blind spot in the strategic renewal literature, and speaks to the theoretical debate concerning the co-alignment and co-creation view (see further elaboration in Section 2.3.3.1).

The *second cluster of literature* revolves around *disruptive innovation*, which encompasses themes such as incumbent-challenger dynamics and the mechanisms employed by incumbents to respond to or pursue discontinuous innovation. Works on incumbent-challenger dynamics provide useful insights into how new entrants disrupt incumbent firms and how incumbent firms respond to disruptions (Ansari & Krop, 2012; Garud et al., 2002). The contexts that incumbent firms manage are thus mostly characterised by competitive and disruptive forces brought about by newcomers in the industry. In these works, innovations are typically brought forth by newcomers rather than by incumbent firms, as incumbent firms generally suffer from internal inertia and are locked in to their old trajectories (Ansari, Garud, & Kumaraswamy, 2016; Casadesus-Masanell & Zhu, 2013; Egfjord & Sund, 2020; Hunt & Ortiz-Hunt, 2017; Raffaelli, Glynn, & Tushman, 2019). When incumbents pursue innovation, it is generally through investing in, cooperating with or acquiring innovative newcomers (Anokhin, Örtqvist, Thorgren, & Wincent, 2011; Di Lorenzo & van de Vrande, 2019;

Giustiziero, Kaul, & Wu, 2019; Henkel, Rønde, & Wagner, 2015; Kim, Steensma, & Park, 2019; Rothaermel, 2001b). As Eklund and Kapoor (2019) suggest, this literature's zealous pursuit of explanations on the difference in performance between incumbents and new entrants has led to an under-exploration of how and why incumbent firms (proactively) meet the challenges from external contextual changes when seeking renewal.

Moreover, these works rarely consider firms in TMIs. Instead they tend to focus on high-tech and service sectors (including semiconductors, services, digital platform services, biotechnology, automation, fin-tech etc.) (Egfjord & Sund, 2020; Jiang, Tan, & Thursby, 2011; Kapoor, 2013; Marx, Gans, & Hsu, 2014; Palmié, Wincent, Parida, & Caglar, 2020; Rothaermel, 2001a; Vértesy, 2017). This is probably because there is a higher rate of new entrants or start-ups disrupting the existing competitive landscape in high-tech sectors than in TMIs.

On the other hand, there are a handful of works that explain the mechanisms of incumbent firms as a source of discontinuous innovation even in mature industries (Bergek et al., 2013; Onufrey & Bergek, 2020). For example, Bergek et al. (2013) investigate large incumbents in the automotive industries, and suggest that those firms employ 'creative accumulation' (i.e., building on existing knowledge and capabilities while creating new ones and integrating the old and new knowledge and capabilities) to foster the development of discontinuous technologies. Overall, these insightful works tend to focus on how incumbent firms strategically handle their knowledge or technology contexts internal and external to the firms, while other forms of contexts such as institutional and spatial contexts external to incumbent firms are often downplayed.

There are exceptions documenting how incumbent firms in high-tech sectors strategically handle their institutional contexts outside the firm in face of disruptive innovation, but the efforts of those incumbents generally aim to hinder innovations launched by newcomers (e.g. Garud et al., 2002) or withstand regulatory pressure (Benner, 2008; Bohnsack, Kolk, Pinkse, & Bidmon, 2020). As such, we still do not know much about how incumbent firms in TMIs navigate their institutional contexts as they pursue innovation and renewal. Addressing this knowledge gap not only helps to advance understanding of the strategies used by incumbent firms to manage contexts for innovation and renewal, but also to further our knowledge of incumbent firms as a source of innovation, even in TMIs.

The *third large cluster of literature* concerns *incumbent firm behaviours in sustainability transitions (ST)*. The general theme in this cluster somewhat overlaps with the disruptive innovation literature in the sense that incumbent firms are typically portrayed as obstructive to the radical innovations developed by newcomers that (potentially) disrupt the incumbents' business. The radical innovations studied in the ST literature are those gearing towards systemic transitions towards sustainable production and consumption.

The contexts managed by incumbent firms are socio-technical in nature, which is also largely underpinned by institutions (i.e., regulative, normative and cognitive rules). The incumbent firms investigated in the ST literature are

predominantly those suffering from inertia and being locked-in, and therefore tend to strategically defend and maintain the extant socio-technical configurations (termed the 'regime') in which they have strong positions and vested interests. For example, Smink, Hekkert, and Negro (2015a) demonstrate that incumbent firms in the LED and biofuels industries in the Netherlands exercise institutional strategies to undermine the potential and validity of sustainable innovations developed by newcomers, and consequently keep those innovations on a leash.

The negative stereotypical portrait of incumbent firms is being increasingly questioned within the ST community. For instance, Steen and Weaver (2017) show that incumbent firms may also strategically reorient themselves towards sustainable innovation, and diversify, due to regulative pressure from their context or a firm's internal desire to redeploy existing resources for renewal. As such, the topic of incumbent firms' potential and efforts in radical and sustainable innovations which are believed to accelerate systemic transitions is gaining traction. Despite this, we still know very little about how incumbent firms, after reorienting with radical innovation, strategically deal with the misalignment between their innovation and the dominant socio-technical context (i.e., the regime) supporting the existing core and unsustainable technologies. This is another important knowledge gap to be addressed. Addressing this gap is useful for increasing our knowledge on incumbent firm strategies, targeting their social-technical context underpinned by institutions during innovation and renewal journeys towards sustainability. It is also useful for developing theories regarding the under-explored role of incumbent firms in shaping socio-technical regimes and contributing to sustainability transitions.

In short, the third cluster of literature in ST points to an unresolved debate about the role of incumbent firms regarding innovation and sustainability transitions. This is the second debate that this dissertation directly relates and speaks to (see further elaboration in Section 2.3.3.2).

Finally, *the fourth cluster of literature* revolves around *innovation-based renewal aggregated to regional and industry levels*. This literature emphasises the institutional context affecting the innovation behaviours of incumbent firms associated with industrial renewal (Coenen et al., 2015; Eriksson et al., 2019; Moodysson & Sack, 2016). This is not surprising given that institutions as 'rules of the game' provide guidance for and regularise firm behaviours (North, 1990; Scott, 2014). This point echoes the literature in strategic renewal, disruptive innovation and incumbents in sustainability transitions. This suggests that understanding the institutional dynamics of the contexts of incumbent firms, and how incumbent firms manage their institutional contexts, is important for furthering our insights into how innovation occurs and is managed (Phillips, 2014). Nevertheless, the operationalisation of institutional analysis in innovation studies is still a big challenge (Gertler, 2004; Hollingsworth, 2000). Arguably, there are two reasons for this challenge: 1) there is no general consensus about what is meant by institutions, and 2) the extant conceptualisations of the innovation process lack explicit focus on the role of institutions and responses of innovating actors. As a result, institutional analysis in existing studies appears to

be ad-hoc and lacks systematic rigour. This is by no means to say that the analysis in prior studies is sloppy. Rather, the shortcoming lies in the two reasons mentioned above when we look at those studies as a whole, which results in knowledge fragmentation. Tackling this operational challenge requires developing a framework that assists systematic and rigorous analysis of institutional influence on the innovation process, while accounting for how innovating actors (e.g., incumbent firms) handle institutional enablers and barriers. Directly related to this, this dissertation offers one such framework to assist with tackling the methodological challenge.

Taken together, there is still ample room for advancing our knowledge in the strategies of managing contexts for innovation and renewal, especially concerning incumbent firms in TMIs which seem to have largely slipped from attention in recent innovation studies. It is also important to account for the process and longitudinal aspect (i.e., dynamic and diachronic in nature) of innovation and renewal so that our understandings are not based on static snapshots (Schmitt et al., 2018; Van de Ven et al., 1999). In summary, important gaps that provide purchase for knowledge advancement regarding incumbent firms in TMIs managing contexts for innovation and renewal include:

1. *Theoretical aspect:*
   How and why incumbent firms in traditional manufacturing industries strategically manage *different forms of their outer contexts* in their innovation and renewal journeys?
   (This elaborates on the overarching research question of this dissertation.)

   Following an answer to the above question,
   1a) what can we learn and contribute to the debate on the 'co-alignment' vs. 'co-creation' views in the strategic renewal literature?

   1b) what can we learn and contribute to the debate on the role of incumbent firms in innovation and sustainability transitions?

2. *Empirical aspect:*
   What is specific to firms in traditional manufacturing industries regarding managing contexts for innovation and renewal?

3. *Methodological aspect:*
   How can we systematically and rigorously analyse the interplay between institutional influence and the behaviours of innovating actors as the (path-breaking) innovation process unfolds?

This dissertation addresses those research gaps, which is in line with the research aim and research question. To this end, I use an analytical framework that is constructed by drawing on a set of different yet related theoretical notions. Before presenting the analytical framework, I will first elaborate on the two specific

unresolved theoretical debates to which this dissertation speaks and contributes with novel insights.

2.3.3.1 Unresolved Debate 1: Co-alignment or co-creation in strategic renewal

According to Schmitt et al. (2018), one of the core debates in the past three decades of strategic renewal research revolves around the agency of incumbent firms in relation to the outer contexts of those firms. They call the two contrasting views "co-alignment" and "co-creation" (Schmitt et al., 2018, p. 91). Essentially, the co-alignment view describes firms as inert and only react to changes in a firm's outer contexts (Kwee, Van Den Bosch, & Volberda, 2011; Stienstra, Baaij, Van den Bosch, & Volberda, 2004), whereas the co-creation view suggests that firms proactively shape their outer contexts to create future competitive advantages (Agarwal & Helfat, 2009; Kim & Pennings, 2009; Ravasi & Lojacono, 2005). This section provides an elaborated and stylised presentation of these two views, by highlighting their theoretical tensions and shortcomings. Table 3 juxtaposes these two views in a stylised presentation.

The co-alignment view argues that firms undertake strategic renewal to re-align with contextual changes in order to achieve fit between firm-internal strategy and capabilities. Contextual changes may be in different forms, such as technological advancement, regulatory changes, macro-economic changes, market trends and consumer preferences and so forth. (Huff, Huff, & Thomas, 1992; Kwee et al., 2011). In this regard, the multiplicity of contexts is acknowledged. With its theoretical roots in population ecology and neo-institutional theory, the basic assumption of this view is that firms are inert and reactive to changes in their environments (Hannan & Freeman, 1984; Stienstra et al., 2004). To avoid being selected out by competition, firms try to adapt to changes in their outer contexts (Huff et al., 1992). In other words, changes in contexts serve as antecedents and triggers for firms to initiate internal changes (Benner, 2008; Schmitt, Barker, Raisch, & Whetten, 2016). As such, this view is dominated by an outside-in approach whereby research focuses on how firms initiate and implement changes internally in order to adapt to external contextual changes. The role of a firm's outer contexts and related firm strategies is basically pushed to the background without any further examination and theorisation, as if strategic renewal processes unfold in a vacuum (Schmitt et al., 2018). This is probably one of the main reasons we have the impression from this view that firms have no agency to change and shape their outer contexts. Another reason may be attributed to the fact that studies embracing the co-alignment view tend to focus on explaining various mechanisms associated with managerial inertia that make the necessary internal changes difficult (Tripsas, 2009; Volberda & Lewin, 2003), and therefore little attention is given to how firms act towards shaping the outer contexts.

Table 3. Overview juxtaposing the co-alignment and co-creation views

	Co-alignment view	Co-creation view
Role of outer-contexts	Antecedent/trigger of strategic renewal	Antecedent of strategic renewal, and target of a firm's strategic actions
Agency of firms to shape contexts	No	Yes (but limited to shaping the industry and market contexts)
Multiplicity of contexts considered	Yes (but confined to different contextual antecedents)	Very little (especially regarding multiple forms of contexts firms strategically shape)
Assumption about firms	Inert, reactive, mimetic	Proactive, future-oriented
Theoretical roots	Population ecology, neo-institutional theory (emphasising adaptation-selection-retention; isomorphic pressure in the industry/organisational field)	Co-evolutionary theory, complexity theory (emphasising recursive and complex interactions between firm strategy and contexts)
Purpose of renewal activities	To re-align with environmental shifts, and achieve 'fit' between firm and its contexts	To create market opportunities and steer industry evolution towards the firm's advantages
Renewal process characteristics	Generally punctuated and discontinuous; Some are incremental	Continuous
Outside-in or inside-out approach	Outside-in	Inside-out (albeit mildly)
Role of persistence	(Over-) emphasising persistence as a barrier to change and firm renewal	Neglecting the role of persistence
Shortcomings identified	• Contexts and firm strategies to shape contexts are marginalised; • Over-emphasis on persistence as a barrier to change and renewal, overlooking the potential role of persistence in driving renewal.	• Multiplicity of contexts and corresponding firm strategies are under-recognised, especially beyond the market and industry contexts; • Neglecting the role persistence plays in renewal.

Since studies adopting a co-alignment view are largely occupied with a focus on inertia, they tend to emphasise a firm's persistent behaviours related to resource allocation, managerial attention and commitment to prior development trajectory (Burgelman, 2002; Fang, Chrisman, & Holt, 2021). These behaviours are also conceptualised as 'strategic persistence'. Due to the association of persistence with inertia, persistence is dominantly regarded as an opposition and barrier to changes, innovation and firm renewal (Fang et al., 2021). It is argued that a firm's strategic persistence generally leads to poor performance and organisation failure (Audia, Locke, & Smith, 2000; Williams, Chen, & Agarwal, 2017). While intuitive, one could reflexively ask whether persistence only serves as a barrier to change and innovation associated with strategic renewal.

Nevertheless, the co-alignment view does acknowledge that firms are able to change and realign with their environments. It is argued that such changes come about when stress accumulated from the misalignment between firm strategies and changes in the environment reaches a tipping point (Huff et al., 1992). As such, the strategic renewal process from a co-alignment view is characterised by punctuated and discontinuous changes inside the firms (Jansen, 2004; Schmitt et al., 2018). However, some studies do suggest that firms change incrementally and slowly (Martens, Matthyssens, & Vandenbempt, 2012). Such changes tend to manifest as firms imitating the strategy of successful counterparts or adopting their industry's dominant logic and the industry recipe from which the isomorphic pressure creates a bandwagon effect (Stienstra et al., 2004). In other words, firms co-align with other firms in their industries (Volberda & Lewin, 2003). In short, the co-alignment view does not show that firms enact strategies to shape and change contexts in the course of strategic renewal.

Conversely, the 'co-creation' view suggests that firms proactively shape and change their contexts or external environment to create future competitive advantages (Agarwal & Helfat, 2009; Flier et al., 2003; Ravasi & Lojacono, 2005). Proponents of this view generally have their theoretical roots in evolutionary theory and complexity theory. Their basic assumption is that firms are proactive and future-oriented (Schmitt et al., 2018). This view not only acknowledges that contextual changes may trigger strategic renewal, but it also treats contexts as the target of a firm's strategic actions throughout renewal processes. Strategic renewal is seen as a continuous process that unfolds in specific market or industry contexts (Ravasi & Lojacono, 2005). In other words, strategic renewal represents a firm's constant efforts to innovate and change in line with its changing environment, and to proactively create market opportunities for its innovation and steer the evolution of its industries for the firm's advantage (Agarwal & Helfat, 2009; Kim & Pennings, 2009; Peltola, 2012). More specifically, firms may influence industry standards, guide consumer preferences, and steer market trends through mechanisms such as advertising, celebrity endorsement, marketing campaigns, diffusing their own novel product designs and so forth (Kim & Pennings, 2009; Ravasi & Lojacono, 2005).

Studies embracing this view tend to adopt an inside-out approach, albeit mildly in my opinion. In comparison with studies that examine a firm's internal

innovation and future-oriented change efforts (Flier et al., 2003; Volberda & Lewin, 2003), the number of studies that zoom in on a firm's strategies to shape and change their outer contexts during strategic renewal is very limited (e.g. Kim & Pennings, 2009). Moreover, even those few studies that uncover a firm's contextual strategies are limited to the industry and market contexts, overlooking a firm's strategies to manage and shape other forms of contexts such as the spatial and institutional contexts (Kim & Pennings, 2009; Peltola, 2012). When the institutional context is considered, it is confined to country-level regulations, and the societal norms and widely-shared perceptions are hardly accounted for (Flier et al., 2003). In other words, the multiplicity of contexts and a firm's corresponding strategies to shape contexts remain marginalised in the studies embracing the co-creation view.

While studies from the co-alignment view tend to (over-)emphasise a firm's persistence in hindering strategic renewal, proponents of the co-creation view seem to ignore the role of persistence, which results in an impression of 'change fetishism'. While innovation and change are important in order for firms to keep pace with, or even to lead contextual shifts, it is reasonable to assume that some attributes of firms are so highly valued by managers and owners that they are intended to be kept (largely) intact, and/or that some attributes cannot be changed simply because firms are unable to change them for various reasons (Fang et al., 2021). Presumably, a firm's persistence may affect how it instigates changes both internally and externally for renewal. Even though a firm's proactive agency to innovate and to shape contexts is therefore highlighted in research adopting the co-creation view, it is important that the role of persistence is taken into account when explaining a firm's strategic renewal.

In summary, the co-alignment view and the co-creation view have provided us with useful insights about a firm's renewal behaviours in relation to the outer contexts. Due to their difference in theoretical roots and research focus, these two views present quite contrasting arguments about how firms behave in and towards contexts. While some contend that firms exhibiting either co-alignment or co-creation behaviours is simply a matter of how organisational members socially construct their reality (Barr, Stimpert, & Huff, 1992), I argue that what is empirically observed may very much have to do with the researcher's assumptions and correspondingly analytical focus. In other words, the theoretical tensions between the two views partly stem from the worldviews of firm managers and partly from a researcher's own ontological assumptions and research focus. Following suggestions by Poole and Van de Ven (1989) on identifying and using theoretical tensions to stimulate theoretical development, Schmitt et al. (2018) recommend a paradox or 'both/and' approach instead of an 'either/or' approach to leverage the theoretical tensions between the co-alignment and co-creation views and advance our understanding of strategic renewal. Farjoun (2010) has set a good example with his seminal work where persistence and change are conceptualised as a duality that drives innovation, organisational change and renewal. In this dissertation, I subscribe to a 'both/and' approach to 1) a firm's co-alignment and co-creation behaviours, and 2) a firm's endeavours to persist

and change for strategic renewal. Given the lack of research on how firms manage and shape their outer contexts of multiple forms throughout the strategic renewal process, I focus on addressing this gap, and subsequently use the findings to respond to this debate and to advance understanding of the strategic renewal of firms.

2.3.3.2 Unresolved Debate 2: The role of incumbents in sustainability transitions

Although not directly connected to the subject of strategic renewal, recent arguments put forth by transitions scholars advocating better understandings of incumbent firms in relation to their external environments in the setting of sustainability transitions (Farla, Markard, Raven, & Coenen, 2012; Geels, 2014; van Mossel, van Rijnsoever, & Hekkert, 2017) are fundamentally related to the aforementioned debate in the strategic renewal literature. For instance, Geels (2014) suggests taking an 'inside-out' perspective to study firms and firm strategies towards their external environments. In his arguments, established firms not only adapt to external pressures, but also strategically attempt to shape their environments (i.e., the socio-technical contexts underpinned by institutions). This calls for transitions research to focus on firm-level analysis – particularly the strategic actions used by firms towards their outer contexts, and to take a more agentic view of firms by "acknowledging deliberate strategy, intentionality and interpretation" (Geels, 2014, p. 268). This section elaborates on the vibrant debate in transitions studies regarding the role of incumbents in sustainability transitions (Köhler et al., 2019).

While Geels (2014) highlights the agency of established firms in shaping their outer contexts, whether and how such 'shaping' is geared towards defending or changing the status quo is the core of this debate. Highly influenced by the notions of 'path-dependence' from evolutionary economics and of 'isomorphic pressure' from neo-institutional theory, transitions studies tend to depict incumbent firms as inert and locked-in to the existing technologies that dominate their sectors (conceptualised as the socio-technical regimes). Considering sunk investment, vested interests, and maintaining power positions, incumbent firms are inclined to obstruct radical innovations developed by new entrants operating in niche spaces, and to defend the status quo and stability of the regime from disruption (Smink et al., 2015a). For instance, incumbent firms may explicitly cast doubts on, and deny, the technological and economic feasibility of the niche innovation, set industry standards that suppress deviating solutions, attack the credibility of niche innovators, and mobilise political power to silence niche advocates (Dewald & Achternbosch, 2016; Penna & Geels, 2015; Smink et al., 2015a). When facing substantial regulative and normative pressures from society, incumbent firms may also exercise unobtrusive maintenance by acknowledging the importance of novel and sustainable alternatives on the one hand, while inducing latent complexities into the process of niche development on the other hand. In doing so, they place niche innovators in a 'war of attrition', eventually stalling radical innovation and defending regime status quo (Dewald & Achternbosch, 2016; Zietsma,

Ruebottom, & Slade, 2018). From this point of view, incumbent firms are portrayed as 'villains' in radical and sustainable innovation, and in the transitions of their sectors and general society (Hellsmark & Hansen, 2020). As Hansen and Coenen (2017) contend, incumbent firms lack motivation and the ability to innovate and change substantially.

This stereotyped portrait of incumbents has been increasingly questioned by contrasting observations and arguments in the transitions communities (Köhler et al., 2019). The countering voices contend that incumbent firms have both motivations and capacities to reorient with alternative technologies. The primary motivations of reorientation are argued to be various pressures (e.g., regulative, cultural, normative pressures or natural jolts) outside the firms, as well as a firm's aspiration to redeploy existing resources to capture new market opportunities (Steen & Weaver, 2017; Turnheim & Geels, 2013). Penna and Geels (2015) studied the slow reorientation of US automakers towards developing electric vehicles and conclude that incumbent firms rarely reorient to solve societal problems such as climate change, but rather to first and foremost capture economic and strategic opportunities over rivals.

In terms of innovation capacities, Steen and Weaver (2017) and Mäkitie (2020) drew on evidence from the Norwegian energy sectors and showed that incumbent firms diversify into other sectors and develop new and sustainable technologies. Berggren et al. (2015) studied two large established firms in the heavy vehicle industry in Sweden and showed that firms may pursue multiple technological strategies through either keeping the old and the new ones separate or integrating them. Turnheim and Geels (2019) drew on the case of French tramway diffusion and demonstrated that incumbent firms from adjacent sectors can play a leading role in the development of radical alternatives.

Nevertheless, the shortcoming of this stream of arguments is its assumption that regime transitions would eventually take place when large and powerful incumbents reorient or diversify with sustainable innovation (Geels, 2014; Raven, 2006). What is overlooked is how and why during the innovation processes incumbent firms manage and shape the very socio-technical contexts they are deeply embedded in. Arguably, it is unravelling this overlooked issue that helps us better understand the ways in which innovative incumbent firms contribute to regime change and system transitions.

This echoes the complaint that the socio-technical regimes are often black boxed at the expense of explaining niche breakthrough, resulting in a lack of insights into regime dynamics (Steen & Weaver, 2017; Turnheim & Sovacool, 2020). Admittedly, there are theoretical propositions based on prior studies of how firms may shape their environments such as through corporate political strategies and manipulating ideologies and public debates to influence the cultural environment. However, those strategies were empirically demonstrated to stall innovation and hinder transitions rather than drive change. In other words, the variety of strategies by incumbent firms to shape contexts during the innovation journeys and drive regime change still largely lacks empirical grounding and remains under-theorised.

While the debate on the role of incumbents in innovation and sustainability transitions is ongoing, some scholars have made useful suggestions about how to better understand incumbent behaviours in contexts. For instance, Steen and Weaver (2017) suggest viewing established firms as multi-level actors that tread both regime and niche levels, affecting niche-regime interaction. They recommend future research to provide better explanations for the timing of incumbent reorientation in light of market opportunities and firm-external pressures. They also suggest paying more attention to (specialised) suppliers rather than mostly focusing on large and lead firms in order to uncover the roles and strategies of non-lead firms in developing alternative technologies and influencing socio-technical system transitions. Developing these suggestions further, Turnheim and Sovacool (2020) call for greater emphasis on pluralising incumbency with regard to i) a multiplicity of incumbent actor types; ii) a variety of incumbent strategies; iii) the transient or changing nature of incumbent strategies (over time); and iv) the various resources that incumbents may deploy to support transformative change.

In summary, it is time we move beyond the debate on whether incumbent firms play an obstructing or accelerating role in sustainability transitions, as we have a good amount of evidence showing that not all incumbent firms are 'forever stuck in the old ways'. We therefore need to "engage more subtly with claims around the role of incumbents in transition processes" (Turnheim & Sovacool, 2020, p. 181). Building on the suggestions by Turnheim and Sovacool (2020) and Steen and Weaver (2017), I proceed to uncover a more nuanced understanding of 1) different types of incumbent firms; 2) the conditions under which these firms reorient with radical and sustainable innovations, and 3) how and why these innovative firms proactively shape socio-technical regimes and thereby drive transitions. This requires that I make attempts to open the 'black-boxes' of innovation process and the 'regime' while studying firm-level strategic decision making and actions to deal with enablers and barriers in the socio-technical contexts underpinned by institutions. In doing so, I strive to further illuminate and theorise the agency of incumbent firms in terms of leading innovation and their contributions to regime dynamics, niche-regime interactions and system-wide transitions.

2.4 Analytical framework

In this section, I present the analytical framework that guides my analysis of the empirical cases in line with the research question and research aim of the dissertation. We cannot rely on a single theoretical lens to dissect the multiplicity of contexts and explain the strategies of incumbent firms to manage contexts for innovation and renewal, because it would elevate one form of context and the corresponding strategies by firms at the expense of other forms of contexts and strategies. The analytical framework is therefore constructed here by incorporating different notions that are relevant for analysis. First, I present the

notion of strategic renewal as a duality of change and persistence, which serves to sensitise the analysis to the role of persistence in addition to innovation and change. Then I present the notion of 'engagement with contexts' to denote an overarching frame for understanding firm strategies in relation to multiple forms of contexts. Next, I focus on frames that allow for analysing specific forms of contexts and firm strategies, and thereby present the notions of 'institutions, legitimacy and strategic responses', as well as 'MLP and strategic niche management'.

2.4.1 A duality of strategic renewal: Change and persistence

Strategic renewal is generally understood as firms making changes to secure their long-term survival and prospects alongside the ever-changing outer contexts (Friesl, Garreau, & Heracleous, 2019; Schmitt et al., 2018). Renewal scholars such as those represented in the co-alignment or co-creation views generally emphasise the importance of change. However, a duality perspective entails acknowledging two contradictory and complementary sides that simultaneously constitute a complex phenomenon (Jackson, 1999). Drawing on a duality perspective, strategic renewal is thus understood not just in terms of change, but also of persistence (Farjoun, 2010).

According to Agarwal and Helfat (2009, p. 282), the endeavours to change made for the purpose of strategic renewal involve "refreshing or replacing [the firm's] attributes". 'Persistence' as the flip side of change can be conceptualised as 'maintaining and keeping intact the firm's attributes'. Based on this conceptualisation as used in the dissertation, persistence should therefore not be equated with 'continuous change or persistence of change'. The conceptualisation of 'persistence' used here is much more specific than what Farjoun (2010) terms 'stability' in his conceptual paper. Persistence here denotes a pattern of actions and endeavours to keep things unchanged, whereas 'stability' in Farjoun's term could denote a status/state, mechanism or process. In other words, the concept of 'persistence' here represents a specific form of stability in Farjoun's term. For empirical studies, I argue that a more specific or narrower conceptualisation of persistence is necessary for retaining consistency when analysing empirical data. The conceptualisation of persistence here is specific enough to encapsulate a particular pattern of behaviours by firms (and managers), and yet sufficiently broad to allow for flexibility to cover whatever attributes the focal firms persist with. Just as change endeavours are laden with managerial intentionality (Schmitt et al., 2018; Volberda et al., 2001a), persistence endeavours are also infused with intention and the deliberation of a firm's managers. In short, endeavours to both change and to persist at the firm level for strategic renewal are carried out deliberately by firm managers who consider those endeavours necessary and important.

Why is it important to understand strategic renewal as a duality of change and persistence? First, this is based on the assumption that there are certain attributes of their firms that managers value and desire to keep intact in the midst of change

(Fang et al., 2021). What these attributes are is an empirical rather than a conceptual question, as they could vary from case to case. Prior research suggests that firm strategy, areas of resource allocation, product portfolio, core capabilities, collective mindsets and organisational identity could be examples of firm attributes that managers persist with and strive to keep intact for various reasons (Burgelman, 2002; Eggers & Kaplan, 2009; Fang et al., 2021; Tripsas, 2009; Williams et al., 2017). Second, renewal research generally suggests that change is difficult to bring about due to inertia mechanisms at play, and inertia is often associated with persistence (Burgelman, 2002). When we reject the idea that change and persistence are exclusive of each other, we can recognise that they can be mutually enabling as well as contradicting (Farjoun, 2010). In other words, we cannot fully understand how change occurs without simultaneously accounting for the occurrence of persistence and vice versa. If we only focus on change but ignore persistence, or view change as exclusive to persistence, then we only obtain a one-sided understanding of strategic renewal. To obtain a well-rounded understanding, it is thus important to understand strategic renewal as a duality of change and persistence.

A duality perspective emphasises an interdependent relationship between two contradictory elements. These two elements – albeit analytically distinct – are seen as intertwined, not mutually exclusive, and operate at the same time (Schad, Lewis, Raisch, & Smith, 2016). This means that in the duality of strategic renewal, persistence and change occur simultaneously (Farjoun, 2010). The contradictions between persistence and change are considered inherent in their mutual relationship, and tensions or conflicts are expected to arise between the endeavours to persist and to change (Schad et al., 2016). However, the complementarity between persistence and change means that endeavours to persist and to change do not have to crowd out each other (Farjoun, 2010). Persistence may both provide an anchor for and facilitate change, and change may help to realise persistence (Farjoun, 2010). This implies that as managers simultaneously endeavour to change some attributes of their firms while persisting with others, they are expected to deal with the tensions while enhancing complementarity between persistence and change.

While subscribing to the duality perspective to understand strategic renewal, I realise that duality scholars tend to focus on the dialectic relationship between "the two sides of the same coin" (Lewis, 2000, p. 761), but pay little attention to a firm's outer contexts in the sense of how contexts may affect a duality. Connecting that to the duality of strategic renewal as change and persistence, insufficient attention to a firm's outer contexts may risk leading to a misunderstanding that the endeavours to persist and to change occur in vacuum. It is therefore important to place the duality in contexts, especially when the research purpose is to understand and explain how firms manage contexts for innovation and renewal. When analysing a firm's (and manager's) endeavours to persist and to change, I thus account for how those endeavours are connected to a firm's outer contexts, and how contexts are managed to enable the contemporaneous pursuit of persistence and change at firm level. This brings us

to notions related to a firm's strategy to manage contexts. Next, I present the overarching notion of 'engagement with contexts'.

2.4.2 Engagement with contexts

The notion of 'engagement with contexts' is defined here as embedded actors connecting to, leveraging and shaping contexts of different forms in order to create favourable and grapple with unfavourable conditions for achieving goals such as innovation and firm renewal. This definition is my refinement of the notion originally proposed by Gaddefors and Anderson (2019), according to whom 'engagement with contexts' denotes that embedded actors connect to (i.e., find links with) and use (physical and social) resources provided by contexts to create value. With this notion, they acknowledge the multiplicity of contexts, although their research interest is a rural setting. They also emphasise that embedded actors interact with different forms of contexts, instead of simply operating within a context that is nothing more than a background (Gaddefors & Anderson, 2019). Put differently, the interaction between actors and contexts is thus brought to the foreground. Engagement with contexts represents a form of agency vis-à-vis contexts (Gaddefors & Anderson, 2019). Because of the above, I find this notion particularly suitable as an overarching frame through which to understand firm strategies to manage contexts for innovation and renewal, if it is further refined and adjusted.

What I think needs refinement – for the purpose of this dissertation – is that the notion as it was originally proposed could be more comprehensive if it can more explicitly account for the agency of embedded actors in shaping and changing contexts in addition to connecting to and using resources from contexts. This aspect is not absent in Gaddefors and Anderson's elaboration of the relationship between the rural contexts and the value-creation processes of actors, but somehow it is not incorporated into conceptualising the notion. I therefore explicitly include 'shaping contexts' in the notion's definition. Furthermore, although contexts may provide different kinds of resources (e.g., place-based material and immaterial resources from a spatial context, or relational resource from a network context) that actors can connect to and leverage for achieving goals, contexts cannot be reduced to simply a pool of resources. Otherwise, we would highlight the enabling conditions of contexts for value creation at the expense of obscuring the constraining conditions of contexts. After all, contexts may provide resources, but they may also entail a lack of resources. There are elements in contexts such as rules and norms which are not necessarily resources per se, although they could be connected to, leveraged and shaped to enable resource access. Aligning with this dissertation's research aim and research question, I therefore refined the notion as put forward in the beginning of this section.

It should be noted that my refined notion of 'engagement with contexts' differs from Baker and Welter's (2020) notion of 'doing contexts'. The main difference is that I do not consider contexts as merely socially constructed. According to

Baker and Welter (2020), actors could (mentally) bracket in or out (i.e., accept or refuse to enact) enablers and barriers from their 'objected' environments, and consequently make those enablers and barriers (ir)relevant to the pursuit of the goal. While I appreciate that a social constructionist ontology may be particularly helpful in foregrounding actor agency, I argue that reducing contexts to the result of social construction may risk leading us to a voluntaristic approach in understanding how actors manage contexts. In word words, in my opinion, agency cannot transcend all contextual constraints with no limit. Although I agree there is social construction underpinning actor strategies to manage contexts, actors may continuously experience struggles and grapple with contextual conditions that hinder them in their innovation and renewal journeys. Therefore, in my refined notion of 'engagement with contexts', it entails that firms and managers as embedded actors 'connect to, leverage and shape contexts' to create (and exploit) favourable, and grapple with unfavourable conditions, but they do not just 'do' contexts.

After presenting an overarching frame, I now present a set of notions in order to analyse the institutional context and firm strategies.

2.4.3 Institutions, legitimacy and strategic responses

Institutions, broadly understood as the 'rules of the game' (North, 1990), constitute an important form of context in which incumbent firms in TMIs operate. Institutions both enable and constrain behaviours (Scott, 2014). Whether and how incumbent firms 'play by the rules' affects their legitimacy, which suggests whether and to what extent a firm's endeavours are appropriate and desirable (Oliver, 1991; Suchman, 1995). This in turn affects a firm's innovation and renewal. Being strategic – in the sense of being intentional and keeping one's goal in mind – is therefore important for managing the institutional context. Oliver's (1991) notion of strategic responses encapsulates how actors may deal with institutional pressure. In this section, I focus on presenting the notions I draw on to analyse the institutional context and a firm's strategies to manage the institutional context in which they are embedded.

Institutions

First, it is necessary to clarify the elusive notion of 'institutions' and how it is defined in this dissertation. Institutions are not equated with organisations, as institutions are understood as 'rules of the game' whereas organisations (and individuals) are 'players of the game' (North, 1990). Following Scott (2014: 56), 'institutions' are defined in this dissertation as rules comprising "*regulative, normative and cultural-cognitive elements that, together with associated activities and resources, provide stability and meaning to social life*." The three elements of institutions form a continuum, moving "from the conscious to the unconscious, from legally enforced to the taken for granted" (Hoffman, 1997, p. 36).

According to Scott (1995, 2014), *regulative institutions* refer to rules that govern behaviours on the basis of expedience. Individuals or stipulators craft regulative rules because they believe such rules can advance their interests, and they comply with regulative rules because they wish to avoid sanctions (oftentimes, legal sanctions) or seek the attendant rewards. While regulative institutions may depend on normative and cognitive backing, they primarily rely on *coercive mechanisms* for influencing behaviours. Empirical indicators of regulative institutions include laws, regulations, directives, formal structures of control and so on. Basically, regulative institutions inform actors about 'what is/is not allowed'.

Normative institutions are rules that guide behaviours on the basis of social obligation. The main *mechanism* of control is *normative*. Norms and values are two main forces through which normative institutions exert influence over behaviours. Values indicate what is preferred or desirable according to the standards to which behaviours can be assessed and held up. Norms prescribe how things should be done, and define what means are legitimate and appropriate for pursuing valued ends. While some values and norms apply to all members of the collective, others are only applicable based on a member's role and position. People and organisations thus adhere to certain normative institutions contingent upon their situations and roles within those situations. People generally learn about and gradually internalise normative institutions through socialising activities, but they can also be imposed upon with normative rules by others. In addition to norms, values and role expectations, certification and accreditations are some other empirical indicators of normative institutions. Violations of normative rules can result in shame and social exclusion, whereas compliance may confer respect and honours. In short, normative institutions prescribe 'what should be/is appropriate to be done'.

Cultural-cognitive institutions are rules that influence behaviours based on shared understandings and meanings. They are called 'cultural-' because how wide understandings and meanings are shared is culturally bounded. Cultural-cognitive institutions are characterised by taken-for-grantedness, since such rules are deeply internalised and entrenched in the minds of individuals. Empirical indicators include shared perceptions, common beliefs, mindsets, cognitive schemas, and mental scripts for action, foundational knowledge bases, and so forth. Cultural-cognitive rules constitute social reality and provide frames through which people makes sense of what happens. There is thus compliance because deviating ideas and behaviours are simply unthinkable or inconceivable to those subject to cultural-cognitive institutions. Under times of uncertainty, these rules are particularly powerful in stimulating isomorphic behaviours via the *mimetic mechanism*: people and organisations imitate successful models or follow orthodoxies because doing so provides a sense of psychological security and does not cause them to stand out as different, odd or 'crazy'. Put simply, cultural-cognitive institutions suggest 'what we can think of and what we think works'.

Admittedly, there is no agreement about how institutions should be defined. Different academic disciplines place varying emphasis on regulative, normative

and cultural-cognitive elements when defining the concept of institutions (see Paper 4 for more details). This dissertation adopts Scott's (2014) omnibus definition because it provides a sufficiently wide scope to capture different institutional forces that affect the innovation and renewal of incumbent firms.

The institutional context in which firms operate is intricate (Scott, 1995). To dissect this intricacy of institutions, it is useful to analyse the institutional context in terms of varying levels (Geels, 2004; Wright & Zammuto, 2013). Just to give a few examples: based on the range of jurisdictions or spatial scales, the institutional context can be operationalised into local, provincial/regional, national, and international levels (Scott, 2014). In terms of degree of structuration and the stability of a socio-technical system, the institutional context can be analytically divided into niche, regime and landscape levels (Geels, 2004). Although the core underlying dimension that defines the levels is the scope of the phenomenon encompassed, "any particular set of distinctions among levels is somewhat arbitrary" (Scott, 2014, p. 105). This means that there is not one best or universal way to divide the institutional context into a specific set of levels. Connecting that to this dissertation, when dissecting the intricacy of the institutional context through levelling, it is important to be mindful regarding the scope of an institutional context relevant for incumbent firms in TMIs as they pursue innovation and renewal. While subscribing to the level distinction of MLP (to be presented in the next section), I also find it useful to divide the levels based on the spatial origins of the institutional forces affecting a firm's innovation and renewal processes (see Paper 3).

Legitimacy

Actors (individuals and organisations) compete for social fitness in the institutional context, and the selection criteria is legitimacy (Powell, 1991). Legitimacy can be broadly defined as "*a generalized perception or assumption that the actions of an entity are desirable, proper or appropriate within some socially constructed systems of norms, values, beliefs, and definitions*" (Suchman, 1995, p. 574). Regulative, normative and cultural-cognitive institutions can be seen as criteria for evaluating whether and to what extent something or someone is legitimate or not (Deephouse, Bundy, Trost, & Suchman, 2017; Scott, 2014). Compliance with regulative, normative and cultural-cognitive institutions is therefore posited as crucial for embedded actors to gain and sustain legitimacy.

Legitimacy matters for firms because it affects social and economic exchanges by affecting a firm's access to markets and resources, and through offering leeway for innovation, which consequently facilitates survival (Brown, 1998; Deephouse & Carter, 2005; Meyer & Rowan, 1977; Walker, Schlosser, & Deephouse, 2014). Legitimacy helps actors avoid or mitigate being questioned or challenged by others (Meyer & Rowan, 1977), which is important for firms developing innovation, especially when the innovation is not yet fully-fledged and sufficiently competitive in relation to current solutions.

Legitimacy can be understood as a property, such as reputations and the trustworthiness of carrying out certain tasks due to an actor's resource

endowment, displayed capabilities and superior relational access and so on (Suddaby, Bitektine, & Haack, 2017). On the other hand, legitimacy can also be understood as a process wherein actors socially (de)construct legitimacy (Suddaby et al., 2017). Firms as embedded actors can acquire, accumulate, spread and transfer legitimacy as they strive to achieve their goals, such as innovation and renewal. Meanwhile, firms may also attack and diminish the legitimacy of their rivalries to eliminate some competition (Deephouse & Carter, 2005; Smink, Negro, Niesten, & Hekkert, 2015b). The strategic actions by actors to forge and shape the legitimacy of themselves and/or of others are conceptualised as *legitimacy work* (Lefsrud, Graves, & Phillips, 2020). Since regulative, normative and cultural-cognitive institutions serve as criteria of legitimacy judgement, legitimacy work can be seen as an important form of strategy employed firms to manage the institutional contexts during their innovation and renewal journeys. Firm strategies encompass more than legitimacy work. This brings us to the notion of strategic responses.

Strategic responses

Neo-institutionalists tend to highlight the isomorphic forces of institutions whose regulative, normative and cultural-cognitive dimensions foster the congruence and coherence of behaviours by actors operating in the same institutional context (Greenwood, Oliver, Suddaby, & Sahlin-Andersson, 2008; Meyer & Rowan, 1977). However, there is increasing recognition of the role of human agency since DiMaggio's (1986) seminal work suggesting that actors are not 'cultural dopes' who simply comply with institutions. It is argued that reflexive and knowledgeable actors enjoy 'partial autonomy' to respond to and shape the institutional context in which they are embedded. This scholarly recognition has led to burgeoning conceptualisations of actor agency in relation to their institutional context, bringing the consideration of agency, power and interests back into institutional analysis and theorising (Powell & DiMaggio, 1991). Among those influential seminal contributions is Oliver's (1991) notion of 'strategic responses'. It was "the first systematic attempt at articulating the range of potential responses" by embedded actors who are under institutional pressure for conformance (Lawrence & Suddaby, 2006, p. 217).

Oliver (1991) identifies five types of strategic responses: to acquiesce, compromise, avoid, defy, and manipulate. These five types vary from passive to active agency to resist institutional pressure. To *acquiesce* is when actors accede to institutional pressure, such as habitually following taking-for-granted rules, imitating successful and widely accepted models, or consciously obeying rules in anticipation of specific self-serving benefits. *Compromise* is when actors make concessions when confronted with conflicting institutional demands or with incongruence between institutional expectations and organisational objectives. This may be accomplished through balancing and accommodating the expectations of multiple constituents to achieve parity, through pacifying institutional pressure with conformance to the least minimal level, or through bargaining and negotiating with the source of institutional pressure in the attempt

to exact some concession from the source or from external constituents. *Avoidance* refers to an actor's attempt to eliminate the need to conform to institutional pressure, which can be done via concealing nonconformity, buffering themselves from external scrutiny and evaluation, via escaping by exiting a domain where institutional pressure is exerted, or through significantly altering their own goals and activities.

Defiance signifies a more active form of resistance to institutional pressure. It can be accomplished through dismissing or ignoring rules and expectations when the potential enforcement of those rules and expectations is perceived to be low, or when an actor's goals and interests significantly conflict with those rules and expectations. In addition to dismissing rules, actors may also defy institutional pressure by challenging or contesting the rationality and validity of rules and expectations. Actors may even attack, belittle and denounce the rules and the constituents who create and enforce those rules that pressure actors for conformance. Finally, *manipulation* refers to actors purposefully attempting to co-opt, influence or control institutional pressure and evaluations. Through co-opting, actors invite others to support their objective so as to neutralise opposition and enhance legitimacy. Influencing is a tactic of manipulation that is more directly targeting at shaping and changing institutions. This can be done by shaping public perceptions, lobbying for regulatory changes, or shaping the standards based on which actors and their endeavours are evaluated. Controlling involves an actor's efforts to establish power and dominance over other constituents in order to dominate the source, allocation or expression of social approval and legitimation (Oliver, 1991).

While acquiescence, compromise and avoidance are rather passive forms of strategic responses, and are likely to contribute to the maintenance and reproduction of existing institutions, defiance and manipulation represent the exercise of active agency by actors to intentionally resist institutional pressure, which may lead to the change and transformation of institutions. According to Oliver (1991), an organisation's *willingness* (bounded by organisational scepticism, self-interest, and control) and *ability* (bounded by organisational capacity, conflict and awareness) to conform to external demands from the institutional environment would be helpful in order to predict which type of strategic responses they are likely to enact.

I subscribe to the notion of 'strategic responses' as a useful conceptual tool with which to analyse firm's strategies to manage their institutional context for innovation and renewal, although I argue that it is necessary to relax the following two assumptions in order to capture a wider range of firm strategies. First, the conditions afforded by the institutional context are not rife with only pressure for conformance as this assumes only the constraining role of institutions without acknowledging an institution's role in enabling actor behaviours. There could be other conditions in the institutional context – such as a lack of certain rules or standards in a nascent field, which do not immediately entail pressure for conformance yet are relevant to a firm's innovation endeavours. Second, an actor's goals and objectives are not always, and thus should not be assumed as

only, conflicting with institutional demands. There could be situations wherein a firm's objective to innovate and renew align well with (some aspects of) institutional demands. In those situations, institutions are a source of motivation for achieving goals rather than some adverse pressure for conforming against an actor's goals. Relaxing the assumptions of institutions as a source of pressure and conflicting with the goals of actors means that the notion of strategic responses could involve a wider range of strategies, including purposefully *creating new rules (in a nascent field), leveraging enabling rules, and enhancing the diffusion of (enabling) rules* and so forth, to facilitate the accomplishment of actors' goals such as innovation and renewal. Instead of strictly applying Oliver's (1991) notion of 'strategic responses' when analysing empirical data, I therefore use it as a guide, while remaining open to other types of strategies that firms employ to manage their institutional context.

Notably, there are several other influential concepts that capture actor agency of managing institutions, namely 'institutional entrepreneurship' (DiMaggio, 1988; Garud, Hardy, & Maguire, 2007) and 'institutional work' (Lawrence & Suddaby, 2006). Institutional entrepreneurship refers to "the activities of actors who have interest in particular institutional arrangements and who leverage resources to *create* new institutions or to *transform* existing ones" (Maguire, Hardy, & Lawrence, 2004, p. 657) in order to "realise interests they highly value" (DiMaggio, 1988, p. 14). Divergence from and change to (as opposed to reproduction or reinforcement) existing institutions characterises institutional entrepreneurship as a form of institutional strategy (Lawrence, 1999). Actors (individuals or organisations) who undertake institutional entrepreneurship are change agents, called 'institutional entrepreneurs' (Battilana, Leca, & Boxenbaum, 2009).

Moving the theory development forward, Lawrence and Suddaby (2006) argue that institutional entrepreneurs can intentionally work to maintain, disrupt and tear down existing institutions, in addition to creating new ones. They propose the concept of '*institutional work*' referring to "the purposive action of individuals and organisations aimed at creating, maintaining and disrupting institutions" (Lawrence & Suddaby, 2006, p. 215). Rather than typically portraying a heroic story of institutional entrepreneurs (Battilana et al., 2009), the literature in institutional work captures practices or work undertaken by an array of actors, including those who have the resources and skills (or can leverage those of others') to influence institutions, and those who support and facilitate endeavours of creating, maintaining and changing institutions (Lawrence & Suddaby, 2006). The focus on work and practices means that the institutional outcome does not define the pattern(s) of action as an institutional strategy. Rather, it emphasises the intentionality and ways through which actors carry out strategies to affect their institutional environment so as to exploit favourable and grapple with unfavourable conditions for realising their interests and goals (Lawrence, 1999; Lawrence & Phillips, 2019).

Both institutional entrepreneurship and institutional work entail the intentional efforts of actors to shape institutions, which are similar to the manipulation

strategy included in Oliver's (1991) typology of strategic responses. It should be noted that an actor's strategies to manage their institutional context are not necessarily aimed at manipulating institutions. They may be triggered by institutional stimulus, and therefore purposefully (re)act to capture (market) opportunities afforded by institutions or change of institutions, without any intention to create, maintain or change institutions. I thus recognise the concepts of institutional entrepreneurship and institutional work as forms of firm strategies with which to manage institutional context. However, my analysis on the empirics is not confined to those two forms, nor to a strict application of the five types of strategic responses as proposed by Oliver. I use them as a conceptual repertoire that guides my analysis, while remaining open to other forms of strategies used by firms to manage their institutional context in their innovation and renewal journeys.

Concluding this subsection and moving to the next subsection where the notions of MLP and strategic niche management will be presented, I argue that the three concepts of 'shielding', 'nurturing' and 'empowering' as proposed by Smith and Raven (2012) can also be drawn on to analyse a firm's strategies to manage the institutional context for innovation associated with firm renewal. Although the three concepts were not initially positioned within the domain of organisational institutionalism, they complement the notion of 'strategic responses' in three ways. First, they incorporate a consideration of technology which is usually neglected in most notions in institutional theory (Funfschilling, 2014). Second, they highlight proactive rather than reactive agency by actors to manage institutions in the face of adverse selection pressure that are institutional in nature (Funfschilling, 2014). Third, they make explicit the purpose of proactive agency in creating a protective space for (path-breaking) innovation (Smith & Raven, 2012). While the three concepts originate from strategic niche management, they are therefore drawn on in this dissertation as a part of the conceptual repertoire to guide my analysis of firm strategies to manage their institutional context for innovation and renewal (see Paper 4 for their extensive use in this dissertation).

2.4.4 Multi-level perspective (MLP) and strategic niche management (SNM)

To compensate for the lack of attention to technology and innovation, I draw on the 'multi-level perspective' (MLP) and concepts within strategic niche management (SNM) from the sustainability transitions literature to understand the socio-technical context in which firms operate, and firm strategies to manage the socio-technical context. The advantage of MLP and SNM in analysing context and actor strategy lies in their incorporation of the interplay between technology, actors and institutions in explaining the mechanisms and process of innovation and socio-technical transitions (Fuenfschilling & Truffer, 2016; Funfschilling, 2014; Geels, 2004, 2020; Turnheim & Geels, 2019). Admittedly, neither MLP nor SNM are normally used for firm-level analysis, as they are geared towards

analysis at system-level. However, when the focus of the analysis is on firms-in-contexts (as translated from Geel's (2014) notion of 'firms-in-industries'), MLP and SNM can be 'translated' and applied as powerful analytical tools. In this dissertation, MLP is thus drawn on as a heuristic device through which to understand the contexts in which firms operate (Geels, 2011), instead of as an explanatory framework denoting how socio-technical system level change occurs (Geels & Schot, 2007). Since MLP lacks "analysis of the strategies of firms and their importance in transitions" (Berggren et al., 2015, p. 1017), SNM is used to complement it in that regard. SNM – in particular the concepts of 'shielding', 'nurturing' and 'empowering' – is drawn on to understand the strategies of innovative firms to manage contexts, rather than as a framework explaining how a novel technology comes about with little focus on specific actors (Smith & Raven, 2012). When drawing on MLP and SNM, I make the assumption that innovative firms are important constituents of a collective of actors in the socio-technical system whose interests and goals do not always align and can be in conflict (Farla et al., 2012; Smith & Raven, 2012). After this brief introduction to MLP and SNM, I now proceed to provide further elaboration.

Multi-level perspective

MLP has its theoretical roots in a combination of theories from social science: evolutionary economics (Dosi, Freeman, Nelson, Silverberg, & Soete, 1988; Nelson & Winter, 1982), neo-institutional theory (Powell & DiMaggio, 1991; Scott, 1995) and Gidden's structuration theory (Giddens, 1984). It acknowledges multiple forms of contexts in which large-scale socio-technical change occurs. Three particular forms of contexts are emphasised in MLP, the socio-, the technical- and the institutional contexts. MLP posits that the social context has a strong institutional underpinning (Geels, 2002, 2004; Rip & Kemp, 1998) and it is intertwined with the technological context. MLP (Geels, 2002) divides the intertwined socio-technical context with institutional underpinnings into three analytically distinct levels: landscape, regime, and niche.

In MLP, *landscape* refers to the exogenous processes and forces that influence, but remain independent from, regimes and niches. It is a highly stabilised environment which include things like macro-economic situations and processes, broad political ideologies and agendas, climate change, demographic change, broad cultural norms and values and so on. Changes in landscape are much slower than in regimes and niches (Geels, 2002).

Regime (also called 'socio-technical regime') refers to the middle level where socio-technical configuration is highly institutionalised towards a specific technological trajectory. A regime is characterised by self-stabilisation, inertia, path-dependency and guidance for incremental innovation along the dominant technological trajectory (Markard & Truffer, 2008). Geels (2002) dissects the socio-technical configuration of a regime into different elements: technological knowledge, infrastructure, industrial networks, cultural and symbolic meaning, policy and markets/user practices. With its socio-technical nature, regime in MLP accounts for both the supply- and demand sides of innovation, which involves a

diverge set of actors such as firms, business communities, end users, scientists and engineers, policy makers, societal interest groups and intermediary associations and so on. The concept of the socio-technical regime in MLP is therefore much broader than the concept of 'technological regime' introduced by Nelson and Winter (1977) which focuses solely on a community of technicians and engineers, as well as their cognition and beliefs about what is feasible or worth attempting.

The socio-technical regime in MLP is dominantly understood as 'rules' or 'grammars' entrenched in the complex of engineering practices, production process technologies, product characteristics, skills and procedures, ways of handling relevant artefacts and persons, and ways of refining problems (Rip & Kemp, 1998). In other words, a socio-technical regime tends to be equivalent to a set of institutions and 'rules of the (innovation) game' (Geels, 2004). However, a socio-technical regime should not be understood as purely rule based. This is because a regime also encompasses a material dimension (Verbong & Geels, 2007) which tends to be downplayed and subordinated to the consideration of rules in the MLP literature (Sorrell, 2018; Svensson & Nikoleris, 2018). This material aspect is considered in terms of infrastructure and other material artefacts, for instance (Raven, 2007; Smith, Stirling, & Berkhout, 2005). While institutions and rules are entrenched and reflected in materiality, the material dimension of a regime also sets the scope for the rules and institutions at play. Fuenfschilling and Truffer (2014) offer an eclectic viewpoint wherein regime represents the dominant alignment of actors, materiality and rules towards a rationality (i.e., 'institutional logic') supporting a core technology in a sector. This is the viewpoint adopted in this dissertation in the understanding of the socio-technical regime.

The *niche* level represents the locus of radical and path-breaking innovation. A niche is often conceptualised as 'a protective space' in which experiments on radical technologies are carried out in isolation from the selection pressure prevalent in the regime. The socio-technical configuration in a niche is similar to that of the regime in terms of texture, but it is comparatively much smaller in scale and less stabilised. Actor networks are still being formed, and rules are 'in the making' and far from being clearly articulated and institutionalised within a niche (Schot & Geels, 2007).

It should be noted that even with its socio-technical nature, a niche in MLP (also known as a 'technological niche' as suggested by Schot, Slob, and Hoogma (1996) and Raven (2005)) should not be confused with a 'market niche'. It differs from the concept of a 'market niche', as used by Levinthal (1998) for example, which refers to a distinct application domain which has a distinct selection environment involving distinct functionality as well as price sensitivity that consequently triggers a new technological trajectory development. Raven (2006) implicitly suggests that technological niche innovation is first developed to become a market niche where rules are relatively more stabilised before it is more widely adopted, and eventually replaces the dominant regime where rules are highly (and dynamically) stable. Returning to the MLP theorising, most niche

innovations fail to disrupt and replace the dominant regime due to a lack of sufficient performance development (i.e., poor results from experimentations), and/or lack of wide-scale social embedding in terms of buy-in and adoption by actors outside the niche. Occasionally, niche innovations succeed in breaking through and replacing the dominant regime. This process occurs when landscape changes pressure the regime, rendering windows of opportunities for niche expansion, and when the niche innovations are sufficiently developed to compete with and survive over the dominant technology in the regime (Geels, 2002).

While MLP has been influential for understanding the process of how innovation and sustainability transitions come about, it is often criticised for being deterministic and not taking agency into account (Geels, 2011). For instance, Berggren et al. (2015, p. 1017) contend that the "multi-level perspective *suffers from a lack of analysis of the strategies of firms and their importance in transitions*". Parallel to this, Farla et al. (2012) call for a closer look at the strategic actions of actors involved in sustainability transitions, and how different types of actors (be they in the regime or niche) innovate (or not) and strategically shape the regime and niche contributing to (or hindering) transitions. This dissertation responds to this call by focusing on the strategic actions taken by incumbent firms in TMIs, by drawing on concepts from strategic niche management.

Strategic niche management

The 'strategic niche management' literature focuses on fostering radical innovations in technological niches which have the potential to overcome regime selection pressure and eventually change the current regime, and devotes attention to understanding (and advising policymakers) how to strategically create protective space to fend off regime selection pressure during innovation processes (Markard, Raven, & Truffer, 2012; Raven, 2006). In this dissertation, strategic niche management is used to understand the strategic actions carried out by incumbent firms in TMIs to manage the socio-technical context during their innovation journeys associated with firm renewal. In particular, Smith and Raven's (2012) concepts of 'shielding', 'nurturing' and 'empowering' are drawn on to reconceptualise innovation process with a radical or path-breaking nature.

Smith and Raven (2012) propose three main mechanisms for creating protective space for radical innovations in niches: shielding, nurturing and empowering. *Shielding* refers to processes of holding selection pressure at bay from the mainstream selection environments or regime selection pressures, so that radical innovation can be nurtured and further developed rather than being nipped in the bud. Examples of regime selection pressure include i) established industry structures, ii) dominant technologies and infrastructure as a material selection environment, iii) guiding principles and socio-cognitive processes anchored in an established knowledge base geared towards incremental innovation along the existing trajectory, iv) markets and dominant user practices, preferences, routines including price mechanisms, v) public policies, dominant political power, agenda and so on. Shielding can take passive or active forms. *Passive shielding* refers to searching (or waiting) for and exploiting opportunities or the generic spaces that

precede deliberate mobilisation. For instance, solar cell researchers in the 1970s drew on generic public support for material research (Knoppers & Verbong, 2001). Another example could be tapping into the environmentalist milieu, where users are more willing to pay a higher price for the environmental performance of a product despite poorer or fewer functionalities in conventional terms (Smith, 2007). *Active shielding* refers to deliberately and strategically creating and mobilising opportunities or spaces to hold off regime selection pressure. A typical example of active shielding is (lobbying for) technology policy intervention via tariffs or taxes to counteract cost differentials on the supply side, or via quotas or public procurement to alter preferences on the demand side of innovation. Incumbent firms establishing incubator units separated from the firm's daily operation is another example of active shielding (Smith & Raven, 2012).

Nurturing refers to processes that support the development of a radical innovation, which involves assisting interactive learning with regard to knowledge accumulation and critical reflections, articulating expectations, and building supportive networks around the innovation (Smith & Raven, 2012). In general, the main goal of nurturing is to develop a radical innovation in terms of technical performance, and to increase legitimacy and social acceptance beyond the initial niche actor communities.

Empowering refers to the processes of developing the competitiveness of a radical innovation to enable its increasingly widespread diffusion. This is achieved via 'fitting-and-conforming' or 'stretching-and-transforming' the selection environment dominant in the regime. A "fit-and-conform" approach focuses on improving the alignment of the innovation with the existing regime selection environment (Smith & Raven, 2012, p. 1030). It tends to render the innovation – despite being initially radical and path-breaking in nature – incremental in its socio-technical implications. In other words, although an innovation may be developed and widely adopted, it is dis-empowered in the sense of sustainability and regime transformation. On the other hand, a "stretch-and-transform" approach entails changing the mainstream selection environment and restructuring the existing regime (Smith & Raven, 2012, p. 1030). Drawing on Fuenfschilling and Truffer's (2014) conceptualisation of regime mentioned above, this 'stretch-and-transform' approach can be further elaborated as suggested in Paper 2 in this dissertation, where 'restructuring to instigate regime change' is conceptualised as *(re)shaping actors, institutions and materiality in the regime as well as fostering the alignment of these three elements towards a new rationality centred around a radically new technology*.

Despite Smith and Raven's (2012) initial intention to shed light on niche-building mechanisms for radical/path-breaking innovation, these three mechanisms of shielding, nurturing and empowering also provide valuable purchase for conceptualising the path-breaking innovation process, particularly if a researcher's interest is in the socio-technical contexts of the innovation process, or the interplay between institutional influence and the (strategic) responses of innovating actors as the innovation process unfolds. This opportunity is captured in Paper 4, where the radical/path-breaking innovation process is reconceptualised

as *a process constituted by three iterative and interconnected subprocesses of shielding, nurturing and empowering. These three subprocesses subsequently emerge and unfold over time, and they share temporal overlaps with each other on a timeline*. This reconceptualisation serves as an important building block for attending to the methodological gap addressed in this dissertation with regard to analysing institutional influence (i.e., the dynamic interplay between institutions and the behaviours of innovating actors) in the unfolding (path-breaking) innovation process.

2.5 Summary of theoretical background

Positioned in the interdisciplinary field of innovation studies, this dissertation aims to advance understanding of the strategies of incumbent firms in TMIs regarding managing contexts for innovation and renewal. While the internal environment or inner contexts of firms are not completely ignored, it is a firm's outer contexts and firm strategies that are the main focus of analysis. Since contexts have different forms (e.g., institutional, spatial, social, technological) and offer both opportunities and challenges to affect innovation and renewal processes, incumbent firms need to strategically manage different forms of contexts to create and exploit favourable conditions, while grappling with unfavourable ones. Extant research into incumbent behaviours with respect to innovation and renewal – clustering in four bodies of literature, namely the literature on strategic renewal, disruptive innovation, incumbent behaviours in sustainability transitions, and on industrial/regional innovation-based renewal – have provided us with very useful insights into how incumbents act and behave in relation to contexts. There is still ample room for advancing our knowledge of the subject, however, especially concerning incumbent firms in TMIs, which have been largely overlooked in recent innovation studies. More specifically, this dissertation seeks to make the following contributions:

1. *Theoretical aspect:*
   How and why incumbent firms in traditional manufacturing industries strategically manage *different forms of their outer contexts* in their innovation and renewal journeys?
   (This elaborates on the overarching research question of this dissertation.)

   Following an answer to the above question,
   1a) what can we learn and contribute to the debate on the 'co-alignment' vs. 'co-creation' views in the strategic renewal literature?

   1b) what can we learn and contribute to the debate on the role of incumbent firms in innovation and sustainability transitions?

2. *Empirical aspect:*

What is specific to firms in traditional manufacturing industries regarding managing contexts for innovation and renewal?

3. *Methodological aspect:*
   How can we systematically and rigorously analyse the interplay between institutional influence and the behaviours of innovating actors as the (path-breaking) innovation process unfolds?

To that end, this dissertation applies an analytical framework that is constructed by incorporating different yet highly relevant sets of notions for understanding the contexts and strategies deployed by incumbent firms in TMIs to manage contexts for innovation and renewal: i) strategic renewal as a duality of change and persistence, ii) engagement with contexts, iii) institutions, legitimacy and strategic responses, and iv) MLP and SNM (especially the concepts of 'shielding', 'nurturing' and 'empowering'). Next, I present the methodology employed in this dissertation.

3 Methodology

In order to present the methodology employed in this dissertation, I will first provide a description of my philosophical stance. I will then present the research design and methods for data collection and analysis.

3.1 Philosophical stance

Guba and Lincoln (1994) explain that ontology concerns one's worldview regarding the nature of reality and, therefore, what can be known about it; whereas epistemology concerns the nature of the relationship between the (would-be) knower and what can be known. Generally speaking, positivism and social constructionism represent two polar types of ontology. Critical realism lies somewhere in between these two ontologically polarised ends (Alvesson & Sköldberg, 2009). I consider myself a *critical realist* regarding ontological stance. I subscribe to the view that there is a reality that is independent of our minds and cognition. Reality to me is therefore more the *priori* and basis rather than the mere result of human cognition, which contrasts with the arguments of social constructionists. On the other hand, I do not subscribe to the positivistic view that reality is confined only to observables, nor do I agree that scientific knowledge is the objective representation of reality. Instead, I believe that all knowledge is to some extent fallible, and that theories are value-laden (Alvesson & Sköldberg, 2009; Sayer, 1992). Critical realist Bhaskar (1975) distinguishes between the 'intransitive' (i.e., the world theories are about) and 'transitive' (i.e., theories about the world) dimensions of knowledge. We may have different understandings and rival theories about the world. Regardless of how similar or different our understandings and theories are about the world, the world itself is, however, independent of our understandings and theories about it. Despite our theories about the world (transitive dimension) change, the world itself (intransitive dimension) does not necessarily change because our understanding of it changes (Sayer, 2000). For instance, the shape of the earth (intransitive dimension) did not change when we shifted from a theory of the earth being flat to a theory of the earth being round (transitive dimension). Similarly, gravity did not function differently before and after Galileo's Pisa tower experiment.

Social science is more complex, however, in the sense that social phenomena are to a large extent composed of and constructed by knowledgeable human agents who make interpretations and build knowledge. We therefore cannot deny that the social world exists with dependence on at least some human knowledge and understandings. However, this does not rule out the physical and material aspects of the social world, which cannot be conflated with our interpretation and understandings. The properties of the physical and material aspects of the social

world both enable and constrain our ability to understand, interpret and manoeuvre (Sayer, 2000). Meanwhile, the properties of the physical and material aspect of the social world can be leveraged and drawn on via human practices based on our interpretations and understandings of those properties. A critical realist ontology thus does not exclude an interpretive dimension of social science, while leaving room for causal explanations and generative mechanisms (Sayer, 2000). For Bhaskar, these mechanisms have the potential to function, but are not necessarily activated. Necessary condition(s) must be met for mechanisms to be activated and hence work. A critical realist ontology therefore recognises the possibility that causal powers exist but are unexercised, and if/when exercised are not observed (Bhaskar, 1975). According to Sayer (2000, p. 12), there are two implications of this: first, "what has happened or been known to have happened does not exhaust what could happen or have happened"; second, at a given point of time the structures and powers of objects constrain and enable what can happen, but do not pre-determine what will happen. For this reason, a critical realist ontology also acknowledges contingency and contextual/situational variation, while leaving room for human agency (Sayer, 2000; Van de Ven, 2007).

Bhaskar (1975) proposes viewing the world as stratified into three domains (i.e., the real, the actual and the empirical), although he is mostly concerned with nature science. Considering both social and natural science, Sayer (2000) helps clarify Bhaskar' three domains: the 'real' is whatever exists, be it natural or social, and refers to the structures and causal powers of objects that are unobservable. The 'actual' refers to the observable (although not necessarily observed) events that are caused by the unobservable structures and powers if/when they are activated. The 'empirical' refers to the domain of our experience of the events in the actual, caused by the structures and powers in the real when they are activated. In other words, the empirical is what we actually observe and experience. Sayer (2000) further explains that we may try to learn about the unobservable entities by reference to the observable effects which can only be explained as the product of such entities. Our explanation and knowledge are fallible, nevertheless. In other words, our empirical research may be able to capture our experience of the real and the actual, but it can never reach the real by definition. That is why we try our best and may still make mistakes, however, this should not stop us from seeking to advance knowledge. Judging whether our explanations are good/acceptable or not can be based on judgmental rationality, which means that we can publicly discuss our claims about reality as we think it is, and marshal convincing arguments supporting those claims (Easton, 2010).

Associating the above philosophical discussion with my dissertation, I consider that contexts have the power to enable or hinder the behaviours of incumbent firms (and firm managers) during the innovation and renewal processes, however, that power is to some extent contingent upon how firms and managers within the innovation and renewal processes manage those contextual enablers and barriers. In other words, in my opinion contexts may influence but not determine the behaviours of firms and managers. I therefore - at the empirical level - observed different contextual influences and the strategic behaviours of

actors in different innovation and renewal processes. Through analysis of the empirics I have observed, I strived to (at the actual level) abstract and theorise the causal mechanisms behind contextual influence and an incumbent firm's strategic actions towards contextual influence during the innovation and renewal processes. My quest to tease out the causal mechanisms is signalled clearly in the research question addressing 'how' and 'why' incumbent firms in TMIs strategically act in relation to contexts relevant to their innovation and renewal. My interpretation of causality "can only be justified in terms of their compatibility with our most reliable beliefs" (Sayer, 1992, p. 104). In other words, it is based on the theoretical background and analytical framework I adopt in this dissertation to understand the focal phenomenon. I strive to build convincing arguments to support my results and explanations through theoretical reasoning and the provision of empirical evidence. Despite that, I do not claim to generate universal knowledge about the phenomenon, rather, I generate pieces of concrete and context-dependent knowledge that add to a larger knowledge domain.

Alvesson and Sköldberg (2009, p. 43) describe a critical realist's research process as a process of "constant digging in the ontological depth of reality". This implies that for a critical realist, the goal of research is to come closer to an understanding of how causal mechanisms work. To that end, it is important to conduct abstract research, because it can prepare us to become more sensitive to the existence and workings of the causal mechanisms when making observations of empirical phenomenon. To accomplish this, I have undertaken in-depth theoretical discussion, both in the kappa and within each of the papers, addressing the identified knowledge gaps. I acknowledge that my theoretical (pre-) understandings have influenced what I saw and how I made sense of what I saw in the empirical field, however, this is in line with my critical realist ontological stance that knowledge is theory- and value-laden. While the presentation of the theoretical and thematic progression might appear to be linear, my dissertation journey has been filled with numerous iterations between my immersion in an array of literature and in the empirical materials – a diligent quest for an answer to my research question and the fulfilment of my research aim. In other words, my research process is actually a process of going back and forth between theory and data (i.e., iterating from abstractions to empirical observation and to further abstractions of new insights). This is sometimes referred to as 'retroduction' (Sayer, 2000) or 'abduction' (Alvesson & Sköldberg, 2009; Van de Ven, 2007).

3.2 Methods: Case studies, data sources and analysis

3.2.1 Case study research and case selection

We should make choices about research design primarily based on the research aim and questions (Silverman, 2015). Qualitative case study allows researchers to study a phenomenon occurring in rich and real-world contexts (Eisenhardt &

Graebner, 2007).According to Yin (2018: 2), case study is appropriate when the following three conditions are simultaneously met: 1) when the main research questions are 'how' and 'why' questions; 2) when the researcher has no or little control over behavioural events; and 3) when the focus of the research is a contemporary phenomenon. The aim of this dissertation is to advance understanding of the strategies of incumbent firms in TMIs to manage contexts for innovation and renewal. It thus involves a contemporary phenomenon in real world contexts that I have no control over given my role as a researcher outside incumbent firm's innovation and renewal processes. While addressing the 'how' in the overarching research question of this dissertation may come across as descriptive, addressing the 'why' signals my goal to seek explanations and go beyond descriptions. Furthermore, when viewing innovation and renewal as processes unfolding over time instead of snapshots or punctuated events, it is important to capture the longitudinal aspect of strategic actions taken by incumbent firms and the rationales behind their actions (Van de Ven et al., 1999). It is difficult to satisfy both a longitudinal requirement and the need to capture the richness of contexts in which an incumbent firm's actions occur with a large scale quantitative research design, because it is likely to curtail the contextual richness and nuances of explanations for which this dissertation strives (Siggelkow, 2007). Qualitative case studies are therefore considered an appropriate methodological approach to employ in this dissertation. This is also consistent with my critical realist ontology and with the 'intensive' research design as described by Sayer (2000).

Admittedly, this choice of intensive design and qualitative case studies has limitations in the sense that the findings from this dissertation cannot be generalised to the entire population of incumbent firms in TMIs. The limitations of the results will be critically considered and discussed towards the end of this dissertation. As argued above, however, the goal of enquiry and theorising is not aimed at statistical generalisation, but rather at the analytical transferability of the resulted nuanced explanations.

For a critical realist, "case studies as a research method… involves investigating one or a small number of social entities or situations about which data are collected using multiple sources of data and developing a holistic description through an iterative research process" (Easton, 2010, p. 119). While a single case study allows for in-depth investigation into the phenomenon under research, especially when it comes to understanding how the phenomenon unfolds over time, multiple case studies generally add complementary insights and strengthen the validity of results from a single case study (Yin, 2018). This is not to say the more cases the better, because there is an inherent trade-off between 'depth' and 'breadth' given the researcher's limited time, access and resources (Easton, 2010). I have therefore striven to draw on the advantages of both a single case study and multiple case studies, which has led me to make an eclectic choice regarding case study design in this dissertation: first, in each of the individual papers, I have employed a single case design to capture rich information and generate insights based on the corresponding research aim and question addressed

in the respective paper. Each individual paper addresses a different research gap, which in different ways help to advance understanding of the strategies of incumbent firms in TMIs to manage contexts for innovation and renewal (see Section 1.2 and Section 5). I then compile, juxtapose and synthesise the findings of the three empirical cases of five different incumbent firms operating in different TMIs, and search for similarities and differences in the patterns of the firms' strategic actions and for explanations of those patterns (Eisenhardt, 1989; Eisenhardt, 2021). This results in my answer to the research question (see Section 5.1).

There are concerns about case study research, especially regarding the generalisability of results. According to Easton (2010, p. 119), "case research allows the researcher the opportunity to tease out and disentangle a complex set of factors and relationships, albeit in one or a small number of instances." It is not the goal of this dissertation to provide results that are statistically generalisable, nor to generate theories that are universal or independent of contexts. The persuasion of case studies lies in their power to sharpen existing theoretical understandings by addressing gaps, challenging underlying assumptions in extant theoretical understandings, and providing empirical illustrations of abstract relationships and mechanisms suggested by the researcher concerning the focal phenomenon (Siggelkow, 2007). In this dissertation, the cases serve to address research gaps, to reveal novel insights unknown or unclear in our extant theoretical understandings, and to provide illustrative support to my extension and development of extant theoretical understandings (see Paper 1 - 4) and analytical method (see Paper 4).

Since the primary function of the empirical cases is to extend existing theoretical understandings and to illustrate abstract mechanisms, I have employed purposive sampling (Emmel, 2013) and an 'information-oriented selection' strategy (Flyvbjerg, 2006) to select cases. This means that cases are selected based on two principles: first, the case should display the theoretical characteristics of the phenomena of interest, and secondly the case is selected "on the basis of expectations about their information content", so as "to maximise the utility of information from small samples and single cases" (Flyvbjerg, 2006, p. 230). In practice, I have translated those two principles into these selection criteria: each case needs to 1) be about incumbent firm(s) operating in TMIs pursuing innovation and renewal, and 2) have potential to fill the corresponding research gaps identified and enhance the theoretical insights targeted in each of the papers of this dissertation.

For example, in order to advance understanding of how SME managers in a rural industrial setting engage with contexts of different forms in the course of the firm's strategic renewal characterised by deliberate change hinging on persistence, I selected the empirical case of Gnosjö Automatsvarvning's strategic renewal journey. This SME operates in the metal product manufacturing industry, and is located in the rural industrial district of Gnosjö in southern Sweden. This firm has undergone significant renewal in the last three decades. This fits with Criteria 1 above. The managers of the firm also make endeavours to deliberately

change some of the firm's attributes while persisting with others, despite different kinds of pressure and obstacles from the firm's contexts. This matches with the feature highlighted in my proposed reconceptualisation of strategic renewal as endeavours to deliberate change hinging on persistence. There are indications from a myriad of media archival articles that the managers explicitly connect to, leverage and shape the firm's outer contexts in the firm's strategic renewal journey. The availability of longitudinal data allowed their renewal journey to be tracked over time. I have also gained rich access to speaking with the firm's managers and observing on-site and in real-time some of their renewal-related activities. This helps me capture their action rationales, as well as complementing and triangulating with archival data. Despite a single case, it can thus be expected to provide rich information allowing the generation of useful insights to address the corresponding research gap.

Three empirical cases were selected for this dissertation: 1) the strategic renewal of Gnosjö Automatsvarvning, 2) the HYBRIT initiative championed by SSAB, LKAB and Vattenfall, and 3) EBPA's EV charger development (note, EBPA is a pseudonym of the case firm). Table 4 provides an overview of each of these three empirical cases.

After presenting and justifying qualitative case studies as the research design and principles for case selection in this dissertation, I present the methods of empirical data collection and analysis.

Table 4. Overview of the three empirical cases

Case 1: Strategic renewal of GAS
Industry: Metal product manufacturing
Investigated in Paper 1
Brief Introduction
GAS is a metal turning SME located in the rural industrial district in southern Sweden. It was founded in 1974 by Olle and Solweig Fransson. In 1988, the couple transferred 80% of the firm's shares to their teenage daughters Linda and Anna, who have served as the firm's CEO and vice CEO since 2012. The Fransson family has 100% ownership of the firm. Today, the top management team consists of the above four members of the Fransson family, and the production manager Jens and innovation consultant Mikael. The managers have continually made efforts to refresh and enhance the firm's core attributes, particularly ownership, competence and competitiveness, for the firm's survival and long-term prospects, however, they (especially the Fransson family) insist on keeping the ownership within the family, maintaining the firm's location in Gnosjö, retaining specialisation in metal turning, and not establishing branch office/facility nor acquiring other firms outside Gnosjö. The combination of deliberate change and persistence of the managers regarding the firm's attributes render certain contextual conditions relevant and challenging for the firm's renewal. These contextual conditions include the fierce price-based global competition dominant in the metal manufacturing industry, the outflow of and lack of inflow of human capital in the rural industrial district, local gender norm bias against female leadership, and wider societal bias against industrial jobs and education etc. The managers strategically connect to, leverage and shape the outer contexts of the firm, in order to achieve changes and persistence with the firm's attributes they intended, and ultimately to ensure the survival and long-term prospects of the firm. What were their contextual strategies for firm renewal over the years and why such strategies? This is examined in the case study covering the period from 1988 to 2019.

Case 2: HYBRIT
Industry: Steel production (primarily); mining, and energy production
Investigated in Paper 2 and Paper 4
Brief Introduction
HYBRIT ('Hydrogen-breakthrough-iron-making technology') is a radical process innovation project initiated by the large Swedish steel-making firm SSAB in 2015. Early in 2016, the mining firm LKAB and energy firm Vattenfall (both are large firms owned by the Swedish state) joined this project. These three firms established a new venture called 'Hybrit Development AB' in 2016, wherein they pooled resources, competences and power to develop this radical innovation. The innovation is considered radical for at least two reasons: 1) it uses hydrogen in the reduction process when making steel from iron ore (i.e., the so-called 'HDR' technology), replacing the coke-based reduction technology that has dominated the steel sector for centuries; 2) the residue of the HDR process is water instead of carbon dioxide, which means it could contribute to almost emission-free steel production and hence to reducing carbon emissions from the 'hard-to-decarbonised' steel and energy sectors (11% is caused by the steel sector in Sweden, and SSAB was responsible for most of it). Although HDR was proven feasible at laboratory scale, it is a tremendous challenge to realise at industrial scale. Normally, switching to radical technology entails stranding expensive assets and rendering existing competences obsolete for the involved firms. It may also entail disrupting the power of incumbents in the sectors. Generally, incumbents tend to benefit from and defend the status quo. This is not so for the three firms championing HYBRIT. Not only did they reorient and collaborate towards this radical innovation journey, they also proactively worked to change the status quo of the steel sector (and to some extent the energy sector), in Sweden, the EU and globally. How and why they did so in the socio-technical contexts underpinned by institutions is examined in the empirical inquiry covering the period of 2013-2020.

Case 3: EBPA's EV charger development
Industry: Electrical product manufacturing
Investigated in Paper 3
Brief Introduction
EPBA was established in the 1920s as a metal product manufacturing firm in Sweden. Over the years, the firm has diversified into the electrical product manufacturing industry, which is where the firm mainly operates today. In the 1990s the firm developed a product for heating the combustion engines of cars, and this product later became the cash-cow product for the firm. Combustion engine heating unit now has a dominant design, as it has become a rather mature product. In 2007, EPBA's top-management started to seek a new product area in which they could innovate and secure the firm's long-term future. They particularly sought to innovate environmentally friendly products and in nascent areas. The ideation period led to their deciding to develop the electric vehicle (EV) charger in 2008, although there was little market for EV and EV chargers at the time. Given EPBA's vested interest in combustion engine heating units, it is surprising that they decided to develop EV chargers which would cannibalise their former 'cash cow'. In so doing, EPBA reoriented themselves to enter the EV niche and embarked on a new development trajectory. Today, the EV charger has become the new 'cash cow' for the firm. EPBA was relatively small back in 2007, subject to resource constraints and limited power in the industry hierarchy. A special feature of this firm is that they already straddled multiple industries in 2007, operating in the electrical product manufacturing industry, with products consuming electricity from the energy sector, and supplying their product to the automotive industry (where the EV niche emerged). During EPBA's innovation-based renewal journey, they encountered many enablers and barriers in the institutional context underpinning the socio-technical one. These institutional elements encompass regulative (e.g., policy, technical standards), normative (societal norms) and cognitive (shared perceptions) rules that EPBA strategically navigated despite resource and power constraints. How and why did they do so? This is the focus of the empirical investigation covering the period from 2007 to 2018.

3.2.2 Data sources and analysis

Case studies allows flexibility for data collections. They involve collecting data from different sources which is helpful for data triangulation (Easton, 2010; Yin, 2018). I mainly used interviews, archival data, and on-site observations, and collected documents from the case firms and other online sources for this dissertation. The data collected is longitudinal, because I see innovation and renewal as processes unfolding over time (Van de Ven et al., 1999), and I have focused on studying the strategic actions of incumbent firms to manage contexts as the innovation and renewal processes unfold. In this section, I first elaborate on the different data sources, before presenting the methods of data analysis. Table 5 (at the end of this subsection) provides an overview of the data sources and methods of analysis for the three empirical cases. Please refer to the appendices attached at the end of the corresponding papers in this dissertation for details of each data source used for each of the three cases.

Data sources

Interviews

Interviews are an efficient way to acquire information about 'what/why contexts matter', 'what actions have been taken or will be taken' and 'why took or plan to take those actions' directly from the informants. Interviews also allow for in depth probing into the rationales, perceptions and views of the informants, something which is hard to achieve with other data collection methods (Silverman, 2013). Semi-structured interviews were conducted for all three case studies. The semi-structured interview design enables open-ended questions based on my specific research aim and research question, while leaving sufficient room for the informants to provide relevant yet unexpected information. Interview guides were designed in line with the research aims to facilitate the semi-structured interviews for each of the three cases, and customised based on the roles of the informants in relation to the focal firm's innovation and renewal processes. Unstructured interviews were also conducted for two of the three case studies when, for example, identifying potential incumbent firms to study, holding informal conversations (e.g., chatting over long coffee breaks), and when the informants were moving around and so on. These unstructured interviews allowed me to capture unplanned opportunities to speak and acquire information from the informants that was relevant for understanding the cases, including asking follow-up questions based on previous interviews.

The selection of interview informants was primarily based on their centrality to the incumbent firm's innovation and renewal processes. By centrality, I mean that the informants play important roles and/or are knowledgeable about 1) the innovation and renewal processes of the focal firms, and 2) contexts that are relevant for the innovation and renewal processes. The main types of interview informant include the focal firms' CEOs, owner-managers, research and

development/technology managers, key consultants, policymakers and representatives from funding providers, customers, and CEOs and managers from rivalry firms. An additional informant was a valuable 'door opener' who helped me establish initial access to several firms in a municipality where she had served as business developer for over 20 years. This additional informant also took part in several individual unstructured interviews and a group interview, where she acted as a 'knowledgeable outsider', serving as a great source of triangulation with other informants inside the case firms.

'Snowball sampling' was used as the main method of identifying interview informants while adhering to the 'centrality principle' mentioned above. This means that interview informants were asked to recommend other informants who they felt played key roles and/or were knowledgeable about the focal firm's innovation and renewal processes, and/or relevant contexts for further interviews. In addition, I have also identified interview informants through archival data, document studies and online information sources. The resulting list of informants is thus balanced between informant recommendations and identifications from document and online data searches, avoiding bias selection where informants only represent one view and merely confirm each other. Interviewing different informants on the same case allowed for complementing and triangulating different views across the different informants. Whenever possible, I interviewed the same informants more than once in order to ask follow-up questions and obtain updates on the focal firm's innovation and renewal processes (including new actions taken/planned regarding manging contexts), and to triangulate their accounts with similar questions from previous interviews with them.

In total, 58 interviews were conducted for the three case studies, with an average of 60 minutes per interview. Most of the interviews were conducted on a one-on-one basis between myself (and/or my co-author) and the informant. For the second case study (Gnosjö Automatsvarvning's strategic renewal journey), several group interviews were conducted in which key informants from the firm and a few knowledgeable outsiders participated to provide both individual and collective views on the firm's renewal journey and contexts. Of the 58 interviews, I participated in 42 (21 interviews for Case One, 8 interviews for Case Two, and 13 interviews for Case Three). For Case Two (HYBRIT), 16 interviews were conducted by my coauthor in 2018, we both participated in six of the eight interviews in 2020 and I undertook the remaining two of the eight interviews in 2019 and 2020. The interviews were recorded only with the consent of the informants, which was mostly given. On occasions without informant consent, the interviews were not recorded but extensive notes were written down either during or directly after the interviews. All interview informants were provided information about the research projects prior to the interviews, about my role as a PhD candidate researcher, and about the main purpose and themes of questions for the specific interview. They were given the opportunity to opt out of interviews if they decided to do so. Due to the sensitive information of the third case (EPBA's EV charger development), all interview informants were anonymised and the case study firm was also given a pseudonym. The interview

informants in Case Two (HYBRIT) were also anonymised (unless the data was from archival media sources), although it was decided unnecessary to anonymise the three case firms and the innovation initiative since they have relatively high profiles in media coverage.

Archival data

Archives are useful for collecting longitudinal data while offering almost real-time accounts of what happened long ago in the past. Archival data is therefore a significant source in my dataset for this dissertation. I have used two main channels to collect archival data: 1) the "Retriever Mediearkievet" database, and 2) newsletters and press releases available on the websites of the case firms. The "Retriever Mediearkievet" database is the Nordic region's largest digital news archive. It provides articles and news reports from major Swedish newspapers, rural newspapers, and hundreds of business and industrial magazines through keywords. The articles are available on the database the same day they are released. This database was suitable because the case firms included in this dissertation are all Swedish firms. The limitation of using this database to retrieve information related to the case firms' innovation and renewal journeys is that the innovation and renewal journeys must be high profile enough to attract media attention, and/or the representatives from the case firms must be outspoken in the media about their views and activities. The results retrieved from this database were therefore primarily useful for understanding two of the three cases in this dissertation, the Gnosjö Automatsvarvning case and the HYBRIT case. I tried using different keywords when using this database to retrieve articles. In the end, I found that using the name of the case firms and/or the name of the innovation initiative as keywords was most effective in retrieving articles relevant to the aim of this dissertation. The articles retrieved not only documented the views and activities of the case firms (especially top-management and staff involved in the firm's innovation and renewal journeys), but also the views and activities of a wide range of actors outside the firms, which significantly helped me understand the contexts and the case firm's strategic actions to manage those contexts. The information collected from different media sources and various views from different actors have also been highly valuable for complementary and triangulation purposes.

In summary, I collected over 1600 pieces of archival reports, newsletters and press releases about the innovation and renewal journeys of the case firms through the two archive channels. I used archival data to track what had happened in the case firm's innovation and renewal journeys over time, as well as the contexts. I also used that data to identify critical events, and subsequently asked interview informants about those critical events during interviews. This was helpful in obtaining detailed descriptions about the firm's activities and contexts, and in minimising the risk of informants giving general accounts or (un)wittingly following scripted information (Ma, Seidl, & McNulty, 2021).

On-site observations

In order to see with my own eyes and capture the case firms (including firm managers) taking strategic actions to manage contexts for their innovation and renewal, I conducted on-site observations whenever possible. In total, I conducted 22.5 hours of on-site observations. These on-site observations cover Gnosjö Automatsvavring's strategic renewal journey (15 hours) and EBPA's EV charger development (7.5 hours). Examples of on-site observations include the managers on-stage debate with politicians lobbying for policy changes, innovation strategy meetings with stakeholders within and outside the case firm, an education seminar hosted by the case firm, and so on. Observations also include factory visits to the case firms through which I gained more knowledge about the firm's operations and development history. Field notes were taken during or immediately after on-site observation, documenting what I saw and heard, and my immediate reflections.

Documents and other online sources

I collected a wide range of documents and information through visits to the case firms and from available sources online. These include product brochures, firm meeting power-point slides, industry reports, whitepapers from branch/interest organisations lobbying for policy change, government and EU policy documents, tweets from the incumbent firm's tweeters and Linked-in accounts, press meetings and debates with politicians hosted by the case firms, and statistics about the case firm's development from the Amadeus Database. Most of these documents and online data were helpful in understanding the contexts relevant to the incumbent firm's innovation and renewal journeys. Some (e.g., tweets, online press meetings, online debates) even provided real-time information about how the case firms (including managers) tried to influence their contexts for innovation and renewal.

One could indeed question why alternative methods such as ethnography or surveys were not used for data collection. Ethnography can be helpful to capture contexts and a firm's strategic actions to manage contexts in real time, and thus to eliminate retrospective bias from informants. However, the commencement of the case firm's innovation and renewal journeys date back more than a decade ago, which makes ethnography impossible. The dispersed geographical locations at which the different case firms undertake activities associated with innovation and renewal also makes ethnography unfeasible for a single researcher. This is why ethnography was not employed. Whenever possible, however, I conducted real-time onsite observations and used archival media data and real-time online sources to capture events as close to real-time as possible. Surveys were not used for data collection for at least three reasons. First, it does not help to capture the longitudinal aspect of a case firm's innovation and renewal journeys some of which span over a decade. Secondly, it restricts the freedom of informants to describe in detail the contexts, strategic actions and action rationales for managing contexts. Thirdly, it does not allow the researcher to directly probe further into interesting information provided by the informants. Given the need to obtain

contextual richness and nuanced explanations of firm strategies, survey was not employed.

In short, the dataset for this dissertation is very rich and consists of primary and secondary data collected through diverse sources. This has allowed me to gain an in-depth understanding of the empirical cases in line with the research aim and the research question. It has also allowed me to complement and cross-check information from the different sources and accounts.

Data analysis

The activities I undertook for data analysis consisted of *transcribing interviews*, *sorting out field notes*, *writing case chronologies and narratives* and *coding empirical data to find themes* pertaining to the strategic actions taken (and intend to be taken) by incumbent firms to manage contexts.

All recorded interviews were transcribed standard-verbatim. The interview data used for coding comprised interview transcriptions and interview notes. I went back to listen to the interview recordings at least once to make sure no major information was missed, and to discern the tones and consider whether there were implied meanings between the lines from the interview informants. This was important in order for me to better understand the information and meanings provided by the informants, which may not be directly captured in interview transcription.

I conducted longitudinal analysis for each of the three cases. I used archival data and interviews as the main sources to construct the chronologies of the innovation and renewal processes. This was combined with writing narratives about the empirical case: how the respective innovation and renewal process unfolds over time, what contexts matter and how they matter in terms of enabling and/or hindering the innovation and renewal process, what actions the case firm (including firm managers) take or intend to take to deal with contextual enablers and barriers, and why they did things in the ways they did. Other sources of data were also used to complement the interview and archival data for chronology construction and narrative writing. Field notes were sorted based on cases and incorporated into the case chronologies and narratives. I started by constructing chronologies and writing case narratives alongside and after data collection. Both the chronologies and narratives were refined as I collected more data and gained a deeper understanding of the cases. Condensed versions of the case chronologies and narratives were used to present the empirical cases in the papers of this dissertation.

I coded the empirical materials both alongside and after data collection, although the majority of coding was conducted after data collection. The coding process and the process of chronology construction and case narrative writing thus sometimes overlapped in time. This helped me to see what types of actions and what forms of context were particularly salient at what points of the innovation and renewal processes. Before I started coding any of the material, I read through it once to familiarise myself with the data to ensure I had at least a basic

understanding of the content of the material. This was important in order to avoid mechanical and un-reflexive coding without contextual understanding. It also helped me to sort out which pieces of material were particularly important for the research aim and thus needed to be coded in greater detail versus pieces that were less relevant and thus not given as much attention. The empirical data was coded for all three cases either according to pre-defined theoretical codes or 'in vivo' based on emerging themes found during the coding process. The main goal of coding is to identify themes (Ryan & Bernard, 2003) pertaining to 1) contextual enablers and barriers to the case firm's innovation and renewal processes, 2) the activities and actions taken (intend to be taken) by the case firms (including firm managers) during the innovation and renewal processes, and 3) which of the actions were aimed at managing contexts and why. I ultimately sought causal mechanisms and in-depth understandings of the empirical phenomenon. Coding was conducted using Excel Spreadsheets for the case of Gnosjö Automatsvarvning's strategic renewal journey and that of EBPA's EV charger development. The data analysis software NVivo was used for coding for the HYBRIT case. More detail accounts of the coding process for each case can be found in the four papers of this dissertation.

While acknowledging innovation and renewal as interactive processes which may involve different types of actors (e.g., firms, universities, government agencies etc.) from business and innovation systems (Kline & Rosenberg, 1986), this dissertation focuses on the strategic behaviours of incumbent firms in the processes of innovation and renewal. Those incumbent firms are the ones which initiate, invest, involve, and have the highest stake in the innovations and their own renewal. The information on other actors is included in this dissertation, and regarded as part of the contexts that incumbent firms deal with during the course of innovation and renewal.

After this extensive elaboration of the research methodology, I now present a summary of the empirical findings.

Table 5. Data sources and analysis methods of empirical cases

Case	Primary data source(s)	Complementary data source(s)	Methods	Units of analysis	Paper
Strategic renewal of GAS	• Media archival articles (418 pieces); • 21 interviews (avg. 55 mins/interview); • On-site observation (over 15 hours)	• Firm's internal documents (e.g., situation analysis report); • Publicly available data from Amadeus database and other online sources	Single case design (analysis on one firm); Longitudinal analysis and identifying themes	Renewal activities & process; managers' actions in and towards contexts; Firm attributes targeted for change and persistence	Paper 1
HYBRIT	• 24 interviews (average 60 mins/interview); • Media archival articles (over 1200 pieces)	• Publicly available data collected online (e.g., firm annual reports, press-release, tweets, online conferences etc.)	Single case design (analysis on three firms); Longitudinal analysis and identifying themes	Motivations for reorientation; Innovation barriers; Regime (socio-technical configuration); Institutional context; Firm actions; Innovation process	Paper 2 and Paper 4
EBPA's EV charger development	• 13 interviews (average 60 mins/interview)	• On-site observations (7.5 hours); • Firm documents (e.g., archived product brochures, presentations etc.); • Publicly available documents (e.g., industry reports, EU policy documents).	Single case design (analysis on one firm); Longitudinal analysis (with multilevel focus) and identifying themes	Innovation process; Institutional context (enablers & barriers) encompassing three socio-technical regimes; Firm actions towards institutional enablers and barriers	Paper 3

4 Summary of empirical findings

In this section, I present a summary of empirical findings from the three cases in light of the overarching research question of the dissertation (i.e., how and why incumbent firms in traditional manufacturing industries strategically manage contexts in their innovation and renewal journeys).

4.1 The case of Gnosjö Automatsvarvning

When examining the strategic renewal journey of Gnosjö Automatsvarvning (GAS), I found that this metal turning SME's managers undertook various innovation and change initiatives. Their innovation projects encompassed technological, production process, and organisational innovations. These innovations reflect the managers' endeavours to primarily make changes to three attributes of the firm: family ownership succession, competence and competitiveness. The owning family's strong desire to maintain the firm's ownership within the family, to keep the firm in the rural industrial district of Gnosjö, to remain in the industrial specialisation of metal turning and to retain an organic growth mode, means that the firm's strategic renewal is characterised by strong persistence with regards to those attributes that the owner-managers are determined to keep intact. When GAS managers made efforts to innovate, enact ownership succession, and refresh and enhance the competence and competitiveness of the firm, they therefore did not compromise on what they wanted to persist with no matter how difficult it was and would be for them. In other words, the GAS strategic renewal process is characterised by the managers' simultaneous endeavours to deliberately persist with some firm attributes while changing others for the purpose of securing the firm's long-term survival and prospects.

The contemporaneous pursuits of deliberate persistence and change at the firm level were challenging and rife with tensions, due to several external contextual conditions that were local-district based, network based, or societal-rule based. The managers acted strategically outside the firm in order to resolve those tensions and secure the firm's survival and long-term prospects. Their contextual strategies are conceptualised as 'defying-' and 'changing hindering institutions', 'creating local support infrastructure' and 'leveraging enablers to reach wider networks'.

Ownership renewal was problematic when the first generation of owner(-managers) transferred 80% of the firm's share to their two daughters and when the daughters later took over as the firm's CEO and vice CEO. They encountered many doubting and opposing voices in the local district of Gnosjö because there was an entrenched gender bias against females being business leaders. Since the

owner-managers were determined to keep the firm in the district rather than relocating it, they openly disagreed with and challenged the rationality of those local opposing voices. The mother Solweig and her daughter and CEO Linda, voluntarily participated in several formal and informal initiatives to change the local gender bias. For instance, they accepted invitations from the Swedish enterprise ministers to serve as female-leader ambassadors to give talks in local schools and to mentor other female entrepreneurs in order to make female leadership in business more acceptable and legitimate in the district. In return, they gained legitimacy as female leaders of GAS.

The firm faced tremendous challenges in terms of refreshing and enhancing their competence, because the rural district suffered from a human capital outflow and lack of inflow, and the local inhabitants were generally educated below higher-education level. The managers lamented the difficulty of recruiting the competent workers they need to grow and secure the firm's future. If the firm had been located or had a branch in another place, such as within or adjacent to a big urban city like Gothenburg, it would have been easier to recruit competent workforce. Alternatively, they could have acquired another small firm to enhance their own competence. These were not options, however, because the (owner-) managers insisted on the firm's location and organic growth mode. What aggravated the difficulty of recruiting competence was the societal bias against industrial jobs and education prevalent in Swedish society, where people associated jobs and education in TMIs with words such as 'dirty', 'boring', 'blue collar', 'low social status' and 'for those who cannot make it to universities'. There were thus few people willing to take industrial programs in high schools, which led to a severe lack in the supply of competence for firms like GAS operating in TMIs.

The managers were very concerned about the deficit in the supply of competence and proactively worked outside the firm to instigate changes. They invested their own time heavily and directed the firm's resources to deal with the challenges. For instance, the CEO, Linda, took the initiative to gather 30 local firms to sponsor the establishment of a high school in the Gnosjö district to increase the supply of competence to the local firms, including GAS. She also participated in numerous network meetings and activities both inside and outside the district to raise awareness and call for collective efforts to change societal bias against industrial jobs and education. For the same purpose, she repeatedly appeared in national radio interviews and newspaper debate articles wherein she lobbied for changes in national education policy in a direction that would mitigate the lacking supply of competence for industrial firms. In 2019, the management of GAS decided to invest one million Swedish kronor in developing a virtual reality game and launching it at the large international gaming event Dreamhack. This was to showcase to youths and digital talents that working in an industrial firm such as GAS was fun, knowledge-intensive, and full of career advancement opportunities. The managers participated in diverse knowledge networks outside the district regarding (radical) production process innovation to tap into various cutting-edge competences not available in the firm or the local district. For

instance, when they wanted to test the idea of replacing mineral oil with vegetable oil in the production process for sustainability purposes, they leveraged the knowledge and advanced equipment of actors in their network, such as national research institutes, and universities in Gothenburg and Stockholm, by committing to joint research projects.

To enhance competitiveness while retaining a specialisation in metal turning and running the firm in a high-cost country like Sweden was also not an easy task. Globalisation meant that subcontractor firms like GAS in the metal processing industry generally faced fierce price-based competition, and there was a general expectation from large customers that such firms should follow customers by relocating production facilities to low-cost countries. Offering low prices and relocating facilities seemed to have become the norm for many metal processing firms in Sweden. Instead of following norms and expectations, GAS managers openly defied the need to do so. They leveraged the district's reputation (i.e., 'the Gnosjö Spirit') of people being entrepreneurial, and subcontractor firms being good at solving problems for customers, and were able to reach and attract many representatives from (potential) customer firms from Sweden and abroad to come and visit GAS to explore business opportunities. Some of their visitors included high-level Swedish politicians and even the Swedish Prince, which helped to draw public attention to GAS and augment GAS's image as an excellent subcontractor. Furthermore, GAS managers gathered local actors to create supporting organisations through which they could collectively pool resources and legitimacy to apply for international quality certifications, for public funding for innovation initiatives and to forge collective competitiveness. In 2019, the GAS managers invested three million Swedish kronor in an initiative called 'MakerSquare', in which they aimed to enhance the collective competitiveness of the local firms against rivalries in low-cost countries on the one hand, and to break the entrenched practice of purchasers of the customer firms who relentlessly pressing subcontractors on price. Instead, they aimed to switch the communication touchpoint from purchasers to product designers with whom they could focus on added value rather than low price.

In short, the managers of GAS used four contextual strategies to resolve tensions between contexts and their contemporaneous pursuit of persistence and change during the firm's strategic renewal.

This case reveals the contextual strategies used by an established SME or supplier firm during a strategic renewal journey consisting of many innovation processes. The following two cases focus on the specific innovation processes associated with the renewal of firms, and further uncovers firm strategies when managing multiple forms of contexts.

4.2 The case of HYBRIT

Contrasting with general expectations that mining, steel and energy firms are some of the most inert and polluting actors, the case of HYBRIT shows how the three Swedish incumbents LKAB, SSAB and Vattenfall collaborated to reorient themselves with a radical and sustainable process innovation for steelmaking. They encountered barriers and enablers during their ongoing innovation journey, that they dealt with strategically, and concurrently drove large-scale changes in their industries and beyond.

While these firms had been exploring alternative technologies that help in reducing carbon emissions for over a decade, alongside the increasing regulatory and social pressures of doing so, it was the material endowments in their specific location in northern Sweden, and the firm's core fixed-assets (especially SSAB's blast furnace in the Oxelösund facility) reaching the end of lifecycle and in need of replacement that motivated their reorientation with HYBRIT. On the one hand, tightening climate regulations after the Paris agreement and Sweden's ambitious climate goal threatened the legitimacy of LKAB's and SSAB's continuous operation in Sweden, because they were two of the largest greenhouse gas emitters in the country. As these firms wanted to maintain operations in Sweden, they were highly motivated to develop and reorient themselves with alternative and clean technologies in production. Compared to the other emission reduction technologies that SSAB had been exploring, the HYBRIT technology appeared to be the most effective as it basically replaced coke and coal in the steel production process. In order to realise HYBRIT's potential for making fossil-free steel, the energy used for hydrogen and steel production also need to be fossil-free. Northern Sweden offers material and spatial advantages for the three firms to gather together and develop HYBRIT on an industrial scale. Northern Sweden not only had iron ore mines and sufficient hydro- and wind energy supply, but it also had the three mining, steel and energy firms located proximate to each other. LKAB and SSAB had frequent collaborations, historically. These unique spatial advantages gave the three firms a competitive edge in terms of developing HYBRIT together.

Stranding core fixed assets ran counter to the investment logic of capital goods and scale-intensive firms like SSAB, LKAB and Vatternfall, however, such assets had their lifecycles and needed to be replaced when they reached the end of their lifecycles. One of SSAB's largest fixed assets - a blast furnace in the Oxelösund facility – would reach the end of its lifecycle in 2025. SSAB realised that they would not need to strand expensive assets if they replaced the blast furnace with an electric-arc furnace. The timing thus offered a great window of opportunity for them to switch away from coke-based steel production from iron-ore, and to pursue HYBRIT beyond lab-scale. LKAB faced similar situations regarding their pellet production facilities. Although the firms will replace those core assets stepwise in the years to come, the pace of the their reorientation towards clean technologies has accelerated. The firms aimed to create future competitive

advantages based on sustainable technologies through the joint venture of HYBRIT.

During their collaborated innovation journey, the firms encountered opportunities and also enormous challenges. In terms of financing such a costly initiative, they gained help from national steel association Jernkorntoret when applying for public funding, and eventually obtained public funding from the Swedish Energy Agency covering 25% of the developing cost of HYBRIT for the pilot phase, while the three firms shouldered the remaining 75% of the cost equally. The firms also tried to tap into EU-level funding by leveraging their connections with the Swedish government to enhance legitimacy. One crucial factor for HYBRIT was the supply of hydrogen, which was insufficient due to the limited number of hydrogen producers. While Vattenfall took on the task of building hydrogen production facilities, the three firms also urged other hydrogen producers to ramp up production. HYBRIT meant that actors such as hydrogen producers and the Swedish Energy Agency, which were previously unrelated to the steel sector, now became an important part of the actor-network, while coke and coal suppliers became less important, at least for these three firms. At the global scale, the three firms participated in the formation of a leadership group ('Leadit') with the Swedish and Indian governments and industrial firms after the United Nation's climate summit in 2019, with the aim of accelerating industrial transitions towards a fossil-free future. The efforts of the three firms in shaping actor networks thus went beyond national and sectoral boundaries.

Another crucial factor for HYBRIT is the supply of an enormous amount of clean energy. The substantial enhancement and building of electricity grids was necessary to secure the transmission of clean electricity. The lengthy permitting process in Sweden for physical infrastructure building seemed to stand in the way. The usual 8-10 years' time of permitting process, and the complicated rules and regulatory procedures for permitting threatened the pace of developing HYBRIT according to the time plan. The three firms repeatedly raised their concerns in the media and policy debates, urging the Swedish government and related authorities to simplify permitting rules and procedures, and to significantly shorten the time required for the permitting process. Partly due to competitive pressure, the three firms decided to accelerate the HYBRIT time plan by three years and argued that rules and stakeholders should give way to HYBRIT despite their respective concerns and priorities. They connected the firm-level innovation initiative with the national image of Sweden to press for timely regulatory change, as they contended that permitting regulations and processes could potentially cause Sweden to lose its reputation as a global innovation leader and frontrunner transitioning to a carbon-neutral economy.

On the demand side of innovation, the three firms strove to change and foster the alignment of various rules to support HYBRIT. One major set of rules they targeted were the carbon-price level and benchmarking criteria within the EU ETS framework. They prominently contended that the current low carbon-price level and exclusion of LKAB's sustainable pellets when setting benchmarking criteria suggested that the EU were overcompensating polluting firms such as SSAB's

rivals, which used the dominant coke-based technology in steel production. If the EU carbon price level was significantly increased and the benchmarking rules tightened, it would mean much higher costs for HYBRIT's rivals, and therefore even out the price difference between fossil steel and HYBRIT steel (which was expected to be 20-30% more expensive). In other words, it would make HYBRIT steel more competitive in the steel sector where the basis of competition was largely based on price (and quality).

In order to encourage market acceptance, the three firms actively participated in developing a life-cycle analysis of the carbon footprint of steel products, and in pushing for green labelling on steel products. In doing so, they aimed to alter the selection criteria from simply price- and quality-based to including and even prioritising considerations of the carbon footprint. Only when end consumers were aware and willing to pay for products made from fossil-free steel would it entrain the upper part of the value chain to accept HYBRIT steel. While SSAB was initially somewhat passive in terms of directly influencing the purchasing norms of their business-to-business customers, they later became much more proactive, such as establishing an agreement with the Swedish automaker Volvo to develop the world's first car using fossil-free HYBRIT steel. The three firms also prominently advocated for public procurement to create demand for HYBRIT steel.

In summary, the reorientation of the three incumbents through HYBRIT was motivated not only by regulative and social pressures, but also by the firms' desires to maintain operations in Sweden and to create future competitive advantages by leveraging the unique conditions of material endowment in northern Sweden, and by taking advantage of good timing when their core-fixed assets reached the end of their lifecycle. During their ongoing innovation journey, the firms shaped and fostered the alignment of actors, materiality and rules in their sector(s) and beyond towards a rationality that supported their novel technology in the making. In the meantime, they also intentionally encouraged the removal of support for HYBRIT's rivals whose steel production relied on the dominant coke-based technology. In doing so, the three incumbents contributed to accelerating industrial transformation associated with sustainability transitions.

4.3 The case of EPBA

The incumbent EPBA differed from the three large and lead firms in the HYBRIT case in the sense that EPBA was a less powerful and resource-equipped SME supplier. EPBA was also involved in three different industries: it primarily operated in the electrical product manufacturing industry, it supplied products to the automotive industry, and its products consumed electricity from the energy sector. This cross-sectoral involvement provided EPBA with opportunities and challenges during their innovation journey of developing electrical vehicle (EV) charger.

Compared to the regulative and social pressures experienced by the three HYBRIT incumbents, EPBA's reorientation from the combustion engine car heater to EV charger was motivated primarily by the management's aspirations to enter a nascent field and to develop an environmentally friendly product that could bring competitive advantage to the firm in the long term. With such aspirations, the management searched for opportunities in their contexts around 2007. Their multi-sector involvement sensitised them to information in specific areas. They soon focused on the EV niche in the automotive industry, as they observed that tightening climate policies in the EU and Sweden were pressuring automakers to produce low-emission vehicles, and that the general perceptions of the technological and economic feasibility of EV had changed in a positive direction. They then found a connection with their own knowledge and competence accumulated from decades of success in developing and manufacturing combustion engine heating units, and decided to develop an EV charger, even though the EV niche had little market acceptance at the time.

EPBA took a meticulous step to spend just enough resources to make a prototype of EV charger and launched it at the international electrical product manufacturing exhibition 'El-Fack'. The main purpose of this was to send a signal to other actors in the industry regarding EPBA's future trajectory, and to show EPBA's technological capabilities in the nascent niche of EV. In the meantime, EPBA actively sought collaboration with lead customers. Their involvement in the energy regime helped them to establish partnership with the large energy firm 'Fortum', which expressed its ambition and had also made significant investments in promoting the EV niche in Sweden. EPBA received financial and business foresight support from Fortum through this partnership, when developing the prototype. They also gained wide attention through Fortum's TV commercial showing EPBA's prototype. With Fortum as their first customer, EPBA became supplier to EV demonstration programs in several large Swedish cities funded by the Swedish government. The innovation of the EV charger was thus largely shielded and protected from the lack of a mature market. In parallel, EPBA was able to build legitimacy for itself as an innovative firm moving into the nascent EV niche.

In addition to efforts to build legitimacy for the firm, EPBA intentionally forged legitimacy for their innovative product of EV charger. When developing the prototype, EPBA drew on a symbolic design to make the prototype appealing to the general public. They made the prototype look like a green plant, evoking an association with sustainability and friendliness to the natural environment. Such an aesthetic and meaning-infused design was important for a nascent product that would be introduced as public infrastructure, and the design gained public acceptance. Their prototype was rewarded with a design prize in 2009, confirming the firm's efforts to forge legitimacy for their product. As the EV niche has become increasingly mature since 2007, expectations for the EV charger changed from a focus on aesthetics to a focus on function and large-volume production. EPBA thus adjusted their product design to make it look robust and industrial in

line with changes in expectations, in order to foster wider acceptance and diffusion.

The other side of the coin when building legitimacy is to combat forces that can delegitimise a product or a firm. During the prototype launch episode, EPBA was concerned about the Swedish energy policy discussion: there were strong voices about closing down several nuclear power plants and the hydro power plants that supplied a large share of clean electricity in Sweden. However, there was no clear plan discussed regarding alternative solution of clean energy supply to meet demand in the long term. EPBA's management was concerned that if energy firms resorted to importing brown coal from abroad to meet energy demand, it would then make charging EV with unclean energy an unsustainable and illegitimate option. Agitated by this potential threat, EPBA's CEO prominently raised his concern and urged policymakers to come up with a long-term and sustainable solution. Fast forward to EPBA's EV charger diffusion episode, their rivals from Germany advocated a strict mechanical protection requirement to be included in the EV charger installation standard on an EU scale. If this was realised, it would mean that EPBA could not obtain CE-marking and sell their EV charger widely in the European market without substantially altering their product design, which would be very costly. To neutralise this threat, EPBA joined forces with their competitors and with standardisation experts in Sweden. Together, they argued at the EU level that such a high requirement was not necessary in all places, and that there should be different degrees of mechanical protection allowed by the standard so that manufacturers and customers firms can decide which degree to comply with according to place-specific conditions. In the end, the German advocacy of high requirement and the Swedish advocacy of different degrees of compliance were both encoded into the EU standard for EV charger installation. In other words, EPBA created and stretched the interpretive flexibility of the standardisation pressure imposed by their German rivals. In doing so, EPBA protected and empowered their EV charger to be diffused widely in the European market.

EPBA's risk-averse and eclectic approach to managing rule-based context was particularly salient in the face of regulative uncertainty when their product development process was deterred by no standard for EV charging plug at the EU level. Rather than pursuing a standardisation strategy, they were initially hindered by the norm of following strict standards as a Swedish electrical product manufacturer. When their German rival proposed a design and boldly announced that it should be the future EU standard, EPBA was taken aback on the one hand and sceptical of their rival's standardisation strategy on the other hand. The main actors from the automotive, energy, and electrical product industries involved in the standardisation committee at the EU level could not agree on a common standard for EV plug between 2009 and 2012. One of the main disagreements during the standard discussion was between the German (so called 'Type 2') design and the Italian-French's ('Type 3') design.

During this long deterrence period, EPBA's management was hesitant about investing further to develop the technological and functional aspects of their EV

charger, because the efforts could potentially be wasted if they turned out to be misaligned with the final standard. Instead of joining the standardisation fight at the EU level, EPBA's management retreated because they knew they did not have the resources and power to influence EU level standard at the time, and that even if they won with their own plug design proposal, they would have difficulty gaining financial return. They therefore redisposed and re-concentrated efforts in building the local market and strengthening their own position as an EV charger supplier in Sweden. Meanwhile, they actively observed the standardisation discussion and joined meetings where the discussions took place at the EU level in order to obtain foresight about which competing design was gaining more support from the powerful and dominant actors in the standardisation committee. They also joined a testing initiative in Sweden to learn which plug design was in fact superior in terms of performance, safety and cost criteria. As a result they learned that their German rival's plug design was sufficiently qualified and that the powerful automakers had converged to support the German Type 2 design. Eager to end this deterrence period, EPBA's CEO announced their support for the Type 2 design. In other words, they compromised and changed their attitude from being sceptical to being supportive when they had a strong stake in the decision about a common EU plug standard.

In summary, EPBA's reorientation to EV charger development was primarily motivated by the management's aspirations to enter a nascent field and to develop a sustainable product. Opportunities stemming from societal-level regulative changes and from changes of perceptions in the automotive industry added to the motivation for EPBA to enter the EV niche. EPBA's ability to match internal capabilities with external opportunities prompted them to decide on developing an EV charger, and consequently developing a new and sustainable trajectory for the firm's future. During the innovation process associated with the firm's renewal, EPBA strategically navigated various rule-based enablers and barriers despite their disadvantage regarding resource and power constraints. Similar to the other four case firms (i.e., GAS and the three lead firms in HYBRIT), EPBA's strategy to manage contexts was to protect and empower their own innovation. However, EPBA's strategies to navigate contextual enablers and barriers was characterised by a risk-averse and eclectic approach. It should be noted that their seemingly reactive responses were reflexive and transient. They pivoted their strategies depending on a combination of factors such as the perception of own power position, latitude in manoeuvring, change of industry directionality, and the stake they had in a particular rule they encountered.

Having presented a summary of findings from the three empirical cases, I now discuss the findings in line with the research questions and highlight the contributions of this dissertation.

5 Discussion

In this section, I first answer the overarching research question based on the empirical findings from the case studies. Then, I discuss the dissertation's theoretical, empirical and methodological contributions vis-à-vis the synthesised research gaps highlighted in Section 2 and Table 2.

5.1 Answering the research question

This dissertation sets out to address the overarching research question of how and why incumbent firms in traditional manufacturing industries strategically manage contexts in their innovation and renewal journeys. A short and concise answer to this question is that firms leverage, shape and foster the alignment of elements from different forms of contexts - such as institutional, network, local-spatial, and technological contexts - in order to protect and empower their innovations associated with firm renewal.

This concise answer needs to be further elaborated to bring out nuanced explanations such as the following:

While innovation is an important means to renewal, a firm's renewal process is not characterised only by change and creating novel products and processes, but also by persisting with some attributes of the firm that management either desire or are determined to maintain. This means that a firm's strategic renewal is comprised of simultaneous efforts to pursue both change and persistence. As a result, and depending on what is to change and persist for a particular firm, certain contextual elements are rendered more salient and relevant for the firm's renewal. These elements may stem from various forms of contexts. While simultaneous pursuits of change and persistence may not immediately contradict each other, contradictions and tensions may arise from the interface of the contexts and the firm's pursuits, which makes the efforts to both change and persist challenging. Firms therefore strategically engage with contexts to resolve those tensions. This could involve, but is not limited to, defying and changing institutions or societal rules which hinder firm-level innovation and change that is hinged on persistence, creating and changing support infrastructures locally (and beyond) to make up for a place-based lack of resources, and leveraging and forging diverse networks to develop knowledge and to improve capabilities to change hindering institutions and rules. Notably, the relevant enablers and barriers from different forms of contexts are not independent, which implies that they may interact to reinforce or mitigate their influence on innovation and renewal that hinges on persistence. A firm's strategy to manage contexts therefore not only involve leveraging and

shaping the individual contextual elements, but also fostering alignment between those elements to support the firm's innovation and renewal endeavours.

While firms share a similar and overarching pattern, as mentioned above, a firm's strategies to manage contexts are not homogenous. The heterogeneity of their strategies and rationales can be explained by the resource- and power endowment of firms, the extent to which the firm's innovation and renewal endeavours are enabled or hindered by contexts and top-management's aspirations. Firms that are rich in resource- and power endowment are generally large and lead incumbents in their respective industries. Such resource- and power rich firms appear to more directly foster changes in contexts to protect and empower their innovations, whereas their less resource- and power equipped counterparts tend to navigate their way forward by concentrating on building legitimacy and taking advantage of changes set in motion by powerful actors with whose direction they align. This is because instigating contextual changes on a wide scale requires a significant amount of resources and power influence, and a firm's primary purpose of innovation is to secure its long-term prospects rather than to perform the role of 'change hero'. This is also why in times of significant uncertainty, the less resource- and power-equipped firms tend to compromise and retreat for the most part to prepare their capacity to advance once the uncertainty is sorted out by their powerful counterparts. In other words, the strategies of resource- and power-rich firms in shaping contexts tend to carry a spearheading feature, whereas their counterparts' strategies feature a relatively risk-averse and eclectic approach.

These contrasting behavioural patterns are mediated by top-management's aspirations, and the extent to which a firm's innovation and renewal endeavours are enabled or hindered by contexts. When a firm's innovation and renewal endeavours are severely hindered by certain contextual elements and the firm's top-management has a strong aspiration to change those elements, even a less resource- and power-equipped SME can display strategic action, with the ambition to instigate change on a wide scale in context. In this case, their strategies to manage contexts appear to be most proactive, agile and pronounced. The management of the firm take on the role of 'change agent,' and make their ambition heard in public discourse. They actively join, build and leverage diverse actor-networks to mobilise collective resources and power to advocate and enact the intended contextual changes. They also invest their own time heavily and direct the firm's resources to endeavours to stimulate contextual changes. Their endeavours to stimulate contextual change could encompass, but are not limited to, building place-based infrastructure and changing institutions on a wide societal scale that is beyond their specific industry and spatial location. While they might not – and tend not to – have a plan completely worked out in terms of how they will instigate contextual changes, they seem intentional and attentive to picking up and creating opportunities encountered along the way.

The contexts that affect a firm's innovation and renewal are not static, which means that the extent to which contexts enable or hinder a firm's endeavours to innovate and renew can change. A firm's strategies to manage contexts therefore

appear to be transient in terms of the forms of contexts that they engage with, and the extent to which they do this.

5.2 Theoretical contributions

This dissertation aligns with the core of innovation studies as regards how innovation takes place, and links this core with firm renewal. In doing so, this dissertation contributes to innovation studies by offering nuanced explanations of the strategies used by incumbent firms in TMIs regarding managing different forms of contexts for innovation and renewal. The contributions supplement recent innovation studies that skew towards start-ups and firms in the high-tech and service sectors (Bathelt et al., 2013; Radicic et al., 2020). By joining two vibrant theoretical debates in the strategic renewal literature and the sustainability transitions literature, specific contributions are made by adding to the understanding of strategic renewal as a duality in contexts, and to the understanding of an incumbent firm's proactive agency in leveraging various contextual factors for reorientation, and in shaping contexts to accelerate transformative change. Table 6 provides a summary of the theoretical contributions (corresponding to the synthesised gaps highlighted in Table 2). Next, I outline and elaborate the contributions to the two theoretical debates in the strategic renewal literature and in the sustainability transitions literature.

Table 6. Main theoretical contributions

Aspect	Research Gaps/Shortcomings	Contributions
Overall	Extant research neglects firms in TMIs and lacks explanations of how and why incumbent firms in TMIs manage different forms of contexts in their innovation and renewal journeys.	This dissertation focuses on incumbent firms in TMIs and offers nuanced explanations: firms strategically manage elements from different forms of contexts, such as institutional, networks, local-spatial, and technological contexts, in order to protect and empower their innovations associated with firm renewal.
Response to the debate in the strategic renewal literature: Co-alignment vs co-creation	The co-alignment view marginalises a firm's outer contexts and firm strategies to shape contexts throughout the renewal process. It (over-)emphasises persistence as a barrier to innovation. The co-creation view under-recognises the multiplicity of contexts and correspondingly firm strategies. It neglects the role of persistence in the renewal process.	This dissertation contributes with the conceptualisation of strategic renewal as a duality of deliberate persistence and change, which should be understood in relation to a firm's outer contexts. It reveals that persistence can serve as an engine and motivation for innovation and change. It theorises the strategies by TMI firms regarding managing different forms of contexts during innovation-based renewal processes. These contextual strategies matter not only for innovation and change, but also for sustaining the persistence desired.
Response to the debate in the sustainability transitions literature: The role of incumbents	There are three unresolved issues in this debate, regarding: 1) different types of incumbent firms, 2) the conditions under which these firms reorient with innovations, and 3) the proactive agency by incumbents to shape and change the socio-technical regime.	This dissertation pluralises incumbent firms by their resource- and power endowments (i.e., lead firms vs supplier SMEs). It sheds light on previously neglected factors motivating incumbent reorientation: managerial aspirations, the timing of a firm's investment cycle, place-based resource endowment, and multiple-industry involvement. It illuminates and theorises the proactive agency of incumbents to instigate regime change as 'restructuring': (re)shaping and fostering the alignment of actor(-network), materiality and institutions towards a new rationality that supports novel and sustainable technology in the making, while dismantling the old rationality that supports the dominant and unsustainable technology.

5.2.1 Response to Debate 1: Co-alignment or co-creation in strategic renewal

My main message in response to this debate is to pay attention to 'deliberate persistence and change' as a duality of strategic renewal (Farjoun, 2010), and to place this duality in the firm's outer-contexts while recognising the multiplicity of contexts. It is therefore suggested that the proponents of the co-alignment view should not fix their focus on persistence as a barrier to change, but recognize persistence as a motivation and engine to change (cf. Burgelman, 2002; Fang et al., 2021; Huff et al., 1992). It is also suggested that proponents of the co-creation view start considering the role that persistence plays in strategic renewal and firm strategies in relation to multiple forms of contexts, rather than focusing only on a firm's efforts to create market opportunities and shape industry evolution (cf. Agarwal & Helfat, 2009; Flier et al., 2003; Kim & Pennings, 2009; Peltola, 2012). Taking into account the multiple forms of outer contexts and a firm's strategies to manage contexts throughout the strategic renewal process is necessary in order to better explain both a firm's co-alignment and co-creation behaviours. I have thus advanced this debate by incorporating a duality perspective which suggests strategic renewal as simultaneous endeavours to persist and to change a firm's attributes for the purpose of securing the firm's long-term prospects, and by enhancing our understanding of the roles of the outer contexts and a firm's strategies to manage the outer contexts, which this debate has so far not addressed sufficiently.

My case study findings indicate that it is because firms and their managers want to persist with some attributes of their firm that they are motivated and propelled to change other attributes in line with the changing outer-contexts or the environment. In turn, (successfully) promting firm-level changes in line with the outer-contexts supports and enhances the feasibility of the endeavours to persist with the designated attributes. During this recursive and interactive process of persistence and change at the firm level, a firm (represented by their managers) strategically leverages, shapes and changes the outer contexts of multiple forms (e.g., institutional, network, local-spatial, technological contexts). Their contextual strategies function as mechanisms to realise the duality of persistence and change at the firm-level, with the ultimate purpose of securing the firm's long-term survival and prospects in its contexts.

To better understand strategic renewal as a duality of persistence and change, it is important to contextualise this duality by moving our analytical focus beyond the dialectic tensions between the two sides. The findings from Gnosjö Automatsvarvning's strategic renewal journey reveal that the dialectic tensions of persistence and change are instantiated and become pronounced when we place them in the firm's outer contexts. For instance, refreshing and enhancing the firm's competence did not immediately conflict with the deliberate efforts to retain the firm's industrial specialisation and district location. It is when we place this set of change and persistence in the specific institutional and local-spatial

contexts that we observe tensions, such as societal bias against TMIs and the human capital outflow from (and lack of inflow to) the rural industrial district that threatened the possibility of refreshing the firm's competence while at the same time retaining industry and locational choices. In order to ensure that the firm would have sufficient and renewed competence for the sake of long-term survival and prospects, it is therefore necessary to resolve the tensions *between* contexts *and* the deliberate efforts to simultaneously persist with and change the firm's attributes. This is where a firm's contextual strategies become relevant.

The role of contextual strategies is to realise and sustain the duality of deliberate persistence and change in the course of securing a firm's long-term prospects. By connecting to, leveraging and shaping relevant aspects of the firm's contextual conditions, a firm (represented by its managers) strive to resolve the tensions between its contexts and the endeavours to persist and change the firm's attributes simultaneously. For instance, in the case of Gnosjö Automatsvarvning, the managers proactively worked to change societal bias against, and to forge a positive societal perception towards, traditional manufacturing industries. They did so by directly, or via networks, lobbying for education policy change, influencing societal discourse in the media, inviting youths for factory visits, and investing in VR gaming technology to showcase the internal knowledge-intensive work environment and career prospects for staff. The managers also took the initiative to mobilise resources from within and outside their industrial district to establish local schools to train a (future) labour force in conjunction with the local firms' need for competence.

In the HYBRIT case, to maintain steel-making operations in Sweden, SSAB strove to replace its old coke-based technology with the HYBRIT technology for steelmaking. To that end, old electricity grids had to be replaced or strengthened, and new ones built to support the enormous energy supply needs. Tensions arose when considering the lengthy process and complicated regulations underpinning the permitting process in Sweden. To resolve this tension, SSAB, together with LKAB and Vattenfall in the HYBRIT consortium, prominently advocated changes in the procedures and regulations related to the permitting process.

In the case of EPBA, the management wanted to maintain the firm's anchor in the electrical product manufacturing industry while venturing into the green niche of EV by developing an EV charger. Tensions emerged when the Swedish energy policy discussion demonstrated ambiguity about the long-term solution of a clean energy supply, leaving an impression that importing brown coal would be a short-term solution. If this happened, it would delegitimize EV charger as a sustainable product because it would mean charging vehicles with unclean energy. To resolve this tension, EPBA's CEO took initiatives in the media to call for changes in the energy policy discussion and for long-term policy formulation. In short, a firm's strategies to manage contexts not only play an important role in the firm's innovation process in terms of leveraging enablers and mitigating barriers, but they also matter for realising simultaneous endeavours to persist with some, while changing other, attributes of the firms in the course of strategic renewal.

The above insights are relevant to understanding other kinds of duality related to innovation and renewal, such as the duality of ambidexterity, which involves the two sides of exploration and exploitation (Benner & Tushman, 2003; March, 1991; Tushman & O'Reilly III, 1996). It is now time to move beyond a discussion of when and how to explore and exploit, and of what structural forms of organising would be optimal for separating and integrating endeavours to explore and exploit (Benner & Tushman, 2015). We need to recognise the simultaneous existence of both exploration and exploitation that underpin the duality of ambidexterity. When we place both sides of this duality in a firm's outer contexts, we may generate fruitful insights into the contextual conditions that sustain and/or hinder such a simultaneous pursuit, the kinds of tensions that emerge between the outer contexts and the duality of ambidexterity, and how firms strategically deal with those tensions in their contexts to enact and sustain the simultaneous pursuit of exploration and exploitation which is presumed to eventually lead to firm renewal.

Echoing Schmitt et al. (2018), I argue that it is time for strategic renewal research to advance insights with a 'both/and' rather than an 'either/or' perspective when explaining the content, process, outcome and contexts of strategic renewal (Agarwal & Helfat, 2009; Volberda, Van den Bosch, Flier, & Gedajlovic, 2001b). A duality or a 'both/and' perspective can be employed to study 'persistence and change', and 'co-alignment and co-creation'. A truly 'both/and' perspective in my opinion *does not have to* resort to explanations guided by an interval or sequential logic where one side of the duality precedes or follows the other side (cf. Jansen, 2004; Schmitt et al., 2018), nor to searching for optimal forms of structural separation/integration within the firms for the purpose of resolving tensions and balancing both sides of the duality (Benner & Tushman, 2015). Supplementing prior research efforts, I argue for explanations that are underpinned by a concurrent or contemporaneous logic that accommodates both sides of the duality being enacted simultaneously. To achieve that, I suggest a contextualised approach whereby we illuminate the duality's tensions in the firm's outer contexts and unravel how a firm's contextual strategies play a role in resolving tensions and in realising the simultaneous efforts to persist and to change, to co-align and to co-create renewal conditions in contexts.

Given the multiplicity of contexts (Flier et al., 2003; Kline & Rosenberg, 1986; Pettigrew, 1987; Van de Ven et al., 1999), endeavours to co-create firm-level and contextual-level changes (i.e., co-creating firm internal and external changes) for the purpose of strategic renewal should involve more than just inter-organisational learnings (Jones & Macpherson, 2006), creating market opportunities and steering industry evolution via standard setting in conjunction with the innovation and change taking place in the focal firms (Eggers & Kaplan, 2009; Kim & Pennings, 2009; Peltola, 2012). In other words, in addition to the factors related to the industry and market contexts, there are other forms of contexts that enable and hinder a firm's strategic renewal endeavours. My case study findings reveal that the institutional context at different levels (e.g., sectoral and societal levels; local, national and transnational-levels) and the spatial context (e.g., place-based

resource endowment or the lack of it) enable and hinder a firm's strategic renewal. This requires firms to strategically act to manage and shape those relevant factors from different forms of contexts in order to move forward with innovation and firm renewal. In sum, it accentuates the importance of the co-creation literature broadening its analytical efforts and expanding its explanations by accounting for multiple forms of contexts, and, correspondingly, a firm's strategies to manage contexts.

5.2.2 Response to Debate 2: The role of incumbents in sustainability transitions

This vibrant debate revolves around whether and how incumbent firms reorient themselves with innovation, and consequently defend or change the regime status quo. While there are empirical observations of incumbents being defenders and drivers of transitions, it is now time to "engage more subtly with claims around the role of incumbents in transition processes" (Turnheim & Sovacool, 2020, p. 181). In response to this debate, I will use the case findings to discuss my contributions to existing understandings with respect to 1) different types of incumbent firms, 2) the conditions under which these firms reorient themselves with innovation, and 3) how and why they proactively shape and change the socio-technical regimes and thereby drive transitions.

First, pluralising incumbent firm types in terms of role and power position in their respective sectors is a fruitful way to set the stage for nuancing explanations of firm reorientation and strategic actions upon shaping the socio-technical regime towards transition (Turnheim & Sovacool, 2020). Existing studies tend to assume that incumbent firms are large lead firms with significant resources and power to obstruct regime change brought by small niche actors (Smink et al., 2015a; Zietsma et al., 2018), or to induce regime change through their own reorientation (Geels, 2014). This dissertation broadens this view of incumbent types by studying lead and powerful firms and less-powerful supplier firms, both of which display highly innovative behaviours. While the findings provide further empirical support to the proposition in prior research that a lead firm's reorientation can have profound effects on resource transfer and regime change processes throughout the value chain (Geels et al., 2016; Steen & Weaver, 2017), my findings suggest that such effects cannot be realised without the reorientation and support of their specialised suppliers.

In the steel sector, HDR technology cannot be realised on an industrial scale by the three lead firms without the sufficient participation and growth of hydrogen suppliers. In the automotive sector, the transition towards electric vehicles produced by large automakers would be highly unlikely without specialised suppliers from the electrical product industry providing electric vehicle chargers. These supplier firms do not just follow their lead customers, as they also strategically – although possibly not to the same extent as their lead customers – shape their contexts and drive changes for the sake of their own innovations. The reorientation and contributions of these (less-powerful) supplier firms to system-

wide transformation appear to be more significant than has been hitherto recognised in the sustainability transitions literature (Steen & Weaver, 2017). For this reason, we cannot fully understand the (positive) role that incumbent firms play in driving system transitions if we overlook these innovative suppliers and only focus on the lead and powerful firms. This calls for more research attention to address how incumbent firms – both the lead firms and supplier firms – collaborate to develop and scale up (radical) innovation, and collectively drive the industrial transformation associated with sustainability transitions. It also entails further zooming in and unpacking the firm-level behaviours of these two different types of incumbents rather than subsuming their impacts at the sectoral level (cf. Steen & Weaver, 2017).

The conditions motivating incumbent reorientation not only encompass more factors than existing studies have recognised, but also reflect managerial aspirations for sustainability, which is under-acknowledged in extant studies. The case study findings show that various external pressures (e.g., regulative, cultural, normative pressures or natural jolts) outside the firms, and managerial aspirations to redeploy a firm's existing resources to capture new market opportunities (Raven, 2006; Steen & Weaver, 2017; Turnheim & Geels, 2013) are only part of the conditions motivating firm reorientation. One under-acknowledged factor is the aspirations of firm managers to contribute to a greener world. Extant explanations for firm reorientation have mostly emphasized economic rationality, assuming that firm managers lack interest in solving societal problems such as climate change (Penna & Geels, 2015). In contrast, my case findings show that firm managers do show concern for climate change which affects their decisions on what type of new products, processes and business areas to develop when they attempt to renew their firms. For example, in the electric vehicle charger development case, EPBA's managers were concerned about climate change and thus made mitigating climate change a guide when generating new product ideas.

Other neglected factors that my case findings bring to light include the timing of the investment cycle, placed-based natural resource endowment and multiple-industry involvement. For firms in capital goods intensive industries such as steel, mining and energy firms, the timing of core-fixed assets reaching the end of their lifecycle is a great window of opportunities for the firms to reorient with a radically new technology that requires the replacement of core fixed assets. These types of firms are generally less willing to strand core fixed assets due to the significant sunk cost. However, when such assets reach the end of their lifecycle, it means that the concern for not stranding assets is largely ameliorated, opening up room for firms to more seriously change their technological trajectory than keeping alternative technology exploration inside the labs. After all, firms may have already started exploring alternative technologies at lab scale long before actually changing trajectory, as they experience increasing regulatory and normative pressures and as they forecast future market trends. In other words, external pressure and firm aspirations to redeploy resources and to capture market opportunities do not necessarily trigger firms in capital goods intensive industries to reorient towards radical and sustainable innovation (Mäkitie, 2020; Steen &

Weaver, 2017; Turnheim & Geels, 2013). These motivations need to be considered in conjunction with the firm's investment cycle.

Place-based resource endowment is another overlooked factor in explaining the conditions motivating incumbent reorientation. The existence of multiple important natural and historical resources in a location that provides a higher possibility of realisation and the competitiveness of a new technology can prompt firms in that location to reorient and join forces to take advantage of place-based resources. This is evident in the HYBRIT case, where northern Sweden has iron mines and sufficient wind- and hydro-energy, as well as historical co-location and cooperation between two large mining and steel firms. This helps to explain why HYBRIT, championed by the three mining, steel and energy firms, developed in northern Sweden instead of somewhere else. This not only points to the importance of materiality that has been hitherto over-shadowed by attention to missions, visions and institutions in the transitions literature (Sorrell, 2018; Svensson & Nikoleris, 2018), but also confirms the need to improve our spatial understanding of transitions (Coenen, Benneworth, & Truffer, 2012) where a firm's motivation to reorient is closely connected to place-based resource endowment.

Involvement in multiple industries is another neglected factor that enables firm reorientation. Existing studies tend to treat a firm's involvement (in the form of diversification) in multiple industries as the outcome rather than the antecedent or motivation of firm reorientation (e.g. Steen & Weaver, 2017; Turnheim & Geels, 2019). The case of EPBA shows that straddling multiple sectors or regimes may itself offer more room for these types of firms to identify nascent niches to reorient towards. Put differently, involvement in multiple industries in the sense of having a position in the overlaps of value chains can be both the motivation and outcome of incumbent reorientation. On a reflexive note, while involvement in multiple industries before reorientation may be more apparent for supplier firms serving customers in different industries, we can reasonably extend that to lead firms whose supply chains involve multiple industries and sectors. In this regard, rather than considering 'straddling multiple regimes' as a unique attribute of supplier firms only, we can rethink our taken-for-granted view that firms usually operate in a single sector (cf. Fuenfschilling & Binz, 2018). This can help us better explain the heterogeneous motivations of incumbent reorientation.

Finally, we cannot presuppose that regime change and system transitions will occur when large lead firms reorient themselves with alternative technologies (cf. Berggren et al., 2015; Geels et al., 2016; Raven, 2006). This assumption may direct us away from uncovering the intentionality and proactive agency of incumbent firms to shape and change their socio-technical contexts associated with large-scale transitions. This is perhaps why regime dynamics so far have been largely black-boxed (Turnheim & Sovacool, 2020), and we do not yet know much about how incumbents strategically instigate regime change. By unpacking the strategic actions and rationales of incumbent firms (Farla et al., 2012), my case findings show that the studied firms proactively shape and change socio-technical regimes primarily to protect and empower their innovations that are not

favoured by the rationality in the extant regimes. While this explanation is intuitive, my case findings reveal the variety of strategies that firms deploy to shape and change regimes.

One important strategy deployed by powerful lead firms is the restructuring strategy, whereby they shape the actor (-network), materiality and institutions of the regime and foster the alignment of these elements towards a new rationality that favours their radical innovation. Meanwhile, they also strategically facilitate the dismantling of support for the old technology. In other words, the strategies used by innovative incumbents to shape and change regime involve not only establishing a new institutional logic or rationality but also dissolving the old one on which the focal regime is organised. While this echoes the 'stretch-and-transform' strategy theorised by Smith and Raven (2012), it can be understood as a regime-based approach and differs from a niche-based one. This is because a niche-based approach emphasises niche actors gathering momentum to attack and break through the regime, whereas a regime-based approach emphasises regime actors such as incumbent firms venturing into niche space to develop innovation, and simultaneously operating in the regime to restructure the regime logic.

Arguably, a regime-based approach may be more effective to transform an entrenched regime than a niche-based one. This is because incumbent firms are very aware of 'the rules of the game' in the regime, and have been players of the game for quite a long time. They are therefore expected to have a better understanding of the opportunities and challenges they would encounter along the innovation journeys than de novo niche actors or new entrants. Moreover, given the significance of incumbent firms in terms of job creation, economic contributions, and impact on the natural environment, their appeal to mobilise public resources and lobby for policy changes towards favouring their sustainable innovations are more likely to be heard and to garner support from various stakeholders. This is evident in the HYBRIT case, where the three mining, steel and energy firms obtained substantial public funding support, and lobbied for substantial changes in Swedish national regulations regarding permitting, and in EU ETS rules regarding carbon pricing and benchmarking criteria. What seems paradoxical is that those firms that have been widely considered 'hard-to-decarbonise' incumbents now prominently chant, "we are taking the lead towards a fossil-free future, we hope everyone else supports us."

While lead firms can use their rich resources and power to instigate regime change, their less-powerful and resource-equipped suppliers tend to refrain from a spearheading strategy. This is exemplified in the case of EV charger supplier EPBA. Supplier firms tend to focus less on charting institutional change and more on forging legitimacy of their niche innovation and of themselves as innovators. They leave the daunting tasks of changing regime institutions to their lead counterparts because such tasks require significant power and resources that they do not have. By concentrating on legitimacy work, these supplier firms can piggyback on the changes set in motion by their lead counterparts. In times of high uncertainty when both regime and niche actors negotiate about new rules and standards, the innovative suppliers 'retreat to advance' by observing the

inclinations of dominant regime actors, learning about the techno-economic bases of those inclinations, and making compromises. These seemingly reserved tactics appear to be highly reflexive in terms of not wasting limited resources and of (re)disposing the firm to full-speed advance when the uncertainty is cleared.

However, a supplier firm's strategies are not static. When these firms have a high stake in a particular rule and perceive that they have latitude to manoeuvre the rule, they change from seemingly 'fit-and-conform' to proactively stretching (although not necessarily transforming) those rules through creating interpretive flexibility. For instance, the case study firm EPBA used their own expertise and evidence from rich experience in the electrical product regime to argue for different levels of mechanical protection to be allowed vis-à-vis the strict requirement imposed by their rivals regarding the EV charger pole installation standard. In doing so, the firm combated the delegitimising forces against their niche innovation empowerment. This case provides support for and elaborates on the transient nature of incumbent strategies (Turnheim & Sovacool, 2020). It also challenges the idea of niche empowerment as two dichotomous forms of 'fit-and-conform' and 'stretch-and-transform' (Smith & Raven, 2012). It seems more appropriate to view those two strategies as polar types that occupy two opposite ends of a spectrum where innovative firms agilely walk back and forth depending on a combination of factors such as their perception of their own power position, latitude in manoeuvring, change of industry directionality and the stake the firm has in a particular institution.

In summary, this dissertation contributes to the debate on the role of incumbents within the sustainability transitions literature by uncovering and explaining the proactive agency of incumbents to instigate regime change, by advancing the plural understandings of incumbent firms and their strategies, and by bringing to light important but neglected factors that motivate incumbent reorientation. While doing so, this dissertation also shows that even firms that are expected to be most inert and polluting demonstrate a proactive reorientation by developing radical and sustainable technologies that potentially revolutionise their industries and drive societal changes associated with sustainability transitions.

5.3 Empirical contributions

Against the background of recent innovation studies skewing their attention towards (start-up) firms in the high-tech and service sectors, and overlooking incumbent firms in TMIs, this dissertation offers empirical insights on the specific contextual conditions faced and strategies employed by incumbent firms in TMIs to manage contexts for innovation and renewal.

The first set of insights relate to the particular contextual conditions that incumbent firms in TMIs face in developed economies. The empirical findings reveal that societal institutions and place-based (lack of) resources are important factors that enable and hinder a firm's innovation and renewal. One major barrier

regarding societal institutions is the societal bias against TMIs, which assumes TMIs to be low-tech, of low social status, boring, and for those who fail schooling. This can be attributed to the hype in public discourse about high-tech and digital firms, but also to the education system and related policies that lacks directionality to influence and educate the younger generations in line with the competence needs of industrial firms (see also, Eklund & Pettersson, 2017). The bias against TMIs meant that a supply of competence was lacking, hindering the efforts of TMI firms to innovate and renew themselves, and consequently negatively affecting their long-term survival and prospects.

Another institutional barrier to innovation and renewal by TMI firms is the relatively slow adjustments of relevant regulations and policies that do not match the pace and magnitude of innovation ambitions and efforts among TMI firms. For example, the three incumbents in HYBRIT ambitiously developed a radical process innovation, but their progress was hindered by complicated permitting rules and lengthy permitting processes. The competitiveness and market acceptance of the HYBRIT technology would be curtailed by the current EU ETS rules if there were no significant changes to those rules. EPBA's efforts to develop the EV charger and to contribute to the greening of industry and society would be in vain if energy policies continued to lack a long-term perspective regarding how sufficient clean energy would be produced, transmitted and distributed.

The gradual shift in norms and values towards sustainability and societal benefits, and not just focusing on economic rationality, provides opportunities for TMI firms to innovate and transform. This institutional enabler offers firms more leeway and courage to come up with, develop and realise novel ideas that they would probably not have without such an enabler. EPBA's reorientation from combustion engine heating units to EV charger development illustrates this point well. Nevertheless, this shift in norms and values needs to be much more rapid and significant for TMI firms producing raw materials or components for consumer products to benefit with (radical) sustainable innovation that entails a premium price. Otherwise, the market acceptance of (in the sense of willingness of customers to pay for) such innovations would remain low.

As to place-specific factors, TMI firms in certain locations enjoy particular advantages, such as a combination of natural resource endowment, the co-location of related and previously unrelated firms that turn out to be crucial for specific innovations, place-based reputation and trust shared among firms, the existence of knowledge centres, and the supply of a competent workforce. The lack of those spatial factors in turn is disadvantageous for firm innovation. Although such factors have been highlighted in explaining national and regional level innovation and renewal (Coenen, 2007; Holmen, 2002; Porter, 1990), they are not sufficiently recognised in the explanations of firm-level innovation and renewal, especially firms in TMIs (Agarwal & Helfat, 2009; Schmitt et al., 2018).

The second set of empirical insights contributed by this dissertation relate to the strategies deployed by incumbent firms in TMIs to manage contexts for innovation and renewal. Their strategies are closely related to the aforementioned contextual conditions they face. Admittedly, the firms studied represent those that

are highly innovation-driven and proactive in managing contexts, and so their strategies cannot represent those of all TMI firms. However, the unique cases are the revealing ones, and they provide a good understanding and set a starting point for exploring similarities and alternatives further.

The empirical findings show that the studied firms in TMIs actively raise public awareness and attempt to change the societal bias against TMIs. Managers from these firms participated in interviews and debates on various media to accentuate the lack of rationale for the bias and explain that the bias mismatch with realities in TMI firms. They leveraged network meetings and space to mobilise collective efforts to change societal bias and call for policy reform. While digital technologies are often suggested by prior research as input for TMI firms to improve productivity and innovativeness, this dissertation finds that one of the TMI firms studied also used digital technologies to alter societal bias and to forge a positive perception towards TMI firms.

Regarding the asynchrony of regulation and policy update vis-à-vis a TMI firm's innovation endeavours, the studied TMI firms – especially the resource- and power rich lead firms – prominently advocate more rapid and ambitious changes in relevant regulations and policy. When doing so, they even go so far as to accuse current climate-related regulations and policies of hindering rather than promoting sustainable innovation and industrial transformation towards greener production and consumption. They venture into the realms of societal norms and perceptions when accusing hindering regulations and policy such as through publishing meaning-infused videos, in order to create wider societal pressure to force the rapid regulatory and policy changes that the firms desired. In the meantime, they tried to accelerate the shift in norms and values towards sustainability and societal benefits beyond economic rationality. Understanding that their products are usually 'invisible' to end consumers, as they are embedded in consumer goods (see also, Dewald & Achternbosch, 2016; Kushnir, Hansen, Vogl, & Åhman, 2020), the studied TMI firms took the initiative to develop and implement lifecycle analysis and green labels that inform consumers of the carbon footprint of the end products (and components).

Finally, the studied firms appeared alert to place-specific (dis)advantages. They leveraged and enacted those advantages while attempting to minimise the disadvantages. In contrast to the 'winner takes it all' logic that we usually observe in the behaviours of high-tech firms such as many in Silicon Valley, the studied TMI firms focus on creating collective competitiveness through infrastructure building and collaborating (even with rivals) to innovate and to secure firm survival and prospects in the long term.

In summary, we can indeed rethink whether 'traditional' is a misnomer when we describe firms operating in long-established industries (Bathelt et al., 2013; Radicic et al., 2020), because it may have a negative and non-innovative connotation that does not match the innovative firms in those industries. Even those firms that are generally expected to be most inert and polluting display high innovativeness and proactive actions to strategically handle various contextual enablers and barriers, while concurrently driving the wider industrial and societal

transformation associated with economic development, social welfare creation and sustainability transitions.

5.4 A methodological contribution

This dissertation contributes an operational framework that assists systematic and rigorous analysis both within and across empirical cases to tackle the challenge of operationalising institutional analysis when studying the innovation process (see Table 7 below; for more elaboration see Paper 4). This framework is particularly suitable for path-breaking innovation cases, where institutional pressures are salient and protection mechanisms such as shielding, nurturing and empowering are required. Typical examples of such innovations are radical innovations developed in socio-technical niches and (potentially) altering entrenched regime rationality. HYBRIT is one such example.

This framework addresses the definition of institutions by adopting Scott's omnibus definition that recognises the regulative, normative and cultural-cognitive elements. It also incorporates a reconceptualisation of innovation process, where both institutional influence and the responses of innovating actors are brought to the front. When putting both institutions and innovation process into a matrix with a clear coding scheme, the framework serves as i) a sensitising device, ii) a data structuring device, and iii) a comparison and connection drawing device for within-case and cross-case analysis. When the framework is filled with coded content from an individual case, it facilitates identifying themes and patterns as the researcher scrutinises the coded case horizontally, vertically and diagonally across the framework. This helps to reveal important patterns such as 1) how regulative, normative and cultural-cognitive institutions influence the entire innovation process and actor responses to those influences; 2) within each subprocess of the entire innovation process, how the three types of institutions interact to affect innovation endeavours and how actors configure their behaviours to respond to those influences as they strive to shield, nurture and empower innovation; and 3) how institutions in one of the regulative, normative and cultural-cognitive realms during a subprocess of innovation may be reinforced or cancelled out by the effect of other institutions in the same or a different realm, in a later subprocess of innovation. When conducting cross case comparison, it is recommended that the researcher first fill one framework with content from a single case, and then juxtapose two or more filled frameworks for cross-case comparison. This can improve the systematic clarity and rigour of cross-case analysis.

Table 7. An operational framework for analysing institutional influence on the innovation process

		INNOVATION PROCESS					
		Shielding		Nurturing		Empowering	
		Institutional influence	Actors' behaviours	Institutional influence	Actors' behaviours	Institutional influence	Actors' behaviours
INSTITUTIONS	Regulative	SRI (+/-)	SRA	NRI (+/-)	NRA	ERI (+/-)	ERA
	Normative	SNI (+/-)	SNA	NNI (+/-)	NNA	ENI (+/-)	ENA
	Cultural-cognitive	SCI (+/-)	SCA	NCI (+/-)	NCA	ECI (+/-)	ECA

6 Conclusion: Implications, limitations and research outlook

In conclusion, this dissertation argues that incumbent firms in traditional manufacturing industries proactively undertake innovations as they pursue long-term survival and prospects. Even firms that are generally expected to be the most inert display highly innovative behaviours and carry out radical innovations that can potentially revolutionise their industries. In their innovation and renewal journeys, TMI firms do not passively experience or take as given different contextual enablers and barriers outside the firms, such as societal norms and regulations, diverse networks and place-based (lack of) resources. Instead, they strategically manage those factors by leveraging, shaping and fostering the alignment of the relevant contextual factors, in order to protect and empower innovations. This dissertation also argues that a firm's renewal process is not solely characterised by innovation and change, but also by deliberate persistence regarding certain firm attributes that the management value and are determined to retain. Persistence is argued here as an engine and motivation for innovation and change, rather than as a barrier, as many prior studies assert. As such, firms deploy contextual strategies not only to protect and empower innovation, but also to simultaneously ensure that persistence with some firm attributes are realised. Overall, this dissertation offers nuanced explanations of how and why incumbent firms in TMIs manage contexts for innovation and renewal in the so-called 'post-industrial era'. In doing so, it makes important contributions to innovation studies.

Next, I highlight this dissertation's implications for innovation managers and policymakers.

6.1 Implications

In this section, I outline the implications for innovation managers and policymakers seeking to stimulate innovation and the renewal of incumbent firms in TMIs.

6.1.1 Managerial implications

When incumbent firm managers strive to exploit favourable, and grapple with, unfavourable conditions for their own innovation and renewal, it is not sufficient to just manage what is within and across firms for the purpose of competitiveness in the market. This dissertation shows that the contextual enablers and barriers that matter for firm innovation and renewal encompass space beyond the domain or boundary of the firms and firm networks. In order to effectively manage

contexts for innovation and renewal, it is therefore important to consider issues related to innovation governance, such as infrastructure building for collective goods, influencing national- and cross-national government policies and sectorial regulations, and engaging in shaping and changing societal norms outside firm's boundaries. These issues related to innovation governance (Borrás & Edler, 2014, 2020), as shown in this dissertation, affect whether and to what extent a firm's innovation and renewal endeavours are legitimate, feasible and endurable in both the short and long term. Such innovation governance issues cannot be assumed by firm managers as the tasks of the governments and the state alone (Borrás & Edler, 2020). If managers in incumbent firms – regardless of their firm's size, resources and power position in their respective industries - overlook such issues, they may miss exploiting opportunities and/or run into backlashes stemming from the firm's external environment along their innovation and renewal journeys. This does not, however, advocate corporate behaviours that lobby policymakers and other sectoral actors to offer the protection and maintenance of their old and unsustainable products, processes, technologies and ways of organising, with the purpose of sustaining the firm's vested interests and established power even though it entails negatively locking in the system and preventing societal wellbeing and advancement (Geels, 2014; Grabher, 1993; Smink et al., 2015a; Zietsma et al., 2018).

While addressing innovation governance issues that bear relevance to firm-level innovation and renewal tends to require tremendous efforts beyond those that a single firm can shoulder, it does not provide an excuse for the idea of 'let's focus on minding our own business'. Instead, incumbent firms in TMIs may collaborate to pool resources, power and legitimacy to address those issues together. This echoes what Coyne and Van de Ven (2021) suggest as "running in packs". However, doing so requires willingness from innovation managers, and setting out time and resources for such endeavours, if they want to effectively manage contexts for a firm's innovation and renewal. Put simply, don't just mind your own business. It is important to 'work in, but also work out!'

6.1.2 Policy implications

This dissertation has implications for policymakers seeking to stimulate innovation and facilitate renewal of firms in TMIs. First, policies should contribute to mitigating prevalent bias against, while stimulating pride and interest towards, firms in TMIs. For instance, it is important for policies to communicate that firms in TMIs are not historical remnants of industrialisation but rather undergoing an exciting transformation towards advanced and sustainable production (e.g. Government Offices of Sweden, 2016). Policies should also advocate and support collaborations between industrial firms and education institutes from the primary to university levels. While it is appreciated that young students are allowed the freedom to choose and pursue areas of study according to individual interests, we should not undervalue or dismiss regular and

coordinated study visits to, project works with, and internships in modern industrial firms that young students could participate in.

When providing funding support to stimulate innovation projects among firms in TMIs, policies should consider both research and development (i.e., the supply side) and commercialisation (i.e., the demand side) of innovation processes. On the supply side, policy instruments such as regulations and funding could target a firm's investment life cycle. The timing of one investment cycle or the life of fixed assets approaching an end can be a great window of opportunity for incumbents to change or diversify onto a new trajectory involving innovation and renewal. Policy instruments could target such timing to incentivise firms to innovate and change trajectory while disincentivising them to maintain and reinforce old trajectories. Although public funding support for research and development helps incumbent firms build momentum in the initial stage of innovation processes, such momentum might be offset when the innovation reaches the commercialisation stage and the market is not ready and/or willing to pay (a premium) for the innovation. This is particularly so regarding (radical) sustainable innovation. It is therefore recommended that policies help to stimulate market demand via, for instance, public procurement and providing incentives to end-consumers for choosing innovative and sustainable products.

Policies should provide clear long-term directionality and short-term priorities with regards to coordinating industrial transformation. This can help to reduce the uncertainty that innovations involve, and incentivise incumbent firms to invest, innovate and change development trajectories. Moreover, innovation by, and the renewal of incumbent firms in TMIs are closely linked to related physical infrastructure provision and development. Policies should consider the synchronisation of physical infrastructure development with the innovation and renewal needs of firms. This may also involve simplifying and clarifying regulations regarding permitting, and resolving conflicts between infrastructure building and maintaining/supporting the development of local communities where the infrastructure is built. Otherwise, we would run into paradoxical situations wherein the policies that are geared towards stimulating sustainable innovation are made ineffective by some other policies and regulations that stand in the way of incumbent firms that reorient and develop radical and sustainable innovation.

On a more general level, this dissertation disagrees with those suggestions that policy should focus support on (start-up) firms in high-tech and service sectors in developed economies, and give up support for firms in TMIs (e.g. Martin & Florida, 2009). Echoing previous studies (e.g. Radicic et al., 2016), this dissertation suggests that policy support and instruments to help create favourable conditions for firms in TMIs are important in order for those firms to innovate and renew themselves. This not only contributes to the long-term survival and prospects of firms, but also to the economic development and wider societal transformation associated with sustainability transitions.

6.2 Limitations and research outlook

There are a number of promising future research avenues that build on the findings, and also address the limitations, of this dissertation. On a general level, this dissertation shows that even the incumbent firms expected to be most inert display highly innovative behaviours that have consequences for firm renewal and for industrial and societal transformation. Future research in innovation studies should therefore pay more attention to established firms in TMIs rather than continue to skew attention towards firms and start-ups in the high-tech and service sectors. Three potentially fruitful avenues for future research are highlighted below.

The first avenue concerns extensive research design. This dissertation applies an intensive research design with a small sample of firms from only five TMIs and from one developed country (i.e., Sweden) to seek nuanced explanations for TMI firm strategies to manage contexts as innovation and renewal processes unfold. It did not select any failed cases for empirical examination. The findings of this dissertation could therefore be further validated and enhanced through an extensive research design that uses a larger sample of firms from various TMIs, from other developed economies and from economies that are relatively advanced in industrialisation and on the way towards a post-industrial era. For instance, how do TIM firms in different developed economies manage contexts differently for innovation and renewal? Do, and to what extent, the contextual strategies by TMI firms in transitioning economies differ from those of their counterparts in developed economies? Are there differences, and if so what are the differences regarding contextual strategies by incumbent firms in different TMIs? How can those differences (or similarities) be explained? Addressing those questions would enable a wider scale and scope of cross-case comparison, which could further reveal and explain the important heterogeneity (or similarity) of the contextual strategies of incumbent firms under (or in spite of) different conditions. The resulting insights would be useful for deriving practical and policy implications that are highly contextualised and catered to groups of incumbent firms in their respective settings.

The investigation of failure cases could offer insights regarding what strategies are less effective for managing contexts for innovation and renewal, and why. It should be noted that the contextual strategies found to be employed by the TMI firms in this dissertation should not be regarded as ‘successful strategies’ even though the firms studied are relatively successful or making good progress with their innovation and renewal. Those strategies do not represent a successful recipe to be blindly copied, instead, they can be seen as providing a good reference and guidance, especially for TMI firms with similar characteristics and facing similar context specificities as those studied in this dissertation.

The second avenue relates to the interplay between a firm’s inner and outer contexts and correspondingly to a firm’s strategies to manage those contexts for innovation and renewal. While a firm’s inner contexts are relevant and must be managed for innovation and renewal as numerous prior studies with an outside-in

approach suggest, this dissertation mainly takes an inside-out approach and places analytical premium on firm strategies to manage their outer contexts. The limited consideration in the dissertation regarding a firm's internal conditions, such as a firm's investment cycle and accumulated knowledge base, show that the combination of internal and external contextual factors can be a strong force that motivates firm reorientation towards a new trajectory associated with securing long-term survival and prospects. Future research could extend the insights from this dissertation by expanding analysis of the interplay between a firm's inner and outer contexts, and theorising about strategies by firms to simultaneously manage their inner and outer contexts to create synergies and mitigate contradictions as they facilitate innovation and renewal. When doing so, it is suggested that the multiplicity of the inner and outer contexts be accounted for and not marginalised, because it is conducive to uncovering hidden contextual dynamics and better explains a firm's strategies and rationales under seemingly different or similar conditions.

Third, future research can apply, validate and modify the operational framework offered in this dissertation to assist systematic and rigorous analysis of the interplay between institutional influence and innovating actor behaviours in the unfolding innovation processes. This operational framework could be further applied for cross-case comparison which this dissertation has not illustrated. More applications of this framework for both within-case analysis and cross-case comparison could help to add validity and suggest areas for framework refinement. The reconceptualisation of the innovation process, as incorporated in this operational framework, is presumably confined to innovations that are radical or path-breaking in nature. This is because those innovations are more susceptible to adverse selection pressure from contexts, and hence in need of shielding, nurturing and empowering. In other words, the operational framework is presumably more suitable for path-breaking or radical innovations. Future research may further strengthen the systematic and rigorous analysis of institutional influence throughout innovation processes. This can be done by, for instance, accounting for non-path-breaking innovation when reconceptualising innovation process while considering the role of institutions, and subsequently incorporating the new reconceptualisation to modify the operational framework suggested in this dissertation.

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Appendix 1 Systematic literature search

The purpose of this systematic literature search is to take stock of the extant literature on incumbent firm behaviours in innovation and renewal, and to identify research opportunities with which to move forward regarding the subject of incumbent firms managing contexts for innovation and renewal. I conducted this search using the Web of Science (WoS) database where I employed search keywords "innovation" AND "incumbent" OR "established firm". These keywords were used because my research positioning is in the field of 'innovation studies'. In addition, I also limited the results to the field of "management" and with "English" as source language. I also only included journal articles, and so book chapters or conference proceedings were not included. Following the above steps, the database gave a result of 410 journal articles (note, this is an updated number as of November 2nd, 2019). I then sorted the 410 articles based on "relevance" (the sorting function in the WoS database). This means that the higher the occurrence of keywords used in an article, the higher the article will appear on the resulted list. I then exported the resulting list into an Excel document for analysis and review. This Excel file contains information such as the following for each of the 410 articles: article titles, author names, journal/source title, year of publication, abstract, author keywords and so on.

It should be noted that due to time and resource limits, the analysis of the resulted articles is only based on an analysis of the article abstracts. Only the top 100 articles on the list and also articles containing the word "renew" in the abstracts (i.e., 25 pieces) were analysed. In total 123 [1]out of 410 of the articles were analysed. When reading and analysing the 123 articles based on abstracts, I looked for information along the following dimensions: *a)* the forms of contexts studied/mentioned; *b)* whether and how incumbent firms are considered a source of innovation; *c)* whether and how incumbent firms are change agents (in relation to contexts); *d)* whether an institutional analysis of innovation processes were conducted. Given the above, this systematic literature search is *eclectic* in the sense that is not a traditional systematic literature review, but nonetheless involves systematic search procedures and a careful analysis based on the specific questions in mind.

I wanted to identify which articles involved the topic of renewal. I therefore used "renew" as the search word to search within abstracts among all the 410 articles. Only 25 articles had the word "renew" in their abstract. I include these 25 articles for analysis. Out of these 25 articles, eight articles were about firm-level renewal, including a literature review on strategic renewal and empirical

[1] It is only 123 and not 125 because two of the articles at the top 100 of the resulted list had the word 'renew' in the abstract. Taking away the double count of these two overlapping articles, there are only 123 articles included in the analysis.

studies on strategic renewal and corporate entrepreneurship. Five of the 25 articles were about innovation-based renewal aggregated to regional and/or industrial levels. Ten out of 25 articles were about the innovation of renewable energy at a system or country level, and less related to incumbent firm renewal.
As mentioned above, I read and analysed the abstracts of the selected 123 articles by looking for information along four dimensions of questions. I have synthesized the detailed qualitative results in Section 2.3.3 in the kappa of this dissertation, however, I include some statistics below to give the reader a quick overview.

Dimension/Question	Answer	Counts
Multiple forms of contexts studied?	Yes	11
	No	81
	Unclear	28
Incumbent as source of innovation	Yes	29[2]
	No	34
	Contingent	22
	Unclear	35
Incumbent as change agent (in relation to context(s))	No	47
	Yes	29
	Unclear	44
Institutional analysis of innovation process	No	113
	Yes	7

[2] One should interpret with caution the small difference in the count between 'Yes' and 'No' with respect to whether "incumbent as source of innovation". The number for ‘yes’ is rather high because when using "incumbent/established firm + innovation" as search keywords in the database, the resulted list is more likely to include articles on strategic renewal and corporate entrepreneurship, the ways/incentive for incumbent to innovate, incremental innovation by incumbents, and incumbent adaptation. The number of articles that actually argue for incumbents – in comparison to new entrants - as sources of (radical) innovation is very few.

Appendix 2 List of important abbreviations used

CE marking: marks on products sold in the European Economic Area which signal that the products have been assessed to meet high safety, health and environmental protection requirements. Products without CE markings cannot be traded in the European Economic Area without restrictions. CE marking is a part of the European Union's harmonisation legislation. (source: https://ec.europa.eu/growth/single-market/ce-marking_en)

EPBA: the pseudonym for a case firm that developed electric vehicle chargers

ETS: European Union's Emission Trading System (a cornerstone policy framework aimed at reducing greenhouse gas emission. for more info: https://ec.europa.eu/clima/policies/ets_en)

EU: European Union

EV: electric vehicle

GAS: Gnosjö Automatsvarving (a case firm)

HDI: hydrogen direct reduction (one of the core technologies in HYBRIT)

HYBRIT: an innovation initiative that is the third empirical case; short for 'hydrogen-breakthrough-iron-making technology'

LKAB: a mining firm (one of the case firms in HYBRIT)

MLP: the multi-level perspective

SME: small and medium-size enterprise

SNM: strategic niche management

SSAB: a steel firm (one of the case firms in HYBRIT)

TMIs: traditional manufacturing industries

Vattenfall: an energy firm (one of the case firms in HYBRIT)

VR: virtual reality technology (a new digital technology)

Managing contexts for innovation and renewal

Strategies of incumbent firms in traditional manufacturing industries

Innovation is important for established firms (i.e., incumbents) in traditional manufacturing industries (TMIs) to continuously survive and thrive. While internal factors often receive attention, different factors external to these firms enable and hinder the creation and realisation of novel products and processes. Firms in TMIs thus need to strategically deal with their outer contexts. How they do so in the post-industrial era and why they act in particular ways remain unclear in extant innovation studies. This dissertation offers nuanced explanations of the strategies of incumbents in TMIs, regarding managing contexts for innovation and renewal.

This dissertation investigates three cases involving firms in five different TMIs in Sweden. It shows that even firms that are expected to be the most inert display a proactive reorientation by developing radical and sustainable technologies that potentially revolutionise their industries and drive societal change. Innovative firms simultaneously manage multiple external factors such as societal norms and regulations, diverse networks, and place-based (lack of) resources by leveraging, shaping and fostering the alignment of those factors to protect and empower innovations. A core take-away for innovation managers is to "work in but also work out!"

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