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The "Good Enough" Tsunami: The Disruptive Potential of Low-code and No-code

A multiple case-study on scope, trends, and implications

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Abstract

This paper explores the intersection of disruption theory and technological democratization, aiming to understand the transformative impact of digital technologies on competitive landscapes. Focusing on the thriving field of low-code and no-code (LCNC), we explore its potential as a catalyst for market disruptions. Leveraging insights garnered from in-depth interviews and an analysis of secondary data, we map and categorize trends within the LCNC landscape and its implications. We find that i) LCNC stands as a technological discontinuity marked heightened competition among new entrants vying for dominance, ii) LCNC is adopted through different means by newly established and larger firms, offering distinct advantages, and iii) industries adhering to stringent security and technical standards experience slower adoption rates, thereby reducing their vulnerability to disruptions.

Our study concludes that LCNC will be a "good enough" solution for a growing range of areas. The advantages it offers, including accelerated time-to-market and diminishing reliance on extensive IT knowledge, have the potential to act as a catalyst for market disruption. While larger companies enjoy substantial advantages by incorporating LCNC, they need to be conscious of the disruptive challenges that arise when companies fully harness the potential of the emerging technology.

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1 Introduction

Technological change has been a pivotal element in shaping industries and market dynamics (e.g Anderson & Tushman, 1990). In the wide field of research concerning technological development, democratization of technology and its impact on competitive advantages has increasingly been highlighted (Ferreira et al., 2019; Knudsen et al., 2021; Sousa & Rocha, 2019). As digital technologies rapidly expand, becoming increasingly accessible, old sources of stability are changed and traditional entry barriers are undermined (D'Aveni et al., 2010; McGrath, 2013). The technological democratization, coupled with the fast evolution of digital landscapes, set the stage for disruptive innovations that redefine industry structures and challenge established norms.

The ongoing technological evolution brings us to the doorstep of Christensen's Disruption Theory (1997), which has enhanced our understanding of technological change and its implications. For the past 20 years, the concept has been enormously influential in business circles and a powerful tool for predicting which industry entrants will succeed (Christensen et al., 2015). On the other hand, critics of disruption theory frequently highlight the limited occurrence of large-scale disruptions that align with Christensen's model, leading to an overly broad application (Gans, 2016a; King & Baatartogtokh, 2015; Rovnick, 2018). Recent changes has, however, reignited interest in Christensen's model, prompting discussions about its enduring importance.

While recent research has made important advancements to our understanding of both democratization of technology and disruption, less attention has been awarded to the connection of the two. Thus, despite the wide acceptance and application of disruption theory, a critical gap persists in the literature concerning how the democratization of technology can affect disruption. The current wave of democratization of technology through what is known as low-code and no-code, could potentially be a real, by the book, example of disruption. The technology enables faster time-to-market, lowers the entry barriers, and enables workers without IT competence to develop, implement, and tailor their own technology solutions (Driver, 2022). These characteristics describe a likely example of a "good enough" product to constitute a substitute to current sustaining innovations.

The purpose of this paper is to study whether the low-code and no-code wave can create a tsunami of disruptions, and if so, which industries that are more likely to face disruptions. Given this premise, we frame the following research question:

"How does low-code and no-code impact the potential for disruption?"

In order to answer our research question, we set out to do three main things: First, we use company data from Crunchbase to analyze the industry and evaluate the dominant trends. Second, we conduct an analysis of secondary data followed by semi structured in-depth interviews, to study the potential impact on different types of firms and industries. Finally, we apply the models and interpretations of Tushman and Christensen's disruptive technologies to evaluate whether the immense democratization of technology we see can be a catalyst for market disruptions. This allows us to discuss which type of companies and industries are more and less inclined to be a victim of disruption, reshaping industry dynamics and the competitive landscape.

Our main findings are as follows. First, the rise of LCNC signals a significant technological discontinuity, now ushered by a wave of increased competition among emerging companies, fighting for a dominant design. This is consistent with Tushman's era of ferment (Anderson & Tushman, 1990). Second, we observe that the adoption of LCNC offers distinct advantages to small and established firms. It aids startups in rapid prototyping and accelerating market entry, while enabling larger firms to streamline operations and innovate with reduced resources. We find that established companies typically employ LCNC for less critical internal functions, whereas startups embrace its broader applications. Considering the rapid development of technology, we emphasize how the realm of possibilities will increase, making LCNC "good enough" for an increasing number of functions and industries. Thirdly, we find that industries with high security and technical requirements will likely adopt LCNC at a slower pace, making these industries less prone to disruptions.

In sum, our research contributes to both further research and practice. We aim to cover a gap we believe is underexplored in recent literature. By exploring the intersection of democratization of technology, embedded in the LCNC universe, we provide new insights into the potential for widespread market disruptions. Our findings offer strategic guidance for companies navigating the evolving technological landscape, highlighting how different types of organizations can leverage LCNC to their advantage.

2 Theoretical Background

2.1 Technological Discontinuities and Dominant Designs

Michael Tushman is well-respected figure in the field of management and innovation and his contributions is central to the understanding of how organizations adapt and thrive in rapidly changing environments. In the article «Technological Discontinuities and Organizational Environments", Tushman and Anderson (1986) explore the impact of technological discontinuities on organizational environments. They demonstrate how technology evolves through phases of incremental change interspersed by technological breakthroughs that either enhance or destroy the competence of firms in an industry. These disruptions, referred to as technological discontinuities, bring about substantial enhancements in price-performance ratios compared to current technologies, and significantly increase both environmental uncertainty and munificence. Such technological transformation unfolds gradually through incremental steps until it encounters a significant breakthrough (Tushman & Anderson, 1986). This is illustrated in Figure 2.1 for the US aircraft construction. It illustrates how percentage improvement over previous most capable plane increases drastically through a flurry of development before an innovation gains foothold.

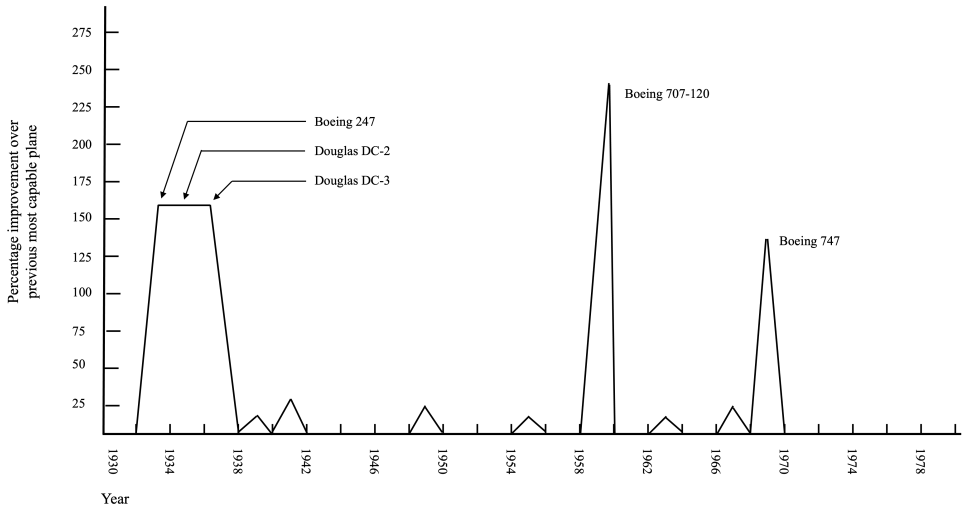

Figure 2.1: Seat-miles-per-tear capacity of the most capable plane flown by U.S airlines, 1930-1978 (Tushman & Anderson, 1986)

Such technological "shocks" can be defined as substantial changes in technology that enable either the delivery of existing products or services with higher quality at a lower cost (or the same quality at a lower cost) or the provision of value to customers in ways that were previously not feasible (Lien et al., 2016). Such discontinuities generate essential technological uncertainty as incompatible technologies vie for supremacy. In addition, as illustrated in the figure, it is often a result of a gradual process where a new technology is under development for many years before it eventually breaks through and creates changes in the landscape.

Tushman and Anderson (1986) distinguish between competence-destroying and competence-enhancing technological discontinuities when analyzing the effects on companies and the organizational environment. Competence-enhancing discontinuities "significantly advance the state of the art yet build on, or permit the transfer of, existing know-how and knowledge" (Tushman & Anderson, 1986). An example drawn from the figure above, is the debut of the jet aircraft Boeing 707-120, with its greater speed and size, significantly changing the economics of the airline industry. Competence-destroying discontinuities, on the other hand, significantly advance the technological frontier, requiring a knowledge, skill, and competency foundation that diverges from previous expertise (Tushman & Anderson, 1986). This necessitates the acquisition of entirely new skills and technological competence.

Competence-enhancing breakthroughs are predominantly instigated by well-established firms. These breakthroughs lead to increased consolidation within product classes, evident in comparatively lower entry-to-exit ratios and reduced variability in sales among different firms. Competence-destroying discontinuities, however, are more infrequent. They can be characterized as pivotal moments in the lifespan of a product category, opening new branches. These disruptions are instigated by emerging companies and pave the way for a surge of new entrants unrestricted by previous technologies and organizational inertia (Tushman & Anderson, 1986)

A factor complicating the situation for established players is that the decision to reposition must be made before the technological shock occurs (Tushman & Anderson, 1986). It is only when an industry standard emerges that most customers will choose to adopt the technology. If the established players have not invested by the time customers mass-adopt,

it is likely to be too late. As outlined, the period from the emergence of the new technology until the shock occurs is characterized by significant uncertainty regarding when (or if) the technological shock will take place and which version(s) of the technology will prevail. This implies that if the established players choose to immediately invest in the new technology, they risk allocating resources and making changes to the organizational structure and business model that may prove imprudent in the long run (Tushman & Anderson, 1986). Conversely, if they choose to remain on the sidelines and await the situation, they risk being too late and missing out on significant opportunities.

Such technological disruptions, regardless of type, seem to provide a unique chance for competitive advantage to firms willing to take the risk of early adoption. Tushman and Anderson (1986) discuss how major technological advancements can create significant changes in industries and present both opportunities and challenges for organizations, highlighting the importance of understanding and adapting to technological discontinuities in order to thrive in dynamic organizational environments.

2.1.1 Era of Ferment

Anderson and Tushman (1990) further extend their work by exploring another punctuating event in the evolution of a technology: the emergence of a dominant design after a technological discontinuity. They argue that a breakthrough innovation marks the commencement of an era of ferment in which competition among variations stemming from the original breakthrough ultimately result in the identification of a single dominant configuration of the new technology. Successful variations are maintained through the incremental evolution of this standard architecture until a new discontinuous advancement initiate a new cycle of variation, selection, and retention (Anderson & Tushman, 1990). Eventually what they refer to as a technology cycle. This is illustrated in Figure 2.2

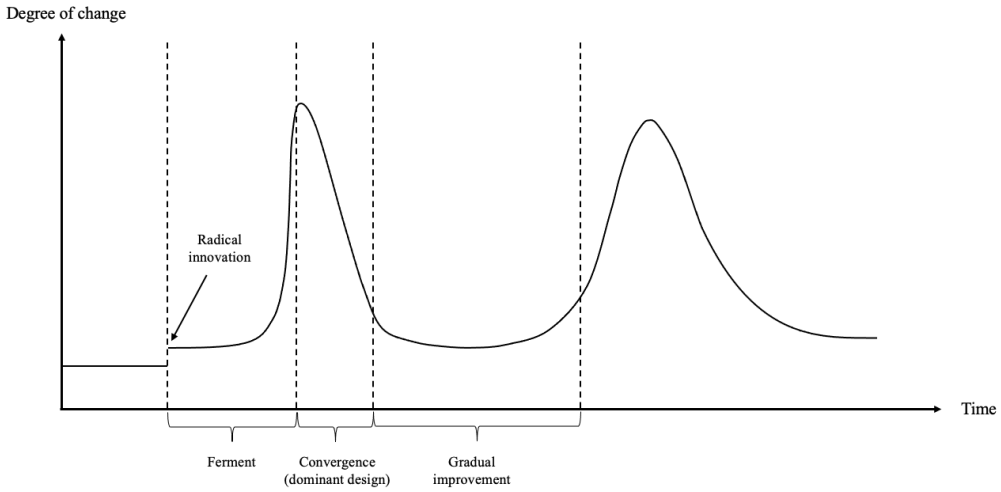

Figure 2.2: Technological change over time

The era of ferment is characterized by great uncertainty, and a high rate of variation of designs, actors, and substitution. Firstly, the introduction of a radical progression increases variation in a product class (Anderson & Tushman, 1990), prevailing two distinct selection processes: competition between technical regimes and competition within the new technical regime. Both the competition between new and old technologies as well as the design competition within a technical order, can be fierce. The prior entails that new technology gradually becomes a stronger substitute for established technology, often resulting in increased innovation and improvement of established technology. The latter consider the many variants of the new technology, both because it is not well understood and because each actor has incentives to differentiate themselves from competitors.

Suarez et al. (2015) explore the concept of a dominant category and its relationship to the dominant technological design and entry-timing advantages in emerging industries. They introduce a visual illustration pinpointing the optimal timing for entering an industry. This is illustrated below in Figure 2.3, which shows that as an industry matures, the number of categories initially increases, and is then followed by an increase in the number of firms. A point is reached where a dominant category emerges, signifying a consolidation phase where the number of categories begins to decrease. This emergence of the dominant category marks the opening of a window of opportunity for new entrants. As time progresses, a dominant design is established, leading to the closing of this window of opportunity as the industry and market stabilize.

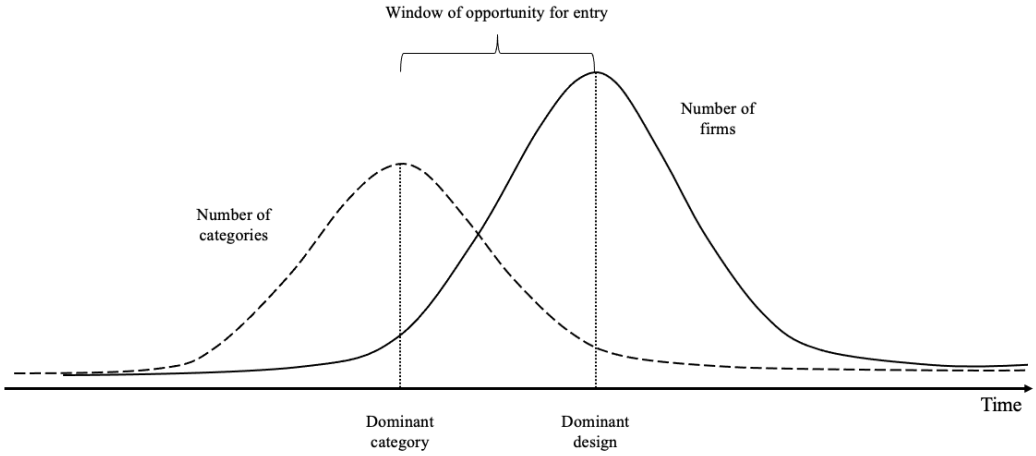

Figure 2.3: Dominant category and dominant design during the industry life cycle (Suarez et al., 2015)

They argue that the optimal time for entry into an industry is when the dominant category is established but before the dominant design emerges. Once a design becomes an industry standard, it is difficult to dislodge. Consequently, a dominant design marks the end of the era of ferment. Something worth noting is that if a dominant design gains foothold, the change is usually irreversible, unlike temporary economic discontinuities. This might imply that when a dominant design of new technology achieves complete recognition, it may be too late for established actors to embrace the movement (Anderson & Tushman, 1990; Lien et al., 2016).

2.2 Disruptive Innovation

For the past 20 years, the theory of disruptive innovation has been enormously influential in business circles and a powerful tool for predicting which industry entrants will succeed (Christensen et al., 2015). It has proved to be a powerful way of thinking about innovation-driven growth. Both leaders of small, entrepreneurial companies, as well as executives at large, well-established organizations, praise it as their guiding star. The theory has its origin in an article from 1995 called Disruptive Innovation, further elaborated in the book The Innovator's Dilemma (Christensen, 1997), by the recently deceased Harvard Professor Clayton Christensen. His work has helped businesses understand how disruptive technologies and business models can transform industries and create new opportunities

for growth, continuing to shape the way companies innovate and adapt to an ever-changing business landscape.

Shortly, in broader terms, the book is about "the failure of companies to stay atop their industries when they confront certain types of market and technological change" (Christensen, 1997, p. 11). More specifically it is about well-managed companies known for their abilities to innovate and execute, who invest in technology, listen to their customers, and scout their competitive landscape, and yet still lose market dominance. Christensen (1997) argues that this can happen across industries, finding the common denominator to be that good management is the most powerful reason the companies failed to stay atop of their industries. This implied, at a deeper level, that there are times not to listen to customers and rather invest and pursue lower-performance products in smaller markets with lower margins (Christensen, 1997). "Disruption" thus describes a process through which a smaller company with fewer resources is able to successfully challenge established incumbent businesses (Christensen, 1997).

What Christensen found was that after a certain point, sustaining innovation creates products and services that are actually better than what the market demands (Greg Satell, 2017). A disruptive innovation, in this context, is a product that shifts the competitive landscape by initially underperforming according to traditional standards but excelling in new criteria that were previously overlooked. Moreover, a disruptive strategy is fundamentally characterized by an iterative approach rather than a deliberate one. It doesn't follow a deliberate march toward specific strategic goals but flourishes through experimentation and agility. That is one of the reasons why a disruptive strategy is most often employed by start-ups financed by venture capital rather than established companies (Greg Satell, 2017).

Disruptive innovations are essentially solutions in search of problems (Greg Satell, 2017). When embarking on disruptive innovations, the goal is not typically to uncover new technologies or enhance existing products but rather to identify a market for a technology that already exists. This is why disruptive innovations almost always necessitate a new business model. Although disruptive technology can alter the dynamics of industries with diverse characteristics, the factors determining success or failure when facing such technology remain consistent across different sectors.

2.2.1 The Disruptive Innovation Model

The disruptive innovation model has been used to explain how new entrants can unseat dominant players in industries by initially focusing on overlooked, low-end or niche segments, offering simpler and more affordable solutions, and then moving upmarket, eventually causing significant industry transformations (Christensen et al., 2015). Figure 2.4 below compares product performance trajectories with customer demand trajectories. As incumbent companies introduce higher-quality products or services to satisfy the high end of the market, they eventually exceed the needs of both low-end and many mainstream customers. This leaves an opening for new entrants in the segment the incumbents are neglecting, eventually potentially moving upmarket to challenge the dominant players.

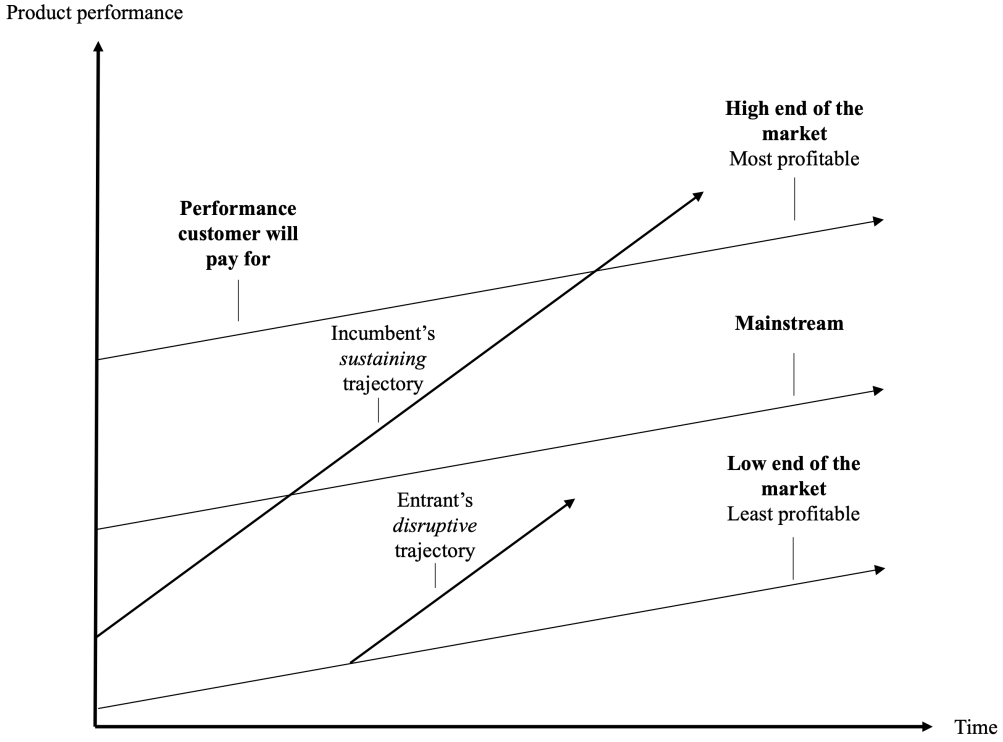

Figure 2.4: Christensen's (1997) Disruptive Innovation Model

According to theory, two characteristics are important for a product or service to be characterized as disruptive. Firstly, disruptive innovations originate in low-end or new-market footholds, markets that incumbents overlook. Secondly, disruptive innovations do not catch on with mainstream customers until quality catches up to their standards (Christensen et al., 2015).

The primary distinction between sustaining and disruptive innovation lies in the performance of the product compared to existing market offerings (Cote, 2022). Sustaining innovation endeavors to develop products that outperform and exhibit superior quality compared to their counterparts. Conversely, disruptive innovations are geared towards creating products that are deemed "good enough", prioritizing accessibility and functional sufficiency over surpassing existing benchmarks. (Christensen & Raynor, 2013) posit that a pivotal aspect of disruptive innovation is that "in every market there is a distinctly different trajectory of improvement that innovating companies provide as they introduce new and improved products". The improvement trajectory of an incumbent company is however shaped by sustaining innovation – the incremental enhancements that most companies consistently produce over time. Typically, these sustaining innovations refine products within established value parameters (King & Baatartogtokh, 2015).

2.2.2 Criticism of the Theory

In recent years, the theory of disruptive innovation has, however, been highly criticized for being too narrow, not explaining the emergence of many of the modern market-leading innovations, e.g., Tesla and Uber. "Disruption is a business buzzword that has gotten out of control", says Joshua Gans, author of the book The Disruption Dilemma (Gans, 2016b). Another article asks if the term is "anything more than a handy marketing slogan" (Rovnick, 2018). Following this, some argue that his framework is overly simplistic and doesn't account for the complexities of real-world business dynamics (King & Baatartogtokh, 2015). Critics contend that his theory may not be as universally applicable as he suggests and that it oversimplifies the factors that lead to business success or failure. Additionally, concerns have been raised about the use of hindsight in his case studies, which might not accurately represent the challenges companies face in real time.

Christensen acknowledged the criticism of disruptive theory, emphasizing that his theory might not be a universal solution for all situations (Denning, 2016). However, he also devoted a lot of time to explain and defend it. Among other arguments, he underlined the importance of adaption and adjustment, saying "our research over the years has shown that due to inherent differences between industries, the process of disruption plays out somewhat differently in each case" (The Boston Globe, 2015). Furthermore, he clearly emphasized the essential role of context and nuance in its application and

stressed the role of a valuable framework for understanding the dynamics of innovation and competitive advantage in many industries. He argued that his critics often misunderstood or oversimplified his work, thus encouraging a more careful examination of the specific conditions and industries (Christensen et al., 2015).

According to his perspective, firms cannot effectively balance exploration and exploitation and must instead spin out the exploratory business to achieve success. Established entities either overlook the need for change or, when they do recognize it, often implement it belatedly or ineffectively (O'Reilly & Tushman, 2008). Excessive focus on exploration increases the likelihood of pursuing unproductive ideas, while an overemphasis on exploitation can result in fatal missed opportunities (Christensen, 1997). In less dynamic environments, the demand for exploration diminishes, whereas in highly competitive scenarios, it becomes more pronounced. In contexts characterized by slow change, continual experimentation may prove inefficient, and the costs of maintaining ambidexterity can be substantial (O'Reilly & Tushman, 2008; Winter, 2000).

2.3 Democratization of Technology

The theories proposed by Christensen and Tushman give considerable attention to the role of technological progress in shaping competitive environments. This is highly relevant today, as technological development is progressing rapidly, potentially outstripping the rate at which humans can utilize it.

Several researchers note a disparity between technological advancements and society's capacity to embrace and fully leverage their potential (Broadridge, 2014; Sweary, 2022). A factor likely contributing to this gap is the complexity of technology. Technological solutions often have too many features, making it expensive and difficult to use (Arbesman, 2016a). This disparity can result in untapped potential, as the adoption struggles to keep pace with the innovations. The phenomenon is illustrated in Figure 2.5, inspired by Avo Consulting (2023) and Mirthinti (2023), visually underscoring the contrast between technological potential and society's actual adoption. The "Technology" curve rises swiftly, mirroring the rapid growth of technology. Conversely, "Typical Adaptation" follows a more gradual path, signaling the challenges society faces in keeping pace with the swift advances of new technologies. The shaded space between the curves represents the growing

adaptation gap, a visualization of the challenge of adopting to continuous technological growth.

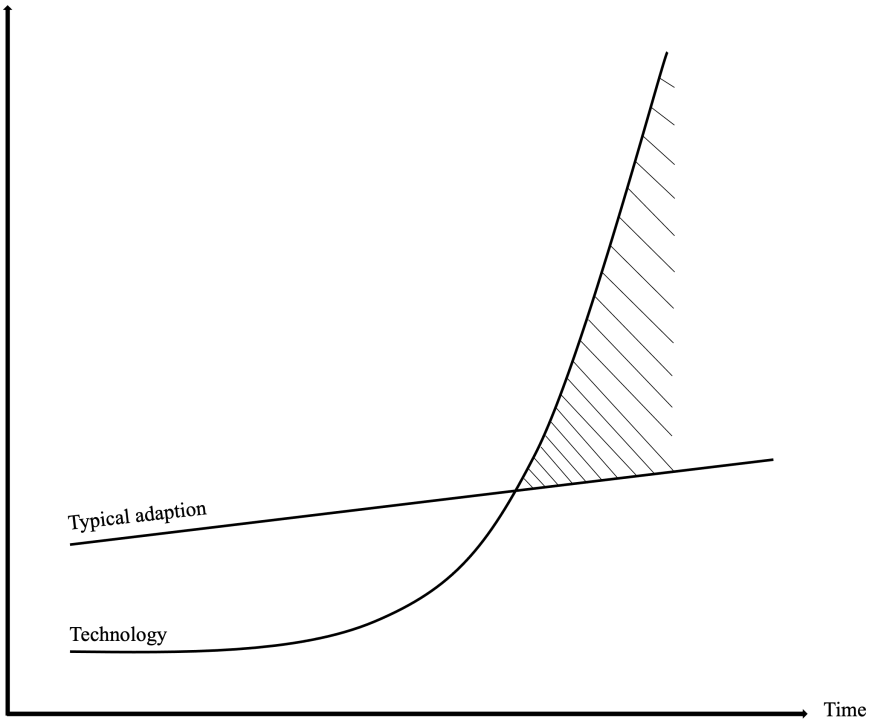

Figure 2.5: Gap between adoption and technological possiblities

However, an ongoing trend of democratization is significantly simplifying the intricacies of technology. Representing a paradigm shift in accessibility and application, the democratization of technology ensures that what was once exclusive to IT specialists and corporate leaders is now widely accessible to the general population (Friedman, 2000). This process involves breaking down the barriers of technological understanding and usage, leading to a reduction in its mystique (Feenberg, 2001). It allows individuals without specialized IT expertise to develop, implement, and tailor their own technology solutions (Driver, 2022b). Accordingly, "citizen developer" has become a new term, referring to those lacking IT expertise who can now create applications (Gartner, n.d.-a). The empowerment of the citizen developer has in fact become a symbol of the increased enablement and accessibility of LCNC. Gartner's anticipation for 2023, was that citizen developers in large enterprises would outnumber professional software developers at a ratio of 4:1 (Kissflow, 2023b).

The democratization of technology is not only a move towards a more inclusive technological society, where access and knowledge are not limited to a privileged few, it is also an

essential response to the growing demand for IT. In 2021, the demand for information systems was projected to increase five times faster than the ability of IT departments to provide them (Waszkowski, 2019). By 2025, it is predicted that 750 million apps will be created, which is more than the last forty years combined (IDC, 2022). The substantial demand greatly exceeds the supply of IT expertise, a trend that will continue until at least 2026 based on forecasted IT spendings (Gartner, 2023). The scarcity of developer talent poses one of the most significant risks for organizations worldwide (Gartner, 2019), and as much as 86 percent of organizations struggle to find technical talent to build applications (Schoen, 2023).

The conventional method of developing applications through manual coding is not only time-consuming but also requires a higher level of competence to deliver quick, secure solutions of high quality (Microsoft Power Apps, n.d.). When an IT department lacks the resources to meet the company's requirements, it frequently results in a scenario referred to as "technical debt." Ward Cunningham introduced the term "technical debt" as a metaphor to depict the trade-off IT departments frequently face between developing clean code, incurring higher costs and delayed delivery, and choosing quick, inexpensive, and "messy" code (Cunningham, 1992). Technical debt is like financial debt, as "it supports quick development at the cost of compound interest to be paid later" (Buschmann, 2011). In essence, because of the insufficient capacity in IT departments, there is a tendency to resort to short-term solutions that could pose challenges in the future.

As technology becomes more accessible to the general population, it is likely to bring about notable changes in the competitive landscape. Even though there is limited research specifically on the democratization of technology and its influence on competition, there is substantial literature focused on the broader subject of digitalization and its effects on competitive dynamics. Knudsen et al. (2021) delve into the nuances of this intersection, examining the effect of digitalization on the sustainability of competitive advantage. They assert that the escalation of digitalization is a transformative force, capable of reshaping market structures, challenging the traditional heights of entry barriers, and altering the essential competitive parameters within markets. Their analysis suggests that companies integrating Big Data into their business models, while capitalizing on powerful network effects, could establish sustainable and self-reinforcing advantages in the digital economy.

Furthermore, they explore the potential for firms to transition to new business models or absorb adjacent markets, highlighting the likelihood that data-driven network firms can consolidate robust advantages in informationally adjacent markets (Knudsen et al., 2021).

A consensus among many researchers is that advanced technologies are instrumental drivers of change, exerting a substantial impact on the economy by fostering the creation of new businesses (Dedrick et al., 2007; M. J. A. Gonçalves et al., 2016; R. Gonçalves et al., 2016; Mejia et al., 2014; Porter & Heppelmann, 2014). This digital upheaval, as proposed by Ferreira et al. (2019) may result in the companies that can adapt to ongoing digital transformations having a greater ability to innovate and identify sustainable competitive advantages ahead of their competitors. On a different note, other scholars anticipate a future characterized by hypercompetition, a constantly changing competitive environment where no action or advantage can be sustained for long (D'aveni, 1994; D'Aveni et al., 2010). This phenomenon is in part driven by technological advancements. A contrasting perspective asserts that digital technology results in more long-lasting competitive advantages. The essence of this argument is that fundamental elements of digital technologies generate self-reinforcing "winner takes all" dynamics (Eisenmann et al., 2011; Schilling, 2002; Zhao et al., 2020).

2.3.1 Introduction of Low-code and No-code

To keep up with the fast-paced, ever-changing technology landscape, and address the challenges of technical debt, companies are actively seeking faster and more cost-effective solutions to meet their software needs (Nguyen, 2023). The most influential trend within democratizing technology currently is the rise of low-code and no-code. The term "low-code" gained prominence following its introduction by the research and advisory firm Forrester in 2014 (Richardson & Rymer, 2014). They explained an approach to create software with less code than traditional development. These platforms use visual building blocks, such as drag-and-drop and pull-down menu interfaces, to quickly build applications and make the whole software development process less complex (IBM Cloud Education, 2022). We will now delve into the history and development of the technology, ending with no-code.

Low-code operates in the space between "off-the-shelf" solutions and custom development

(DiCesare, 2023). “Off the shelf” solutions offer immediacy for standard use cases but often fall short when businesses encounter unique challenges that require tailored functionalities (Derzap, 2022). These solutions are typically rigid, offering little to no room for the kind of customization that specific business processes might demand. On the other end of the spectrum, custom development caters to those unique business needs by providing highly specialized solutions (Derzap, 2022). However, this bespoke approach tends to be time-intensive and costly, not to mention the limitations it poses on future upgrades and scalability. In this context, low-code platforms offer a balanced approach, providing the adaptability to cater to specific needs while maintaining efficiency and reducing the complexities and costs typically associated with custom-built solutions (DiCesare, 2023).

In Forrester’s trend report (Richardson & Rymer, 2014), they emphasized that organizations choose a low-code approach mainly for faster, continuous, and test-and learn delivery. In 2016, Forrester conducted a survey revealing that low-code platforms significantly can accelerate the development time, boasting a potential speed increase of 5 to 10 times (Richardson & Rymer, 2016). Furthermore, these platforms offer enterprises a more cost-efficient avenue to fulfill both market and internal requirements (Sanchis et al., 2019).

Technological democratization, exemplified by the emergence of low-code, is not a recent phenomenon but an enduring evolution integral to the history of software engineering (Gaggioli, 2017; Roberts, 2019). The 1990s marked the beginning of this journey, with companies like Microsoft and Adobe launching comprehensive tools like Word, Excel, and Photoshop, which required no coding skills from the end-user (Leetaru, 2019; Microsoft Research, 2021; Palios, 2022; Willings, 2023). These all-in-one platforms and single-function software solutions laid the groundwork for technological democratization. As we moved into the new millennium, the scene expanded with WordPress, Salesforce, and Shopify introducing platforms that fostered building capabilities, further democratizing computer use (ForceDigest, 2023; Hough, 2013; Sularia, 2021). WordPress made website creation accessible to the masses, while Salesforce and Shopify launched app ecosystems that allowed users to add on functionalities with ease.

Furthermore, the democratization of technology took a leap forward with the advent of Rapid Application Development (RAD) platforms, which introduced a visual, drag-

and-drop interface for application development (Kissflow, 2023b). Apart from being a method for developing applications with reduced code, it represented a shift in working methodologies distinct from the conventional waterfall approach (Outsystems, n.d.). The advantages of Rapid Application Development (RAD) include faster project completion, reduced costs through focused development, and increased developer satisfaction with frequent client involvement and feedback throughout the development process (Outsystems, n.d.). Low-code is characterized as a continuation of RAD, closely aligning with this approach in terms of rapid and iterative development, user engagement, and the reuse of software components (Ismail, 2017; Vincent et al., 2022).

The emergence of low-code platforms further advanced the democratization of technology throughout the 2010s (Richardson & Rymer, 2014). Nevertheless, low-code differs in its goal of enabling users from various organizational units to engage in application development activities (Shala, n.d.). These users, predominantly situated in non-IT business units, possess limited development experience and basic technological skills, earning them the title of citizen developers (Shala, n.d.). Low-code can thus be seen as an even more significant democratization of technology compared to previous technologies, as it encompasses individuals with even less knowledge.

A less intricate form of low-code, suitable for individuals with minimal coding knowledge, is no-code platforms. The distinction between no-code and low-code is that no-code does not involve any coding. In low-code, developers offer assistance through scripting or manual coding, whereas no-code adopts a completely hands-off approach, relying entirely on visual tools (IBM Cloud Education, 2022; Tariq, 2021). No-code enables users to craft applications without any coding expertise, making software development accessible to all, while low-code platforms necessitate a basic understanding of coding (Tariq, 2021).

A handful of no-code solutions have existed since the 1990s, but with limited functionality (Shi, 2021). If users required functionalities beyond what the no-code platform offered, coding experience was a necessity. In the absence of coding, many platforms relied on users selecting and customizing pre-built templates, hindering truly free-form creation (Shi, 2021). This paradigm shifted as the Internet evolved, especially with the advent of Application Programming Interfaces (APIs) that connected different parts of the Internet, revealing the full potential of no-code platforms (Shi, 2021). By 2010, APIs had become

the “connective tissue” of the internet, enabling disparate web platforms to interact, share data, and extend functionality (England, 2022). In this context emerged a new generation of no-code platforms designed to leverage the interconnected web, breaking free from the limitations of earlier no-code offerings. Bubble was introduced in 2012 (Formstack, n.d.), and Webflow followed in 2013 (Shi, 2021), enabling free-form creation without the necessity for code. Since then, many no-code platforms have emerged, and innovators in the space are working on making these platforms not only more powerful but more intuitive and easier to use (Palios, 2022).

Many use the terms low-code and no-code interchangeably, while others are explicit about there being significant differences between these concepts. Interestingly, some platforms initially branded as low-code have evolved to identify themselves as no-code. A prominent instance of this shift is the Norwegian company, Genus, which initially offered low-code solutions but later repositioned itself as a no-code platform provider (Rief, 2021). In this paper, we will consider both aspects together, even though we are aware of their differences. We will refer to low-code and no-code collectively as LCNC.

2.3.1.1 Benefits and Limitations

LCNC development platforms have attracted significant interest for several compelling factors. Several experts emphasize the promising future of these platforms, highlighting their primary benefits. One of the most notable advantages of LCNC platforms is their rapid development capabilities. Users can visually configure applications without the need to write extensive code, significantly reducing the time it takes to bring these apps to market. Cost reduction is another significant benefit. Shortened development cycles lead to direct cost savings, whether applications are developed in-house or by external developers. This cost-efficiency is a compelling reason why organizations are adopting low-code platforms (Richardson & Rymer, 2016).

Furthermore, LCNC platforms simplify the application development process by reducing complexity. Users can focus on customizing software to meet specific requirements without starting from scratch. This streamlined approach increases efficiency and enables businesses to quickly respond to changing demands (Outsystems, 2019). Moreover, LCNC platforms involve business profiles in the development process. Business users, who

have a deep understanding of the organization's needs, can actively participate in the development process. According to (Outsystems, 2019), a substantial 44 percent of low-code platform users are business users collaborating with IT, highlighting the inclusivity of these platforms (Waszkowski, 2019). Maintenance of software is a vital aspect of ensuring that applications remain aligned with business requirements. LCNC platforms also contribute to easy maintenance, which is a vital aspect of ensuring that applications remain aligned with business requirements. This is due to the fact that they generate minimal code that needs to be maintained. This approach ensures that the service offered by the app remains in sync with evolving business needs (Outsystems, n.d.).

While LCNC development platforms offer numerous benefits, the literature has highlighted the several drawbacks associated with LCNC. An often-repeated drawback is the challenge of scalability (Tisi et al., 2019). Many contend that low-code platforms are primarily designed for small-scale applications, thereby constraining their applicability to large-scale projects and mission-critical enterprise applications. This has been viewed as an obstacle for organizations with diverse application requirements, especially those encompassing complex and extensive projects (Tisi et al., 2019). In parallel to these considerations, a survey conducted by (Outsystems, n.d.) sheds light on the main reasons why organizations either have not embraced or are hesitant to consider LCNC platforms. The foremost factor appears to be a knowledge gap, with many organizations lacking sufficient awareness and understanding of what LCNC entails. This knowledge deficit is closely followed by apprehensions about vendor lock-in, concerns about flexibility, and security. Vendor lock-in refers to a scenario in which companies are bound to a single product or service provider, facing challenges in transferring without incurring substantial expenses (Quixy, 2023).

2.3.1.2 Gartner's Framework for Citizen Developer Safe Zones

Many have explored the appropriateness of utilizing LCNC and when traditional IT is a better fit (Crowdbotics, n.d.; McLaughlin, n.d.). Gartner's framework from 2019, "Adaptive Governance Framework for Multiple Solutions in Enterprise", delineates the suitability of LCNC across different levels of business criticality and application complexity, offering a approach to technological adoption (Gartner, 2019). The framework is illustrated in Figure 2.6, depicting its structure as a matrix with two axes. On the vertical axis, we

have "Business Criticality," which scales from "Individual" at the lowest end, denoting applications that serve individual employees with minimal impact on business operations, to "Enterprise" at the highest end, indicating applications that are vital for the entire organization's functions. The horizontal axis, "App Complexity," categorizes applications based on the complexity of tasks they perform, ranging from the simplest level, "CRUD" (Create, Read, Update, Delete), to the most complex level, "Composite," which refers to sophisticated applications integrating multiple functions or data sources.

The color-coded grid within the matrix identifies four zones. The black zone represents areas that are "Off Limits" for citizen developers, suggesting that such complex and business-critical applications should remain under the purview of professional IT departments. The red zone indicates "Danger," where applications have significant complexity or business criticality, demanding thorough IT oversight and governance before they can be deployed. The orange zone is tagged as "Supported," signifying that while citizen developers can contribute to these applications, their efforts should be in collaboration with professional developers and under flexible governance structures. The green zone, considered the "Safe Zone," is where citizen developers have the freedom to operate independently. This zone is deemed to have the lowest risk, where the applications are not critically vital to business operations and are less complex, making them ideal for development by non-IT professionals. This governance framework aims to help organizations navigate the risks and benefits of empowering their non-technical staff to develop applications and can prove to be a beneficial guide for many companies when choosing what kind of IT solution to adopt.

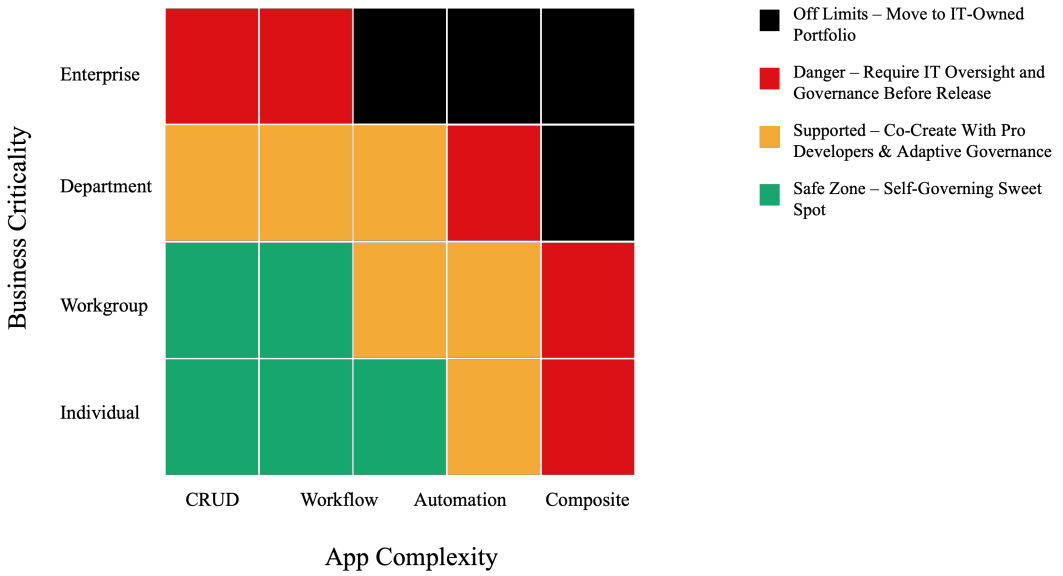

Figure 2.6: Gartner's Adaptive Governance Framework for Defining Citizen Developer Safe Zones

2.3.1.3 AI's Influence on LCNC platforms

Parallel to the rise of LCNC, substantial progress has occurred in the field of Artificial Intelligence (AI). AI can be defined as "a machine's ability to perform the cognitive functions we associate with human minds, such as perceiving, reasoning, learning, interacting with an environment, problem-solving, and even exercising creativity" (McKinsey & Company, 2023). A pivotal moment in AI's development occurred in 1997 when IBM's supercomputer Deep Blue defeated the world chess champion Garry Kasparov (Yao, 2022). This milestone marked a significant turning point in the evolution of AI. Since Kasparov's defeat, the technology has been widely embraced as a value proposition by companies across all industries, aiming to create or enhance the services and products they offer.

When OpenAI, a leading AI company in the United States, introduced the first GPT model in 2018, the journey in the field of Generative Artificial Intelligence began (Marr, 2023). According to Gartner, "Generative AI can learn from existing artifacts to generate new, realistic artifacts (at scale) that reflect the characteristics of the training data but don't repeat it" (Gartner, n.d.-b). It was not until the release of ChatGPT 3 in November 2022 that the world started acknowledging this groundbreaking technology (Marr, 2023). The new technology stands to benefit a range of industries, including

education, research, journalism, mass communication, retail, and various others (Haleem et al., 2022). The Information Technology (IT) sector is no exception. ChatGPT can produce quick, generally accurate code based on information, sentences, or questions that you enter into a Generative AI, called prompts (Open AI, 2023). Through iterative processes with artificial intelligence, developers can receive assistance in fixing errors, saving time, and boosting their productivity.

Up to now, LCNC platforms have created applications from predefined components. However, with the progress in Generativ AI, this approach can undergo changes. However, advancements in Generative AI suggest a potential shift in this approach. Users could soon have the capability to develop applications using natural language, articulating their requirements in plain language (Groden-Morrison, 2023). As Karper (2019) emphasizes, there is a growing realization that future apps will be constructed through conversation rather than through drag-and-drop or coding. Contrary to concerns raised in Forrester's article titled "Will AI Kill The Low-Code Market?" the conclusion leans towards the opposite; AI's emergence is propelling low-code into a realm of increasingly autonomous software development. This shift influences the trend of technology creation moving beyond traditional IT departments. According to Foster, the swift evolution of AI is anticipated to enhance the low-code tool set, contributing to accelerated market growth (Bratincevic & Lo Giudice, 2023). Supporting this trajectory, a 2023 survey of 2,000 IT executives by Microsoft unveiled that 87 percent of CIOs and IT professionals believe that increased integration of AI and automation within low-code platforms would enable them to leverage the technology's complete set of capabilities (Microsoft, 2023).

Recently, there has been a growing trend of LCNC platforms incorporating their own AI assistants. Microsoft's AI assistant, Co-pilot, has gained considerable attention in the technical community. Charles Lamanna 2023, Microsoft's corporate VP for its low-code application platform writes "Makers now have a live in-studio copilot that helps them build solutions and provides suggestions for improvement. To build an app, flow, or bot, you can describe it using natural language and copilot can build it in seconds. It is that easy". Other companies have already introduced or are in the process of launching their own AI assistants, including Salesforce's AI Assistant, "Einstein Copilot" (Salesforce News, 2023) and Mendix's AI Assistant, "Mendix Assist" (Mendix Documentation, 2023).

2.4 Expectations for Findings

In this chapter, we have demonstrated theories of technological development and disruptive innovations, as elucidated by Anderson and Tushman (1990) and Tushman and Anderson (1986) and Christensen (1997). We have also outlined the phenomenon of democratization of technology. Our further aim is to investigate how the democratization of technology, exemplified by adoption of LCNC, may result in a wave of disruption. Our expected findings are divided into three sections, with each expectation represented as a dimension in the modified version of Christensen's model provided as 2.7.

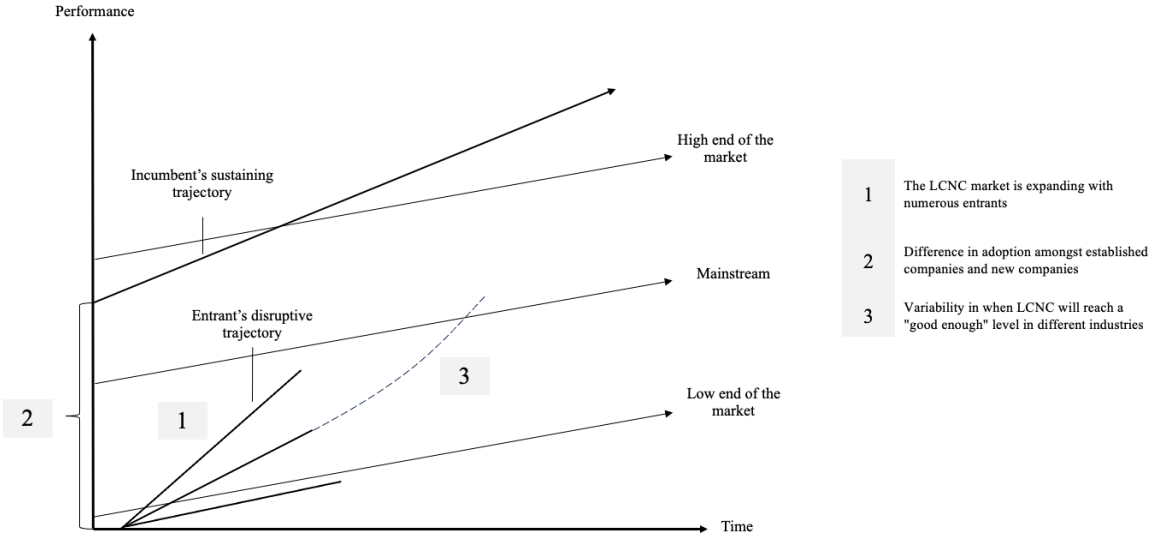

Figure 2.7: Expectations of findings

Our first expectation is that we anticipate observing an increase in LCNC platforms, indicating an "era of fermentation" within the LCNC market. This is illustrated in the initial segment of our model. We envision a landscape filled with LCNC startups, each utilizing LCNC in unique ways, fostering innovation in the pursuit of "the dominant" design.

Further, our second expectation examines the contrasting use of LCNC in newly established companies and larger firms. We predict that LCNC grants smaller firms a strategic edge, allowing them to deploy "good enough" solutions that meet customer demands with efficiency and simplicity. This advantage is expected to enable these firms to establish footholds discreetly, challenging larger incumbents over time.

Our final expectation is concerned with the varied impact of LCNC across industries. We propose that LCNC's influence will differ, especially in sectors with high regulatory or technical complexity. This is rooted in the perceived simplicity of LCNC compared to traditional IT solutions, which, although advantageous for user-friendliness and rapid implementation, may lack the robustness needed for technically complex environments or may fall short in meeting rigorous regulatory requirements. In these sectors, becoming "good enough"' may be more complex, with incumbents using their regulatory and technical capabilities to defend against newcomers. We have illustrated the two dimensions in Figure 2.8 below.

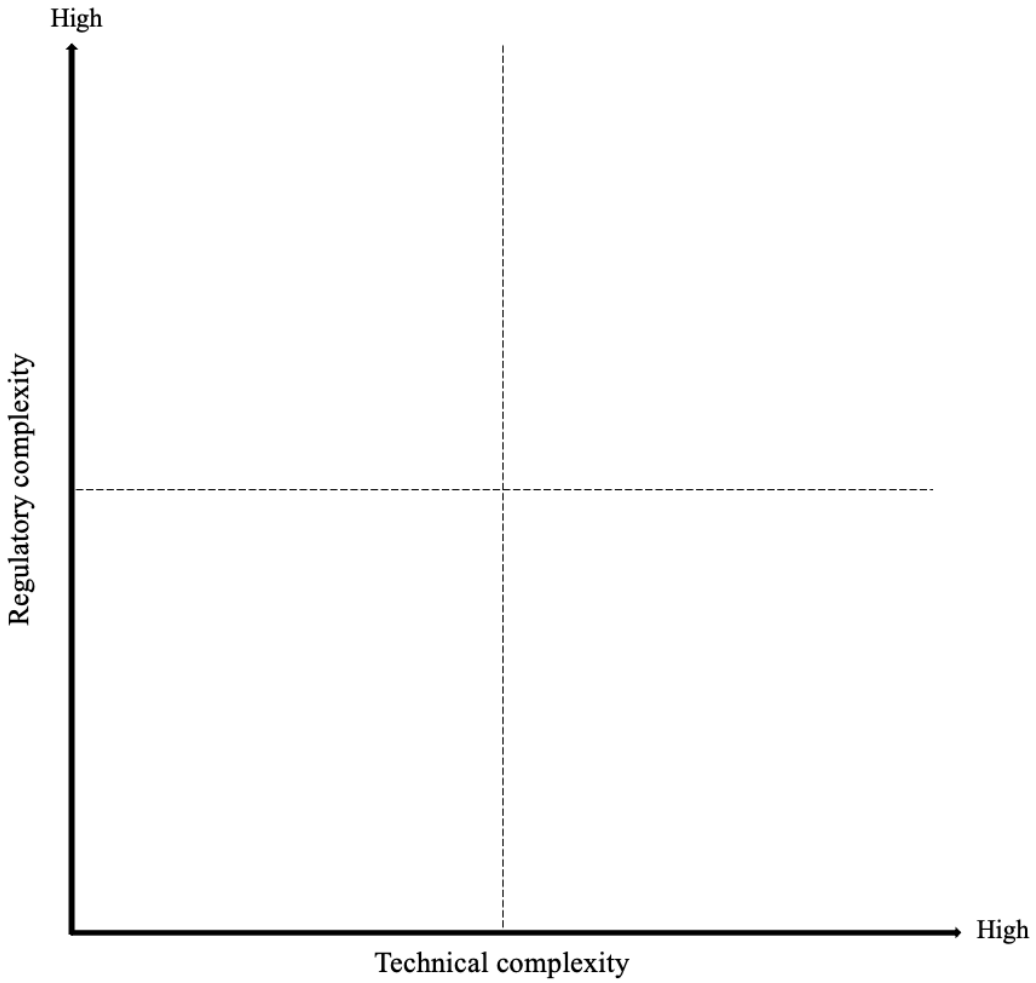

Figure 2.8: Mapping industries by regulatory and technical complexity

3 Methodology

In the following section, the methodological framework of the study will be presented. This will be done based on the illustration of research known as "the research onion" by Saunders et al. (2023). In the illustration, each layer represents different choices a researcher faces during a study. Buschmann (2011) has simplified the illustration, as shown in Figure 3.1:

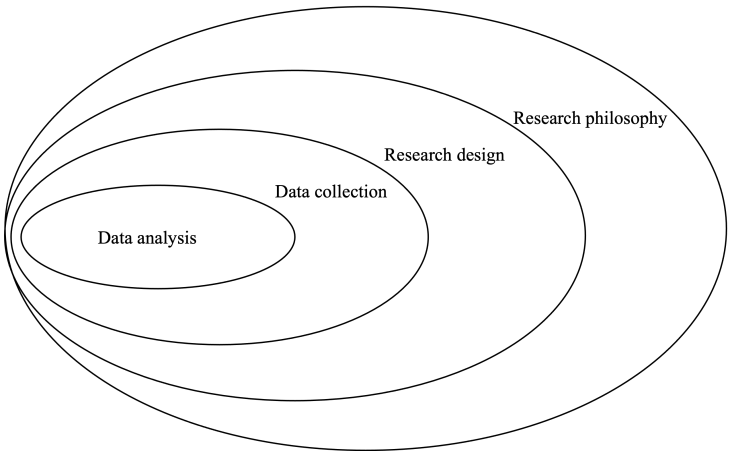

Figure 3.1: Illustration of "The research onion". Based on Busch (2021) and Saunders et al. (2023)

The diagram crafted by Saunders et al. (2023) offer insights into the pivotal factors influencing the selection of data collection techniques and analysis procedures. Initially, the outer layer highlights the fundamental decision-making related to research philosophy and approach, as delineated by Busch (2021). Subsequently, researchers must navigate the choice of a research design, a critical determinant shaping how data will be collected and analyzed throughout the study.

To operationalize our thesis and test our hypotheses, we have used an exploratory design with a qualitative approach, using a multiple case-study method. A multiple-case study includes two or more cases, with the aim of investigating the same phenomena (Michael Lewis-Beck et al., 2003; Yin, 2018). Furthermore, our research has consisted of both interviews with field experts working with LCNC, and a thorough analysis of secondary data. We found this approach suitable as we aim to analyze a relatively uncovered and new field of study. The exploratory method allows us to focus on exploring the trends and characteristics rather than focusing on the underlying causal mechanisms. When

practicing a multiple case-study it is important to understand each particular case, one at a time. Furthermore, the cases need to be similar in some ways. In this thesis, the overall common denominator is employees working with LCNC. As the purpose of our study is to compare and replicate the findings, including to uncover current state, we find this method suitable. The research onion forms the structure of this chapter, and we will therefore delve into each layer of the research onion. Finally, we will discuss validity and reliability, as well as assess any ethical challenges associated with the study.

During our research we have used ChatGPT to proofread and improve language of self-produced text. We find this both useful and interesting concerning our exploration of emerging technologies.

3.1 Research Philosophy

Figure 3.1 shows that you first need to take a stance on the scientific theoretical standpoint. It is an overall decision that holds significance and establishes the course for all subsequent methodological choices (Busch, 2021). Research philosophy denotes a set of beliefs and assumptions about the development of knowledge (Saunders et al., 2023).

Saunders et al. (2023) outline five research philosophies: positivism, critical realism, interpretivism, postmodernism, and pragmatism. Positivism adopts a natural scientist's perspective, aiming for observable social reality and law-like generalizations (Saunders et al., 2023). Interpretivism, a critique of positivism, highlights the human role in creating meanings and argues against studying humans like physical phenomena. Our study adopts a pragmatic research philosophy, aiming to understand the LCNC field and its potential impacts. We utilize both interviews, capturing personal opinions, and external literature for a comprehensive perspective. However, we acknowledge the personal interests inherent in commercial contexts during interviews.

3.1.1 Research Approach

To integrate theory and empiricism, one commonly distinguishes between an inductive and a deductive approach (Grenness, 2001; Johannessen et al., 2010; Saunders et al., 2023). Induction is based on general statements of accumulated observations of specific instances. It implies drawing general conclusions from empirical facts, gathered through

observation or a perception of reality (Grenness, 2001). A deductive approach, on the other hand, implies a starting point focused on established theory, wherein the researcher tests this, usually with clear hypotheses prepared from the beginning (Saunders et al., 2023). Worth to note is that the two approaches are not mutual exclusive, as induction consists of elements of deduction, and vice versa (Ghauri et al., 2020).

Our research approach is primarily deductive, with inductive elements. According to Saunders et al. (2023), it can be advantageous in exploratory studies to combine both a deductive and inductive approach. The deductive approach contributes to structuring the problem and provide direction, while the inductive approach allows for illuminating new aspects not previously covered in theory. In addressing our research question, empirical research is imperative due to the absence of established theories regarding the impact of LCNC on industries, and the relationship between disruption and LCNC. Although separate research exists on disruption, LCNC, and the technological revolution, there is no comprehensive research that encompasses all these elements. However, this does not imply that we disregard established theory in the field, as it can be used to identify concepts we wish to explore further in the process (Saunders et al., 2023). Indeed, we do approach the empirical data with clear expectations as to how the development of LCNC can affect the possibilities of disruption in markets.

3.2 Research Design

We have now peeled away the outer layer of the research onion. Next, we will elaborate on our choice of research design, the general plan of how we will answer our research question (Saunders et al., 2023). Research can be structured to serve an exploratory, descriptive, explanatory, evaluative, or a combination of these purposes. We find the former three most relevant to further amplify.

An exploratory research design is employed when investigating areas that have seen limited prior systematic research, and the research question is often formulated in a more open-ended manner (Saunders et al., 2023). It has the advantage of being flexible and adaptive to change and will likely start with a broad focus and narrow as the research progresses. Next, the purpose of a descriptive research design is to obtain a precise profile of events, individuals, or situations. It is often used when describing variables and

the connection between these, often based on relatively clear hypotheses of what such connections look like (Grenness, 2001). Lastly, an explanatory research design is used when wanting to analyze and establish causal relationships between variables (Saunders et al., 2023).

There has been little targeted research on the field of LCNC, particularly linked to disruption and market effects. While disruption theory is a highly studied research field, LCNC is a relatively new concept, and the bridge between the two are not covered. However, given the broader field of democratization of technology and the overall characteristics of LCNC, we do have some expectations beforehand. Next, our research question is open-ended, asking how LCNC impacts the potential for disruption. This aligns with an exploratory design (Saunders et al., 2023). In addition, the flexibility of the design, suits our research. However, considering our aim of characterizing and mapping the LCNC-landscape including trends and scope, to uncover how the emergence has unfolded, our study also contains a descriptive element. To further elaborate on the research design, we will delve into the four fundamental questions posed by Busch (2021).

3.2.1 Intensive Research Design

An extensive research design implies collecting data from many respondents, for example through a survey. An intensive design, on the other hand, implies to delve deeper and thus collect data from a limited number of respondents, for example through interviews (Busch, 2021). When choosing between an extensive and intensive research design, it may also be relevant to assess the complexity of the research question. Considering our scope of informants, and that our research question is relatively open and complex, we argue for an intensive research design. At the same time, we have focused on establishing a sufficient breadth in the data selection, which may lean towards an extensive research design. Usually, however, an exploratory stance without numerical analysis tends to lead toward an intensive design (Buschmann, 2011).

3.2.2 Research Method

The research method of the study is what Saunders et al. (2023) refer to as the first methodological choice, whether to follow a quantitative, qualitative, or mixed methods

research design. One way to distinguish quantitative research from qualitative research, is to differentiate between numeric data that generates or uses numbers, and non-numeric data, that uses or generates non-numerical data. According to Johannessen et al. (2010), a quantitative research design maps that something happens, while a qualitative method maps why it happens. However, in reality, many research designs tend to combine elements from the two. An example is a questionnaire with both closed alternatives and open questions where the respondent writes his or her own words. A mix method catches this type of research design.

Given the openness and the complexity of our research question, and the limited availability of numeric data on the field, we base our research on a qualitative design. The method is often preferred in intensive research designs and opens for a deeper understanding of the field of NCLC and its potential consequences. A qualitative research design makes it easier to delve deeply into studying more complex and open-ended issues (Busch, 2021). Nonetheless, it should be emphasized that the outcomes may exhibit a lower degree of transferability when contrasted with quantitative data collection.

3.2.3 Time Perspective

A central question is whether data should be collected at one or multiple time points (Busch, 2021). The main advantages of collecting data several times in one research, are to be able to study possible causal relationships and complex development trends. By collecting data at one time point, on the other hand, through a cross-sectional study, you provide a snapshot of the phenomenon you are studying (Johannessen et al., 2010).

In our study, we conduct interviews with each respondent one time. This makes it possible to analyze connections between phenomena, but not trends over time. Given our time constraint of one university semester, conducting a longitudinal study is not feasible. It is therefore important to be aware of the limitations of a cross-sectional study (Busch, 2021). As discussed, causal relationships and trends over time are hard to measure in the field of LCNC. Considering that we map and categorize various companies, and considering the dynamic and evolving nature of the LCNC field, neglecting to examine the changes and growth in specific categories over time represents a potential vulnerability that we acknowledge.

3.2.4 Research Strategy

Broadly speaking, a strategy can be described as a predetermined course of action aimed at accomplishing a specific objective. In the context of research, a research strategy can thus be characterized as a systematic plan outlining how a researcher will approach the task of addressing their research question (Saunders et al., 2023). The choice of research strategy is contingent upon several factors, including the research question and objectives, research philosophy, the scope of existing knowledge, research, and the availability of time and resources (Saunders et al., 2023). Lastly, it is important to note that the strategies are not necessarily mutually exclusive.

Based on the explorative and intensive research design we will carry out a case study as our research strategy. Yin (2018) defines a case study as an in-depth inquiry of a subject or phenomenon within its authentic real-life context. The type of research strategy can subsequently lead to a profound understanding of the phenomenon and serve as a foundation for the further development of theories (Saunders et al., 2023). Furthermore, Yin (2018) discusses four types of case study designs based on two dimensions. He distinguishes between single- and multiple case studies, and unitary or multiple units of analysis. The matrix is shown in Figure 3.2.

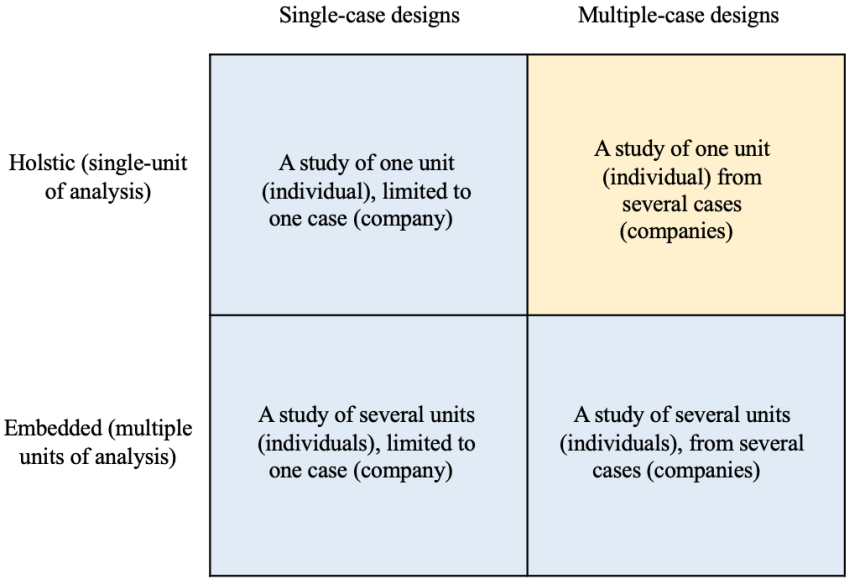

Figure 3.2: Case study designs, based on Yin (2018) and Johannessen et al. (2010)

The evidential strength derived from multiple cases is frequently deemed more persuasive, rendering the overall study more robust (Yin, 2018). Our research is placed in the upper right quadrant, characterized as a multiple case-study design based on one single unit of analysis. This is because we examine characteristics concerning disruption (a single unit) in light of the emergence of LCNC, thus interviewing several LCNC actors (multiple case-units).

3.3 Data Collection

According to Busch (2021), several methodological choices need to be considered regarding data collection. We will now discuss how we have proceeded in the selection of methods and literature, as well as the design of the interview guide and the execution of interviews. In the assessment of methodological choice, the research design and philosophy should be considered (Busch, 2021). Based on the qualitative approach and characteristics of a case study, to gain a comprehensive understanding of the phenomenon, Saunders et al. (2023) emphasize the advantage of combining data from multiple sources. Based on the exploratory and intensive research design of the investigation, we have chosen to conduct one-on-one semi-structured in-depth interviews and an analysis of secondary data.

3.3.1 Analysis of Secondary Data

An analysis of secondary data entails collecting data in the form of existing documents. Such an analysis allows data transfer across time and space for reanalysis with different objectives than the original collection intent (Saunders et al., 2023). Yin (2018) argues that information gathered through such an analysis is likely to be relevant to every case study topic due to its overall value. In the context of case study research, the principal purpose of documentation is to validate and complement evidence obtained from other sources.

This technique was first employed as the starting point for the study, to develop an understanding of the concept of LCNC and gain insight into trends, potential changes and effects, scope, and platforms. By engaging in existing literature and research from both official journals as well as more freely written articles in Medium, for instance, we obtained a comprehensive understanding of the technology. As the term LCNC is relatively new,

we found the documents written by programmers rather than scientists just as useful. However, we were concerned with weaknesses such as biased selectivity (Yin, 2018), thus carrying out systematic searches and remaining critical when assessing and collecting data.

Our examination has encompassed mainly publicly available statistics and documents, serving as a means to delineate an overview of the industry's key actors and their distinctive attributes. In addition, we gained access to several pertinent reports by Gartner through dialogues with the company, as well as company data in Crunchbase. Both are crucial in shaping our understanding of how technology has emerged through adoption and growth.

The technique played a key role as a foundation for shaping data collection by providing a preliminary understanding of the relevant themes that could be explored during the interviews. Besides playing a crucial role in our delineation of the research question and scope of the study, it is also part of the study in the way we have utilized the company data from Gartner to analyze historical growth, both general and specific categories.

3.3.2 Interviews

The advantage of in depth semi-structured interviews lies in the flexibility of the method, allowing for comprehensive, freely expressed, and more detailed descriptions of the unit of analysis (Johannessen et al., 2010). The approach relies on a structured interview guide as a foundational framework, yet the specific questions, topics, and sequences during the interview may exhibit variability. Such interviews therefore create a good foundation of key events combined with participants' relativist perspectives (Yin, 2018). This provides the data collection with an overarching structure, while also allowing for flexibility throughout the process.

The technique facilitates interview subjects to delve into themes and concepts that the researcher may not have contemplated (Saunders et al., 2023). Follow-up questions can also be posed during the process, contributing to a more in-depth exploration of key topics. In this way, access to detailed explanations and descriptions of how LCNC affects different industries, and which implications this can have, could be obtained. The technique also allows for the customization of interviews for individual respondents, enabling a focus on questions most relevant to their background. However, having the interview guide as a

foundation was also important regarding the latter comparison and analysis. Even though our research is primarily inductive, the interviews thus contained deductive characteristics as themes used in the interviews were derived from existing theory, with the intention of testing the theory in the context of our research (Saunders et al., 2023).

3.3.2.1 Sample

To comprehend the implications of LCNC, it has been crucial to connect with key individuals in the LCNC industry. Through the analysis of secondary data, we gained insight into which companies it could be valuable to engage with, and found relevant individuals based on their job description. We aimed to interview experts in the field of LCNC, individuals working with the technology daily. We therefore excluded companies using the technology and delimited the sample to individuals with knowledge across industries. The majority of our informants were individuals working for an LCNC platform. Furthermore, we delimited the sample actors operating in Norway. This decreased the size of the universe persistently. We selected nine informants from various categories for our discussions, as depicted in Figure 3.3.

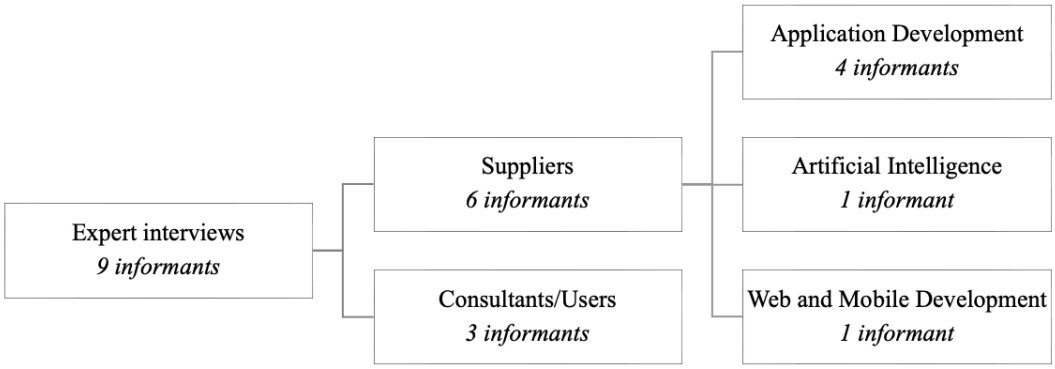

Figure 3.3: Overview of informants

This can be considered a relatively small sample, but we emphasize that the interviewees have extensive experience working in the field. The "suppliers" reach for some of the same customers, but considering the size of the Norwegian market, they also tend to have found their niche. Indeed, by including three informants helping companies to adopt the technology, we got a comprehensive understanding of the market characteristics.

Furthermore, in conjunction with the information obtained from the analysis of secondary data, we believe that we have acquired a satisfactory data foundation to address our research question.

3.3.2.2 Interview Guide

As previously indicated, semi-structured in-depth interviews are grounded in an interview guide, which we formulated in advance of the interviews (see Appendix A). The guide is compartmentalized into three principal sections, all firmly anchored in the theoretical framework expounded in the preceding chapter. The first segment aimed to uncover trends and the development of LCNC, both in terms of categories and platforms, and in terms of overall trends. The second segment emphasized the adoption of LCNC regarding size and time of establishment, directed toward the second part of our research question. Lastly, the third segment were focused on the adoption in terms of industries. Concluding queries allowed the interviewee to expound upon or introduce themes we had not elaborated on earlier.

Saunders et al. (2023) recommend commencing the interview with some introductory questions to familiarize both the interviewer and the interviewee with the interview process. Our introductory questions allowed the interviewee to freely discuss their background, company, and work. Furthermore, our questions were logically structured and well formulated, in an approach going from broad to increasingly specific. However, the questions were also formulated to ensure that respondents provided responses that were as open and detailed as possible. This allowed the informants to define and describe the situation as they desired, thereby potentially revealing attitudes and facts (Saunders et al., 2023). Finally, we intentionally refrained from asking leading questions to avoid influencing the respondents' answers.

3.3.2.3 The Execution of the Interviews

The execution of the interviews with the selected informants were conducted from October 16 to November 10, 2023. Prior to the interviews, we communicated with the respondents through email, where the purpose of the study and the overall plan for the interview, including the interview guide, were presented. With this approach, the interviewees had the opportunity to prepare before the interviews and gather additional information

if necessary. We believe that this contributed to obtaining more in-depth and higher-quality data. Thorough preparation is crucial for conducting effective interviews, as it enhances the researcher's credibility and results in more comprehensive and precise answers (Saunders et al., 2023). Therefore, we started the process by conducting industry and firm-specific knowledge, mapping key stakeholders and customers. This allowed us to form a preconceived notion of the industry and gain an overview of the information we would require from the interviewees to address the research question adequately.

Prior to the interviews, we registered the project with the Norwegian Centre for Research Data (NSD), due to the handling of personal data that can be linked to the interviewees. The duration of each interview ranged from 60 to 90 minutes, which we found to be both necessary and sufficient to cover all the topics in the interview guide. All the interviews were individual video calls conducted using Microsoft Teams. We found that the video calls facilitated dynamics similar to in-person interviews while being flexible and time-efficient.

During the interviews, our approach involved assigning a primary responsibility to one team member for guiding the interviews and adhering to the interview guide. Meanwhile, the other team member focused on taking notes and presenting contextual follow-up inquiries. The presence of both interviewers was found to be advantageous, simplifying the assurance of comprehensive coverage of pivotal subjects and queries while concurrently fostering an environment conducive to meaningful discourse. The interview guide functioned predominantly as a checklist within this operational framework. We utilized an audio recorder during all interviews, a practice we communicated and obtained consent for at the outset of each session. The use of the audio recorder facilitated our ability to concentrate on listening to the respondents. It also ensured that valuable data material was preserved, potentially contributing to the credibility of the data (Saunders et al., 2023). Additionally, it enables us to incorporate direct quotations in the study.

3.4 Data Analysis

3.4.1 Crunchbase

To be able to analyze and explain how the emergence of LCNC is unfolding, we needed to interpret company data from Crunchbase. We chose to obtain data from Crunchbase, which is the leading destination for company insights, covering early-stage startups to the largest companies in the world. Crunchbase aggregates data from multiple sources, with contributions to the database coming directly from users and visitors to the site.

Companies registered in Crunchbase can choose from predefined Industries and Industry Groups. They have categorized industries into 47 different groups, which are further divided into more detailed industry subgroups (Crunchbase, 2023b). In Crunchbase, LCNC does not belong to a predefined industry or industry group. To collect data on LCNC companies, we employed Crunchbase's search function in the Description Keywords field, allowing us to search for terms mentioned in the company descriptions. To identify the target companies, we selected search terms carefully. We selected keywords such as "low-code" and "no-code." However, as some LCNC companies may not explicitly identify themselves with these terms in their descriptions, we also incorporated keywords such as "citizen developers," "without programming knowledge," "without coding experience," "without coding," and "enables anyone to create." This yielded 2,043 companies.

After exporting the columns of interest for this purpose, we analyzed the data in R-Studio. This method preferred was chosen over Excel, due to its ability to effectively compare the progression of different categories over the years, given the substantial size of the dataset. We imported the entire dataset into R-studio, where we performed necessary data processing and analysis. For all analysis, we removed the rows that did not specify the industry or founded year.

In our category analysis, we focused on studying the progression of individual industries rather than Industry groups. Due to the broad nature of the industry groups, they did not provide us with detailed insights. Further, we needed to distinguish between industries, as they were initially combined in the same column of the original CSV file. Within Crunchbase, companies have the flexibility to designate their preferred industries and are encouraged to select three to five groups. Consequently, a single company might be

associated with multiple industries. Our analysis focuses on the quantity of these tags and how they evolve, thus the total sum of tags does not equate to the number of companies in the market. To reduce the number of industry tags and gain a more comprehensive overview, we decided to unite industry groups that were closely related or essentially two sides of the same coin, labeling them with a collective term to represent the combined categories.

In the analysis, investments are allocated among different industry categories associated with each company. This distribution aims to comprehend investments across various sectors. The total investment for each company is evenly distributed across all industries it engages in. This method assumes uniform investment allocation across a company's diverse industry involvements, a premise that may not consistently align with real-world dynamics. While evenly dividing investments among all associated categories offers a comprehensive view of investment patterns, it may not faithfully reflect actual investment emphasis.

Two drawbacks in the Crunchbase analysis, shared by many companies aggregating private company data, are the reporting delay and potential reporting bias. Regarding reporting delays, there is a time gap from a company's inception to its registration in Crunchbase, with these delays being most conspicuous in the initial phases of venture activity, impacting the recent period we are analyzing. In our analysis, we'll observe a distinct shift in trends post-2021, attributing it to reporting delays rather than an actual downturn in LCNC development. Concerning reporting bias, this issue arises from user contributions and website visitors to Crunchbase, who may represent the companies or investment firms they provide information about. This introduces the risk of presenting an overly optimistic portrayal of a company or industry sector.

3.4.2 Interviews

Before analyzing our interviews, we transcribed the audio and conducted a data cleaning process. Furthermore, we conducted transcript summaries to start to become familiar with our data, the first step of a Thematic Analysis. The primary objective of conducting such an analysis is to identify themes or patterns within a dataset. This analytical method provides a systematic, yet adaptable approach for qualitative data analysis (Saunders

et al., 2023). Important under such a qualitative analysis, is that we conducted the analysis partly simultaneously with the data collection. Partly due to practical reasons, and partly due to that theory and knowledge emerge during the process (Grenness, 2001).

Next, we started coding out data to categorize the data with related meaning. We developed codes to systematize the information and make it readily accessible for analytical work. Each code represented a single word denoting a category. Subsequently, we formulated several themes, comprised of codes interrelated to one another. The codes were devised based on recurring topics from the interviews, key points from the theoretical foundation, and subjects we deemed essential to address the research question. After the data was coded, we compiled a document where we gathered what the various respondents had stated concerning the different categories. We then summarized what had been articulated under the various codes. This enabled us to test our propositions rigorously and systematically against the data, explore alternative explanations, and elucidate potential negative cases that emerged. This was done through an iterative explanation-building process (Yin, 2018).

3.5 Evaluation of Data Material

3.5.1 Validity

Validity refers to the extent to which one can draw valid conclusions about what one has set out to examine based on the results of the analysis (Saunders et al., 2023). Furthermore, it entails whether the methods employed measure the intended phenomenon, enabling the accurate representation of the actual significance of the findings. One typically distinguishes between three types of validity: i) internal validity, ii) external validity, and iii) construct validity (Yin, 2018). Considering our exploratory approach, we find the two latter relevant.

To ensure that our findings and analyses reflect the reality of LCNC and its implications, it has been crucial to secure a sufficiently large and representative sample of respondents. According to Saunders et al. (2023), in qualitative studies, data collection continues until reaching a saturation point where additional data no longer influences the analysis. Among other things, we expanded the pool of informants during the study to follow up

on interesting connections. Furthermore, we included different informants considering age, company, position, and categorization of the platform. In addition, by including both consultants and platform suppliers, we believe we got a more diverse picture. These measures were taken to ensure a sample that is perceived to be representative and relevant to our research questions.

However, what potentially weakens the validation of the study, that comes to light in the findings, is the diverse opinions on certain issues. By also analyzing secondary data, on the other hand, we have removed answers we preceded as invalid, increasing validity. However, the fact that the sample is non-randomized and that we conduct data at one time point, lowers the validity, and complicates generalization.

3.5.2 Reliability

A study's reliability is about the extent to which data collection and analysis yield consistent and reliable findings (Saunders et al., 2023). In qualitative research, reliability is not based on achieving the same results for external observers, as is the case in quantitative research. This is because qualitative research relies on context, making it challenging to obtain identical results in different interview processes. Instead, emphasis is placed on ensuring that the results are sensible for external observers, given the collected data. In our study, we have been transparent in our approach to data collection, analysis, procedures, and other methodologies we have employed.

Preparing for the interviews, we developed a carefully structured interview guide to ensure a systematic collection of data. We initiated each interview by introducing ourselves and explaining the purpose of the research, providing information about anonymity and confidentiality. This may have reduced the likelihood of inaccurate responses, as it contributed to creating a confidential atmosphere between us and the interviewee. By using semi-structured interviews, we allowed informants to answer freely. To avoid influencing the responses of the respondents, we avoided leading questions to the best of our ability. The use of audio recording allowed us to focus on the interviewee rather than taking extensive notes. This, combined with the fact that we were both present during each interview, likely reduced the chance of misinterpreting the answers, thus reducing the challenges of interview bias or observer errors (Saunders et al., 2023). The fact that

the two of us analyzed the data afterward may also have contributed to minimizing the likelihood of our perspectives and opinions influencing the treatment and interpretation of the findings.

Another challenge related to respondent answers is "researcher demand," which involves respondents providing answers they believe the interviewer wants (Saunders et al., 2023). By sending out our interview guide in advance, one may argue that the informants could be biased in answering what they think we wanted to hear rather than what they think. However, considering our structural approach, we experienced several informants disagreeing with our initial assumptions.

3.5.3 Ethical Considerations

Research ethics concern appropriate behavior by a researcher towards the informant and/or others affected by the study (Saunders et al., 2023). According to Busch (2021), some of the most important research ethical questions revolve around informed consent, confidentiality, and the potential consequences of research for individuals and groups. Throughout the entire research process, we have sought to maintain a high ethical standard. We have focused on accurately conveying theory and research methodology with proper referencing. In the analysis, we have been careful not to draw our conclusions based on what the interview subjects have said. We have also ensured to present findings in a precise manner, regardless of whether the findings align with our expectations or not. Furthermore, the data processing has been conducted in accordance with the guidelines of the NSD. This includes, among other things, treating all information confidentially and in accordance with privacy regulations, as clarified to the participants through a consent form (see Appendix B). Participation was voluntary, and the informants gave consent either in writing, orally, or via email. Audio recording consent was secured, and the recordings will be erased upon the conclusion of the research project. Additionally, all data in the study is anonymized, a detail conveyed both in the consent declaration and during the interviews. Lastly, the interviews were marked by mutual respect, honesty, and trust.

4 Findings

In this chapter, the findings from the data collection will be presented. The chapter is divided into three parts and will follow the structure outlined in Section 2.4. To answer our research question of how LCNC impacts the potential for disruption, initially, we will explore the current state of the LCNC landscape. Subsequently, the focus will shift to the adoption and utilization of LCNC technologies within newly established companies and larger firms. The final section will delve into the distinct impact of LCNC technologies across various sectors, exploring whether the path to become "good enough" is more intricate in industries marked by strict regulations and technical complexity.

4.1 The Development of the LCNC Landscape

Recently, the market for LCNC development technologies has experienced a significant surge. Gartner Inc. forecasts that the global low-code development technology market will reach 26.9 billion USD in 2023, marking a 19,6 percent rise from the previous year (Gartner, 2022). The trend of companies classifying themselves as LCNC on Crunchbase reflects this anticipated growth. This is illustrated in Figure 4.1, depicting the registration trends on Crunchbase from 1990 to 2023. The registration numbers remained minimal until 2010, after which a more pronounced growth trajectory was observed. The mid-2010s witnessed accelerated growth, with registrations more than doubling from 66 in 2013 to 134 in 2016. We also see that the number of companies decreased from 2017 to 2018 before rapidly increasing again to a peak in 2021 with 290 registered companies. However, there is a noticeable decline in 2022 and 2023, with registrations dropping to 85 and 74, respectively. As outlined in Section 3.4.1, this is likely attributed to a delay in the registration process, considering companies are required to self-register.

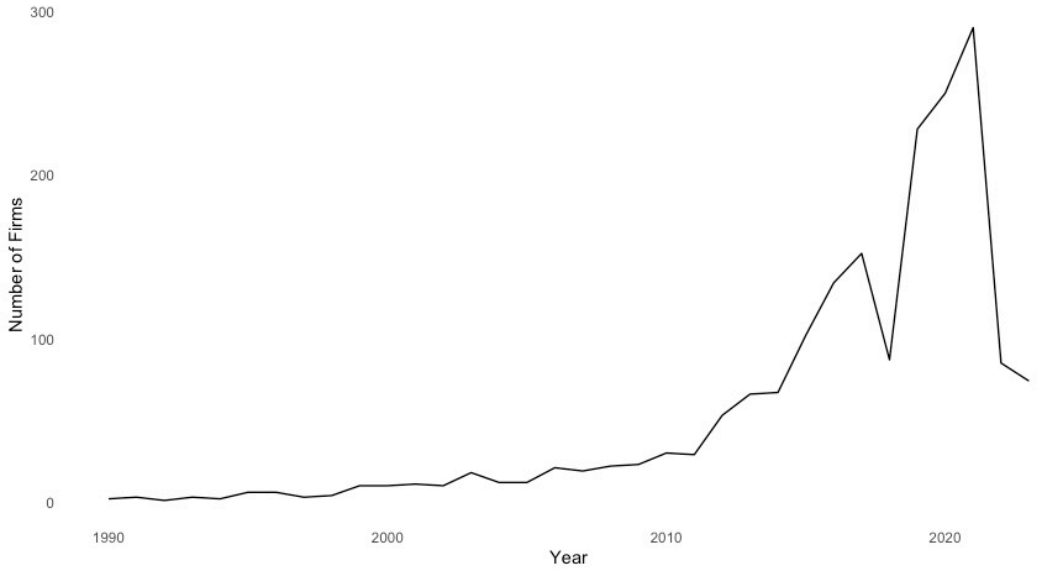

Figure 4.1: Development of number of LCNC companies over time (Crunchbase, 2023a)

The figure unmistakably indicates a solidification of the LCNC market in recent years. In the early stages of emerging markets, characterized by the influx of new participants, definitions are frequently ambiguous, and there is considerable uncertainty regarding the industry's meaning, boundaries, and even its existence (Aldrich & Auster, 1986; Dobrev & Gotsopoulos, 2010; Lieberman & Montgomery, 1998). From our interviews, it is apparent that the terms "low-code" and "no-code" have become "into vogue", almost turning into buzzwords in the field. It is highlighted in the interviews that companies want to be associated with these terms, although not all claims to this classification may be accurate.

> *"I believe the most significant trend in LCNC now is that the LCNC concept has never been so expansive. Firstly, it is very challenging to distinguish between LC and NC. Secondly, LC and NC now encompass everything non-traditional in development and the traditional way of coding. From the way we work, essentially programming without actually writing code, to configuring or tweaking off-the-shelf solutions. Everyone uses the terms LC and NC, branding themselves as such if they find it appropriate"* (Informant 6).

In addition to the many companies branding themselves as LCNC, there are also several that emphasize the difficulty in categorizing the landscape due to the significant differences between categories. Bock and Frank (2021) point out that platforms within the low-code environment exhibit significant variation across multiple dimensions. Although certain

technical features are shared by many LCNC platforms, the different platforms differ significantly in functional scope, primary purpose, range of technologies involved, breadth of applicability, means of design and specification, and other aspects. This is indicative of markets in their fermenting phase, illustrated by (Tushman & Anderson, 1986). We will address this finding further in the discussion section. The complexity of attaining a comprehensive market overview, given its multidimensional nature, is underscored in our interviews.

> *"I believe that it is very challenging to classify the market, so if you manage to achieve something like a 100 percent dimensioning of the LCNC segment, you would be the only ones in the world to have accomplished that. It's very difficult because it's not a singular thing. It doesn't fit into a 2x2 matrix. It is multidimensional, so there are many dimensions here within which these platforms are dimensioning themselves. Therefore, it is quite demanding"* (Informant 7).

As the informants are highlighting, these terms have taken on a broader and more diverse meaning. Many businesses fit into multiple categories and there are many overlaps within the categories. This makes categorizing the industry into distinct categories a challenging task and can therefore be a subjective matter.

As our objective is to present a thorough view of this landscape, we will utilize empirical evidence gathered from articles, expert interviews, and data acquired from Crunchbase to gain a comprehensive understanding. In the following subsections we evaluate different categories, delve into what the various platforms offer to their customers, and determine the current prevalence of these categories in the market.

4.1.1 LCNC categories

Numerous websites and companies have released articles categorizing the LCNC market into distinct categories. While many classifications share fundamental similarities, distinctions often arise with unique terminology and diverse categories. To exemplify how various entities categorize the market, we showcase three distinct classifications conducted by Gartner (2022), Unigram Labs (2022), and Madrona (Li et al., 2020). By highlighting how these entities segment the market, our goal is to unveil different characteristics of the

industry.

In 2022, Unigram Labs compiled and reviewed more than 130 companies, systematically organizing them by category to facilitate an understanding of the key players in the market (Unigram Labs, 2022). Unigram Labs offers a classification that is primarily function-based, dividing the LCNC market into distinct groups based on the specific business function or capability they enhance or provide. This approach focuses on the end-use or purpose of the LCNC tools within a business context. They divided the LCNC platforms into nine different groups. These groups are Business Intelligence, Customer service/CRM, Enterprise Application Development, IoT/Industrial Automation, Machine Learning, Marketing/E-Commerce/Design, Software Development, Web/Mobile App Development, and Workflow Automation. The classification with descriptions are shown in the Table 4.1

Categories	**Description**
Business Intelligence	Business Intelligence tools transform information into actionable knowledge to enhance company decision making
Customer Service/CRM	Customer Service/CRM platforms efficiently manage communication, opportunities, and documentation related to customers, supporting them through the buying and selling process
Enterprise Application Development	Enterprise Application Development utilizes visual platforms for developers to create comprehensive enterprise-wide applications and manage custom databases for business processes
IoT/Industrial Automation	IoT/Industrial Automation platforms connect hardware to the internet and enable automatic operation of industrial processes without human intervention
Machine Learning	Machine Learning tools make ML models accessible to non-data scientist users with the growth of AI.
Marketing/E-Commerce/Design	Marketing/E-Commerce/Design Tools commonly known as martech, empower marketers in campaign management and customer relationship management.
Software Development	Software Development Tools cater to technologists with a focus on enterprise application development.
Web/Mobile App Development	Web/MobileApp Development tools include a CMS and user-friendly capabilities
Workflow Automation	Workflow Automation tools integrate and facilitate end-to-end business processes for LCNC users.

Table 4.1: Unigram Labs's (2022) classification

Alternative classifications distinguish between internal and external applications, such as the classification from Madrona (Li et al., 2020). Madrona's classification is based on how low-code applications interact with users, manage data flow, and utilize databases. The classification thus breaks down the "application stack" into three segments: The Interface Layer, The Data Flow Layer, and The Database Layer. The interface layer is the part of a low-code application that users engage with. This includes features like forms, visual elements like charts and apps for displaying information. The data flow layer, on the other hand, handles important database tasks such as creating, retrieving, updating, and deleting data. It also manages business rules, logic, and connections to external services. The third layer, "Database", acts as a central system that helps the interface and data flow layers work together.

Madrona further refines this classification by positioning various groups along two dimensions. Internal applications encompass Dashboards/Data Visualization, Data Connectors and Automation Tools, Backend as a Service, and Visual Editors/Builders. Whereas external applications include Visual CMS and Site/App Builders, Forms, and Specific Tools. Mobile App Builders and Next-Generation Spreadsheets straddle both internal and external domains.

Figure 4.2: Madrona's classification (Li et al., 2020)

Thirdly, Gartner emphasizes the various types of platforms and technologies in the LCNC market, employing a comprehensive categorization. This classification is centered on the technological approach and the nature of the automation and development processes facilitated by these platforms. They have classified the landscape into seven different groups: Low-code Application Platforms (LCAPs), Business Process Automation (BPA), Multiexperience Development Platforms (MDXP), Robotic Process Automation (RPA), Integration Platform as a Service (iPaaS), Citizen Automation and Development Platforms (CADP), and other LCD technologies. Below is an overview of the distinct groups, supplemented by detailed descriptions of the categories.

Categories	Description
Low-code Application Platforms (LCAPs)	LCAPs are tools that help create and operate custom applications quickly by simplifying the need for extensive programming
Business Process Automation (BPA)	BPA automates complex business tasks using advanced technologies, going beyond basic data handling.
Multiexperience Development Platforms (MDXP)	MDXP are sets of tools that make it possible to develop apps that work well across various digital platforms and interaction methods, allowing for more flexibility in how users engage with the application.
Robotic Process Automation (RPA)	RPA involves getting a computer to perform actions in a system by simulating human interaction with the user interface.
Integration Platform as a Service (iPaaS)	iPaaS is a service that facilitates the connection of different software applications.
Citizen Automation and Development Platforms (CADP)	CADP focus on automating workflows, creating web-based forms, connecting data and content across different software-as-a-service applications, and generating reports and data visualizations.
Other Low-Code Development Technologies	Other Low-Code Development Technologies include tools for rapid mobile app development (RMAD) and rapid application development (RAD).

Table 4.2: Gartner's (2022) classification

In 2022 Gartner predicted how the various categories would evolve in the years ahead (Gartner, 2022). At that time, LCAP stood out as the largest category, and they forecasted it to maintain its prominent position in 2024, growing 55 percent from 2022 to 2024. Although LCAP stands as the largest market segment, the citizen automation development platform (CADP) is anticipated to experience the most rapid growth, with a projected growth rate of 68,3 percent from 2022 to 2024. CADP can be broadly defined as the business-led process of creating, integrating, automating, and continuously improving

digital solutions (Quicbase, n.d.). Typical use cases of CADP are streamlining of workflows, design of online forms, connecting data and content between different software applications, and generation of reports and visualizing data (Gartner, 2022). It refers to how citizen developers can execute minor IT projects without going through the IT department.

Moreover, the remaining categories also show consistent growth trends extending into 2024, with iPaaS forecasted to grow by 38 percent, RPA by 34 percent, MDXP by 42 percent, and other LCD Technologies by 33,94 percent. This data is illustrated in Figure 4.3, with values presented in millions of US dollars, from 2021 til 2024 (Gartner, 2022).

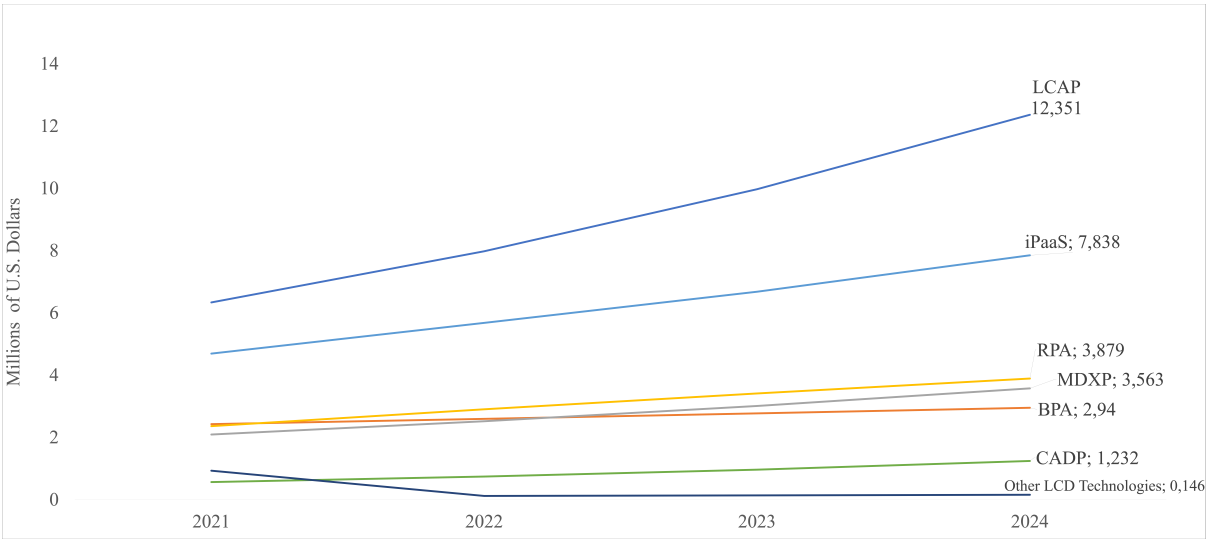

Figure 4.3: Gartner's (2022) prediction of the different LCNC categories

4.1.2 Market Analysis

As illustrated in Figure 4.4, the emergence of LCNC started to materialize after 2014. This aligns with the introduction of the concept by Foster (Richardson & Rymer, 2014). To illustrate the development of various categories within the LCNC field, we have studied the progress envisioned by established actors from 2014 to 2022. Our analysis involved examining the number of established companies associated with different LCNC categories to observe growth and identify the categories with the highest company representation.

In examining the top ten categories from our dataset, a clear pattern of growth emerges, particularly from 2018 to 2021. This is illustrated in Figure 4.4. During this period, we observed a consistent and robust increase in registrations across most categories, reflecting an expanding landscape. We can see a decline in registrations in 2018, as well as after

2021, without having found an explanatory reason for this either in Crunchbase's systems or through the interviews.

Regarding the development within each category, Web and Mobile Development consistently holds the title of the largest category throughout the entire period, particularly from 2018 to 2020. According to Unigram Labs (2022), the Web and Mobile Development is a large category that has been evolving, as we can see in Figure 4.4. During the interviews, it became evident that this market is crowded and competitive, characterized by *"falling prices and a growing market"* (Informant 7). This category allows people with limited technical expertise to easily create appealing websites and small applications. Companies like Wordpress, Bubble, Adalo, Webflow, and Wix dominate this category. WordPress stands out as the dominant player, currently utilized by 40 percent of the world's top ten million websites (W3Techs, 2021). Following closely is Artificial Intelligence (AI), which notably distinguishes itself with a significant number of registrations. This underscores the importance and rapid growth of AI, reflecting the attention and innovations that have occurred within this field in recent years.

Besides the top two categories, several other sectors have shown significant presence and growth. Machine Learning, E-Commerce/Marketing and Financial have been frequently cited. Blockchain, Enterprise Software, Cloud and Developer Tools represent smaller, yet significant portions of the registry.

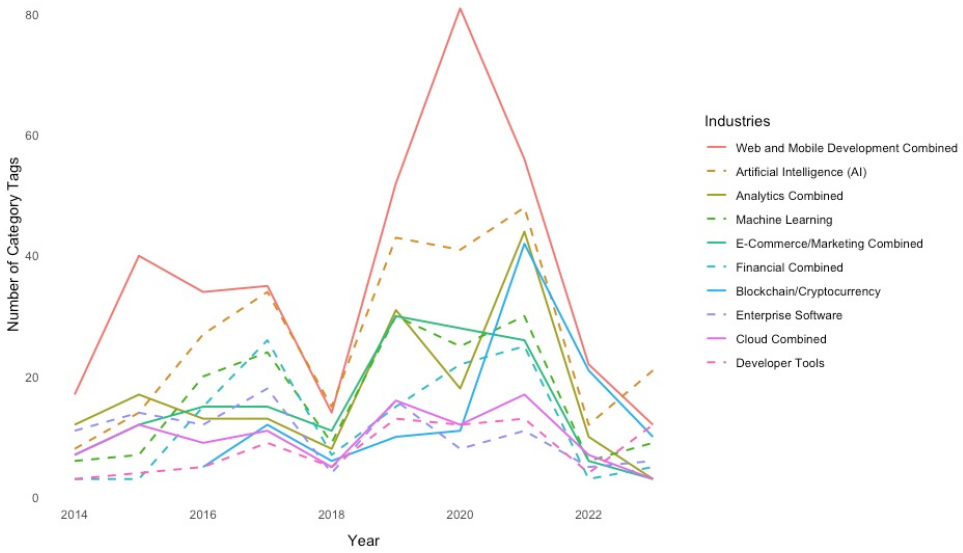

Figure 4.4: Development in the top ten industry categories from 2014 – 2023 (Crunchbase, 2023a)

Focusing on the period from 2014 to 2023, certain categories stand out for their remarkable growth. This is illustrated in Figure 4.5. AI, Machine Learning and Blockchain have shown an impressive trajectory. AI, starting with a modest presence, escalated to 48 registrations by 2021, indicating sustained industry interest and innovation. Similarly, Blockchain initially less prominent, achieved a peak of 57 registrations by 2021. We have also seen a substantial growth in categories like Financial, Developer Tools, B2B, and Developer APIs.

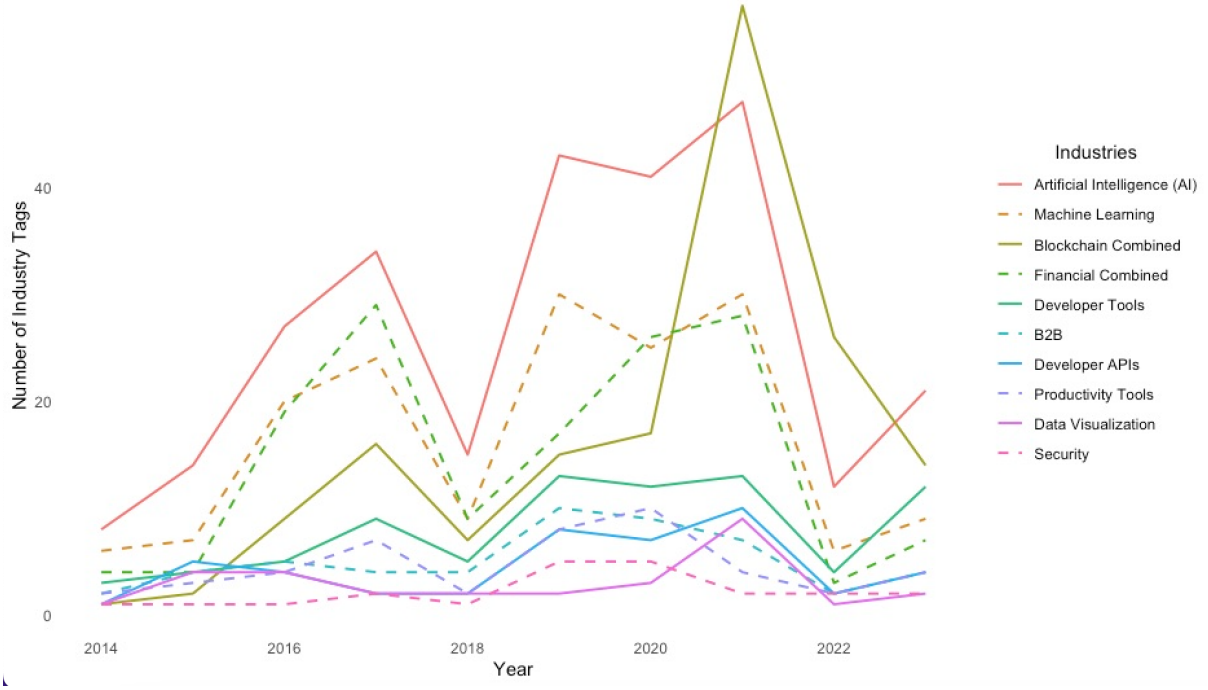

Figure 4.5: Development in the top ten industries with most growth from 2014 to 2023 (Crunchbase, 2023a)

Examining the categories with the most significant growth from 2018 to 2023, we observe common trends. As illustrated in Figure 4.6, we can see that AI, Machine Learning, and Blockchain still stand out as the fastest-growing categories. Interestingly, "Enterprise Software" and "Enterprise Resource Planning (ERP)" have also entered the top ten list of rapidly expanding categories, suggesting a rising relevance and popularity of LCNC solutions for enterprises.

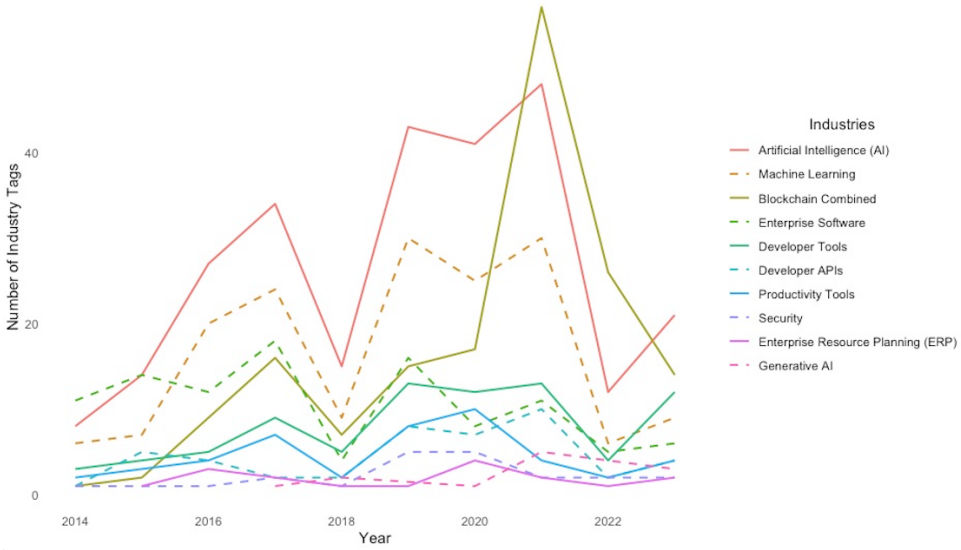

Figure 4.6: Development in the top ten industry categories with most growth from 2018 to 2023 (Crunchbase, 2023a)

Analysing investments across different categories highlights considerable disparities in funding levels. The categories, such as AI, Financial, Machine Learning, Analytics Combined and Enterprise Software, not only secure frequent mentions in the top ten list but also attract substantial funding. The highest investment is within AI, while Financial closely follows. Furthermore, Machine Learning and Analytics have significant financial backing. Interestingly, despite not being prominently featured among the ten most mentioned categories in Figure 4.7, Productivity Tools, and B2B have all acquired substantial investments. It is noteworthy that Web and Mobile Development, despite being highly popular, has garnered comparatively lower investments than other categories.

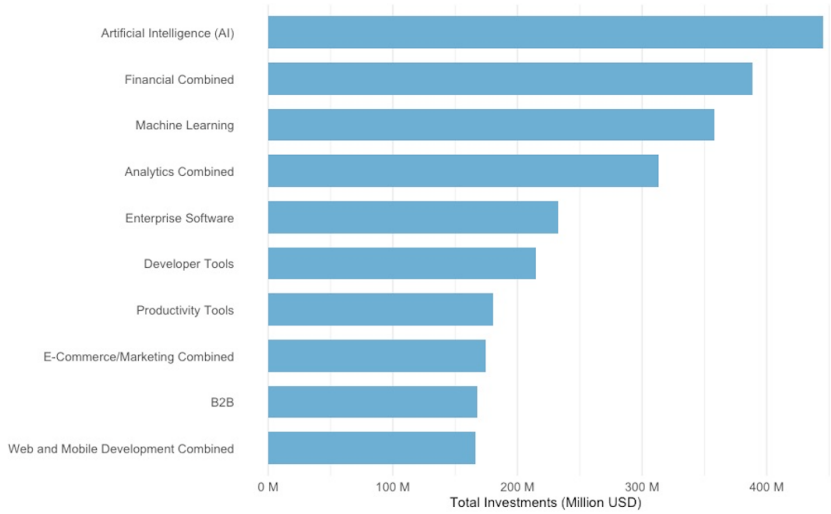

Figure 4.7: Top 10 most invested industries (Crunchbase, 2023a)

4.1.3 The Enterprise Segment

During our interviews, we identified a growing trend of LCNC in the enterprise market. This aligns with Gartner's predictions of LCAD as the largest category with a substantial predicted growth rate. Figure 4.6 illustrates the emergence of Enterprise Software and Enterprise Resource Planning (ERP) among the top 10 fastest-growing categories since 2018, an interpretation strengthened by several informants. The informants emphasize the ongoing growth in the enterprise category, with numerous companies strategically targeting this market segment. While earlier concerns existed regarding the suitability of LCNC solutions for the complexity of large enterprises, technological advancements have progressively facilitated their integration into this market segment. The emergence of various platforms now allows for the creation of intricate and comprehensive solutions, making LCNC solutions increasingly applicable, also for large enterprises.

> *"NC is making its way into the enterprise segment. It's relatively new that larger businesses must now engage with platforms differently to create various types of applications"* (Informant 7).

> *"The enterprise market is definitely growing. Lately, several platforms have emerged where one can create relatively complex and comprehensive systems"* (Informant 6).

Numerous prominent players with substantial resources are present in this market. In 2021, Gartner released a report titled, "Magic Quadrant for Enterprise Low-Code Application Platforms" (Vincent et al., 2022), and is shown in Figure 4.8. The report gives an overview of Enterprise Low-Code Application Platform that fulfills a set of criteria. The Magic Quadrant identifies Leaders, Visionaries, Niche Players and Challengers along the two dimensions: completeness of vision and ability to execute.

Figure 4.8: Gartner's(2022) Magic Quadrant for Enterprise Low-Code Application Platforms

Outsystems, Mendix, Microsoft, Salesforce, and Service Now are recognized as leaders in the field, whereas Quickbase, Unqork, and Retool are categorized as Niche players. Appian, Zoho, and Pegasystems are identified as Visionaries, while Oracle falls under the Challenger category. During our interviews, we noted that Salesforce and Microsoft Power Apps have a substantial market share in Norway. Several informants have highlighted that Mendix, a prominent international player and a "leader" according to Gartner, faces challenges in establishing itself in Norway due to a perceived late entry into the market. This shows that entering the market can be challenging, emphasizing the importance of early entry to secure a significant market share.

International players coexist with smaller entities such as Appfarm, Genus, Compose Software, and More in the Norwegian market. Despite the significant resources and teams of major players, some believe that smaller companies can compete effectively against international counterparts. This arises from the fact that smaller players in the market possess a potential advantage in terms of cost structure and agility. Their ability to provide specialized products and quickly embrace new tools and market trends could serve as a competitive strength. In contrast to larger corporations, which may require more time to align strategies and evaluate new technologies, smaller entities can swiftly introduce innovations. This agility and commitment to embracing cutting-edge technology

may position them as formidable rivals to their larger counterparts.

If we consider four Norwegian companies, we see that all of them have experienced revenue growth from 2020 to 2022. Leading companies such as Genus and Neptune have maintained their market position and have experienced an increase in operating revenues of 15-18 percent, while newer companies such as Appfarm and Compose Software have grown by 162.6 percent to 180 percent from entering the market (Forvalt, n.d.).

4.1.4 Sub-Conclusion

The current landscape of LCNC technologies has undergone remarkable growth, evident in both Crunchbase registration trends and Gartner's market projections. The sector's expansion is characterized by the increasing convergence of LCNC platforms, broadening their capabilities. However, this diversification introduces complexity in categorizing the market due to its multi-dimensional nature.

Examining category trends, it is apparent that overarching categories like Web and Mobile Development, Artificial Intelligence (AI), and Analytics are at the forefront. Notably, AI and Analytics stand out as the fastest-growing categories. Blockchain, Financial, and Developer Tools also demonstrate rapid growth. Furthermore, we observe an increase in the adoption of LCNC among enterprises, as evidenced by interviews and the analysis in Crunchbase. This trend is driven by these platforms' ability to address complex organizational needs.

4.2 LCNC Utilization Across New and Established Companies

4.2.1 Decreased Development Time

A widely recognized benefit of LCNC, as highlighted in the literature, is its capacity to facilitate easy testing of new prototypes in the market, accelerating both development and deployment time (Alamin et al., 2021; Kass et al., 2022; Martinez & Pfister, 2023; Ødegård, 2023; Outsystems, 2019). This advantage has also been substantiated through our interviews, where we have gained insight into how this unfolds differently in newly established companies in contrast to large firms.

For newly established companies, LCNC is firstly about reducing time-to-market and to test prototypes and develop an MVP (Minimum Viable Product). A specific example is the Norwegian electricity supplier Volte, that went from conceptualization to a competitive service within a two-week timeframe (Avo Consulting, 2021). The key results achieved through the implementation of LCNC in Volte underscore two critical aspects with LCNC: rapid development and substantial cost and time savings. The initial testing enabled Volte to adapt quickly to end-users' preferences. This meant that any assumptions proven incorrect could be iterated upon, leading to continuous improvements. The effect on efficiency and cost reduction to startups is confirmed through interviews:

> *"Right now, there are approximately 15 startups developing their products on Informant 7, and there is no doubt that they reach the market much more expeditiously. The utilization of this technology significantly reduces costs. Undoubtedly, this serves as a substantial contributor to fostering greater innovation, enabling companies to expedite their market entry, ascertain Product-Market Fit, acquire initial customers, and construct their products with significantly fewer resources than previously deemed necessary"* (Informant 7).

Drawn from our interviews, explaining the situation, is that "*the start-up costs to challenge an incumbent drop*" (Informant 5) and that the use of LCNC "*will lead to more ideas actually being tested and potentially realized*" (Informant 4). Furthermore, it is highlighted

that "*once you are in the market, you already constitute a competitor to existing actors*" (Informant 8). Based on this, as time-to-market is significantly reduced through LCNC, it will likely be beneficial for new entrants to use this technology.

For large companies, with already established internal systems, the focus is more often directed toward improving existing processes at a faster pace. This is driven by the time saved when citizen developers are no longer reliant on IT specialists during the development of new solutions. Furthermore, a faster way to reach the goal result in lower costs associated with each project. This has implications for large companies in terms of the number of projects that receive support and are executed.

> *"What has often been a challenge before is that if you wanted to have an IT project, you had to internally seek funding to carry it out. They have often been so costly that only innovation or the major projects have received funding for this, and that is not the case anymore. Now we also see that smaller projects, smaller departments, perhaps those who never got the IT budget, are now getting funding. So, it circulates more efficiently throughout the entire organization"* (Informant 2).

Merely all literature on the field highlights these benefits, which in essence is the core of what LCNC is all about. As companies can reduce the time of building infrastructure needed for IT projects for customers, whether it entails internal automation or services targeting customers, it likely enables you to carry out an increasing number of projects. In fact, Informant 6 goes to the extent of stating that "*existing challenges are always solved in a faster and better way*" (Informant 6).

4.2.2 Less IT Knowledge Needed

The fact that less extensive IT knowledge is needed, is another well-known benefit of LCNC. When using technology is easier and less complicated, we are likely to see more companies and organizations appear, especially where IT knowledge earlier could have been an obstacle. This suggests reduced entry barriers for emerging companies:

> *"Suppose, for instance, someone have a business concept of considerable strength, yet lack IT expertise or possess very limited IT knowledge. In such a scenario, I believe that a LCNC platform, when invested in and mastered,*

> *eliminates IT as a hindrance. Thus, one can launch the idea, introduce it to the market as a prototype, for example, without IT posing a constraint"* (Informant 6).

In the context of reduced entry barriers, several informants note that emerging companies can build their entire solution on a LCNC platform, thereby avoiding the necessity to hire various specialists.

> *"If you're considering launching a sole proprietorship, a small business, create a small business, family-run enterprises or retail, I genuinely believe that you can construct almost everything using low-code. This means you won't necessarily have to go through the process of hiring a designer here, a developer there, and various other specialists. With a lean core team, you can achieve substantial development without requiring highly specialized expertise. I'm optimistic that this technology will pave the way for more startups to thrive, as it empowers them to navigate the initial stages more efficiently. In essence, I see a distinct advantage for startups in leveraging this approach"* (Informant 3).

For large companies, this advantage unfolds in a way that allows more employees in the company to take control of their processes, empowering citizen developers. Less training is required to develop such applications, potentially reducing the workload of IT departments, and allowing them to work on more complex programming tasks (Kass et al., 2022). Informant 8 characterizes LCNC as a "bridge" that connects business and IT:

> *"Previously, IT received a mission from the business, stating that they needed an application to look a certain way and perform specific tasks. They were provided with a document outlining the requirements, and then IT did their best based on the information they received. Often, there is a disconnect between what the business envisions and what IT and development envision, as they are two different perspectives. This is where the concept of LCNC comes in, attempting to bridge the gap between business and IT"* (Informant 8).

By bringing together business and technology, non-programmers can participate in the development process (Kass et al., 2022; Rokis & Kirikova, 2022), potentially improving the

quality of software products (Bock & Frank, 2021). Considering the increasing demands for IT knowledge and to stay digital (Schoen, 2023), this is highly beneficial. In addition to the factors mentioned above, LCNC is crucial for relieving some of the burden on the IT department, and reduce "technical debt" (Omeyer, 2021). Informant 8 explains how companies end up with technical debt and how it can be a bottleneck in companies:

> *"What has become increasingly evident in recent years, and what we believe has propelled the rise of LCNC, is the abundance of demands coming from the business side. They have so many needs and constantly send requests to IT: "We need this, we need this, we need this," and they haven't allocated enough resources to deliver. This results in what is known as "technical debt". So, IT ends up with a significant technical debt, only able to produce as much as they can with the resources at hand"* (Informant 8).

On the other hand, we find divided opinions regarding the technological expertise needed to effectively utilize LCNC solutions. Most findings suggest that at a minimum it requires a fundamental interest, while others state that it requires fundamental IT knowledge. Informant 1, a business-educated consultant, primarily assisting other companies in automating their internal processes, emphasizes that there is no experienced disadvantage. The consultant's knowledge lies in understanding business processes, strategy, and development, enabling a comprehension of the purpose and goals of companies implementing such technologies. On the contrary, several informants underscore that you still have to be a programmer, one of them firmly expressing that *"there has not been a huge democratization of people building stuff. It's just been IT becoming more efficient so that it's more an efficiency play"* (Informant 5). This does not align with the significant development of citizen developers predicted by Gartner (Kissflow, 2023a). This aligns with the comprehensiveness of defining the scope and terms, possibly leading to different measures.

In addition, there is a significant difference between LC and NC in terms of the scope of coding, which also influences the required level of technical understanding. Moreover, several of the informants argue that the demand for technical understanding will decrease as AI improves, enabling the development of applications through text rather than coding. Numerous individuals highlight that the integration of Co-pilot and other AI assistants

into LCNC tools will further simplify the application development process, ultimately propelling the expansion of LCNC at an accelerated pace.

4.2.3 Adaptation Levels and Diverse Utilization

When integrated with LCNC, we find a dual impact on a firm's resources: (i) it enhances resource optimization, and (ii) it demands fewer resources. The initial observation implies achieving more with the firm's existing resources, while the latter asserts that firms require fewer resources to leverage LCNC capabilities. We see that this plays out differently for large and newly established companies.

A noteworthy finding is that smaller and newly established companies can utilize LCNC full-stack solutions, even without traditional code, to a greater extent than established firms. For those seeking to establish something new, this implies the ability to manage resources differently, thereby expediting the realization of their business idea. That new companies can more easily use a LCNC platform as their standard, initiating their digital system, is highlighted by several informants:

> *"The large companies probably balance their use of both pro-code and low-code, while the small ones, if they choose to go for low-code they may predominantly rely on low-code solutions, potentially even more than traditional programming"* (Informant 2).

Newly established companies can adopt LCNC solutions for their entire operations because unlike established companies. This is because these companies do not possess a significant amount of data or extensive systems. Large and highly established companies *"may have very old core systems and they want to clean up the existing mess. Meanwhile, the new entrants and companies entering a market don't have a lot of data or extensive systems. Therefore, they may find it easier to establish new processes using low-code tools"* (Informant 1)

In addressing the inquiry regarding why recently established companies opt for LCNC solutions to construct their entire IT system, Informant 4 stated that it *"is because they can effectively operate within the limitations of the solution, allowing for significant flexibility"* (Informant 4). The strategic choice of LCNC is highlighted as more advantageous for startups, especially because of the complexity of large systems. Traditional Enterprise

Resource Planning (ERP) systems may prove too cumbersome for small companies, making LCNC solutions a better alternative.

> *"For a startup company, the large ERP systems, such as SAP or other systems from major giants, might be too heavy for a small company to use, and then you actually don't need anything more than low-code solutions"* (Informant 3).

Consequently, startups might even be able to integrate emerging technology from the inception of their operations, shaping their resources and strategies around the innovative technology (Zahra, 2021). However, there are disagreements as to whether startups using LCNC will have to *"undergo a migration towards more traditional code"* (Informant 7) due to the volume and control aspect, or if they can solely keep using it regardless of growth.

In contrast, larger firms tend to use LCNC relatively more for purposes around the core business, preferably to automate existing internal processes and/or for various support functions. Typically, enterprises deploy LCNC solutions for internal purposes rather than extending them to external customer-facing applications. Informant 3 emphasizes the considerable challenge involved in replacing core systems for large firms:

> *"They are bound by the way things have always been for many, many years, and simply replacing it is almost impossible, so they can only add and supplement low-code solutions to the legacy systems"* (Informant 3).

Furthermore, they tend to explore and apply the technology in the innovative part of the company rather than the IT department. This entails that they might use LCNC technology as a springboard for digitalization in general, often through projects. Consequently, it is often treated distinctly from traditional programming crucial for the company's operations:

> *"I believe larger companies may use low-code technology as a stepping stone to digitization in general, extending down to the cultural aspect. Surrounded by smaller solutions that provide a positive business case in each isolated scenario but don't scale up to diverse millions in size and savings. Yes, you save some time. Yes, it certainly adds up to a significant amount when considering the many people involved. However, it's not about deciding to undertake a case just because it saves 50 million kroner. Whereas, for a smaller company, I think*

it's more about adopting a low-code platform as their standard" (Informant 3).

The adoption levels of both larger, established as well as new companies, are also shaped by the cost structures of various LCNC platforms. The licensing models are known as subscription-based pricing, operating on a yearly or monthly per user or per application basis (Joshi, 2023). Evaluating the license costs is thus essential for every company potentially adopting the technology, and *"usually, the first thing you think about when acquiring LC or pro code is whether to buy these licenses"* (Informant 2). This underscores that licenses are expensive, and often seen as a hurdle.

For enterprises employing LCNC in the business to consumer (B2C) sector with a considerable user base, the associated expenses become noteworthy. Newly established companies, on the other hand, often use LCNC as their full stack solution, thus embracing a substitution-oriented approach. These firms often weigh the option of traditional ERP system licenses against building LCNC platforms, and the cost-effectiveness of LCNC solutions emerges as a compelling argument in favor of smaller enterprises. Informant 3 highlight the intricate nature of this dilemma, revealing that the cost of acquiring licenses is, in fact, likely to be less significant for smaller entities than for large firms:

> *"Should we simply build a system from scratch that solves the problem, or should we use licenses for all of them to utilize a low-code solution? And then you might see that it's challenging to make that decision and take that cost. The cost is small in a small company, but it costs a lot in a large company if you can't get everyone on board. But in the long run, a license is a license. You can have 10 applications on one license, and you can also have 50 million products on one license, but initially, you might just have one, and then the cost is extremely high to take on for just one product"* (Informant 3).

In large firms, however, the bureaucratic complexities can also complicate the matter. Justifying license costs involves navigating through layers of approvals and discussions with superiors. Several informants highlight the challenges faced in larger companies, where the decision-making process can be intricate and potentially hinder the adoption of low-code solutions:

> *"In large companies that have not obtained licenses, you have to justify to your*

> *boss – "Hey, I'd like to create an application, and I need 100 licenses. Can I spend 10 million on this?" Yes, no, probably not, and this limits low-code development in larger companies. Whereas in smaller companies, it's about substitution. Should we go for a license on an ERP system from XYZ, which would cost 1000 kroner per month, or build low-code platforms with a license for 300 per month, for example? Then the business case is actually positive for the smaller companies"* (Informant 3).

Small and newly established firms, on the other hand, tend to be more forward-thinking, less hierarchical and without existing rigid systems (Aldrich & Auster, 1986). This frequently leads to small companies experimenting with emerging technologies. In addition, newly established companies tend to be easier to move, and a new implementation is likely to face less resistance:

> *"It's been a consistent truth that smaller companies tend to be more agile. In a way, it has always been a reality. So, the strategy of a small company aiming to capture market share from a larger one has essentially been a constant. Whether we have low-code or not"* (Informant 4).

Lastly, however, established enterprises "*typically have more resources, can conduct more research and development, as well as to experiment with various methodologies, frameworks, and tools. This enables larger enterprises to allocate more personnel to work on such matters simultaneously*" (Informant 1). While startups predominantly need to attain knowledge through learning, larger enterprises may have the immediate capacity and resources to procure competencies (Pfister & Lehmann, 2023; Wiklund & Shepherd, 2003). The availability of resources and financial capital plays a decisive role, as our informants predominantly collaborate and work with large enterprises rather than newly established companies.

4.2.4 Expanding Benefits and Scope

The quality, precision, and user interface of LCNC platforms have evolved and improved immensely since its origin. However, there are still barriers associated with the use of LCNC today. Highlighted in the literature are issues related to customization, compatibility, technical limitations, volume, and level of security (Bock & Frank, 2021; Kass et al., 2022;

Martinez & Pfister, 2023). The latter will be at the core of the next chapter. Many of these factors seem to still be a barrier for firms, and according to Informant 3 “As of today, LCNC cannot compete with traditional coding at all levels”. It is also well known that many developers do not wish to work with LCNC due to the low level of technical education required (Wayner, 2019).

However, another informant underscore how LCNC do not intend to challenge traditional IT, arguing that: *“LCNC is not really about challenging traditional IT, but there will be fewer areas where it is the right choice. Because the reality now is that all consulting companies are pushing for as large, heavy, and time-consuming development processes as possible, but the reality is that it is completely unnecessary in many contexts”* (Informant 7).

Furthermore, several of our informants highlight that these barriers are diminishing with time, rendering LCNC a more suitable, “good enough”, solution across an expanding array of scenarios. Another informant predicts that, with time, traditional coding will be exclusively reserved for the most demanding tasks:

> *"I anticipate that the realm of possibilities will gradually increase until reaching a point where aspects become apparent as areas where LCNC cannot effectively compete, or it starts to outperform traditional coding in the long run. At that point, traditional coding may only be necessary for the most complex tasks"* (Informant 3).

Today, solving complex problems in LCNC involves taking many "workarounds," eventually making traditional coding a simpler choice. It is therefore crucial that if LCNC is to be used for more complex solutions, it must be approached in a simpler way than traditional coding. However, the functionality of LCNC platforms is getting better and better and the scope of the possibilities are expanding. Important drivers include increasing demand, competition and investments, as well as AI technology and customer feedback loop. Forrester underscores this, predicting a 50 percent annual growth, entailing that LCNC is both growing and spreading (Rymer, 2018). Informant 2 emphasizes that the growth is accelerated through the interaction with AI: *"Low code today involves a lot of drag and drop, almost like being in PowerPoint. When Co-pilot arrives, you can have the code and functionality generated"*. Informant 9 emphasizes how crucial the "*feedback*

loop" is for the development of platform functionality. "As demanding customers set higher requirements for suppliers, more functionality is gradually incorporated into user interfaces, making it even easier to build" (Informant 9).

A virtual example of the latter is ExxonMobil, one of the world's largest publicly traded international oil and gas companies. They started using Microsoft technologies in 2019 "to collect real-time oilfield data, make faster drilling decisions, prioritize personnel deployments, detect leaks and monitor greenhouse gas emissions" (Egan, 2019). The collaboration with Microsoft resulted in the platform developing more functionality. Informant 3 puts further emphasize on the feedback loop, saying that *"I know that the work of ExxonMobil had a significant impact on the further development of the Microsoft Power Platform"* (Informant 3).

As the functionality of LCNC improves, the technology is increasingly likely to become a "good enough" solution for numerous processes and tasks. Consequently, it has the potential to replace many processes that were previously developed using traditional IT. Drawing from our findings, we posit that the threshold level at which LCNC becomes a "good enough" alternative to traditional IT is anticipated to rise. This is depicted in Figure 4.9, where the categories of processes and tasks that lean towards traditional IT as the optimal choice are likely to decrease. This implies that traditional IT will only be the preferred option for processes that are highly critical to the core of businesses.

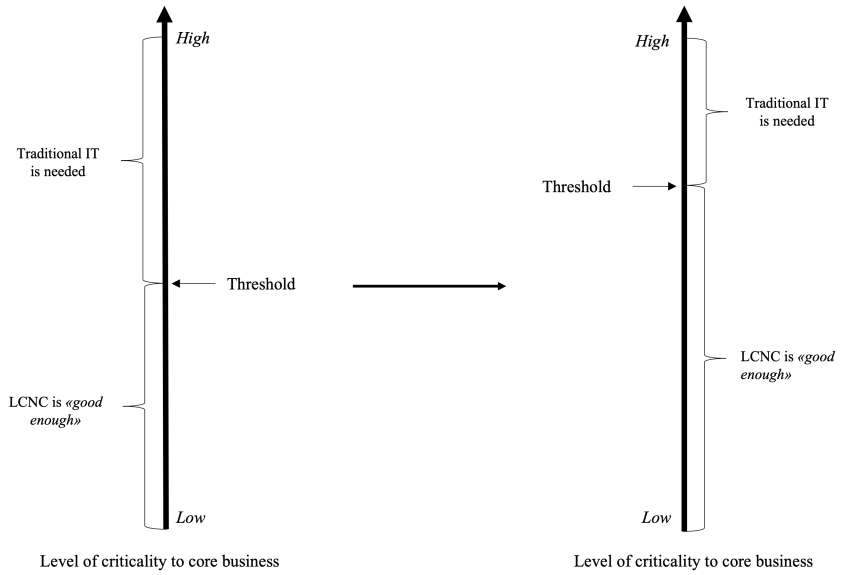

Figure 4.9: Visualizing how the threshold level can increase over time

Comparing this to Gartner's "Adaptive Governance Framework for Multiple Solutions in the Enterprise" (Ingham & Shotton, 2023), shown in Figur 2.6, it can be interpreted as LCNC becoming an increasingly preferred choice over time as LCNC platforms increase its robustness. The functionality of LCNC can thus challenge the concept of complexity by offering solutions good enough to most companies.

In the original framework posed by Gartner, zones where citizen developers can safely operate without significant risks to business operations, are distinctly marked. However, as LCNC platforms become more sophisticated, the boundaries of these zones can shift. Such a modified version of Gartner's framework is shown in Figure 4.10. The new model illustrates that there may be an expansion of the "Safe Zone" and "Supported" areas, implying that LCNC platforms are becoming robust enough to handle more complex and business-critical applications in the future. As the technology matures, it may allow for more complex workflows and automation tasks to be undertaken by citizen developers, thus enabling faster deployment and innovation while still maintaining governance and oversight.

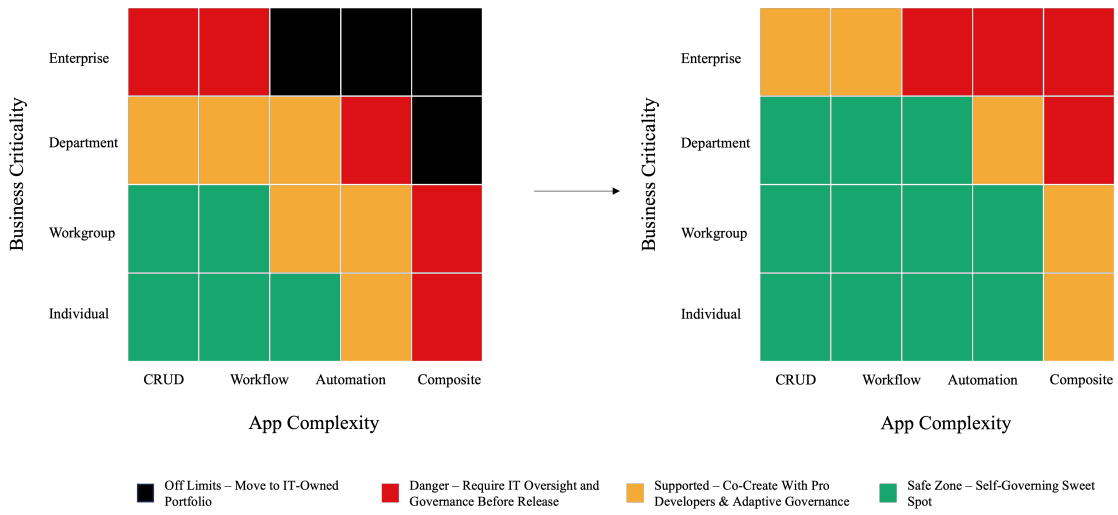

Figure 4.10: A modified version of Gartner's "Adaptive Governance Framework for Multiple Solutions in Enterprise (Gartner, 2019)

4.2.5 Sub-Conclusion

In this chapter, we have examined the differing impacts of LCNC platforms on newly established companies compared to large, established enterprises. New firms leverage the rapid development capabilities of LCNC, facilitating swift market entry and agile

adaptation to consumer feedback. Large enterprises primarily use LCNC to enhance existing systems and processes. Next, LCNC lowers the IT knowledge barrier, crucial for small startups lacking in-depth technical skills, allowing them to bring business ideas to life without traditional IT constraints. Larger companies benefit from enabling their staff to become citizen developers, fostering innovation and reducing dependence on IT departments. Lastly, as LCNC technology advances, it is expected to become a more viable alternative for a broader range of business applications, potentially shifting the traditional IT paradigm offering more avenues for market disruption.

4.3 Characteristics Influencing Industry Adoption

Our initial observation regarding LCNC and its application across different industries is that companies in this field have not strategically positioned themselves within specific segments. Most notably, we discovered that all our informants operate across various industries, often describing themselves as *"industry-independent, providing a pathway to digitization"* (Informant 7). Views on LCNC-appropriate industries varied, with little consensus on preferred sectors. As emphasized earlier, they claimed that "*there are always things that can be improved and digitized across every sector"* (Informant 6). While these entities have garnered a significant customer base in particular industries, it seems more like a result of chance than an intentional strategic choice.

In line with a changing competitive landscape, leaders of companies heavily engaged in technology-based sectors, such as electronics, pharmaceuticals, telecommunications, and computing, as well as those in industries that rely extensively on technology, including airlines, brokerage firms, banks, and electric utilities, are required to enhance their comprehension of the connection between strategy and technological evolution, ensuring a tightly integrated approach between the two elements (Bettis & Hitt, 1995). When characterizing a solution as complex, we typically imply that its construction is challenging. The mentioned examples are industries we regard as technically complex in our research. Regarding regulated industries, we base our interpretation on the definition in Cambridge Dictionary as “a type of business that is controlled by government rules” (Cambridge Dictionary, n.d.). These sectors typically face stringent regulatory frameworks to ensure compliance with safety standards and data privacy.

4.3.1 Regulatory and Technical Complexity

Firstly, companies within technically advanced industries are likely to possess extensive internal IT infrastructure and software solutions. We find that in industries with minimal or no tradition of developing internal IT systems, the impact of LCNC is more pronounced, particularly in sectors with a limited history of creating their software. This entails that in industries with the opposite scenario, like technically advanced sectors, the use of LCNC would be less appropriate. Secondly, through our interviews, we find that technically advanced industries often are characterized as relatively concentrated and capital-intensive, with high barriers to entry due to need of equipment and people. These characteristics constitute the foundation for our findings wherein LCNC is expected to encounter its limit earlier in such industries.

However, as we have highlighted earlier, even though LCNC is a drive to further democratization of technology, in many cases it still requires technical knowledge. Considering that there are many workers with technical competence in those industries, one may argue that they are likely to understand LCNC better than other industries without the same knowledge:

> *"The more developers on a team, the higher the actual impact of NC solutions. And that's because they are built on the same mindset as coding. Technical teams perform very well with NC because they can understand what they are streamlining"* (Informant 4).

Overall, we find the dimension of technical complexity to be evident in affecting the implications of LCNC. The dimension of regulatory complexity has, on the other hand, given us contradictory answers. Most findings suggest that regulations specifically do not affect the potential of using LCNC. Some emphasize how it is an influencing factor, but not a strong or decisive one. One informant even holds the opposite view:

> *"If highly regulated industries, will have lower adoption of LCNC? I believe it is the opposite! The more regulated, the more clearly regulated, the easier it is to create low-code solutions or use low-code to create solutions. The industries most conducive to low-code usage are those where everything is defined elsewhere. In the public sector, for example, all services are defined by*

> *law and/or regulation. Rule-based processes are suitable for low-code, but not discretionary ones"* (Informant 9).

We thus find that it does not necessarily apply to both dimensions introduced above. However, a more specific type of regulation, is the aspect of security. Through our research, it is evident that the requisite level of security is a decisive factor to level of adoption:

> *"So, there are other sectors, like deeply regulatory ones, such as those dealing with national security. It's very irrelevant for those types of sectors. I mean, when the control aspect is very important. As it happens in deeply regulated industries like national security and such, then this is actually completely off because they do not get control over part of the stack. It is us who deliver it. We define it. Thus, if the control aspect is very important, then this is largely exclusive"* (Informant 7).

For instance, in the case of the Norwegian Defense, operating in an industry where high security and continuous availability are crucial, storing all data in the cloud and potentially experiencing a cloud service outage would potentially have catastrophic consequences. The adoption of LCNC solutions for mission-critical tasks and sensitive data management within the military will thus likely be a very gradual process for tasks critical to core business.

The healthcare industry is another example drawn from our interviews, mainly due to the handling of patient data. However, in 2021, technical solutions that meet the requirements of the GDPR for the protection of health information in cloud services were recognized by the EU's data security body (Aandahl & Landmark, 2021). Furthermore, a report from the Norwegian Directorate of Health and The Directorate of e-health also concluded that cloud services can be used for the processing of personal data in the health sector (Helsedirektoratet & Direktoratet for e-helse, 2021).This entails that there are likely many reasons to why such industries do not jump on the LCNC train, including culture, traditional and old systems, financial resources, and lack of competence. Solely blaming regulations in itself is therefore inaccurate.

Regardless, our findings suggest that the level of security needed is likely to impact the speed and extent of LCNC adoption and its current ability to automate internal

functions. Yet, it is important to note that this typically applies to functions requiring an exceptionally high degree of security. For the majority of tasks and operations, LCNC can offer significant enhancements. This is highlighted by our informants: "*As Microsoft have the same type of security through Outlook, if you are allowed to use Outlook, then you are allowed to use Microsoft PowerApps*" (Informant 1).

In addition, one informant even suggests the contrary, indicating that a high degree of security is better addressed with LCNC:

> *"That is indeed the rationale for why the military uses us. It's security, and it's simply because when you hardcode a solution, you have an endless number of things to consider. You have to deal with so many security aspects"* (Informant 9).

Expanding on the earlier insight regarding LCNC companies serving diverse sectors, we have also discovered that our informants' customer base encompasses large banks and financial institutions, the police and the Norwegian military, as well as construction and public ministries. For instance, LCNC is used to streamline the distribution of materials to Home Guard soldiers (Haarstad, 2020). The findings indicate that the decision to adopt LCNC is more dependent on the specific task or outcome desired than the industry itself. However, due to other factors that we will elaborate on further, there are certain industries less liable to be affected by the emergence of LCNC.

4.3.2 Other Influencing Industry Characteristics

We have also explored alternative characteristics, beside regulatory and technical complexity, that can affect the potential of disruptions. Several informants point out that the types of tasks, logic, and the current IT stack specific to industries are factors influencing the extent to which industries will be impacted. The statement from Informant 6 underscores this point, highlighting tasks involving intricate business logic that are both clearly defined and familiar, making them well-suited for resolution with LCNC:

There are mainly two domains in our company, and as far as we know, these are where NC and LC are currently gaining the most momentum: bank and finance, and insurance. What is the reason for this? It's a complex question, but I think it stems from the fact that LCNC is very well suited in industries where there might be complex business logic,

but where it is well-defined and known (Informant 6).

Next, another informant highlights that industries that are characterized by "*long workflows and investing significant financial resources on optimizing existing data*" (Informant 1), are particularly well-suited for LCNC. In addition, as previously stated, LCNC is better suited for industries with a limited history of internal IT. The construction industry is highlighted as an industry that lacks a history of internal IT development, making LCNC particularly well-suited for this sector. In this industry, adaptation is crucial due to distinctive processes, and that "off-the-shelf" solutions are rare. Informant 7 emphasizes the importance of preventing these industries from accumulating technical debt, thereby providing significant business value: "*We prevent them from ending up in a position of technical debt, right? That suddenly the app is a complete crisis in 3 years. They've bought themselves out of it*" (Informant 7).

Several informants highlighted that the influence of LCNC is particularly pronounced in business to business (B2B) contexts, contrasting with its impact in business to consumer (B2C) scenarios. In this context, banking and media have been highlighted as industries that will experience fewer benefits and be less inclined to adopt next-generation LCNC solutions. A mentioned reason is that LCNC applications can fall short in terms of visual appeal, especially when technology is the key differentiator from competitors. The statement by Informant 6 underscores this point:

> *"There are indeed some use cases where LCNC is not suitable today, and where I don't think it will be suitable. For example, if the primary value proposition for a customer is the presentation of a product, and the way you present marketing and market communication is absolutely crucial and at the forefront, then an LCNC platform is probably not the solution"* (Informant 6).

However, another informant underscores the importance of differentiating frontend and backend in such cases, as web and mobile development is in fact made to create a better and more visual experience for end users. Thus, contradicting the statement above. What we have highlighted so far is not straightforward, with different approaches in light of background and the type of LCNC they offer. This leads us to another finding; that the adoption of these technologies is also influenced by organizational traits such as culture, willingness, and inflexibility.

Organizational culture has been emphasized as a crucial factor influencing the adoption of LCNC. In the private sector, innovation has long been considered crucial for creating, developing, and leveraging competitive advantages and ensuring the survival of businesses (O'Reilly & Tushman, 2011). However, studies show that organizations often struggle to be innovative and adapt to dramatic changes in their environments (Foster, 1986). This is especially true in large businesses with long traditions and during periods of growth. In this context, culture plays a significant role. Firstly, culture can act as a barrier and limit radical innovation and necessary adaptation. However, culture can also, precisely, through its adaptability, be a competitive advantage (Chatman et al., 2014; Hillestad et al., 2014; O'Reilly & Tushman, 2011)

For instance, as highlighted by several informants, conservatism and adherence to traditions are identified as detrimental factors hindering the adoption of LCNC:

> *"In general, the oil and gas sectors tend to be somewhat conservative. They possess substantial capital, yet often exhibit a conservative, rule-based perspective on many aspects. Generally, they lag behind in the development trend compared to many other players, primarily due to the lack of incentives to transition into the digital realm. For these industries, the paramount concerns are safety and timely delivery. Not everything has to be very digital. And it's also not a problem if one spends a few more hours than usual because there is so much capital in circulation. Based on what I have heard, most of the largest enterprises in the industry have embarked on this journey, but they vary in their maturity regarding how far they have progressed*" (Informant 3).

In Seksjon 4.2, we discussed the challenges faced by larger, well-established companies, hindering their ability to navigate dynamic conditions, complicating the process of implementing strategic and cultural changes. However, a growing focus on digitalization and new technology is highlighted as important in today's cultural work:

> *"... It concerns the general focus on digitalization, and I believe large companies have realized that it is challenging to engage an entire organization in a digital journey if the digital objective is too distant from the daily work of engineers, economists, and lawyers. They need something that can actually start at a level that is understandable to people, so that people can be more*

> *involved. Thus, I think many view this in a similar way as we do: it's about digital culture as well. It's about creating a culture that is receptive, desirable, and motivated to drive digital development"* (Informant 3).

Lastly, we find that the processes of decision making are likely becoming more democratized, enabled by a younger generation entering the labor market. An illustrative question about decision-making was asked by Informant 2:

> *"Shall you let the IT manager, with 30 years of experience, be the sole authority in determining the course of action, or should someone else take the lead? This person holds a key to the basement bedroom. Is this the right approach for the future? If not, it could result in the absence of LC in your company, to put it simply. Someone else must take on the decision-making responsibility"* (Informant 2).

Informant 3 adds a transformative insight regarding LCNC and leadership development: *"The shift from a hierarchical "I decide what everyone should do" approach marks a significant change. Previously undemocratized, it has now become more decentralized, empowering those with the best understanding within the domain to make decisions further down the organizational hierarchy. This shift is not about outsourcing potential challenges to a central team in Oslo and hoping for prioritization. Instead, it's about taking ownership and saying, "with the tools we have now, let's build an MVP for the solution"* (Informant 3).

Overall, we thus find the willingness and organizational culture to be important in those industries and companies adapting LCNC. Having an organizational culture not prone to innovative transitions, will likely create a competitive disadvantage as LCNC is changing the way managers operate and collaborate, enabling technology to be shared more seamlessly across the organization (Bettis & Hitt, 1995).

4.3.3 LCNC Implementation in Internal Processes Across Industries

Building on the information presented in this section, we now want to explore how technically advanced and industries requiring high security may be affected of the unfolding of LCNC internally. In Section 4.2.4 we elucidated that as LCNC evolves and enhances its functionality, the scope of possibilities will widen. Several informants highlight that the application domain of LCNC will progressively approach more business-critical solutions. What we find is that the process of LCNC replacing traditional IT will occur at different rates according to industry.

We notice that in industries with high security requirements and technical complexity, LCNC is predominantly utilized for less critical functions, such as inventory management, time registration or ordering police certificates. There lies uncertainty as to whether LCNC will ever replace the traditional IT systems in these sectors, particularly those crucial for national security. An informant remarked, *"when it comes to the security of the realm in extreme areas, such as the construction of defense boats, it might not be advisable to have it stored in the cloud"* (Informant 9).

Concerning other industries mentioned by the informants, like banking and finance, and oil and gas, there are several entities in these sectors currently adopting LCNC. However, its primary use is for less critical support functions or as a component of their digitalization efforts and employee engagement. Informant 3, who works in an industry that is technically complex and characterized by high level of security, underscores this:

> *"The low-code aspect falls more into the digitalization part for us, and then it tends to transfer something from the innovation pot to IT because we have seen that this is valuable and something that should actually be used. Now we can implement it and integrate it into our governance structures within IT. But we don't say that low code is governance. It's not about managing large systems that require 3 to 4 people 100 percent every day just to keep the systems up and running. That's not where we are. But we could get there if we build low code now that becomes critical enough to require such governance that it needs to be managed 100 percent by people working with it daily"* (Informant 3).

We demonstrate this by integrating Figure 4.11 presented in Section 4.2. The original diagram has been adapted to center on security instead of regulation, as we have reformulated our initial expectation. Thus, we do find that industries characterized by high technical complexity and industries with high security requirements, will likely adopt LCNC more slowly and that the threshold for when LCNC will be "good enough" is likely to be higher in such industries. The diagram below illustrates how these industries likely will face disruption internally at a slower pace compared to industries where these factors are not present.

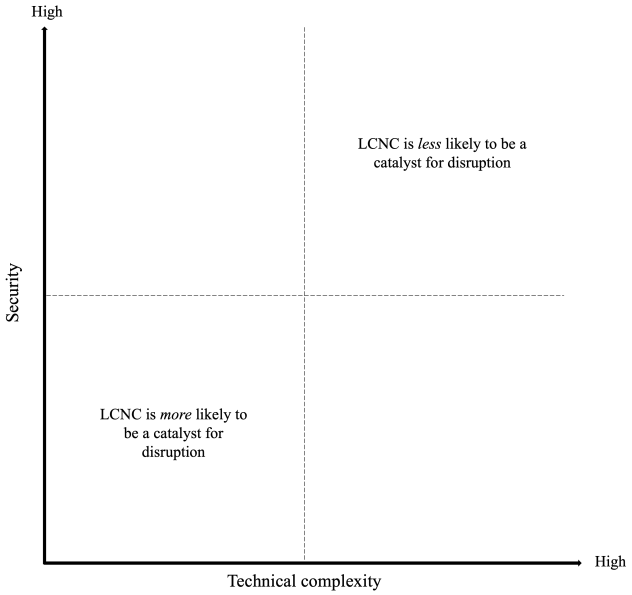

Figure 4.11: Industries more or less likely to be affected by LCNC

4.3.4 Sub-Conclusion

Our findings indicate that regulations do not exert a significant impact on LCNC. Instead, technicality and security are likely to constitute a hinder for LCNC greatly unfolding. LCNC's influence is intricately linked to the characteristics of individual tasks, and existing IT structures within specific industries. Organizational factors, such as culture and a proclivity for innovation, emerge as crucial determinants, underscoring the nuanced and dynamic nature of LCNC's influence. Furthermore, we revisit the discussion from Section 4.2.4, of the technology increasing its influence internally. We emphasize that the differing impact across industries can be analyzed by exploring how LCNC unfolds more swiftly in sectors with lower technical complexity or less stringent security requirements.

5 Discussion

In the coming decades, grappling with the essence of change will prove challenging as entirely new technologies start to shape the way we work, live, and endeavor to innovate. Innovation in the digital era differs from that of earlier generations. In essence, technology has provided us with potent new tools, and we must acquire the skills to wield them effectively (Greg Satell, 2017). In the following part we will interpret the meaning of our findings in accordance with theories of disruption.

5.1 LCNC as a Discontinuity

Based on our analysis of Crunchbase data, insight gathered from interviews, and existing literature, we will now delve into the emergence of LCNC within a theoretical framework. As the LCNC market experiences substantial growth, Tushman and Anderson's(1986) theoretical concept of technological discontinuities offers a perspective to comprehend its broader evolution and anticipate future developments.

5.1.1 Growth and Development of the LCNC Market

The development of LCNC can be viewed as a technological breakthrough, particularly observed from the mid-2010s, where this discontinuity marked a departure from the incremental progression of technology. During this phase, we observe a surge of LCNC companies appear, signifying a shift away from gradual changes. The expansion observed in the LCNC market aligns with Tushman and Anderson's(1986) description of discontinuity. They define a product discontinuity, as a phenomenon wherein a new product forms, offering a distinct advantage over previous versions in cost, performance, or quality. While LCNC may introduce certain constraints, its value proposition lies in dramatically lowering the cost and increasing the efficiency of software development, thereby democratizing the creation and deployment of applications. It can be depicted as a peak in Figure 2.1 in Section 2.1, where the rise signifies a percentage enhancement in efficiency relative to earlier products.

Our findings underscore that LCNC, as a technological breakthrough, is competence-enhancing, meaning that the discontinuity draws on existing skills and knowledge. This

is attributed to the fact that LCNC technology is not an entirely novel concept. As noted by Forrester, "low-code platforms are a converging category, not a new one," emphasizing the evolutionary merging of existing technologies within the LCNC domain (Richardson & Rymer, 2014). Established players need to adjust to new elements, but their foundation is rooted in familiar technology, such as traditional IT and RAD, sharing several similarities. Given that many LCNC platforms demand a certain level of coding expertise, companies and individuals possessing solid IT knowledge can now leverage this competence in a new way. Additionally, our findings highlight that major industry players have been strategically positioned to capitalize on the fresh opportunities arising from the LCNC discontinuity, aligning with the typical characteristics of competence-enhancing discontinuities (Tushman & Anderson, 1986). Given their substantial market influence, resources, and customer base, these companies can incorporate the LCNC platform as either a component or an "add-on" to their more established systems. This places established companies in a more advantageous position compared to independent LCNC platforms.

The rapid and sudden growth of new players suggests that the LCNC landscape is currently in a phase of fermentation. In an era of ferment, Tushman and Anderson (1986) posit that two distinct selection processes are at play: (i) competition between technical regimes and (ii) competition within the emerging technical regime. In the realm of competition between technical regimes, companies frequently weigh the decision of choosing between traditional IT or a LCNC solution. In our interviews, many informants pointed out that companies commonly consider traditional IT first, and if it proves unsuitable, they then explore the option of LCNC. This underscores the competition between the old and new technical regimes, a rivalry often intense during fermenting phases (Foster, 1986). As we have highlighted, several advocates of existing systems express skepticism about LCNC, perceiving it as an inferior coding alternative. This skepticism indicates that LCNC is disparaged by some, a common pattern when new technologies are introduced (Jenkins, 1975; Schon, 1971). This is often due to initial performance issues and reliance on unproven assumptions and competence misaligned with the established technological order (Jenkins, 1975; Schon, 1971).

Regarding competition within the emerging technical regime, we have illustrated the rapid

increase in the number of actors since 2014. The LCNC market is not in a settled state; instead, we find it amidst a phase of experimentation, where companies are exploring various paths. This understanding is rooted in insights from informants, who have emphasized the emergence of numerous actors engaging in diverse market segments. This is further supported by the abundance of actors and categories documented in Crunchbase. We have also noticed variations in the level of competition based on the different categories within the LCNC market. As previously stated, the Web and Application market exhibit a high degree of rivalry.

The challenges associated with categorizing and defining the LCNC market are challenges typically prevalent in the initial phase of an industry's lifecycle (Suarez et al., 2015). The terms "low-code" and "no-code" are used interchangeably, signifying that actors might employ the terminology to attract a large pool of customers (Zuckerman et al., 2003). This ambiguity in terminology is heightened by the multidimensional nature of the market, creating overlap and complexity in classification. Suarez et al.'s (2015) concept of unclear market definitions in emerging markets, emphasizing the intricate challenge of defining clear categories within the dynamic and evolving LCNC market. The distinct classifications from Gartner (2022), Unigram Labs (2022) and Madrona (Li et al., 2020), underscore this argument.

The emergence of the LCNC market and its trajectory can be better comprehended through the terms "dominant category" and "dominant design". Utilizing insights from both Suarez et al. (2015) and Anderson and Tushman (1990), the emergence of a dominant category signifies the opening of a window of opportunities for new entrants. This development also aligns with Tushman and Anderson's (1986) description of the "fermenting phase" that follows a significant market shake-up. Applying the framework, LCNC has now outpaced other competing technologies, establishing itself as the dominant category. This ascendancy of LCNC has effectively opened a window of opportunities, also defined as the fermenting phase, during which new players can dive in and potentially thrive. This pivotal phase in the LCNC market's evolution is captured in Figure 5.1.

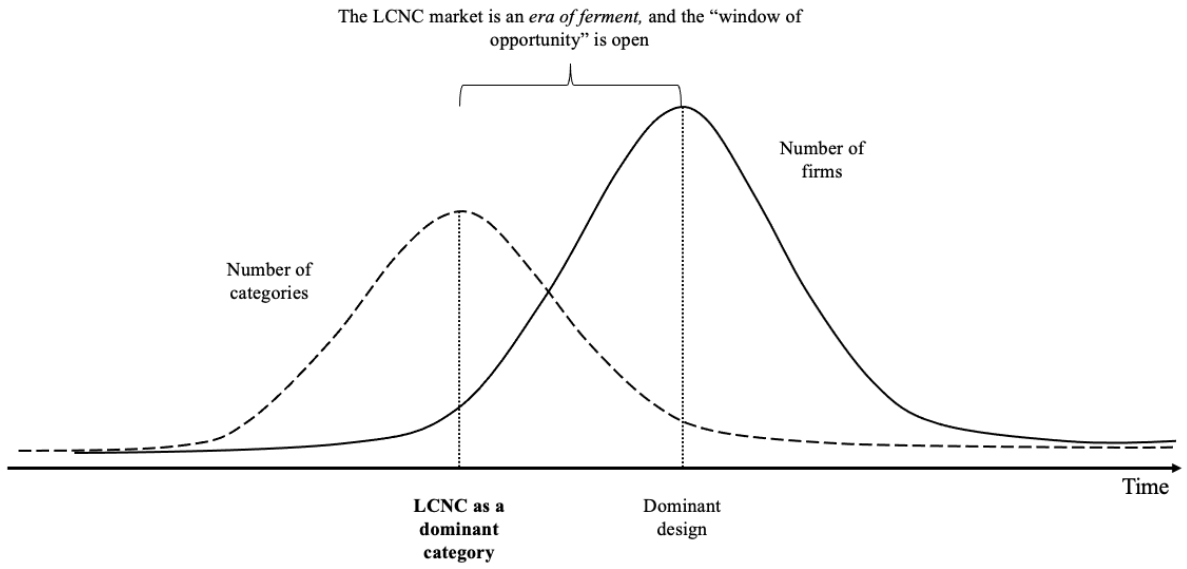

Figure 5.1: LCNC as a dominant category

When the window of opportunity is open, the players compete to win the battle for the dominant design (Suarez et al., 2015). From our analyses in Crunchbase, we observe several categories experiencing rapid growth, such as AI and various developer/productivity tools. However, it is challenging to predict at this point which category will become the dominant design, and when it will happen. Scholars have explored how long this window will remain open, and a consensus among them is that the endpoint of the window of opportunity coincides with the emergence of a dominant design (Abernathy & Utterback, 1978; Anderson & Tushman, 1990; Klepper, 1996; Utterback, 1994). At that point, companies may find it less appealing to establish a presence in the market, and the market will stabilize.

Tushman and Anderson (1986) state that the length of the fermentation period may depend on the type of technological discontinuity. In the case of breakthrough innovations like LCNC, which build upon existing knowledge, the fermentation period tends to be relatively short. This implies that the emergence of a dominant design in the LCNC will occur more quickly, due to a succession of major advances enhancing an established knowledge base. With each subsequent instance, the technology becomes increasingly well understood and institutionalized (e.g. Constant, 1980). None of our interviewees indicates that a consolidation phase has started to occur, as suggested by Tushman and Anderson (1986) to be the natural progression after a period of fermentation. However, the

progression from 2020 to 2021 is not as pronounced as it was in earlier periods, suggesting that we may be on the verge of entering such a phase.

5.1.2 The Future of LCNC

Concerning the future development of the LCNC market, all informants suggest that the landscape will be shaped by a strategic positioning game in the upcoming years. It will likely be a dynamic period where companies pinpoint their business model, wherein some will carve out their expertise to specific industries, while others will become domain specialists. A diverse array of strategies will likely surface, with some firms advancing in complexity and others positioning themselves to attract a wide customer base. There is a shared viewpoint among those interviewed that to thrive and navigate the competitive landscape, actors must initially establish themselves within niche markets. This is due to the challenges of competing against major, intricate, full-service providers like Microsoft, Mendix, and OutSystems, known for their vast user base and substantial resources. After establishing a solid foundation within a niche, some informants are highlighting that the companies can systematically broaden their offerings. Regardless of the chosen path, it has been suggested that companies may benefit from strategic repositioning to establish a distinct presence. This can be crucial for potentially achieving visibility and ensuring a sustainable future in the dynamically evolving LCNC market.

The future of the LCNC landscape appears to be on the verge of a consolidation wave, with expectations of several acquisitions in the years to come. Informants mainly attribute this to two reasons: i) large companies seek to maintain competitiveness by acquiring the knowledge and forward-thinking of smaller firms, and ii) it is challenging for smaller companies to achieve significant growth on their own. Rothaermel (2001) emphasizes that incumbents' survival during disruption was not due to their development of new technology, but rather through gaining access to it through licensing agreements, strategic alliances, joint ventures, and acquisitions. This reflects the historical trajectory followed by industry leaders like Microsoft and IBM. Despite not pioneering radical technological breakthroughs like the Internet, they achieved success through adaptation, utilizing strategies such as licensing, strategic alliances, and acquisitions (Bower & Christensen, 1995).

Looking at the consolidation trends in the realm of AI in Figure 5.2, we identify a

significant increase in acquisitions made by large technology companies in recent years. Insights from industry informants suggest that the LCNC industry might emulate this pattern. It is anticipated that such strategic acquisitions could substantially alter the market landscape, as larger companies may opt to assimilate expertise through acquisitions instead of internal development.

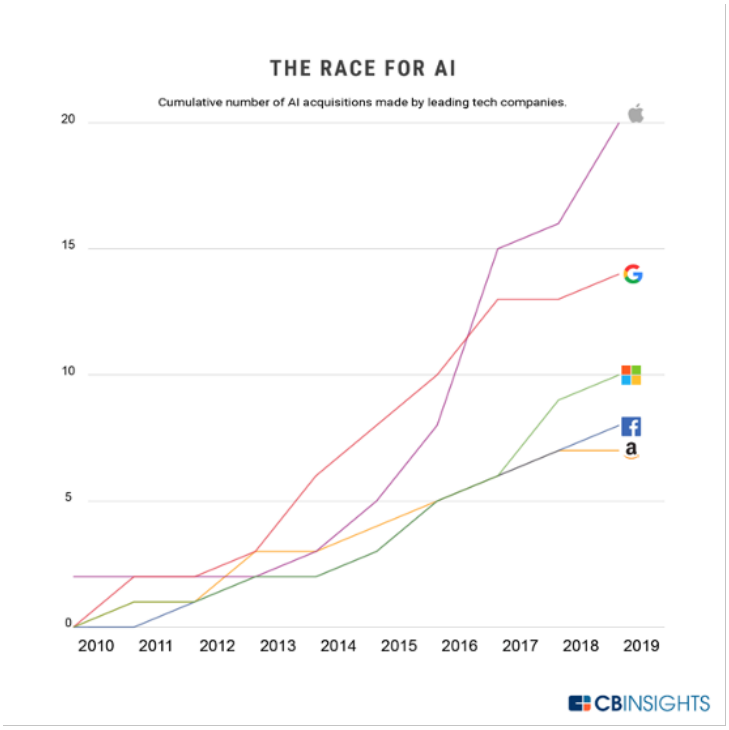

Figure 5.2: The Race for AI (CBInsight, 2019)

5.2 LCNC Enabling Disruptive Innovations

Whereas Tushman's work on technological discontinuities and the era of ferment provides insights into how radical technological shifts affect the competitive landscape, Christensen's theory of disruptive innovation complements this by offering a nuanced understanding of how incumbent firms may struggle to adapt to emerging technologies and navigate the challenges posed by disruptive market entrants. Tushman's focus on the transitional phase and organizational responses to discontinuities aligns with the challenges incumbents face in adapting to disruptive forces. We have now established how the emergence of LCNC can be characterized as a technological discontinuity, followed by a current era of ferment. This part will delve into the disruptive potential of LCNC and discuss why and how LCNC will likely engender more disruptions.

King and Baatartogtokh (2015) pinpoint four crucial aspects of disruption theory: (i) the progression of established market players through sustaining innovation; (ii) the tendency to exceed customer needs; (iii) the capability to manage and respond to disruptive threats; and (iv) that incumbents end up struggling due to the impact of disruption. They provide a foundational context for the discussion, mainly with focus on the first two, considering the current technological discontinuity, where disruptions due to LCNC have not yet manifested.

It should be emphasized that our interpretation of disruption aligns with broader interpretations such as those found in Tushman and Anderson (1986) regarding technological discontinuities and Danneels (2004) concerning disruptive technologies. Consequently, a key area of exploration involves understanding the nature of such disruptive outcomes and the processes through which they unfold, also within companies (Millar et al., 2018). However, Christensen's (1997) core concept of "good enough" will influence the discussion.

5.2.1 Incumbent's Focus on Sustaining Innovation

One of the enduring patterns in business is the tendency for leading companies to falter in maintaining their supremacy when technologies or markets undergo changes (Bower & Christensen, 1995). Christensen argues that performance oversupply opens the door for simpler, less expensive, and more convenient, and almost always disruptive, technologies to enter (Christensen, 1997). It is commonly stated that our capacity to grasp technological intricacies today has been surpassed by the complexity itself (Arbesman, 2016b). Furthermore, as we showed in Figure 2.5, this also extends to our utilization of IT, falling far short of its actual potential. Technology today has thus created products that are better than what the market demands.

One of our most important findings has been the difference in use and level of adoption regarding the size and time of the establishment of company. Firstly, established companies use the technology on top of internal, traditional data systems, for automation of existing tasks, and support functions non-critical to core business. According to theory and the increased efficiency and possibilities of LCNC, this might entail that they underestimate the disruptive forces, adopting it to move further along their current trajectory. Rather

than leveraging LCNC for creative thinking, many use it to automate previously manual tasks. This can therefore be seen as a process of digitalization to sustain continuous growth, often distinct from the work of the general IT department.

Due to factors like size, culture, and existing systems, the process of becoming digitally mature, is inherently more challenging for larger firms. However, this is also, in fact, one of the exact reasons why established firms can be disrupted (Christensen, 1997). Incumbent firms often face severe difficulties in adapting to radical technological change (Foster, 1986). Essentially they use new technology for incremental improvements rather than exploiting the full potential, suffering from legacy and path dependency. Considering the current issues of compliance and scalability of LCNC, adopting the emergent technology at a larger scale is likely not beneficial for such established companies. Even though they possess the resources, their processes and values are inconsistent with the technology. This is consistent with Christensen's "Capabilities Framework" (Christensen, 1997, p. 186). Thus, as established businesses aim to uphold their growth trajectory, their size and success render the rationale for entering an emerging market during its nascent stage more complicated.

When confronted with a disruptive technology, the conditions for maintaining competitiveness alters. In sustaining technologies, evidence strongly suggests that companies which focus on extending the performance of conventional technologies, and choose to be followers in adopting new ones, can remain strong and competitive (Christensen, 1997). This is not the case with disruptive technologies. There are enormous returns and significant first-mover advantages associated with early entry into emerging markets in which disruptive technologies are initially used. A key characteristic of disruptive technology is that it signals a shift in the basis of competition (Christensen, 1997).

Christensen et al. (2015, p. 7) argue how "disruptive innovations do not catch on with mainstream customers until quality catches up to their standards". Following this is that disruption is a process that takes time, essentially one of the reasons why it is frequently overlooked by incumbents. As we explained, the current phenomenon of LCNC is a continuation of RAD from 2010, or even earlier, and gained momentum when cloud technology became available. The concept of abstracting away code is therefore nothing

new and is essentially a parallel to what democratization of technology is about: making something complex available to some experts, accessible to the public.

In Christensen's (1997), he found that established firms facing disruptive technology often saw their main development challenge to be the technical enhancement of their technology to fit existing markets. Conversely, the most successful companies in commercializing disruptive technology approached it differently, identifying or creating markets where product competition favored the disruptive attributes. History suggests that companies holding disruptive technologies in labs, refining them for mainstream markets, are less successful than those finding markets embracing the initial disruptive attributes. Finding that established companies mainly adopt LCNC on top of existing systems, it seems to be an example of the situation first described.

Furthermore, in his study of the disk drive industry Christensen found that companies entering a new market created by innovative technologies within the first two years had a sixfold higher chance of success compared to those entering later (Christensen, 1997). Hence, considerable returns and notable first-mover advantages are linked to early entry into emerging markets where disruptive technologies are initially employed. This raises the question of whether the established firms not embracing LCNC will fall behind new companies starting in low-end markets, slowly increasing their market share.

5.2.1.1 Disruption of Corporate Functions

As enterprises should be aware of the disruptive potential of LCNC, they need to be alert of an internal process exhibiting disruptive characteristics as well. As LCNC develops it is likely to become a "good enough" product for an increasing number of corporate functions within companies as well. This scenario aligns with the common pattern where emerging technologies begin by targeting less demanding or niche segments, such as support functions in our case, before gradually expanding to encompass more critical, core functions. As LCNC evolves and improves, it gradually gains capabilities and efficiencies, making it suitable for more central and essential functions within the company. Figure 5.3 illustrates our findings regarding the internal effect of adoption of LCNC.

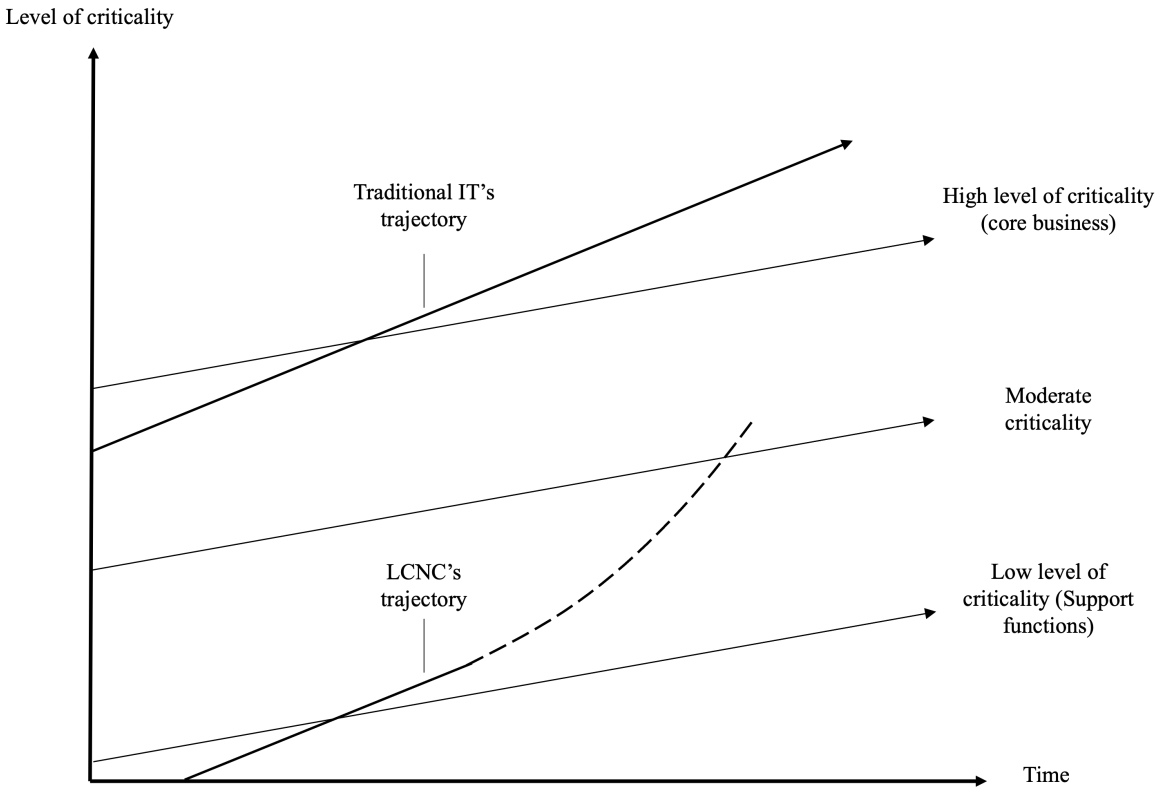

Figure 5.3: Proposed trajectory of LCNC within companies

The graph of disruption is illustrated with high level of criticality to core business being the traditional high end-market. This type of disruption internally, can have a transformative impact on the traditional ways of conducting business operations within the company. It may require organizations to adapt, reallocate resources, and potentially reshape their strategies in response to the changing landscape of technological capabilities. This transition marks a pivotal moment where the technology disrupts traditional approaches to corporate functions, aiming for the "mass-market" (Christensen, 1997). This development may likely prompt organizations to adapt its strategies, workflows, and possibly even its corporate culture. There may be a need for reskilling or upskilling employees to leverage the full potential of the technology, as LCNC bridges the areas of IT and business. Companies might also need to reassess their existing processes and structures to be able to fully integrate the technology into their core operations.

The process described above is already happening due to the continuous improvement of LCNC. However, as potential disruption normally should be handled with care (Christensen, 1997), this type of disruption is beneficial to be aware of due to the positive

effects it may have on company performance. An incumbent company not adopting LCNC is likely to allocate excessive resources and time to IT and innovation. Irrespective of future development, LCNC has gained foothold, and there are undoubtedly tasks in every firm that can be improved. This applies not only to large enterprises but also to SMEs. The small and medium-sized enterprises (SMEs) constitute more than 99 percent of all businesses in Norway, and 47 percent of the employees in the private sector. Collectively, they account for nearly half of the annual value creation in the country (NHO, n.d.). Several informants pointed out that LCNC creates a significant opportunity in this market, as they are now capable of providing an enhanced digital customer experience, surpassing their major competitors entangled in legacy challenges.

The adoption of LCNC holds the promise of a reduced time-to-market, fostering a conducive environment for the emergence of startups. Beyond hastening market entry, it is anticipated to bridge the technology gap, and enable optimization and automation of operations. This efficiency boost, in turn, creates a leeway for organizations to allocate more time and resources to innovative and forward-looking endeavors. Next, a strategic embrace of LCNC can become a competitive advantage, potentially leaving companies hesitant to adopt it at a disadvantage. However, the extent of LCNC's disruptive impact on corporate functions hinges on the industry context. Industries marked by technical complexity and a high-security threshold are less likely to experience the transformative shift.

5.2.2 Entrants Focus on Underserved Markets

Firstly, the basic idea of LCNC was essentially to combine the best off-the-shelf and customized tailor-made solutions through a quicker and more affordable approach. Rooted in a low-end foothold, as evidenced by its name denoting a reduced need for coding, one can argue that LCNC aligns with the theory of disruption. Notably, it deviates from traditional IT paradigms with its subscription model, user-friendly adoption, and transient presence within a firm's infrastructure. An intriguing facet lies in its ability to empower non-developers in the mass market, expanding accessibility and usability. Despite these disruptive attributes, few innovations truly meet the criteria of disruption (Christensen et al., 2015). Some argue that LCNC, in essence, serves as a sustaining innovation in the technology market, enhancing productivity and possibilities from the "supply side" (Gans,

2016a). Despite of how you frame it, the disruptive effect of LCNC is likely to drive both the democratization of technology as well as IT upmarket.

Despite LCNC disruptive characteristics, it neither will nor aim to disrupt away all traditional code. The goal of LCNC is not to become a complete substitute, but to become "good enough" to digitalize current, cumbersome solutions, to increase productivity and live alongside traditional coding (Urne et al., 2023). Quite obviously, the world does not diminish in technological complexity. LCNC is rather a way to accelerate technological development dramatically. As we noted in our findings, many existing challenges can be solved in a faster and better way. As technology in itself does not resolve issues, its effectiveness, nevertheless, hinges on appropriate application (e.g., (Carr, 2003; Goodell, 2011).

However, when using and adopting technology is easier and less complex, we are likely to see more companies and organizations appear, especially where IT knowledge earlier have been a hinder. The startup cost of challenging an incumbent has dropped due to LCNC. As our findings show, this is mainly due to faster time-to-market and the lower requirements of IT knowledge. There is no doubt that new companies are able to reach the market much more expeditiously, with reduced cost. Without a doubt, this significantly contributes to promoting greater innovation, allowing companies to accelerate their market entry, determine Product-Market Fit, acquire initial customers, and construct their products with considerably fewer resources than previously considered necessary.

We find that optimism surrounds the potential for LCNC to pave the way for increased startup success, empowering them to navigate initial stages more efficiently. This offers a distinct advantage for startups, signaling a shift away from the notion that technology is the determinant of a firm's success. The conventional bottleneck has been shattered, and success is increasingly contingent on solving meaningful problems and adopting a superior business model. Competence and financing, once deemed critical, are no longer as limiting. Furthermore, startups incorporating emerging technology from the outset, can align their resources and strategies with LCNC (Zahra, 2021). This proactive integration allows for the cultivation of valuable experience and expertise, providing a strategic advantage. Consequently, those adept at harnessing and applying LCNC unlock immense possibilities, laying the groundwork for disruptive innovation.

Moreover, Cuthbert and Pearse (2021) state that no-code technology is complementary to an agile development approach. Although increased development speed and a shorter time to market might be beneficial in the early stages of a startup, it will be essential to plan for growth to avoid the early death of the developed product. In the context of technological development, this entails finding new strategic gaps in market spaces where competition is minimized, commonly referred to in literature as blue oceans (Kim & Mauborgne, 2004). This is thus compliant with the characteristics of LCNC insofar that it creates a foundation for growth and a culture. Furthermore, aligning with consequences of the democratization of technology, underscoring the importance of a sustaining competitive advantage beside technology (Ferreira et al., 2019; Knudsen et al., 2021; Sousa & Rocha, 2019). This further underscore the strength and potential that LCNC possesses to bring about disruption.

5.2.3 Industries Less Likely to Face Disruption

We have now stated that established companies facing 'the innovator's dilemma' may find it challenging to transition to LCNC methodologies, potentially opening opportunities for agile, disruptive startups to emerge and gain a competitive advantage. However, Christensen et al. (2015) argue that his prerequisites for succeeding as a disruptive innovator will not apply to every company in a shifting market.

Andreessen (2011) highlights that in certain sectors, especially those grounded in real-world activities like oil and gas, the software revolution primarily presents a significant opportunity for incumbents. This is consistent with our findings. Firstly, we consider the entry barriers to be higher in technically advanced industries due to the high need of equipment and extensive financial capital. This is consistent with literature as a factor preventing startup entry into a market (e.g. (Robertson et al., 2003). Examining the requirements of high security, underscoring national security, the entry barriers, on the other hand, has a distinctively different meaning, as it is publicly financed services, often without market competition.

This leads us to the factor concerning criticality to society. Often, industries or firms that are characterized as highly technical and require high security, are highly regulated due to the criticality to society and dependency to markets. Examples of such are the

military, national banks, and oil companies as e.g., Equinor. Thus, the implications and prerequisites are not alike the ones in a free market. Startups are insofar no real threat to their operations. Due to the size of the operations and quality requirements, startups aiming for a low-end market, is in fact less possible.

Nevertheless, as technically advanced industries often heavily rely on complex technological systems, it also introduces dependencies that can become points of vulnerability. Furthermore, as competition is commonly known as a driver for innovation (OECD, 2023), firms working under strict security might have an organization and culture less willing to adopt LCNC. We are currently navigating a period of technological advancement, and our understanding of the impact resulting from the rise of LCNC remains incomplete. However, as industries tailor their systems to accommodate this type of development, and as cloud technology becomes safer and better adapted to such functions, it will be crucial to be aware of the potential. Especially so, if they have a deeply entrenched development culture rooted in traditional practices.

However, as we find during our interviews, a majority of the LCNC-platforms we talked to work with companies in those respective industries. Therefore, we are not saying that these industries are likely to use less LCNC, or that they will not be affected by the emergence. In fact, they might be most affected by it. Automating tasks with LCNC available to hundreds of people, will be productivity enhancing. What we do entail is that they are less likely to be disrupted by newly established companies using LCNC, due to the complexity and security required. Furthermore, this also entails for the disruption of operations within the companies, as we argue that this process will be slower, in addition to that LCNC will be "good enough" for less functions than in other industries. Emphasizing the significance of integrating digital tools into the overall strategy, operations, and processes is essential, regardless of industry (Dragos et al., 2020; Rokis & Kirikova, 2022). A report from (McKinsey & Company, 2018) states that industrial sectors are poised to experience more disruption in the next five years than in the past two decades, underscoring the importance of the type of task rather than industry in the adoption of LCNC.

5.3 Implications of LCNC's Democratization of Technology

Several researchers state that technological advancement facilitate disruption; that the continuous evolution of technology opens doors for new, often disruptive, developments that can reshape industries, challenge established norms, and introduce innovative solutions (e.g. Andreessen, 2011; Porter & Heppelmann, 2015). This implies that progress and innovations in technology can contribute to the disruption of existing industries or systems by introducing new possibilities and capabilities that were previously unattainable.

As we state in our findings, LCNC is clearly a technological advancement that simplifies the startup phase for new companies, lowering the barriers of entry by saving time, money, and costs. In 2011, Andreessen confidently outlined several reasons to why software will take over the world (Andreessen, 2011). In his article he draws upon various sectors, explaining how they leverage software, with the aim of informing that a software revolution will come. The emergence of LCNC can in many ways be characterized as a step further, extending the hardware to software development. Thus, further facilitating disruptive entry into markets where technology earlier has been a barrier, leading to the creation of more innovative solutions. As such technology evolves, it can give rise to novel approaches or tools that challenge the status quo.

Examining disruption theory from a broader perspective, King and Baatartogtokh (2015) reveal the intricate challenges faced by firms, emphasizing the need for a multifaceted approach, urging managers to integrate disruption theory's insights with traditional strategic analyses. They highlight that the theory of disruptive innovation serves as a cautionary reminder against managerial myopia. Addressing the competitive landscape, rapid technological progress has in fact notably shortened product and service life cycles (Goldman, 1982), contributing to reduced corporate life expectancy (Lifespan, n.d.). The accelerated innovation of LCNC can swiftly render existing offerings obsolete, creating opportunities for disruptive alternatives. In essence, despite presenting formidable challenges, judiciously incorporating disruption theory into strategic analyses provides a crucial vantage point for navigating the dynamic business landscape.

Furthermore, where IT is not a crucial asset, other factors are important for gaining a competitive advantage. Even though LCNC enables increased entrance of new companies, they will not survive without a prominent business model. Several, alternative features thus have importance. We know that IT is no longer a significant barrier and that LCNC is likely to be good enough to disrupt the customer- and market needs in several industries, both through low-end disruptions and new-market disruptions. However, it is essential to emphasize that, irrespective of the established technological foundation and the ongoing democratization trend, a critical factor still lies in the application of this technology. The likelihood of encountering disruptions reminiscent of Christensen's theory is contingent upon firms fostering an innovative mindset, adept problem-solving capabilities, and adaptable business models. However, for those effectively leveraging and applying LCNC, the ensuing opportunities are considerable.

We have encompassed LCNC as a significant technological discontinuity. However, it is essential to acknowledge that utilizing LCNC does not only present advantages. During our interviews, the informants also shared thoughts regarding if the development is progressing faster than what we are facilitating for. The open accessibility of these technologies may mean that we are not fully prepared for their integration, perhaps especially with components involving AI. Firstly, it raises new needs and considerations internally regarding both if, and how, the firm should adopt it. As we have discussed, productivity gains are a benefit, but it raises questions around security and maintenance. Thus, aspects of security and establishing a robust foundation should be prioritized before fully adopting LCNC as part of an IT strategy. Despite Christensen's emphasis on first-mover advantages, adopting a cautious "wait-and-see" approach may emerge as a prudent solution.

While traditional IT maintains its sustaining innovative pace, generating an oversupply of elements and functions, LCNC assumes a crucial role in society. The escalating demand for IT competence propels the development of LCNC. Furthermore, this is not merely a transient situation, but a continuous trend driven by the ongoing digitization of the world. Consequently, alongside other disruptive innovations like AI, future technological utilization is anticipated to become more accessible and democratized. While we have underscored security as a limiting factor, an alternative perspective posits that LCNC

offers a considerably wider scope for collaboration, avoiding reliance on scarce specialized expertise. Consequently, in the long term, LCNC might carry less risk than conventional coding, influenced by the market dynamics of developers and the potentialities inherent in LCNC.

There is an ongoing discussion around the role and adoption of AI and LCNC. In an article in Forbes, Drenik (2023) writes that "The synergy between AI and low code is transformative, democratizing coding and expanding the horizons of software development". This perspective is embraced by numerous individuals, highlighting the role as custodian of a product. Whereas AI increases the productivity of traditional coding and LCNC, fostering accelerated growth in the market (Bratincevic & Lo Giudice, 2023), it is far from being relevant to maintenance (Urne et al., 2023). LCNC tools facilitate iterative development, offering debugging and code improvement capabilities. Whereas AI-generated code cannot be deployed without the developer comprehending the code and assuming responsibility for its maintenance. We therefore argue that LCNC and AI will play important, but balancing, supplementary roles in the immense democratization of technology the world is facing.

Finally, a distinct perspective is that LCNC currently is riding a wave of popularity, eventually expected to gradually align itself more closely with the conventions of traditional IT. This perspective suggests an eventual assimilation of LCNC into the broader framework of established IT practices. However, an alternative viewpoint considers the possibility of LCNC undergoing a transformative integration with AI in a versatile ecosystem. In this scenario, LCNC, driven by AI innovations, could continue disrupting conventional norms and, eventually, redefine our understanding of IT.

6 Conclusion

The purpose of this study has been to enhance our comprehension of the dynamic relationship between democratization of technology and disruptive innovations, by studying the emergence of LCNC. By analyzing secondary data and conducting interviews with key figures in the field, we have provided a comprehensive answer to our research question, exploring how LCNC influences the potential for disruption.

Our findings indicate that the LCNC wave constitutes a significant technological discontinuity in the digital landscape. The market is experiencing growth, characterized by a growing number of participants, category expansion, and an expanding influence across various sectors. Insights from both Tushman's (1986) and Christensen's (1997) bodies of research contribute to our understanding of the interplay between technological evolution, organizational adaptation, and the emergence of disruptive forces. Our study further reveals key characteristics of LCNC that empower firms to enter new markets more efficiently. LCNC facilitates the rapid development of Minimum Viable Products (MVPs) with less coding expertise, enabling quicker and more cost-effective market entries. As development accelerates, the barrier to entry is expected to decrease, making LCNC "good enough" for a growing number of companies and functions.

Moreover, our research provides insights into the distinct approaches taken by both new and established companies in adopting LCNC. Established firms tend to integrate LCNC to automate manual or overly complex internal tasks, while simultaneously reducing the technology gap by empowering citizen developers. In contrast, newly established firms adopt LCNC as a comprehensive solution at the core of their business model. While larger companies enjoy substantial advantages by incorporating LCNC into support functions, they need to be conscious of the disruptive challenges that arise when companies fully harness the potential of LCNC. As LCNC continues to evolve, the threshold for functions where it is deemed "good enough" is likely to rise. This also applies to internal processes. Failure to adopt this technology may result in excessive resource allocation to activities that could be streamlined more efficiently.

We find that sectors that require high technical expertise and a high level of security will adopt LCNC more gradually. LCNC will rather function as a catalyst for resource

optimization and efficiency in less critical business processes. However, as LCNC advances, its capabilities are likely to extend to encompass additional functions within these industries.

6.1 Implications and Contributions

Our primary contribution to the research on democratization of technology centers on the rise of LCNC, which has gained significant ground in the current landscape and is poised to cause further shifts and disruptions. It enables companies to enter new markets faster by identifying a low-end niche as the initial step in developing innovative solutions. Christensen's criteria for defining disruptions, specifically wherein disruption creates new markets, suggests that we cannot precisely forecast where or how disruptions will emerge. However, the inherent benefits and attributes of LCNC indicate that the technology is not only a disruptive innovation in itself but also a catalyst for further disruptions across industries. However, it is crucial to emphasize that simply having access to LCNC does not guarantee its effective utilization. The true value lies in how the technology is utilized. The likeliness of seeing more disruption, in the vein of Christensen's theory, depends on firms' innovative mindset, solutions to problems, and business models. Yet, when the technology is harnessed and implemented effectively, the potential rewards are considerable.

By extension, we also offer a contribution to the literature on LCNC, a concept in development, both in practice and literature. This entails that is exist many articles about the concept, but fewer scientific articles directly addressing this topic. Frameworks, categories, definitions, and companies are therefore somewhat loosely defined. Our aim of categorizing and mapping the landscape and trends can contribute to researchers gaining a better understanding of the concept and its scope. As we realize that "low-code" is a buzzword as much as it is a defined concept, we believe our approach to structurally analyze and define the concept contributes to existing research.

Finally, our thesis adds to the literature of disruption. As Christensen's theory has been either criticized or outworn by many researchers and business professionals, we believe our thesis opens up a new undiscovered area for this research, that we have found to align with what Christensen envisioned. Our findings, particularly the insights of how

LCNC will likely increase its applicability within companies, stand out as a compelling and noteworthy aspect.

To practice, our research contributes to highlighting that companies must address the consequences of LCNC and understand the opportunities it presents. There are always areas for improvement, and significant productivity gains can be achieved through its utilization. Moreover, it has the potential to alleviate existing challenges related to IT, reducing technical debt. Additionally, as we find that LCNC will have an impact, it may be profitable to invest and take a proactive stance to attract talent. It is suggested that those entering the workforce will possess a greater understanding of technological innovations and their advantages. Therefore, keeping abreast of these advancements will undoubtedly prove beneficial.

6.2 Limitations and Future Research

The work related to this study spans one semester, which entails limitations on the scope of the research. Moreover, the dynamic nature of the environment and the concept, with new literature and companies emerging daily, presents a challenge in attaining a comprehensive understanding. This could essentially impact the relevance of this study in future years. However, we argue our study gives a holistic picture of the concept and the current situation.

The majority of our informants work with LCNC solutions on the supply side of the market, mainly representing a LCNC platform. An interesting perspective for future researchers would be to rather interview actors on the demand-side of the market, who might have a different understanding of the concept and its applicability and usefulness. Moreover, we have applied a relatively broad understanding, while it would also be interesting to narrow it to a specific industry or company, analyzing the specific gains or consequences of the adoption.

Lastly, we have specifically interviewed Norwegian actors in the market. This is a relatively concentrated market due to few existing players. Although they operate across various industries, they typically attract a higher number of customers in specific markets, naturally enhancing their proficiency in those areas and aspiring to expand their clientele within those markets. This segmentation among suppliers results in a more harmonious

industry landscape, fostering collaboration rather than intense competition. However, on the other hand, they do face heavy competition from international actors. Thus, future research could benefit by including more firms outside the Norwegian market.

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Appendices

A Interview Guide

INTERVIEW GUIDE

Guide for semi-structured interviews on how the emergence of LCNC is unfolding, the implications of LCNC and in what way the implications can affect the potential for disruption

PART 1: INTRODUCTION

- Introduce ourselves and the assignment; topic, research question, and purpose
- Obtain consent regarding the use of information and audio recordings
- Provide information about the purpose and plan of the interview

PART 2: INITIAL QUESTIONS

ID	Questions
1	Can you tell us about the company and what the company offer to your customers?
2	Can you briefly describe and tell us about your position?
3	Which industries/sectors do you work with and deliver to?
4	Are there any industries that are larger than others or stand out?
5	Who are your biggest competitors?

PART 3: GENERAL ABOUT NO-CODE AND LOW-CODE

ID	Questions
6	What do you see as the most prominent trends in no-code platforms currently?
7	Do you see any trends regarding the different LCNC categories? For example CRM, Workflow, or Software Development? Are there some categories growing more than others?
8	Many LCNC players have emerged lately. How do you think the LCNC landscape will look in the future?
9	What role do you think LCNC will play in the future? How will LCNC work alongside traditional development?

PART 4: DISRUPTION	
ID	**Questions**
10	Do you think the development of LCNC could lead to changes in the competitive landscape in different industries?
11	Is there a difference between established and new companies regarding the use of LCNC? What benefits, if any, would new versus established players gain from using LCNC? Is there a difference in use?
12	Do you think it will be easier for new players to challenge established companies using LCNC? If yes, do you have any examples where small or newly started companies have used LCNC to challenge established market players?

PART 5: INDUSTRY-SPECIFIC QUESTIONS	
ID	**Questions**
14	Do you see industry-specific trends regarding the use of LCNC?
15	Which industries do you believe are (and could be) most affected by the rise of LCNC? Why?
16	Are there specific industries where you see larger barriers or challenges in implementing LCNC? What are those barriers/challenges?
17	Are there industries that you think are more likely to be affected to use LCNC? What characterizes these industries?
18	How do regulations affect the implementation of LCNC in various sectors?
19	Do you have thoughts on implementing LCNC in a technically advanced industry?

PART 6: CONCLUSION	
ID	**Questions**
20	Is there anything else/additional you would like to add? Or something you feel we should have asked about?

B Consent Form

Vil du delta i forskningsprosjektet

"Effects of the emergence of Low-Code and No-Code"?

Dette er et spørsmål til deg om å delta i et forskningsprosjekt hvor formålet er å *få en dypere forståelse av omfanget av Low-Code og No-Code, og hvordan framveksten av teknologien kan påvirke ulike bransjer*. I dette skrivet gir vi deg informasjon om målene for prosjektet og hva deltakelse vil innebære for deg.

Formål
I dette prosjektet, som er en masteroppgave, forsøker vi å undersøke hvorvidt framveksten av Low-Code og No-Code kan føre til flere tilfeller av disrupsjon i markeder. Med dette mener vi at vi skal undersøke om mindre aktører med begrensede ressurser har mulighet til å utkonkurrere større og mer etablerte aktører gjennom å benytte Low-Code og No-Code. Videre ønsker vi å forstå om bransjer som er teknisk og/eller regulatorisk komplekse blir påvirket i større eller mindre grad av framveksten av teknologien, og hvilke sektorer som vil kunne påvirkes først og sist.

Hvem er ansvarlig for forskningsprosjektet?
Norges Handelshøyskole er ansvarlig for prosjektet.

Hvorfor får du spørsmål om å delta?
Vi har valgt ut noen personer fra næringslivet som arbeider med No-Code og Low-Code, som vi ønsker å intervjue (ca. 7). Disse er valgt basert på stilling, selskap og tidligere erfaring/utdanning.

Hva innebærer det for deg å delta?
Datainnsamlingen er basert på intervjuer som tar 60 minutter. Intervjuet er delt i fire bolker hvor vi først tar for oss introduksjon og innledende spørsmål om selskap, kunder og arbeid. Deretter spør vi om No-Code og Low-Code, før vi ser mer overordnet på mekanismer i markedet. Avslutningsvis spør vi et par bransjespesifikke spørsmål for å avdekke forskjeller i bransjer og hvilke bransjer som potensielt vil påvirkes av utbredelsen av No-Code og Low-Code.

Det er frivillig å delta
Det er frivillig å delta i prosjektet. Hvis du velger å delta, kan du når som helst trekke samtykket tilbake uten å oppgi noen grunn. Alle dine personopplysninger vil da bli slettet. Det vil ikke ha noen negative konsekvenser for deg hvis du ikke vil delta eller senere velger å trekke deg.

Ditt personvern – hvordan vi oppbevarer og bruker dine opplysninger
Vi vil bare bruke opplysningene om deg til formålene vi har fortalt om i dette skrivet. Vi behandler opplysningene konfidensielt og i samsvar med personvernregelverket.

Det er kun to masterstudenter (Helle Låhne Smedsrud og June Blydt Paulsen) som vil bruke intervjudataene.

Dataene vil bli brukt anonymt og vil ikke kunne gjenkjennes gjennom kobling til andre data. Vi vil ikke bruke faktiske navn, samt ingen beskrivelser som gjør det mulig å gjenkjenne selskaper eller personer.

Hva skjer med personopplysningene dine når forskningsprosjektet avsluttes?

Prosjektet vil etter planen avsluttes *31. januar 2024. Etter dette vil alle data bli slettet.*

Hva gir oss rett til å behandle personopplysninger om deg?
Vi behandler opplysninger om deg basert på ditt samtykke.

På oppdrag fra *Norges Handelshøyskole* har Sikt – Kunnskapssektorens tjenesteleverandør vurdert at behandlingen av personopplysninger i dette prosjektet er i samsvar med personvernregelverket.

Dine rettigheter
Så lenge du kan identifiseres i datamaterialet, har du rett til:

- innsyn i hvilke opplysninger vi behandler om deg, og å få utlevert en kopi av opplysningene
- å få rettet opplysninger om deg som er feil eller misvisende
- å få slettet personopplysninger om deg
- å sende klage til Datatilsynet om behandlingen av dine personopplysninger

Hvis du har spørsmål til studien, eller ønsker å vite mer om eller benytte deg av dine rettigheter, ta kontakt med:

- *Norges Handelshøyskole* ved professor *Eirik Sjåholm Knudsen (Eirik.Knudsen@nhh.no)*
- Vårt personvernombud: personvernombud@nhh.no eller telefon 55 95 90 00

Hvis du har spørsmål knyttet til vurderingen som er gjort av personverntjenestene fra Sikt, kan du ta kontakt via:

- Epost: personverntjenester@sikt.no eller telefon: 73 98 40 40.

Med vennlig hilsen

Helle Låhne Smedsrud (Student)	*June Blydt Paulsen* (Student)	*Eirik Sjåholm Knudsen* (Forsker/veileder)

Samtykkeerklæring

Jeg har mottatt og forstått informasjon om prosjektet *Low-Code og No-Code* og har fått anledning til å stille spørsmål. Jeg samtykker til:

☐ å delta i *intervju*

Jeg samtykker til at mine opplysninger behandles frem til prosjektet er avsluttet

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(Signert av prosjektdeltaker, dato)