Beyond Continuous Improvement: Unraveling the invisible challenges of implementing organizational change in a Software Industry Company

Rayfran Rocha Lima
rrl2@cesar.school
Cesar School
Recife, PE, Brazil

Ana Carolina Oran
ana.oran@icomp.ufam.edu.br
Universidade Federal do Amazonas
Manaus, AM, Brazil

César França
franssa@cesar.school
Cesar School
Recife, PE, Brazil

ABSTRACT

Organizational change (OC) is crucial for innovation and competitiveness in the software industry, yet companies often lack systematic processes and risk management, leading to inefficiencies and failures worsened by volunteers without OC management knowledge. This paper discusses four overlooked challenges in this area, highlighting a crucial but frequently ignored issue: the inefficiency of OC processes in the software industry. We conducted a company-wide case study to identify the familiarity and use of OC management models and practices applied by volunteers who implement large internal improvements and innovations in software development companies. The findings reveal significant challenges in OC implementation, including the lack of OC specialized knowledge, the knowledge gap about OC effective models, the dependence on exceptional individuals, and invisible or overlooked resistance. Effective OC in the software industry demands a holistic approach that harmonizes technical and managerial competencies aligned with the company's strategic goals. Further research is needed to improve organizational change processes in the software industry, reduce resource waste, and challenge the belief that only continuous improvement ensures company survival and competitiveness.

CCS CONCEPTS

• **Social and professional topics** → *Information system economics.*

KEYWORDS

Organizational change, Invisible Challenges, Internal innovation

1 INTRODUCTION

The 2022 Global Innovation Index report [53] indicates that while the general business sector allocated 3.5% of their revenue to R&D&I projects, the top corporations invested 9.8%, surpassing U$900 billion. Despite these substantial investments, many companies encounter challenges concerning large internal improvements and innovation initiatives such as the transition to agile or self-managed teams [10, 25], digital transformation [57], software process improvement [4], and process automation [37] among other instances of Organizational Change (OC) [22].

Although some organizations benefit from the assistance of specialized external consultants, such as in the case of implementing CMMI or MPS-BR [38], the reality is that most OC initiatives are carried out by internal staff members who participate in or lead an organizational change team (OCT). These volunteers often have a strong commitment to changing the current scenario but possess little or no experience in OC management.

Studies on OC practices have shown that the lack of knowledge or neglect of critical factors — such as effective communication, the coexistence of the previous model during the transition [10], absence of a sponsor [25], and leadership failure [56] — has generated various inefficiencies. These inefficiencies include inadequate planning and control [55], communication failures [11], discrediting of the proposal and low engagement of OCT members [3], delays or freezing due to lack of resources or loss of priority [23], compromising the initiative's viability or the achievement of its goals [23], etc. However, none of these studies sought to understand why the critical factors can hinder these initiatives and how the inefficiencies occur.

To address these gaps, this paper presents the result of an extensive company-wide case study involving the analysis of 82 OC initiatives that provided new empirical insights into the inefficiencies and obstacles faced by internal staff members leading OC initiatives. Our findings reveal four unknown or neglected challenges faced by OCT members and software development companies that want to improve their OC process: (i) Technical knowledge focused on the operational level is not enough, (ii) Low adherence of practitioners to activities suggested by OC models, (iii) Dependence on exceptional individuals due to widespread lack of knowledge about change management, and (iv) Lack of awareness about sources of resistance to change.

2 BACKGROUND

Organizational change (OC) refers to planned or unplanned initiatives that may make changes in the elements of an organization, such as structure, culture, processes, technology, policies, and practices aiming to enhance performance, efficiency, effectiveness [5], or the organization's adaptation to the external environment [7].

Even using other nomenclatures [25], in the software and information technology industry, OC has been a way of life [31]. OC is an ongoing and essential process for companies, occurring continuously or episodically, formally or informally [52]. It is a strategic mechanism for companies to ensure survival and establish robust competitive advantages [8], particularly in highly dynamic business environments [23].

Despite its significance, various studies [10, 23–25] have shown that the failure to adopt OC management knowledge can complicate the implementation of OC in the software industry, making it more susceptible to inefficiency or failure. Consequently, the evolution of many companies relies on individual efforts, leading to unpredictable outcomes.

Smith [44] claims that failure rates of up to 70% have been reported in such initiatives. In an attempt to increase success rates, studies have explored specific aspects that manifest as instances of OCs such as team building [7], adoption of new management practices, software process improvement [32, 46], and adoption of maturity models [43], the transition from traditional team to agile [10], promoting digital transformation [57] or process automation [13], among others.

Lewin's change model, also known as 'Change as Three Steps (CATS)', presents OC initiatives as a process composed of three stages [22]: Unfreeze → Change → Refreeze. This model has been a cornerstone and inspiration, dominating nearly all Western change theories for the past fifty years [30].

There are two main sources for starting an OC initiative. The first comes from external events and crises such as (i) acquisition of a new company or new projects, (ii) pre- and post-merger attitudes in two companies, or (iii) adapting to joint ventures and other inter-organizational arrangements [5]. The second comes from internal events such as revitalization, turnaround, innovation, initiatives to improve internal communications, team productivity [5], and increasingly demanding levels of internal and external customers [7]. OC has long been concerned with fostering organizational adaptation to internal and external environmental changes [5].

OC implementation can impact the entire company or specific areas. Related to the frequency and magnitude of OC, two main types are prevalent [35]: (i) episodic organizational change (EOC), characterized by intermittent and intentional shifts, often implementing the steps of the CATS model, and (ii) continuous organizational change (COC), involving incremental, evolving adjustments that accumulate over time [2, 52].

While the Kaizen model highlights the importance of continuous improvement in all processes [39], the Theory of Constraints suggests that special attention should be given to bottlenecks or constraints, as improving these critical points will have the most positive impact on overall performance [14]. However, it is not enough to make the change in the right place, OC initiatives must be carried out efficiently and aligned with the company's strategy [36]. Finally, each OC initiative should be able to foster organizational learning, promoting continuous improvement in the OC implementation process within the company [42].

3 METHOD

This study is part of a broader research program to generate additional knowledge on organizational change (OC) practices within the software industry. Previous studies carried out by us [23, 24] focused on understanding isolated cases of OC implementation. In contrast, this study examines how a company implements its OC initiatives by analyzing reports of 82 initiatives across 8 departments, each with 40 to 100 members, including managers, coordinators, team leaders, and other roles.

To answer the research question – What factors contribute to inefficiencies in implementing organizational changes in a software industry? – we conducted a company-wide case study [6, 40]. This company employs over 1000 employees and is part of a global software industry conglomerate operating in several countries [23]

collaborating with national and international stakeholders to develop and maintain factory-embedded smartphone binaries [26]. The study focused on reports from OCT members who implemented EOCs during 2023. Using convenience sampling, we approached managers and coordinators to compile lists of individuals leading or participating in EOC teams across the 8 departments.

A significant majority (92%) of managers and coordinators were unfamiliar with the term Episodic Organizational Change, leading us to adopt the terminology "large internal improvement or innovation initiatives" to capture better interventions impacting team dynamics across coordination, management, inter-departmental, and company-wide levels. This terminology adjustment enabled us to gather our target audience's list successfully. The aggregation of these lists formed the basis of our study's respondent population. Given the extensive size of the population and the ease of accessing research subjects, we opted for a census approach.

To collect the data, we initially applied an electronic questionnaire due to the numerous existing cases and the scalable efficiency of this approach, which facilitates standardized data collection. We conducted a pilot study to test and refine the questionnaire before the main data collection. We identified some areas for improvement and the need to include new response options for closed-ended questions and add some open-ended questions. After making the necessary adjustments, we made the electronic questionnaire available from 12/21/2023 to 12/29/2023, where managers and coordinators from 8 departments sent the questionnaire link to their subordinates. As a result, we obtained information on 82 major improvement and internal innovation initiatives (OC initiatives) reported by 32 respondents.

Figure 1 shows that the first two sections comprise respondent and initiative characterization. To create the question for Section III, we based on CATS Model steps: unfreeze, change, and refreeze [22] and 18 procedural OC models Errida and Lotfi [11] that suggest nine macro activities to be executed in each of the three steps, presented in Table 1. In addition, we compiled the results of Dikert et al. [10], Errida and Lotfi [11], Lima et al. [25] to create the list of critical success and failure factors presented in Table 2. Section IV focused on collecting respondents' familiarity and usage of OC models.

After compiling the data, we invited all respondents (32 people) along with their coordinators and managers (totaling 40 people) to a meeting where we presented, validated, and expanded our findings. Only 27 of the 40 invited participants (67.5%) attended this meeting, which was held remotely due to the number of expected participants. Additionally, we randomly selected five EOC initiatives (EOC1-EOC5) from the 82 reported OC initiatives for further investigation through OCT interviews. These initiatives included: Restructuring the chain of command, creating new roles, and reorganizing projects (EOC1); Conducting surveys and training to clarify roles and increase satisfaction (EOC2); Dividing the testing team into specialized groups to increase productivity (EOC3); Automating test request evaluation to reduce high rejection rates (EOC4); Changing the process to reduce unnecessary bug records (EOC5). The interviews took place the following week in two sessions led by two researchers, with 2 to 3 interviewees participating in each session.
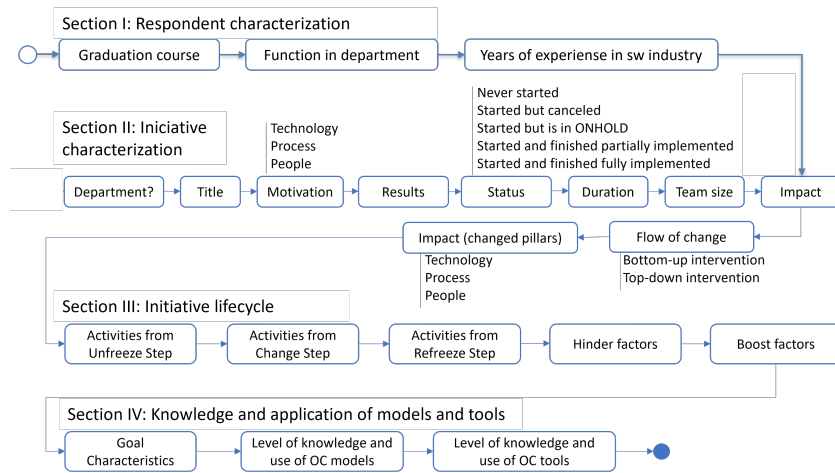
Figure 1: Questionary sections diagram

Macroactivity	Activities
Unfreeze step: Preparing for Change	
1. Do Scenario Analysis	Define sense of urgency, Identify motivations, Perform root cause analysis
2. Create a coalition	Define the CAT, Define the champions, Find volunteers, Set sponsor with proper authority
3. Define vision and plan	Create risk response and action plan, Define goals related to the impact generated and implementation, Define indicators to measure impact generated, Define status communication plan, Define the initiative's vision, Obtain action plan approval
Change step: Implementing the change	
4. Share the vision and plan	Communicate the plan to new OCT members, Communicate the plan to those impacted, Communicate the plan to your coordinator, Communicate the plan to your management
5. Execute and control	Execute and update the action plan, Identify and remove impediments, Reanalyze urgency x deadline, Report initiative status, Review if the initiative is still necessary
6. Produce partial deliveries	Celebrate partial deliveries, Hold a lessons learned meeting, Promote recognition of those involved
7. Sustain the intervention	Find new volunteers, Motivate OCT members, Reinforce the vision of the end goal, Replace OCT members if necessary
Refreeze step: Completing the change	
8. Complete the Change	Transfer results to maintenance, Create report of achieved results, Formalize the initiative closure, Institutionalize the change, Obtain final approval, Release the resources, Train all impacted
9. Learn and evolve	Analyze the results (process and project viewpoint), Identify points for improvement in the process, Identify boost factors, Identify hinder factors

Table 1: Change management roadmap's steps

1. Change vision and strategy	9. Change readiness and capacity for change
2. Change team performance	10. Effective and constant communication
3. Stakeholder engagement	11. Motivation of change agents
4. Resistance in general	12. Training, coaching, and empowerment
5. Leadership	13. Structured approach for change
6. Support and sponsorship	14. Learning and knowledge sharing
7. Change management	15. Transition aspects
8. Monitoring	16. Evaluation and measurement

Table 2: Categories of critical success and failure factors

Available at https://doi.org/10.6084/m9.figshare.25970941, we can access the supplementary material that includes the sections and questions used in the electronic questionnaire, interview scripts, and more deep descriptions of the five EOC initiatives.

To analyze the obtained data, we employed two main steps: the analysis of the electronic questionnaire and the additional interviews. The electronic questionnaire included both open and closed questions. Quantitative data were analyzed using descriptive statistical techniques to identify patterns and trends, while the responses to the open questions were qualitatively analyzed to capture insights and contextual details. Powered by Galaxy AI [41], we recorded the interviews using an S4 smartphone and utilized both the transcriptions and the automatically AI-generated summaries to conduct content analysis [20] and triangulate the data from the questionnaire, enhancing the validity of the findings and providing a more detailed understanding of the factors contributing to inefficiencies in the implementation of organizational changes.

4 RESULTS

4.1 Challenge 1: Navigating Uncharted Waters

Similar to a PMP®to project management [34], an OC Management professional is someone specialized in facilitating and managing change initiatives within an organization, playing a crucial role in analyzing, planning, and implementing significant interventions or transitions, such as new technology deployments, restructurings, mergers, acquisitions, cultural shifts, etc [33]. Their responsibilities range from analysis and planning to implementing and assessing the impact of changes on the company's objectives and performance. Although these activities are carried out by a multidisciplinary team, these professionals are expected to be capable of forming, leading, and guiding this team. Access to these professionals typically comes through hiring external consultancy. However, due to costs, the vast majority of internal improvement or innovation initiatives are led and implemented by volunteer teams within the company, who, in their departments, serve as department managers, coordinators, project managers, system analysts, developers, and testers.

While some studies claim that the background for these professionals is in Business Administration [16, 17, 48] with a focus on company management working at a tactical and strategic level, an analysis of 82 OC initiatives implemented in this company in 2023 revealed that none of the 32 OCT members had such qualifications. When analyzing the responses to the question "What is your undergraduate course of study?", we identified that most electronic questionnaire respondents (70%) have worked at the operational

level as developers, testers, or project leaders. Additionally, all of them had technical bachelor's degrees in fields such as Software Engineering, Computer Science, or Information Systems (54%), Electrical Engineering (29%), Electronic Engineering (9%), Mechatronics (4%), and Design (4%), without any managerial specialization. Though valuable, this predominance of professionals with technical backgrounds poses significant challenges to the effectiveness of OC management initiatives, as many of these professionals lack specific knowledge about OC processes.

In their daily routines, these professionals collaborate with multidisciplinary teams to create technological solutions that meet the needs of external or internal users/clients. Their empirical experience, academic background, and operational mindset can lead to a myopic view regarding understanding OC management when participating in or leading OCTs. As a result, we found (i) resistance among professionals in the software industry to recognize the need for additional skills to implement efficient OCs, (ii) the mistaken belief that internal improvements are limited to automation or process enhancement, overlooking the complexity of OCs that extend beyond identifying isolated issues and creating technological solutions may involving cultural, procedural, and human aspects changes.

Among the initiatives reported, 84% were episodic OCs, involving OCTs composed of 5 to 10 people, lasting 3 to 6 months, and impacting the entire department (49%), multiple departments (24%), and the whole company (11%). Despite this high number of episodic organizational changes (EOCs), the importance of managing risks was neglected, with only 11% of professionals reporting the application of risk management practices in their initiatives.

Many specific challenges of OC initiatives are not apparent to teams focused on developing technological solutions for external clients. The lack of awareness of these challenges has led to various negative impacts: (i) overconfidence in their problem-solving abilities, (ii) resistance to investing in acquiring knowledge about OC management, (iii) increased chances of failure as risks are not identified and managed, leading to a reactive stance towards solving impediments and issues during solution development, (iv) promotion of setting short-term goals without concern for strategic alignment.

Effective management of OCs, especially in the software industry, requires a comprehensive understanding beyond technical skills, including intrinsic knowledge of OC management [9]. The discrepancy between the academic background of practicing professionals and the skills required for effective implementation of OCs underscores the urgent need for organizations to recognize that the effectiveness of OC management initiatives is intrinsically linked to the ability of their leaders and teams to understand and navigate the complexity of organizational dynamics. This suggests a significant investment in training and development in change management. Overcoming these challenges and adopting a more integrated view can enhance the success of change initiatives, ensuring strategic alignment and long-term sustainability.

4.2 Challenge 2: Bridging the Knowledge Gap

This section demonstrates that although a lot of material is available on OC management, OCT members are not familiar with or use

the OC models and practices available when implementing major improvements and internal innovations.

Related to available knowledge, we identified studies interested in OC focused on (i) implementing a change in management model in software development teams [10, 25], (ii) improving software process [4, 55], (iii) analyzing the reactions of change agents and individuals affected by the change [19], (iv) analyzing the readiness of the company and its employees to implement an EOC [29], (v) analyzing the impact of training and the presence of coaching in the EOC process [50], (vi) analyzing EOC as a tool for promoting environmental, social, and financial sustainability [49], (vii) reviewing OC theories in general and suggest future agendas [3, 47, 51], and (viii) identifying the most important factors influencing change management success in construction field [11].

During our investigation into adopting initiatives for internal improvements and innovations, it was revealed that 18% of the 32 respondents did not engage in any Unfreeze step activities. The majority's predominant activities were 'Defining the motivations' at 62% and 'Validating the change idea' at 53%. A smaller faction of respondents undertook tasks such as 'Defining the action plan' (38%), 'Establishing the change agent team' (36%), 'Conducting root cause analysis' (36%), 'Setting goals' (33%), and 'Identifying risks' (31%). The commitment to the other activities was less than 20% among respondents.

An analysis of the Change step activities disclosed a comparable level of low participation, with 24% of respondents confessing to non-involvement in any CHANGE phase activities. 'Implementing the action plan' was the sole activity to receive a majority execution rate of 51%. A minor segment of the group participated in 'Identifying and removing impediments' (44%), 'Monitoring and controlling the action plan' (36%), 'Celebrating partial deliveries', and 'Communicating the action plan to stakeholders' (27%). The other activities saw less than 20% participation rate from the respondents.

Further analysis into the Refreeze step revealed a diminished engagement; again, 24% of respondents failed to undertake any REFREEZE phase activities. Notably, no activity was executed by more than 50% of participants. A subset of the respondents was involved in 'Consolidating the change' (44%), 'Obtaining final approval of outcomes' (44%), 'Analyzing the results achieved against the established goals' (40%), and 'Institutionalizing the change' (36%). Engagement in the remaining activities did not exceed 24% among the respondents.

We also explored the awareness and application of models recommended for the implementation of OC initiatives. Our findings revealed that none of the models intrinsic to OC theme and derived from the CATS Model were familiar to the respondents. Conversely, an average of 85% reported unfamiliarity with the following models: Galpins wheel of nine wedges [12] at 95%, Jick's 10 Steps [18] at 89%, Kotter's 8 Steps [21] at 84%, Lippitt's Theory [27] at 87%, Luecke's 7 Steps [28] at 87%, the Association of Change Management Professionals Model (ACMP) [1] at 75%, and the CATS Model [22] also at 75%. On the other hand, the majority claimed knowledge of the Minimum Viable Product (MVP) at 50%, project management according to PMBOK [34] at 52%, and PDCA [45] at 48%. In terms of usage, less than 30% had employed MVP (29%), Project Management according to PMBOK (25%), PDCA (25%), and Design Thinking (15%). None of

the other models had been utilized, which signifies that only 20% of the models had been used by less than 30% of the respondents.

4.3 Challenge 3: Cultivating OC Expertise Beyond Tech Background

Lack of a formal EOC implementation process in the company, lack of knowledge among OC practitioners about available models, and due to an urgency to respond to daily demands for internal improvement and innovation, we noticed that many initiatives were implemented as quickly as possible, using only the knowledge of the people involved in OCT, neglecting the available knowledge published in the white and gray literature [23]. This scenario has made these initiatives more challenging and prone to failure [24].

In the findings review session, we asked: *Will software industry OC practitioners begin to implement the knowledge of models, methods, and tools specific to OC management?* The response was: If it depends on the interest of the people participating in or leading the OCT in this company, the existence of an additional published framework would not change their way of implementing EOCs.

This prospect is grounded on the fact that 77% of initiatives originate at the operational level, whereas OC management activities are directed towards someone at the tactical or strategic level, who would be the sponsors, yet only 55% have formally defined a sponsor. In other words, there is no natural inclination among OCT members to spontaneously seek out this type of knowledge.

Investing in training programs for all of the more than 1,000 employees proves to be economically unfeasible, especially considering that less than 10% have engaged in similar initiatives over the past two years. However, focusing resources on implementing a formal process, emerges as a viable and promising strategy. This approach not only optimizes costs, timelines, and outcomes but also ensures that the initiative is more controlled and efficient.

In the absence of a formally established process, initiatives aimed at managing OC often rely on the performance of exceptional individuals. These professionals, operating outside conventional standards, act as compensatory agents in the face of knowledge gaps and widespread underperformance among the members of the organization. However, this dependency introduces an element of unpredictability in the outcomes of these initiatives. Without a structured process, the effectiveness of change management is at the mercy of the extraordinary skills of a few, rather than being supported by a robust system that ensures consistency and predictability in outcomes.

As the main consequence of the lack of a formal, systemic, and company-wide OC management process, we observe that each department implements its OC initiatives differently. Moreover, only about 10% of the activities suggested in Table 1 were implemented by less than 30% of the respondents. When asking about the final status of the reported initiatives, we received feedback that 81% were fully implemented, 11% were partially implemented, 7% were on hold, and 1% were never materialized. We also identified that 77% of the initiatives were bottom-up, motivated by individuals at the operational level, and 23% were top-down, motivated by individuals at the strategic level of the company.

Despite the majority of reported projects being completed, only 56% of the initiatives formally defined a sponsor with authority appropriate to the scope of the initiative's impact. Despite 40% of respondents claiming to analyze achieved results, 24% identifying points for improvement in implementation, and 20% formalizing the closure of the initiative. Therefore, the lessons learned and improvements in how to execute these types of initiatives are not shared, preventing the company or departments from evolving their ways of implementing OCs.

4.4 Challenge 4: Handling the Sources of Resistance

In the dynamic landscape of OC within the software industry, resistance emerges as a formidable and often insidious challenge, sometimes invisible or neglected, yet significantly impacting progress [15]. This section delves into three predominant forms of resistance: lack of communication and misunderstanding, lack of engagement and support, cultural misalignment, and fear of change. Each type is critically examined alongside strategic approaches to mitigate their impact, shedding light on these often-overlooked barriers to successful change.

Lack of communication and misunderstanding often result from inadequate communication, leading to misconceptions about the change's goals and procedures. Effective communication was identified as crucial in many studies [10, 11]. In contrast to the varied responses in EOC1 and EOC2 about the initiatives' motivations, goals, and the implementation of action plans, our findings from EOC3, EOC4, and EOC5 demonstrate that emphasizing clear communication of motivations, goals, action, and risk plans, along with stakeholder engagement, led to quicker identification and resolution of barriers. This approach fostered greater synergy and commitment among OCT members and sponsors. Retrospective meetings highlighted that, despite stakeholder resistance, effective communication significantly mitigated potential resistance, reinforcing the importance of clear articulation of objectives and benefits, continuous stakeholder dialogue, and engagement as essential elements in overcoming misconceptions and promoting a supportive change environment.

Lack of engagement and support is enhanced in matrix contexts [34], where departmental projects and change initiatives compete for resources. It was observed that the prioritization of departmental activities compromised the execution of change actions. In the EOC4 initiative, despite clear communication of goals and plans, including deadlines and responsibilities distributed among 10 individuals from different departments and hierarchical levels, frequent delays and replanning needs affected the availability and engagement of those involved. The intervention of sponsors, although it partially mitigated the problem, was not sufficient to solve it. Participants' reports on the influence of departmental project prioritization indicate that mere communication of goals, accompanied by monitoring, does not ensure the execution of activities within the planned timelines. In EOC5, we informed participants about the risks and causes of delays in previous initiatives. In this initiative, we noticed a significant reduction in delays and replanning. Therefore, it is crucial to promote genuine engagement and teach participants to effectively manage their time, emphasizing the need to balance departmental demands with the activities of change initiatives to achieve the desired results.

Cultural misalignment and fear of change are significant barriers to organizational transformation, often leading to resistance. However, this resistance can turn into support when change outcomes are tangible and valuable. This shift from skepticism to endorsement was evident through participant testimonies. Their engagement allowed us to categorize the proposed activities of unfreezing, changing, and refreezing as essential, important, or desirable, and identify activities that could be omitted from the roadmap.

Initially, stakeholders questioned the necessity of the extensive roadmap, which consisted of three steps, nine macro-activities, and 43 activities (see Table 1). However, after survey participants, who had each led an average of 2.5 OC initiatives, classified the activities, the perspective changed significantly. A notable 95% of the activities were classified as essential or important, indicating a collective appreciation for the collaboratively constructed roadmap that integrated insights from both grey and white literature with empirical experience. This alignment reduced the perceived burden and fostered an appreciation for the systematic approach to internal improvement and innovation initiatives.

5 DISCUSSION

In addressing the critical challenges of implementing OC in the software industry, this paper provides insights that bridge the gap between theory and practice. This paper illuminates the nuanced resistances within OC, diverging from traditional paradigms by focusing on the subtleties of communication, engagement, and cultural alignment. These insights enrich our understanding of OC in the software industry, suggesting more intricate management strategies to address these underlying challenges.

While contrasting with some traditional OC strategies, our findings echo the claims of [11, 21, 22], advocating for clear communication and stakeholder engagement as foundational elements of successful change initiatives. This alignment underscores the relevance of blending established OC theories with the unique dynamics of the software industry.

For company leaders and practitioners lacking formal OC management processes and guidance, this paper underscores the importance of integrating technical prowess with strategic OC management practices. It highlights the necessity of fostering a strategic mindset and employing sophisticated diagnostic tools to manage the complexity of OC, thus ensuring that change initiatives are both technically sound and strategically aligned.

5.1 Generality and Threats to Validity

All studies have threats that can affect the validity of their results [54]. This study faces several validity threats, including selection bias, response bias, and recall bias. Selection bias was mitigated through a census approach, while response and recall biases were addressed by refining the questionnaire and focusing on recent initiatives. Internal validity was strengthened through triangulation using multiple data sources and participant validation meetings.

The study's external validity is limited due to its focus on a single large software development company. While detailed descriptions of the environment aim to enhance transferability, the findings may not be generalizable to different contexts. Future research should validate these findings in varied organizational settings.

Despite these limitations, we documented the study context and methodology in detail to facilitate replication. Some threats, such as the reliance on opinion-reported data remain. Nonetheless, the insights gained provide a valuable basis for similar contexts.

6 CONCLUSIONS

This paper presented the complexities and challenges of implementing organizational change (OC) within the software industry. We underscored the inefficiency plaguing OC implementation processes through a detailed examination of the process and insights collected from a wide-company case study. Our study reveals that despite the varied contexts and the uniqueness of each OC initiative, common hurdles significantly impact their success rates. This underlines the importance of a nuanced understanding of OC beyond mere procedural adherence, spotlighting the intricacies of managing change in a sector as dynamic as software development. This study not only bridges the gap between theoretical OC models and practical application but also proposes actionable strategies to harmonize technical and managerial competencies that can help enhance the efficiency and effectiveness of OC initiatives. These contributions offer a fresh perspective on improving OC processes in the software industry.

The challenges highlighted throughout this research, particularly the propensity for initiatives to falter due to a lack of strategic alignment and inadequate risk management, underscore the criticality of addressing these aspects. Successful OC in the software industry necessitates a comprehensive approach that integrates robust communication strategies, stakeholder engagement, and a deep understanding of organizational dynamics. This study emphasizes adopting a more holistic view of OC, where technical and managerial competencies are harmoniously blended to navigate the multifaceted landscape of change within the industry.

Looking forward, one promising direction is the development and validation of a framework that can effectively guide OC practitioners in the software industry, incorporating the lessons learned and insights gained from this study. Additionally, investigating the impact of organizational culture on the success of OC initiatives presents an opportunity to deepen our understanding of the nuances of change management. Ultimately, the goal of future work should be to refine and expand the methodologies and strategies for OC, ensuring that they are robust, adaptable, and capable of meeting the unique demands of the rapidly evolving software industry.

REFERENCES

[1] Association of Change Management Professionals ACMP. 2014. *Standard for change management*. Winter Springs, FL.
[2] Steven H Appelbaum, Sally Habashy, Jean-Luc Malo, and Hisham Shafiq. 2012. Back to the future: revisiting Kotter's 1996 change model. *Journal of Management development* 31, 8 (2012), 764–782.
[3] Achilles A Armenakis and Arthur G Bedeian. 1999. Organizational change: A review of theory and research in the 1990s. *Journal of management* 25, 3 (1999), 293–315.
[4] Sussy Bayona, Jose A Calvo-Manzano, and Tomás San Feliu. 2012. Critical success factors in software process improvement: A systematic review. In *Software Process Improvement and Capability Determination: 12th International Conference, SPICE 2012, Palma, Spain, May 29-31, 2012. Proceedings 12*. Springer, 1–12.
[5] Michael Beer and Anna Elise Walton. 1987. Organization change and development. *Annual review of psychology* 38, 1 (1987), 339–367.
[6] David A Buchanan. 2012. Case studies in organizational research. *Qualitative organizational research* 5 (2012), 351–370.

[7] Maria Goreti Simão Cruz et al. 2002. Reestruturação organizacional direcionada para a formação de equipes: bases teórico-empíricas. *Repositório UFSC* n/a (2002), n/a.

[8] Thomas H Davenport and Donna B Stoddard. 1994. Reengineering: business change of mythic proportions? *MIS quarterly* n/a (1994), 121–127.

[9] Pablo Martin De Holan and Nelson Phillips. 2002. Managing in transition: A case study of institutional management and organizational change. *Journal of Management Inquiry* 11, 1 (2002), 68–83.

[10] Kim Dikert, Maria Paasivaara, and Casper Lassenius. 2016. Challenges and success factors for large-scale agile transformations: A systematic literature review. *Journal of Systems and Software* 119 (2016), 87–108.

[11] Abdelouahab Errida and Bouchra Lotfi. 2021. The determinants of organizational change management success: Literature review and case study. *International Journal of Engineering Business Management* 13 (2021), 18479790211016273.

[12] Timothy J Galpin. 1996. The human side of change: A practical guide to organization redesign. *(No Title)* (1996).

[13] Manishkumar Gami, Parth Jetly, Nidhi Mehta, and Sunita Patil. 2019. Robotic process automation–future of business organizations: a review. In *2nd International conference on advances in science & technology (ICAST)*.

[14] Eliyahu M Goldratt and Jeff Cox. 2016. *The goal: a process of ongoing improvement.* Routledge.

[15] Blanca Grama and Ramona Todericiu. 2016. Change, resistance to change and organizational cynicism. *Studies in Business and Economics* 11, 3 (2016), 47–54.

[16] David E Guest. 1994. Organizational psychology and human resource management: Towards a European approach. *European Journal of Work and Organizational Psychology* 4, 3 (1994), 251–270.

[17] Trung Thanh Ha and Phong Ba Le. 2021. What are the sources of organizational change capability? The role of transformational leadership and organizational justice. *International Journal of Business Administration* 12, 2 (2021), 76–87.

[18] Todd Jick. 1993. Implementing change. *Managing Change, Irwin, Homewood, IL* (1993), 192–201.

[19] Khai Wah Khaw, Alhamzah Alnoor, Hadi Al-Abrrow, Victor Tiberius, Yuvaraj Ganesan, and Nadia A Atshan. 2022. Reactions towards organizational change: a systematic literature review. *Current Psychology* (2022), 1–24.

[20] AJ Kleinheksel, Nicole Rockich-Winston, Huda Tawfik, and Tasha R Wyatt. 2020. Demystifying content analysis. *American journal of pharmaceutical education* 84, 1 (2020), 7113.

[21] John P Kotter. 2007. Leading change: Why transformation efforts fail. In *Museum management and marketing.* Routledge, 20–29.

[22] Kurt Lewin. 1947. Frontiers in group dynamics: II. Channels of group life; social planning and action research. *Human relations* 1, 2 (1947), 143–153.

[23] Rayfran Rocha Lima, Luis Albuquerque, Marcelo Ayres, Suelen Silva, Ana Oran, and César França. 2023. Understanding an organizational change and development intervention applied in a Global Software Industry: a case study. In *Proceedings of the XXXVII Brazilian Symposium on Software Engineering.* 1–11.

[24] Rayfran Rocha Lima, Margefson Barros, Miguel Castro, Ana Oran, Williamson Silva, and César França. 2023. Improving test team performance through an Episodic Organizational Change Implementation: A case study replication and extension. In *Proceedings of XXII Brazilian Software Quality Symposium.* 1–11.

[25] Rayfran Rocha Lima, Marcelo Santana Costa, Ana Carolina Oran, and César França. 2022. Factors that Boost and Hinder the Transition from Traditional to Self-managed Teams: A Systematic Literature Review. In *Proceedings of the XXI Brazilian Symposium on Software Quality.* 1–11.

[26] Rayfran Rocha Lima, Oswald Ekwoge, Bruno Bonifácio, Raquel Cunha, Hualter Barbosa, and Ana Carolina Oran Rocha. 2021. Overcoming Knowledge-Sharing Barriers that Affect Software Quality: An Experience Report. In *XX Brazilian Symposium on Software Quality.* 1–9.

[27] Ronald Lippitt. 1958. Dynamics of planned change. *n/a* n/a, n/a (1958), n/a.

[28] Richard Luecke. 2003. *Managing change and transition.* Vol. 3. Harvard Business Press.

[29] Isomi M Miake-Lye, Deborah M Delevan, David A Ganz, Brian S Mittman, and Erin P Finley. 2020. Unpacking organizational readiness for change: an updated systematic review and content analysis of assessments. *BMC health services research* 20, 1 (2020), 1–13.

[30] Mark Michaels. 2001. *The Quest for Fitness: A rational exploration into the new science of organization.* iUniverse.

[31] Ann K Miller. 2001. Organizational change. (2001).

[32] Sune Dueholm Müller, Lars Mathiassen, and Hans Henrik Balshøj. 2010. Software Process Improvement as organizational change: A metaphorical analysis of the literature. *Journal of Systems and Software* 83, 11 (2010), 2128–2146.

[33] Andrew M Pettigrew, Richard W Woodman, and Kim S Cameron. 2001. Studying organizational change and development: Challenges for future research. *Academy of management journal* 44, 4 (2001), 697–713.

[34] PMI. 2021. *A Guide to the Project Manag. Body of Knowledge (PMBOK® Guide)* (7th ed.). Project Management Institute, Newtown Square, PA.

[35] Jerry I Porras and Peter J Robertson. 1992. *Organizational development: Theory, practice, and research.* Consulting Psychologists Press, n/a.

[36] Michael E Porter. 2008. The five competitive forces that shape strategy. *Harvard business review* 86, 1 (2008), 78.

[37] Jorge Ribeiro, Rui Lima, Tiago Eckhardt, and Sara Paiva. 2021. Robotic process automation and artificial intelligence in industry 4.0–a literature review. *Procedia Computer Science* 181 (2021), 51–58.

[38] Ana Regina Rocha, Mariano Montoni, Gleison Santos, et al. 2005. Fatores de Sucesso e Dificuldades na Implementação de Processos de Software Utilizando o MR-MPS e o CMMI. *Pro Quality. Retrieved from http://www. cos. ufrj. br/˜savio/Arquivos/W2MPSBR/rocha_et_al_2005. pdf* (2005).

[39] Mike Rother. 2009. *Toyota kata.* McGraw-Hill Professional Publishing NY, NY.

[40] P. Runeson and M. Höst. 2009. Guidelines for conducting and reporting case study research in software engineering. *Empirical sw engineering* 14 (2009), 131–164.

[41] Samsung. 2024. 3 novidades de Inteligência Artificial do Galaxy S24. https://news.samsung.com/br/3-novidades-de-inteligencia-artificial-do-galaxy-s24.

[42] Peter M Senge. 2017. The leaders new work: Building learning organizations. In *Leadership perspectives.* Routledge, 51–67.

[43] Sheng-Pao Shih, Ruey-Shiang Shaw, Ta-Yu Fu, and Che-Pin Cheng. 2013. A systematic study of change management during CMMI implementation: A modified activity theory perspective. *Project Management Journal* 44, 4 (2013), 84–100.

[44] Martin E Smith. 2002. Success rates for different types of organizational change. *Performance Improvement* 41, 1 (2002), 26–33.

[45] Durward K Sobek II and Art Smalley. 2008. *Understanding A3 thinking: a critical component of Toyota's PDCA management system.* Productivity Press.

[46] Dirk Stelzer and Werner Mellis. 1998. Success factors of organizational change in SPI. *Software Process: Improvement and Practice* 4, 4 (1998), 227–250.

[47] Elisabeth Supriharyanti and Badri Munir Sukoco. 2023. Organizational change capability: a systematic review and future research directions. *Management Research Review* 46, 1 (2023), 46–81.

[48] Paul D Sweeney and Dean B McFarlin. 2002. *Organizational behavior: Solutions for management.* McGraw-Hill.

[49] Syed Awais Ahmad Tipu. 2022. Organizational change for environmental, social, and financial sustainability: A systematic literature review. *Review of Managerial Science* 16, 6 (2022), 1697–1742.

[50] UYAN Umut and Ayşe Aslan. 2019. Promoting readiness for change: A systematic review of positive psychology in organizational change context. *Yönetim Bilimleri Dergisi* 17, 34 (2019), 349–370.

[51] Maria Vakola, Achilles Armenakis, and Shaul Oreg. 2013. Reactions to organizational change from an individual differences perspective: A review of empirical research. *The psychology of organizational change: Viewing change from the employee's perspective* (2013), 95–122.

[52] Karl E Weick and Robert E Quinn. 1999. Organizational change and development. *Annual review of psychology* 50, 1 (1999), 361–386.

[53] WIPO. 2022. What is the future of innovation-driven growth? https://www.wipo.int/global_innovation_index/en/2022/.

[54] Claes Wohlin, Per Runeson, Martin Höst, Magnus C Ohlsson, Björn Regnell, and Anders Wesslén. 2012. *Experimentation in software engineering.* Springer Science & Business Media, n/a.

[55] Kinza Zahra, Farooque Azam, and Ilyas et al. 2017. Success factors of organizational change in software process improvement: A systematic literature review. In *Proceedings of the 5th International Conference on Information and Education Technology.* ACM, n/a, 155–160.

[56] Nael Zuleikha Zainol and Kowang et al. 2021. Managing organizational change through effective leadership: A review from literature. *International Journal of Academic Research in Business and Social Sciences* 11, 1 (2021), 1–10.

[57] Fadwa Zaoui and Nissrine Souissi. 2020. Roadmap for digital transformation: A literature review. *Procedia Computer Science* 175 (2020), 621–628.