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INNOVATING WITH EMPLOYEES: AN EXPLORATORY STUDY OF IDEA DEVELOPMENT ON LOW-CODE DEVELOPMENT PLATFORMS

Research Paper

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Abstract

In their struggle to deliver new products and enhance internal processes, organisations cannot ignore the innovative potential of employees. A central promise behind low-code development platforms (LCDPs) is the ability for organisations to efficiently involve employees in innovation initiation and have them develop ideas for innovative software applications themselves. In light of the growing need for digital innovation, we undertake an exploratory study of idea development on LCDPs. Guided by an idea management lens, we highlight similarities and differences in stakeholders, roles and process phases between idea development on LCDPs and idea management programs. We find that LCDPs empower employees to navigate the initiation of innovation with more flexibility and autonomy. Organisations in turn benefit from having employees drive idea development on LCDPs if they have adopted adequate LCDP support factors. Overall, our findings suggest that LCDPs constitute a promising avenue to initiate digital innovation with employees across an organisation.

Keywords: Idea development, Low-code development platform, Digital innovation, Employees.

1 Introduction

Organisations are under increasing pressure to innovatively adapt their products and processes to more demanding customers in more competitive marketplaces (Kohli and Melville, 2019). In recent years, combining innovative ideas with digital technologies has become a prominent strategy to cope with these new market demands. At the same time, many organisations have not yet aligned their resources to the growing need for digital exploration, hindering a successful response to digital trends (Nambisan et al., 2017). As observed by digital innovation scholars, IT department are generally held responsible for creating innovative software and hardware, yet at the same time they often lack adequate skills to ensure both the exploitation of existing systems and the exploration of new technologies and use cases (Lee et al., 2015). This observation have led to intensified research on employee-driven innovation, with both practitioners and scholars increasingly considering ordinary employees as potent drivers to quickly build up digital innovation capabilities (Opland et al., 2020).

Efficiently harnessing the innovative potential of employees has been a long-standing challenge for organisations. While innovation has traditionally been the sole responsibility of highly-skilled R&D departments, organisations have come to recognise that innovative resources are in fact scattered throughout departments (Neyer et al., 2009). Over the last decades, managers have tapped into the innovation potential of non-R&D employees by leveraging various tools such as total quality management, continuous improvement and idea management, with varying degrees of success (Gerlach and Brem, 2017; Haapasaari et al., 2018). Taking this one step further, recent years have seen non-IT employees being increasingly involved in digital innovation, notably via digital platforms (Opland et al., 2020). Especially low-code development platforms (LCDPs) are gaining momentum among practitioners for its possibilities of rapid software application development and minimal need

for manual coding (Rymer, 2017). LCDPs promise to put digital innovation within the reach of employees with little coding experience but rich business knowledge, potentially triggering radical changes in the innovation process. Investigating how digital platforms transform the ways in which ideas form, evolve and eventually result in successful innovation is of great interest to digital innovation scholars and the IS field at large (Nambisan et al. 2017). Yet despite growing prominence among practitioners, LCDPs have received scant academic attention. We therefore pose the following research question: *how are innovative ideas developed on low-code development platforms?*

We address our research question with an exploratory study of LCDP use within organisations. We leverage idea management as our guiding lens and put our analytical focus on the stakeholders, roles and process phases of idea development on LCDPs. Drawing on a rich dataset of both interviews and archival data from LCDP developers, vendors, analysts and users, we investigate the involvement of ordinary employees in the idea development process, which we then compare to traditional idea management programs. Our main contribution is an initial set of stakeholders, roles and process phases of idea development on LCDPs, along with four support factors that can help organisations overcome challenges that emerge when ordinary employees drive idea development on the platform. Our initial insights into innovative idea development on LCDPs contribute to the literature on digital innovation management, idea management and the nascent stream of LCDPs. We also provide practitioner guidance by discussing the platforms' potential with regard to idea management programs.

2 Background

2.1 Idea management

For almost five decades, idea management scholars have been constructing knowledge about how firms can capture and harness their employees' ideas to improve corporate products and processes (Thom, 1990). The importance of idea management, as "a sub process of innovation management with the goals of effective and efficient idea generation, evaluation and selection" (Brem and Voigt, 2007, p.306), is increasingly recognised for its ability to help generate innovations within organisations. The adequate management of innovation's early phases is indeed critical to an organisation's success (Thom, 2015). With this in mind, many organisations have been implementing idea management programs to guide the development of innovative ideas.

Idea management programs can be understood as formal programs whose objective is to source new ideas among employees, evaluate and select those with the most value-adding potential, and turn them into innovative outputs. The central tenet behind idea management programs is that employees are knowledgeable experts of their day-to-day work and are therefore particularly suited to generate ideas for new products, services and processes (Kesting and Ulhøi, 2010). In a recent review of the literature, Gerlach and Brem (2017) condense the state-of-the-art knowledge on idea management programs in a conceptual framework. The framework describes the programs' typical process phases, main stakeholders and key roles. In line with other studies in idea management (Bakker et al., 2006; Brem, 2011; Frese et al., 1999; Thom, 2015; Westerski et al., 2011), six stakeholders are identified, playing each one key role in one out of six consecutive process phases. They are: program manager (role: idea manager, phase: prepare), employee (role: ideator, phase: generate), domain expert (role: discussion group, phase: improve), decision maker (role: idea selector, phase: evaluate), IT developer (role: development team, phase: implement), and business manager (role: deployment team, phase: deploy). While remaining open for adaptation to various organisational contexts, stakeholders, roles and process phases form the basic building blocks of idea management programs at large. As such, they help organisations structure and optimise their approach to innovative idea development, notably by framing stakeholder interactions (via roles) and streamlining activity flows (via process phases) (Brem and Voigt, 2007; Fairbank et al., 2003). These clear-cut guidelines however come at the cost of increased rigidities that can result in slow and expensive idea development. For instance, idea management programs constrain the extent to which ordinary employees can actively contribute to idea development, with their role being commonly limited to ideation (Gerlach and Brem, 2017). In

fewer cases, ordinary employees are involved in later phases of idea development, yet they remain under tight managerial supervision and need to act according to the program's predefined process flow. This in turn can undermine successful idea implementation and reduce the overall attractiveness of idea management programs for employees (Neyer et al., 2009).

Organisations have been trying to address these challenges by leveraging digital tools in idea management programs. Prominent examples are idea management systems (Westerski et al., 2011), idea management platforms (Benbya and Leidner, 2018) and crowdsourcing platforms (Blohm et al., 2013). Although it is now widely recognised that digital tools can support innovation (Nambisan et al., 2017; Neyer et al., 2009), few organisations have supplemented their idea management programs with employee-specific tools that reach beyond idea generation (Benbya and Leidner, 2018). Outside these formal programs however, organisations have been adopting digital tools that directly or indirectly support ordinary employees beyond the generation of ideas (Opland et al., 2020). As it has been pointed out in the employee-driven innovation literature, digital tools can be useful in helping employees more actively contribute to the initiation of digital innovation (Laviolette et al., 2016). Some organisations have notably started using digital platforms to unlock the potential of employees in the end-to-end innovation process (Mueller and Renken, 2017). Due to the emergence of the phenomenon however, it is not clear how the use of digital platforms – such as LCDPs – transforms idea development, thus limiting our ability to assess their full potential for the initiation of digital innovations with employees.

Overall, the idea management literature offers a rich starting point to investigate innovative idea development. While idea management programs are generally deployed on an organisational level, its underlying components (i.e. stakeholders, roles and process phases) reflect attributes and activities that can be transferred to the individual level of analysis. For lack of a thorough theoretical understanding of how individuals create digital innovations (Kohli and Melville, 2019), we use idea management as a sensitising device to investigate idea development on LCDPs. The importance of idea management as a long-standing managerial tool and a coherent academic construct is increasingly recognised, and its underlying components enjoy wide consensus support by the innovation management literature (Van den Ende, 2014). In addition to idea management's overall conceptual fit with the phenomenon at hand, its building blocks can serve as a scaffold for analysing not only the initiation phase of digital innovation, but also the evolving temporal linkage between innovation initiation, development, implementation and exploitation (Sandström and Björk, 2010). Reshuffling of and temporal overlaps between traditionally distinct and consecutive innovation phases have indeed been highlighted in the digital innovation management literature, and we expect idea management's building blocks to offer the appropriate level of granularity to capture these evolutions (Nambisan et al. 2017). Furthermore, idea management programs are a prominent approach among practitioners for supporting employees when they create digital innovation (Benbya and Leidner, 2018; Kesting and Ulhøi, 2010; Opland et al. 2020), therefore increasing the relevance of this study outside of academia.

2.2 Low-code development platforms

Low-code development platforms have been drawing the attention of practitioners since 2014, yet without awakening significant academic interest. The term itself was first coined by the analyst firm Forrester to describe “platforms that enable rapid application delivery with a minimum of hand-coding, and quick setup and deployment” (Richardson and Rymer, 2014, p.2). As their distinctive characteristic, LCDPs feature a visual editor where users can quickly and easily combine and recombine pre-programmed components into a functional software application. Decomplexifying the application development process has been a running theme through the history of programming (Gaggioli, 2017) and low-code development cannot be considered a new phenomenon as such. Most notably, LCDPs draw close parallels with rapid application development methods intended for fast and iterative development, sharing key characteristics such as high user engagement and re-use of software components (Ismail, 2017; Vincent, 2019). LCDPs are however distinct in their aim of empowering users from across the organisation to perform application development activities. These users, mostly

based in non-IT business units, possessing little development experience and basic technical skills, are commonly referred to as citizen developers (Rymer, 2017). Using the platform's visual user interface, they may add and discard features and functionalities quickly to kickstart developing their ideas without the help of a developer or significant upfront investment (Richardson and Rymer, 2016). This makes LCDPs a promising tool for the development of innovative ideas, since the platform is particularly suited for testing and refining ideas in iterative cycles of experimentation (Richardson and Rymer, 2014; Rymer and Seguin, 2019). As of yet, innovative idea development on LCDPs is still a nascent phenomenon with few organisations using it as their primary development platform. Against a background of resource-strapped IT units and increasing demands for digital innovations however, idea development on LCDPs is predicted to become more commonplace as platform offerings mature (Rymer, 2017).

As such, LCDPs can be seen as a technology whose distinct characteristics (i.e. pre-coded components, visual interface, central platform) have the potential to transform the early stages of the innovation process, that is how ideas are captured and turned into functional applications. While the use of digital tools has substantial potential for involving ordinary employees in digital innovation development, they also bring about new challenges that can cause organisations to experience a decline in involvement and engagement from employees over time (Opland et al., 2020). Research on employee-driven digital innovation has pointed out that this can notably happen if the tool supports some phases in the innovation process, typically idea generation and evaluation, while leaving others, such as idea improvement, implementation and deployment, unaddressed (ibid). This observation, along with the scarcity of literature on LCDPs and digital innovation development with ordinary employees, inspired us to conduct a study of LCDPs to empirically understand and conceptually guide innovative idea development on these platforms.

3 Methodology

An exploratory study of an emerging phenomenon requires the analysis of a rich dataset (Yin, 2014). As with other emergent phenomena however, access to real-world data about idea development on LCDPs is limited, with few organisations using LCDPs to extensively encourage innovation among their employees (Rymer, 2017). We therefore decided to build a rich dataset by combining data from multiple sources that shed light on idea development on LCDPs from different perspectives. As summarised in Table 1, we collected our data from three sources: (1) expert interviews at an LCDP vendor, (2) analyst reports and LCDP vendors documentation, and (3) LCDP user reviews.

3.1 Data collection

In a first step (1), we performed expert interviews at an LCDP vendor firm to gain an initial understanding of LCDP motivations and use cases. Access was obtained through a professional colleague of the authors and co-founder of the firm. Founded in Switzerland in 2015, the firm offered the LCDP product and low-code application development services and employed approximately 30 people at the time of the study. As part of a larger research project, we conducted 10 interviews with executives and employees to understand LCDP motivations and obtain an overview on the variety of use cases at client organisations. We interviewed individuals having a variety of roles: the firm's CEO and COO, the Executive VP of Sales, a Senior Developer, a Lead Developer, two Platform Developers, a Project Manager, an Account Manager and a Product Manager. Each interview was carried out in person at the vendor's office. The interviews were semi-structured, with the interview guideline adapted as we became more familiar with the topic (Yin, 2014). All interviews were recorded and transcribed to allow for systematic analysis. The insights gained from this first step led to the identification of our research question and motivated further data collection.

In a second step (2), we narrowed our research scope to LCDP use by ordinary employees to enrich our initial understanding of innovative idea development on the platforms. We draw on an LCDP product analysis by Forrester to guide our selection of appropriate secondary data (Rymer, 2017). Specifically, the analysis classifies LCDPs based on their target user group being either citizen

developers (ordinary employees) or professional developers (IT employees). As our primary focus is on LCDPs’ ability to support employees across an organisation when they work on their ideas, we chose to select the citizen developer oriented LCDPs as our cases. This resulted in the selection of 12 LCDPs: Airtable, AppSheet, Betty Blocks, Caspio, FileMaker, Kinton, Kissflow, QuickBase, Scopeland, TIBCO, TrackVia and Zudy. Following a first scan of publicly available data, we excluded platforms with no or insufficient data and searched for additional wide-spread LCDPs targeting citizen developers. This led to the exclusion of Scopeland and the inclusion of OutSystems, resulting in a total of 12 platforms. For the selected LCDPs, we collected archival data from 2014 on, which is the first time the term low-code development platform was coined. The archival data came from two sources: analysts, such as Forrester and Gartner, and the LCDP vendors themselves. For the former, we selected survey reports and analysis that gave insight into the motivations, characteristics and general use cases of LCDPs. For the latter, our focus was on customer stories, survey reports, white papers and blog posts that provided detailed insights into the platforms’ uses within specific organisational contexts. The data collected in this second step revealed the vendors’ shared ambition to position LCDPs as enablers for digital innovation across organisations, therefore validating the relevance of our research question.

In a third and last step (3), we further enriched our dataset with LCDP user reviews. As we expected the previously collected vendor documentation to be biased towards painting an overly optimistic picture of LCDP use, we collected user reviews relating to the same 12 platforms to nuance benefits and capture real-world challenges (salient differences between data sources are highlighted in our findings). We collected a total of 953 reviews from a certified user review platform by analyst firm Gartner (Gartner Peer Insights, 2020). To ensure currency of the thereby collected insights, we selected reviews dating from November 2019 to November 2020. The portal’s reviews are written on a voluntary basis and include details of the reviewer’s role, industry, LCDP usage frequency and years of experience with the platform. Every user review undergoes a rigorous verification process for authenticity, relevance, completeness and legitimacy before being published on the platform. While the length and quality of reviews varies, each review contains an overall comment about the platform and a free-text about positive and negative aspects of LCDP use along with a rating. Most reviews featured additional elements such as purchase motivation, relationship with vendor and recommendations to potential users. By combining the data collected in these three steps (see Table 1), we were able to build a rich dataset on which to base our examination of idea development on LCDPs.

Expert interviews (1)	Analysts & vendor documents (2)	User reviews (3)
Performed between May 2019 – July 2019	Data dating from 2014 – 2020	Data dating from Nov. 2019 – Nov. 2020
10 interviews 114 pages transcript	56 documents 509 pages	953 reviews 667 pages
<ul style="list-style-type: none"> Gain initial understanding of motivations and use cases Gain initial understanding of roles and process phases Identify research question 	<ul style="list-style-type: none"> Enrich understanding of motivations and use cases Enrich understanding of roles and process phases Validate relevance of research question 	<ul style="list-style-type: none"> Nuance understanding of motivations and use cases Nuance understanding of roles and process phases Highlight experienced benefits and challenges

Table 1. Data sources.

3.2 Data analysis

We analysed our data in the same order it was collected, starting with the interview data, then the analyst reports and vendor documents, and finally the user reviews. We followed an iterative approach, moving back and forth between the literature and our data. Our top-down code list was guided by the idea management framework as described by Gerlach and Brem (2017) with its building

blocks being the stakeholders, roles and process phases (i.e. content and temporal linkage). For a richer contextualisation of our focal phenomenon, we added codes pertaining to the LCDP literature, notably distinctive characteristics of the technology such as “pre-coded components”, “visual interface” and “central platform”, and generic use cases such as “process automation”, “operational innovation”, and “customer-facing innovation”. We further added contextual codes such as “organisation size” and “industry”. Two of the authors independently coded the data using the MAXQDA software. During the coding, we also generated codes bottom-up to reflect specificities of the LCDP context. In essence, the bottom-up codes helped us transpose stakeholders, roles and process phases of idea management programs to a context where ideas are developed on LCDPs. We found emerging codes for stakeholders such as “ordinary employee”, “business manager”, “end-user”, “IT developer” and “platform vendor”, and nuanced existing codes such as “deployment team” by splitting it into “deployment team (business)” and “deployment team (technical)”, and by splitting “deployment phase” into “deployment phase (business)” and “deployment phase (technical)”. With these new codes in mind, employee empowerment emerged as a recurring underlying theme. We notably found “autonomy”, “flexibility” and “freedom” to be related emerging codes. Moreover, a set of support factors for successful employee empowerment on LCDPs was consistently and prominently mentioned across all three data sources. We coded them as “innovation culture”, “vendor support”, “IT support” and “IT governance”. At the end of each one of three coding rounds, we randomly selected one expert interview transcript, one analyst document, one vendor document and one user review to compare our coding results. We discussed discrepancies and refined the codes accordingly. By the third round, no major discrepancies were found, putting an end to the iterative coding process.

4 Findings

Our main objective is to understand how innovative ideas are developed on low-code development platforms. We structure our findings in three parts. We first describe five prominent stakeholders involved in idea development on LCDPs along with their roles. We then describe the idea development process on LCDPs and explain its constituent phases. Finally, we highlight a set of support factors that organisations can apply to successfully harness the innovative potential of LCDPs. Table 2 at the end of this section provides an overview of our findings.

4.1 Stakeholders

We found five main stakeholders to be involved in idea development on LCDPs. We now describe each stakeholder, specify their key role(s) and highlight prominent differences with idea development in traditional idea management programs.

Ordinary employee. We found that idea development on LCDPs is heavily driven by ordinary employees. In contrast to traditional idea management programs where employees are mostly limited to reactive idea generation, LCDPs enable them to take on proactive roles in the entire idea development process. Due to LCDPs’ low technical complexity, application development becomes accessible to individuals outside IT and ordinary employees become a driving force over the entire idea development process. Specifically, employees take on the roles of idea managers, discussion group, idea selector, member of the development team and deployment team (refer to Table 2). An interviewee at the LCDP vendor stressed that consequently idea development costs plunge, and innovation can blossom: “*You [i.e. ordinary employee] can try your stuff on your own, and you know, you don’t even have to be a developer for that. So, you have a need, you have the tools to solve the problem. Innovation will happen in that way, because people will be able to work on their ideas without having to involve ¾ of the company to get the resources that they need to do that*” (interview 6, platform developer). Next to ordinary employees, a number of other stakeholders are punctually involved in idea development on LCDPs. These stakeholders are not restricted to a single key role as with traditional idea management programs but, similarly to employees, participate in idea development at multiple points in time with different roles.

IT developer. We found the most prominent stakeholder beside the ordinary employee to be the IT developer. Even though LCDPs aim to democratise technical application development as far as possible, professional developers are still needed to support employees when discussing the idea's underlying technical assumptions, developing and evaluating its application prototypes and most critically when deploying the resulting application in the productive environment. A Betty Blocks user recommended: *"Application development is very easy although it is good to have a mix of developers, because some integrations need coding or at least experience with various coding languages."*

LCDP vendor. In a similar vein, we found the LCDP vendor to be an important stakeholder during idea development and deployment. While this stakeholder is inexistent in traditional idea management programs, the LCDP vendor takes on a critical role in guiding the employee when implementing ideas on the platform and in collaborating with the IT unit when deploying the resulting application on the existing IT landscape. This new stakeholder is particularly vital in organisations where resource-strapped and exploitation-oriented IT units struggle to handle questions and requests coming from employees. As a Betty Blocks user reported, LCDP vendors become part of the improvement and implementation team: *"[I would recommend to] develop a prototype on the platform and engage the vendor to provide support to accelerate the learning curve. While the learning curve for low-code platforms is by definition a lot flatter, having the vendor guide you with best practices is the best approach."*

End-user. Another stakeholder who is actively involved in idea development on LCDPs are the future end-users of the envisioned innovative application. While traditional programs often struggle to include end-users in their processes, functional LCDP applications can be put in their hands quickly and easily so they can contribute to improvement and evaluation with contextualised feedback. This is reflected in user reviews such as: *"We are currently starting to use Outsystems in our company to develop internal applications. We noticed that is very useful to start a project in minutes, and give us the availability to reduce the time until we are able to present a functional prototype to the user."* Even though end-users are not directly involved in the decision of whether ideas will be deployed in the productive environment or not, they considerably guide their evolution on the platform. This has the positive effect that the resulting applications fit their needs and they are often inclined to adopt and promote them once deployed.

Business manager. LCDPs are not (yet) part of formal idea management programs within organisations. As such, there are no formal program managers who guide idea development with an imposed stage-gate process punctuated by meetings with key stakeholders. Rather, employees are given access to the platform by individual business managers who wish to provide a way for them to autonomously test and implement their ideas. To a certain extent, these business managers take on the role of formal idea managers, notably in that they encourage their team to develop ideas on the platform, keep track of progress, provide support and promote the resulting low-code application among target users. A business manager noted about AirTable: *"I can check what each of my team members is doing and they can leave comments on particular issues they wish me to address. It has facilitated tremendously communication between teams in different continents and promotes transparency."*

4.2 Process phases

We found that idea development on LCDPs consists of similar process phases as traditional idea management programs. We now describe each phase, indicate which stakeholders are chiefly involved and, as we have done in the previous sub-section, highlight prominent differences with idea development in traditional idea management programs. Figure 1 provides a detailed view of the idea development process on LCDPs.

Preparation phase. While defining the central problem or topic for idea generation, deciding on the pool of participants, identifying adequate domain experts, and promoting participation are critical for traditional idea management programs, we hardly found any reference to such a preparation phase on LCDPs. This observation is in line with the absence of formal idea managers when developing ideas

on LCDPs. We found that LCDPs mostly rely on employees' intrinsic motivation for working on their idea and quickly building functional applications. However, LCDP adopters still recommend guiding employees in their first steps on the platform, suggesting there might be benefits in adopting some aspects of formal idea management programs, such as problem scoping and innovation promotion. For instance, an AppSheet user recommended to other business managers: *"Start with a simple but troublesome problem first. Get a core group of users excited about the app and be ready to implement suggestions quickly to keep up the enthusiasm."*

Generation phase. We found that ideas that are developed on LCDPs are triggered by employees' daily work practices. This is in contrast to traditional idea management programs where idea generation is mostly motivated by an imposed challenge which may or may not be linked to employees' day-to-day work. By their daily work, employees are knowledgeable about their work domain and can have valuable ideas for enhancing the way they perform their job. In most cases, idea generation happens "off-LCDP" when employees work with other organisational systems, and the idea is then moved "on" the platform for rapid development. However, we found that the platform itself can also trigger ideas. This is for instance the case when LCDPs' novel features inspire unsuspected use cases. An OutSystem reviewer alluded to the way LCDPs can trigger new ideas via its feature updates: *"The platform is continuously evolving so you are able to explore new features (AI, robotics, etc)."* Similarly, an AirTable reviewer mentioned the platforms' automatically generated suggestions for features as a source for new ideas: *"They have automatic built in APP functions that are generated. So, in other words, you may not know you wanted a feature but Appsheet will auto generate it for you. You do not have to use it, but it knows you probably want it."*

Improvement and implementation phases. In contrast to traditional idea management programs where each idea development phase is clearly defined, LCDPs blur the boundaries of idea improvement and implementation phases and cause temporal overlaps in the idea development process. The entanglement of improvement and implementation activities can be traced back to the pre-coded components that enable ordinary employees to quickly implement a functional version of their idea, test it with potential users and modify it as new insights are gained. This emerged as a major benefit for users, as noted by a Betty Blocks user: *"[I like] the speed and ease of development of ideas to working functionality. We can test customer behaviour much faster. It also helps achieve our innovation department's goals in a way that wasn't possible with our existing IT systems. And the fact that we (as mostly business, not IT minded people) can build software ourselves is a great bonus."*

Evaluation phase. In traditional idea management programs, the evaluation phase refers to one or several meetings where domain experts and top-management decide upon the continuation or the abandonment of ideas. The decision to continue idea development in such programs usually implies considerable investment to fund prototypes, technical proof-of-concepts and final applications realised by IT professionals. On LCDPs, the evaluation phase seems to happen in a more implicitly later on in the idea development process. For instance, we did not find any reference to formal meetings with decision makers to decide upon ideas' fate. However, we found hints that an evaluation phase takes place between the improvement and implementation of ideas and their deployment, when business managers decide whether the low-code application is worth deploying in the existing IT landscape by professional developers. Similarly, professional developers evaluate if the idea can be implemented in the IT landscape without major misfits between the existing system and the new application. In comparison to idea management programs, we found that ordinary employee can more easily express their point of view and make their voice heard during this evaluation phase, as their arguments are backed up by functional low-code prototypes and early user insights. This was reflected in a review where an AppSheet user warned: *"Include IT at some point, but don't let them squash your dreams. Developers tend to think of no-code as "cute" and not as powerful, which is not always the case. Even if you hit a wall with AppSheet, using it for wire framing and proof of concepts is incredibly valuable."*

Deployment phase (business). State-of-the-art conceptualisations of idea management views idea deployment primarily as a phase of promotion or selling of the new product to clients and business partners. This is in contrast to idea deployment on LCDPs, which encompasses both strong business

and technical aspects. We therefore decided to split this phase into a “business” deployment phase (i.e. promotion among target group) and a “technical” deployment phase (i.e. integration into existing IT landscape) to allow for a richer analysis. With regard to the business deployment, we found that idea promotion starts early on in the development process, with target users being already involved during idea implementation and improvement. An AirTable review highlighted the visual interface of the platform as a central enabler to promote the application to future users: *“Airtable has a built-in system for the use of shared screens, with which you can select one or more sections of the screen to show web users attached to our session. It is very oriented towards customer management, so it is good to communicate with them at all times.”*

Deployment phase (technical). The technical deployment of low-code applications on the productive environment is a critical step that brings along a number of performance and security risks. We found that LCDPs can help speed up deployment as it enforces a number of rules through its pre-coded components. This allows employees’ low-code applications to more easily be deployed on the existing IT landscape. However, while LCDP vendors often advertise with entirely putting idea development in the hands of ordinary employees, we found that the technical deployment of low-code applications outside the platform cannot be done by ordinary employees without substantial IT support, if employees are involved at all. Some users criticise the dependence on IT staff for technical deployment, as this Outsystems review illustrates: *“In theory it works beautifully, but the implementation is done by developers only, which makes a mess. [...] And nobody from business is able to check, because it's too technical for them.”*

Iteration. With traditional idea management programs, deployed ideas are handed over to business managers to enter the project pipeline. This means that ideas that successfully leave the program are affected to a project management team who takes care of adapting and scaling the new product to ensure maximal profitability. With LCDPs, we found that employees often stay in charge of their idea and work on further improvements by implementing and deploying changes on the platform. A FileMaker user highlights the temporal overlaps between idea implementation and its iterative improvement and deployment in the following words: *“You also can apply changes on production on the fly without stopping the platform to deploy changes.”*

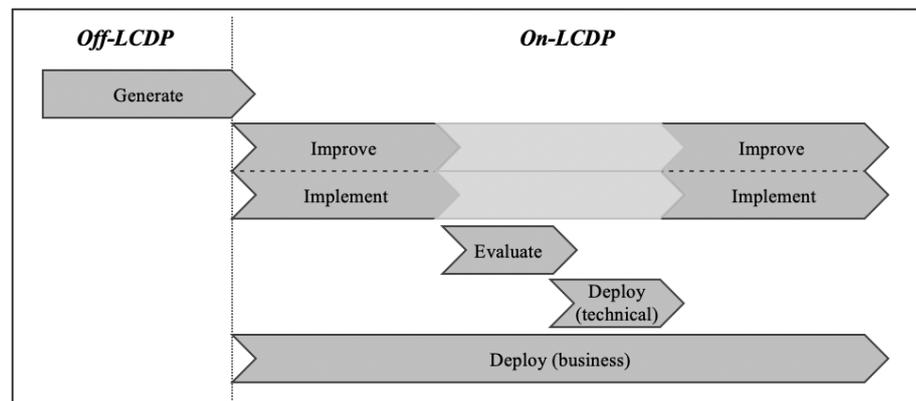


Figure 1. Process phases when developing ideas on LCDPs.

4.3 Support factors

Finally, we found four support factors for idea development on LCDPs to be consistently and prominently highlighted across all our data sources. Organisations can apply these support factors to address new challenges that arise when empowering ordinary employees to develop their ideas on LCDPs. These challenges notably reflect the drawbacks of not having a formal program to support and guide employees in the initiation of innovation.

Innovation culture. We have identified an organisational culture that promotes exploration, learning and tolerance of failure as the most prominent support factors when developing ideas of LCDPs. This is best summarised in a comment made by a Betty Blocks user: *“This is a rapidly changing technology area, be prepared for constant changes, and the amount of cultural change this type of platforms cause is tremendous. You can [implement] a whole platform in 90 days, but your organisation may take 18 months to assimilate it.”* As employees may not be used to actively participating in digital innovation development, an innovation culture is central to promote the exploration of the platforms’ features and use cases. Without a formal idea manager responsible to foster such a culture, giving employees the time and freedom to experiment with the platform is particularly critical, as the following user recommendation illustrates: *“Give yourself time to play with the software and don’t get discouraged if it takes a little time to figure everything out.”*

IT training. Next to building a strong innovation culture, our data suggests that IT training is another central support factor for idea development on LCDPs. This support factor is related to power shifts between stakeholders traditionally involved in the initiation of digital innovation. Most prominently, LCDPs cause changes in power distribution among professional developers and ordinary employees as IT units no longer have the sole monopoly over application development. In contrast to traditional idea management programs where program managers punctually involve professional developers for the tasks of application development and deployment, LCDPs enable ordinary employees to perform most of the technical development by themselves. However, providing ordinary employees with direct access to application development activities comes at the cost of reduced quality control over the end product. While vendor documentation and tutorials can provide some guidance, users mentioned a need for more thorough training on how to efficiently use the platform and for an overall sensibilisation to IT architecture, coding languages and database logics. A QuickBase user warns: *“Despite the simplicity of the app, business users created ineffective data structures that were only marginally better than Excel. Do not let the ease of use lull the organisation into a false sense of security. A ‘citizen developer,’ a term QuickBase markets, still must understand not only the business need but rudimentary database design techniques.”*

IT governance. We identified IT governance as being an important support factor to counteract the vanishing involvement of formal idea managers in a context of innovative application development on LCDPs. Echoing program managers’ task in traditional idea management programs, a governance framework for LCDPs can help clarify how to manage idea development in order to avoid application duplicates, incompatibilities and inefficiencies. A QuickBase user recommends: *“The tool is very flexible and is a strong low code option, however, management of the created applications can get out of hand quickly. [...] I would put in strong guidelines to manage the use of the QuickBase tool to ensure that use is intentional with awareness of ultimate scalability.”*

Vendor support. The last support factor that featured prominently in our data is technical support on the part of the LCDP vendor. Beyond ordinary employees counting on the vendor for help during application development, internal IT units at times need to collaborate with the vendor when deploying low-code applications on the existing IT landscape or requesting new pre-coded components. Moreover, the organisation relies on the vendor for platform maintenance and upgrades. This review by a QuickBase user illustrates the increased dependence on the LCDP vendor: *“We have exactly one person at our company who knows how to deal with the program if something goes wrong - this speaks for the many mysteries of QuickBase. No one else can troubleshoot, and it is difficult to obtain adequate and timely customer service from [the vendor].”*

Overall, our findings were consistent across the three data sources. Expert interviews, analyst and vendor documents, and user reviews offered a congruent view on process phases and stakeholders, the most significant differences being found in our analysis of the support factors. While every data source mentioned all factors in at least some extent, we found IT governance and IT training to be most heavily emphasised in expert interviews, and innovation culture and vendor support to be most salient in user reviews. We suspect these discrepancies to be mostly linked to differences in individual roles; our interviewees were mostly on the technical side and thus more sensitive to technical issues that would concern system implementation and maintenance, whereas users were mostly on the business

side and thus more likely to notice cultural misalignments and product support shortcomings that would impede quick and efficient platform use. Analysts and vendor documents, on the other hand, offered balanced evidence for all support factors, warning against adopting LCDPs without careful integration in the existing technological, cultural and skills landscape (unsurprisingly, vendors systematically positioned themselves as the best option to meet the vendor support success factor, whereas analysts proposed vendor rankings).

		Roles in idea development ¹						
		Ideator	Idea manager	Discussion group	Development team	Idea selector	Deployment team (bus)	Deployment team (tech)
LCDP stakeholders	Ordinary employee	X	X	X	X	X	X	
	Business manager		X			X	X	
	End-user			X			X	
	IT developer			X	X	X		X
	LCDP vendor				X			X
Process phases ²		Generate	Improve & Implement			Evaluate	Deploy	
Support factors		<ul style="list-style-type: none"> Innovation culture IT training 			<ul style="list-style-type: none"> IT governance Vendor support 			

Table 2. Stakeholders, roles, phases and support factors for idea development on LCDPs.

5 Discussion

In the previous findings section, we have described stakeholders, roles and process phases that constitute idea development on LCDPs, along with a set of support factors. Additionally, we have shed light on a number of similarities and differences between idea development on LCDPs and traditional idea management programs. We now highlight salient differences in stakeholders and roles first and in process phases second, and discuss how they relate to the empowerment of ordinary employees. Overall, our findings suggest that LCDPs increase employees’ flexibility and autonomy in the initiation of innovations and thus help organisations better harness their innovative potential.

Regarding differences in stakeholders and roles on the one hand, we have highlighted that LCDPs enable ordinary employees to play the leading role in every phase of the idea development process. They proactively take ownership of a number of tasks that traditionally belong to a variety of stakeholders across organisational departments. Rather than being assigned a predefined role, they flexibly switch between roles as they see fit. This increase in functional flexibility can notably be traced back to LCDPs’ ability to support multi-skilling with employees taking on business-, R&D- and IT-related activities, and to promote the deskilling of software development activities via its low levels of technical complexity (Benders, 1990). In other words, LCDPs increase employees’ flexibility by empowering them to perform a variety of decomplexified tasks across traditionally distinct organisational boundaries. Prior research into the drivers of employee innovativeness had already highlighted that employee flexibility is an important area of focus when fostering innovation (De

^{1,2} Adapted from Gerlach and Brem’s (2017) idea management framework.

Spiegelaere et al., 2014). This has been echoed in the digital innovation management literature, where scholars have highlighted the emergent nature of participation in the initiation of innovations with digital core components (Nambisan et al., 2017). LCDPs hold potential to provide greater levels of flexibility during idea development, ultimately enabling organisations to better allocate their personnel resources for digital innovation (De Spiegelaere et al., 2014).

Regarding differences in process phases on the other hand, we have highlighted that the flow of activities on LCDPs is no longer dictated by a formal program but can be adapted to employees' needs as they develop ideas on the platform. Rather than having to formally validate the outcome of each process phases as they would in traditional idea management programs, employees can autonomously move between phases of idea improvement, implementation, evaluation and deployment by instantly adding, discarding and changing pre-coded components in their functional low-code application. Because idea development on LCDPs requires few resources in addition to the employee, they are freed from many of the traditional constraints related to budget and resource allocation (Bäckström and Lindberg, 2019). This in turn enables them to decide on the sequence and speed of idea development activities on their own. Giving employees freedom and independence in how to proceed, and giving them authority and responsibility to act alone in idea development can favour more valuable contributions to innovation efforts (Amabile et al., 1996). More generally, supporting employees' self-determination with respect to work procedures, goals, and priorities, and fostering their overall autonomy, has been identified as a key area of focus when initiating innovation (Durcikova et al., 2011). As autonomous employees are assumed to have both more needs and more freedom to develop innovative solutions (Amabile et al., 1996), organisations can leverage LCDPs to encourage innovative behaviour among their entire workforce.

Overall, our findings suggest that LCDPs contribute to democratising idea development within organisations in three ways (Laviolette et al., 2016): by making application development more accessible to ordinary employees via pre-coded components, by helping them express their points of view more clearly via low-code application prototypes, and by letting their voices be better heard in decision-making via real-world user feedback (Kristiansen and Bloch-Poulsen, 2010). Consequently, we align with the view that digital technologies, such as LCDPs, can help organisations unlock innovative potential on the individual level (Mueller and Renken, 2017) and enable new individual innovation practices within organisations (Ciriello et al., 2019). We further corroborate with the view that although digital tools can help involve employees in the innovation process, they also bring along new challenges that need to be understood and overcome (Opland et al., 2020). Our data notably suggests a set of support factors that organisations can apply to ease the transition towards using the platform for innovative idea development. These support factors echo the findings of other studies in the employee-driven innovation literature (Bäckström and Lindberg, 2019; Kesting and Uihøi, 2010), corroborating with the view that people, processes and tools must be well-integrated to enable successful innovation (Gressgård et al., 2014).

Our findings have a number of important implications for idea management programs. As for now, idea management practitioners have primarily been leveraging digital tools to support the submission and evaluation of ideas and facilitate their follow-up during development (Gerlach and Brem, 2017). LCDPs open up new perspectives in this regard. Our study shows that the development of innovative ideas can be practiced on an individual level on LCDPs with employees taking ownership of idea development tasks and actively driving the innovation process. For innovation practitioners, this poses the question of whether LCDPs should be integrated to idea management programs as supportive tools or whether they should be regarded as alternatives to these formal programs. In other words, if employees can develop their innovative ideas by themselves on the platform, to what extent do traditional idea management programs remain relevant? In this regard, the support factors we have identified seem to suggest that integrating LCDPs in formal programs as a supportive tool or pre-process might be more valuable than using the platform as a stand-alone alternative. Another practical implication concerns the more active involvement of ordinary employees in digital innovation and the resulting shifts in power distribution among stakeholders (Bäckström and Lindberg, 2019; Kristiansen and Bloch-Poulsen, 2010). Arguably, employees gain in power because they have more flexibility and

autonomy in idea development on LCDPs, while IT units lose some power because they no longer hold the monopoly for innovative application development. In light of the differences in stakeholders, roles and process phases between traditional idea management programs and LCDPs, organisations may have to reassess the governance rules that underlie idea development to successfully integrate ordinary employees in the innovation process (Neyer et al., 2009).

6 Limitations and conclusion

A central promise behind LCDPs is the ability for organisations to efficiently involve ordinary employees in digital innovation development. While LCDPs indeed show potential in lowering the barrier for innovative application development, they also bring along new challenges that can cause organisations to experience low-quality innovation outcomes and a decline in involvement and engagement from employees over time. This observation inspired us to conduct an exploratory study of LCDPs to empirically understand and conceptually guide idea development on these platforms. Drawing on a rich dataset of both interviews and archival data, we analysed how innovative ideas are developed on the platform. We found that ordinary employees gain in autonomy and flexibility when developing their ideas on LCDPs, thereby becoming the driving force behind digital innovation.

This exploratory study is meant as a first step towards understanding the potential of LCDPs for empowering employees in the early phases of digital innovation management. While we have been able to provide initial insights into idea development on LCDPs in terms of stakeholders, roles, process phases, and support factors, we acknowledge a number of limitations to our study. Most prominently, because of the emergent nature of the studied phenomenon, access to gather rich primary data on LCDP use is limited. We therefore built our dataset by combining primary and secondary data from a broad set of LCDP stakeholders, including LCDP developers, vendors, analysts and end-users. This allowed us to gain a particularly holistic view on the platforms' technical and social components and their interdependences, as we gathered rich data about their motivations and use cases from both business- and technology-oriented actors. Our approach leaves room for further validation and enrichment through an in-depth study of organisations having adopted business-oriented LCDPs (i.e. the focus of the current study) and organisations having adopted IT-oriented LCDPs, to achieve a comprehensive understanding of LCDPs' potential for both radical and incremental innovation. Our findings hinted towards LCDPs being better suited for incremental innovation, yet more research is needed to determine its most effective use cases. We see another fruitful avenue for research in focusing on LCDP use on an individual level and examining how new and existent innovation practices are supported by the platform (Ciriello et al., 2019). An understanding of individual practices on LCDPs can help uncover "the twofold role of digital artifacts as means and end" (Ciriello et al., 2018) in the digital innovation process, which in turn can shed light on the nature of digital innovation and guide the design of technical and managerial tools (Nambisan et al., 2017).

Tackling the challenge of generating digital innovation with ordinary employees from a different perspective, we see substantial potential in studying whether and how LCDPs can help organisations adapt their idea management program to the new reality of digital innovation. Scholars have indeed pointed out that idea management programs will continue to enhance organisational performance only if they adapt to prevailing trends, such as the growing entanglement of ideas and digital technology (Thom, 2015). However, it seems that organisations are hesitant about investing in complementary or alternative approaches to traditional idea management programs (Neyer et al., 2009). Finding firms that have adopted LCDPs in the scope of their idea management programs and studying how ideas for digital innovations form and evolve in such a context can therefore constitute a valuable contribution to both scholarship and practice (Nambisan et al., 2017). In light of their ability to help unlock the innovative potential of ordinary employees to quickly build up digital capabilities, we strongly encourage researchers in employee-driven innovation, digital innovation management and the IS field in general to further explore the promising avenue of LCDPs.

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