CO-CREATION AND LEARNING IN DIGITAL TRANSFORMATION CONTEXTS: A DYNAMIC CAPABILITIES PERSPECTIVE

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Objetivo do estudo
Examinar como processos de cocriação em contextos de transformação digital geram aprendizagem em diferentes níveis, profundidades e alcances, identificando as condições sob as quais essa aprendizagem contribui para adaptação e reconfiguração organizacional.

Relevância/originalidade
O estudo integra cocriação, aprendizagem organizacional e capacidades dinâmicas, distinguindo nível, profundidade e alcance da aprendizagem. Essa abordagem evita tratar participação, compartilhamento de conhecimento, melhoria técnica e reconfiguração organizacional como resultados equivalentes.

Metodologia/abordagem
Realizou-se um estudo qualitativo de múltiplos casos com cinco iniciativas digitais, sete entrevistas em profundidade e evidências documentais complementares em um caso. Os dados foram analisados por análise de conteúdo, comparação intracasos e intercasos e interpretação pelas capacidades dinâmicas.

Principais resultados
A cocriação gerou aprendizagem por reformulação de problemas, integração de conhecimentos, experimentação, feedback, mediação e apropriação pelos usuários. Sensing e seizing foram mais frequentes, enquanto transforming exigiu mudanças recorrentes e duráveis em critérios, rotinas, estruturas ou mobilização de recursos.

Contribuições teóricas/metodológicas
A pesquisa distingue nível, profundidade e alcance da aprendizagem; evidencia a aprendizagem como mecanismo e resultado da cocriação; e diferencia aprendizagem localizada, adaptação e reconfiguração organizacional. Metodologicamente, combina análise por caso, comparação transversal e interpretação em duas etapas.

Contribuições sociais/para a gestão
Gestores devem avaliar iniciativas digitais além da entrega tecnológica, verificando se o conhecimento produzido é legitimado, retido, compartilhado e reutilizado. Mediação, governança, documentação, participação de usuários e responsabilidades definidas ajudam a converter experiências locais em aprendizagem organizacional mais ampla.

Palavras-chave: Cocriação, Aprendizagem organizacional, Transformação digital, Capacidades dinâmicas

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Study purpose
To examine how co-creation processes in digital transformation contexts generate learning at different levels, with varying depth and reach, and identify the conditions under which this learning contributes to organizational adaptation and reconfiguration.

Relevance / originality
The study integrates co-creation, organizational learning, and dynamic capabilities by distinguishing the level, depth, and reach of learning. This approach avoids treating participation, knowledge sharing, technical improvement, and organizational reconfiguration as equivalent outcomes.

Methodology / approach
A qualitative multiple-case study examined five digital initiatives through seven in-depth interviews and supplementary documentary evidence for one case. Data were analyzed through content analysis, within-case and cross-case comparison, followed by interpretation using the dynamic capabilities lens.

Main results
Co-creation generated learning through problem reframing, knowledge integration, experimentation, feedback, mediation, and user appropriation. Sensing and seizing were more frequent, whereas transforming required recurrent and durable changes in criteria, routines, structures, responsibilities, or resource mobilization.

Theoretical / methodological contributions
The study distinguishes the level, depth, and reach of learning; shows learning as both a mechanism and an outcome of co-creation; and differentiates localized learning, adaptation, and organizational reconfiguration. Methodologically, it combines within-case analysis, cross-case comparison, and two-stage interpretation.

Social / management contributions
Managers should assess digital initiatives beyond technology delivery by examining whether generated knowledge is legitimated, retained, shared, and reused. Mediation, governance, documentation, user participation, and assigned responsibilities can help convert local experiences into broader organizational learning.

Keywords: Co-creation, Organizational learning, Digital transformation, Dynamic capabilities

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1 Introduction

Digital transformation requires organizations to coordinate resources, capabilities, and knowledge distributed across internal and external actors. Its effects extend beyond technology adoption because organizations must also revise processes, relationships, decision criteria, and business models (Verhoef et al., 2021; Vial, 2019). As the knowledge needed for these changes is rarely concentrated in a single team or organization, adaptation increasingly depends on combining the perspectives of managers, specialists, partners, suppliers, customers, and users (Grant, 1996).

Co-creation is relevant in this context because it enables actors to integrate resources, experiences, and complementary knowledge while jointly defining problems and developing solutions (Prahalad & Ramaswamy, 2004; Vargo & Lusch, 2004). In digital initiatives, participants may do more than contribute to a predefined response: their interaction can reshape how needs are interpreted, which alternatives are considered, and which criteria guide development and use (Nambisan et al., 2019). These interactions also create opportunities for learning through experimentation, feedback, and iterative adjustment (Sjödin et al., 2020). Such learning, however, may remain localized or extend across teams, units, and organizations; it may produce incremental correction or deeper changes in practices and interpretations; and its effects may be temporary or persist through reuse and organizational embedding (Crossan et al., 1999; Zollo & Winter, 2002).

Although digital transformation, co-creation, and organizational learning are established research streams, their intersection remains underdeveloped. Research on digitally enabled co-creation emphasizes collaboration, experimentation, and user participation, while organizational learning research explains how knowledge is interpreted, shared, retained, and institutionalized. What remains unclear is how learning generated in co-creative digital initiatives develops across organizational levels, varies in depth and reach, and contributes to adaptation beyond the immediate project (Barat-Auleda et al., 2026; Iftikhar & Ahola, 2025; Matarazzo et al., 2021; Ringov et al., 2026). The mechanisms that translate learning across professional and organizational contexts and connect localized experience to broader routines, structures, and capabilities also require further explanation (Atanassova et al., 2026; Ivcovici et al., 2025; van Beers et al., 2026). Without these distinctions, participation, feedback, or technical refinement may be interpreted as organization-level learning or strategic reconfiguration even when their effects remain limited, incremental, or temporary (Auqui-Caceres & Furlan, 2023; Ciasullo et al., 2026).

To address this gap, this article asks: How do co-creation processes in digital transformation contexts generate learning at different organizational levels, with varying depth and reach, and under what conditions does such learning contribute to organizational adaptation and reconfiguration? Accordingly, the study examines the mechanisms and conditions through which co-creative learning develops and produces broader organizational effects. Digital transformation is treated as the empirical context, co-creation and learning as the primary analytical constructs, and dynamic capabilities as an interpretive lens for distinguishing localized adjustments from outcomes associated with sensing, seizing, and transforming (Helfat & Peteraf, 2015; Teece, 2007, 2022; Teece et al., 1997). The study adopts a qualitative multiple-case design based on in-depth interviews, supplementary documentary evidence, and content analysis.

2 Theoretical background

2.1 Organizational Learning: Level, Depth, and Reach

Organizational learning is a multilevel process through which individual interpretations may become shared understandings and, under certain conditions, be incorporated into organizational systems, structures, and routines (Crossan et al., 1999). In collaborative settings, learning may also cross organizational boundaries as actors exchange, reinterpret, and apply knowledge developed in different contexts (Inkpen & Tsang, 2005). Building on this process view, the study distinguishes three related but analytically independent dimensions: the level at which learning becomes observable, the depth of the change it produces, and the reach of its effects.

Level identifies the locus of learning, whether individual, team, organizational, or interorganizational. Learning may move across these levels through interaction, shared language, joint problem solving, coordination routines, and the legitimation of emerging interpretations. Such movement is not automatic, however, because sharing knowledge does not necessarily demonstrate its integration, retention, or application at another level. Differences in context, professional language, power, and connections among actors may restrict circulation and collective interpretation (Crossan et al., 1999; Grant, 1996; Ivcovici et al., 2025).

Depth concerns the extent to which learning changes actions, practices, decision criteria, or underlying interpretations. Single-loop learning corrects errors within existing assumptions, whereas double-loop learning involves questioning and revising the norms and interpretive frames that guide action (Argyris & Schön, 1978). Technical refinement or solution novelty should not therefore be treated as sufficient evidence of deep learning. Greater depth requires changes in both interpretation and subsequent action, although these changes may still remain confined to the actors directly involved (Auqui-Caceres & Furlan, 2023).

Reach refers to how far and for how long learning extends beyond the episode in which it originated. It includes circulation among actors and units, interorganizational transfer, retention, reuse in later situations, and incorporation into routines or decision processes (Argote & Ingram, 2000; Zollo & Winter, 2002). Documentation, repositories, and technological artifacts may support retention, but codification alone does not ensure that knowledge remains interpretable or applicable in other settings. Broader effects depend on continued coordination, assigned responsibility, opportunities for application, and the alignment of knowledge with organizational practices (Huvila, 2026; Iftikhar & Ahola, 2025).

These dimensions may develop in different combinations. Learning may be deep but localized, broadly circulated but incremental, or visible across multiple levels without becoming durable. Examining level, depth, and reach separately therefore helps avoid treating participation, knowledge sharing, documentation, and organizational embedding as equivalent manifestations of learning.

2.2 Co-Creation in Digital Transformation Contexts

Co-creation involves the participation of multiple actors in jointly developing value, solutions, and experiences through the integration of complementary resources and contributions (Prahalad & Ramaswamy, 2004; Vargo & Lusch, 2004). Customers, users, partners, suppliers, and internal teams may participate not only in developing organizational responses but also in defining the problems those responses are intended to address. Co-

creation can therefore reshape needs, priorities, evaluation criteria, and possible courses of action rather than merely adding external input to a predefined solution.

This function is particularly relevant in digital transformation contexts, where technical, managerial, institutional, and user-related knowledge is distributed across actors and organizations. Heterogeneous contributions do not combine automatically, however. Knowledge must often be translated across professional languages, interpretive frames, and criteria of legitimacy before it can support joint problem reframing and coordinated action (Ivcovici et al., 2025). Co-creation thus performs both a cognitive and a relational function by connecting distributed knowledge and creating conditions for its integration.

Digital technologies can expand these interactions by connecting dispersed actors, enabling rapid feedback, and supporting the recombination and continuous modification of digital solutions. Their effects nevertheless depend on architecture and governance, which influence who can participate, which contributions become visible, and how control and value are distributed (Nambisan et al., 2017, 2019). Technology therefore enables but does not determine co-creation.

Learning may emerge through cycles of experimentation, feedback, validation, and solution revision. These cycles allow participants to test assumptions, confront different interpretations, and adapt decisions to actual conditions of development and use (Sjödin et al., 2020). Yet the involvement of multiple actors does not itself ensure broad learning or organizational embedding. Power asymmetries, discontinuous participation, conflicting interpretations, and weak coordination may keep knowledge confined to immediate participants or allow it to dissipate after the initiative ends.

Co-creation is therefore treated in this study as an interaction process with the potential to generate learning. Whether that learning extends beyond the immediate initiative depends on mediation, governance, and mechanisms that support knowledge integration, retention, and reuse (Barat-Auleda et al., 2026; Klessova et al., 2023).

2.3 Dynamic Capabilities as a Lens for Interpreting Adaptation and Reconfiguration

Dynamic capabilities concern the processes through which organizations integrate, build, and reconfigure competences, resources, routines, and organizational arrangements in response to environmental change (Teece et al., 1997). Unlike operational capabilities, which support existing activities, dynamic capabilities alter the organizational resource base and enable adaptation and renewal over time (Helfat et al., 2007; Winter, 2003). Isolated improvements or one-off adjustments should not, however, be interpreted as evidence of dynamic capabilities. In digital transformation, technological practices acquire strategic significance when they become connected to broader changes in coordination, decision making, structures, and resource mobilization (Ciasullo et al., 2026).

Dynamic capabilities are commonly organized around sensing, seizing, and transforming. Sensing concerns the identification and interpretation of needs, opportunities, threats, and relevant signals. Seizing involves evaluating alternatives, making decisions, and mobilizing resources, while transforming refers to the reconfiguration of assets, routines, structures, and relationships (Teece, 2007, 2022). These dimensions may operate recursively because actions generate feedback that influences subsequent interpretations and decisions (Atanassova et al., 2026).

Learning contributes to this process by enabling organizations to interpret experience, combine distributed knowledge, and revise practices. Search routines, experimentation,

feedback, knowledge integration, cross-functional sensemaking, and governance structures can connect localized experience to organizational responses (Eisenhardt & Martin, 2000; Helfat & Peteraf, 2015; Zollo & Winter, 2002). Dynamic capabilities may therefore emerge gradually as practices are interpreted, adapted, combined, and stabilized across organizational levels rather than through a single transformative event (van Beers et al., 2026).

Co-creation may support this development by expanding access to knowledge held by users, specialists, suppliers, partners, and internal teams. It should not, however, be treated as a dynamic capability in itself. Co-creation is an interaction process that may strengthen sensing by improving problem recognition and seizing by supporting experimentation, collective evaluation, and resource mobilization (Matarazzo et al., 2021). Its contribution to transforming becomes more plausible when the resulting learning is retained, integrated across levels, and recurrently incorporated into organizational criteria, routines, structures, and subsequent decisions.

Dynamic capabilities are therefore used as an interpretive lens rather than as an initial coding category or an assumed outcome of co-creation. Localized learning and technical refinement may support adaptation without producing organizational reconfiguration. Stronger evidence of transforming requires broader, recurrent, and more durable changes in how resources, routines, responsibilities, and relationships are mobilized

3 Methodology

This study adopted a qualitative, exploratory, and interpretive multiple-case design suitable for examining processual phenomena embedded in organizational contexts (Creswell & Poth, 2018; Eisenhardt, 1989). The empirical setting comprised five bounded digital initiatives in which technology development, adoption, or redesign was associated with changes in work processes, coordination arrangements, user interactions, decision criteria, or resource mobilization. The unit of analysis was the co-creative learning process associated with each initiative, including how knowledge was generated, integrated, and translated into outcomes at different levels and with varying depth and reach. Although two initiatives occurred within the same organization, they were treated as separate cases because they differed in objectives, technologies, actor configurations, and learning trajectories (Yin, 2018).

Cases were selected for their theoretical relevance to co-creative learning. An initiative was classified as co-creative when different actor groups contributed complementary knowledge or resources, influenced problem definition or solution development, and integrated their contributions through dialogue, joint decisions, experimentation, feedback, or iterative revision. The corpus comprised seven in-depth interviews with participants directly involved in the initiatives. Participants were purposively selected because they performed technical, managerial, or institutional coordination roles. Three cases relied on a single interviewee; these informants occupied central positions and described different stages, activities, and actors, but this limitation was considered when interpreting the findings. Table 1 summarizes the five digital initiatives, their main actors, the empirical sources used, and the predominant co-creation arrangements.

Table 1
Characteristics of the cases and empirical corpus

Case	Digital initiative	Main actors	Sources	Co-creation arrangement
University-Court	Interorganizational development of an accessible digital solution for judicial activities.	University and court teams; resident professionals; specialists; users with disabilities.	Interviews E1-E2; documents D1-D2.	Formal partnership involving user feedback, joint decisions, and prioritization of changes.
Banking Automation	Proof of concept for infrastructure and application automation.	Internal analysts; supplier specialists; technical and managerial teams.	Interview E3.	Supplier-assisted experimentation combining internal and external expertise.
Banking AI	Development and redesign of a generative AI solution based on actual use.	Technical team; internal users; business and technology units; specialized AI team.	Interview E5.	Cross-functional feedback, experimentation, and iterative redesign.
Digital Court	Implementation and local adaptation of an electronic case-management system.	Local teams; users; experienced courts; trainers and institutional partners.	Interview E4.	Network-based exchange, training, observation, and local adaptation.
Educational Games	Iterative development of digital educational games and solutions.	Development team; managers; client representatives; partners and users.	Interviews E6-E7.	Client-provider prototyping, validation, feedback, and negotiated adjustments.

Note. D1 = OECD OPSI case record; D2 = IMD/UFRN institutional report.

Publicly accessible documents provided supplementary evidence for the University-Court Case. The documentary corpus comprised an OECD OPSI case record (Organisation for Economic Co-operation and Development [OECD], 2023) and an institutional report published by IMD/UFRN (Araújo, 2023). The documents corroborated the case configuration, user participation, innovation methods, and reported intentions to reuse accessibility and user-centered practices. Because documentary evidence was available for only one case, it was treated as case-specific corroboration rather than uniform triangulation.

Data were examined through content analysis involving corpus preparation, coding, categorization, comparison, and interpretation (Bardin, 2016). The transcripts were organized in ATLAS.ti. One researcher conducted the initial coding using the dimensions in Table 2 as sensitizing categories, while inductive codes were created when recurrent meanings were not adequately represented by the initial framework. Codes were compared within and across cases, grouped into higher-order categories, and refined through iterative review of transcripts, excerpts, and case summaries. Divergent evidence was retained to qualify the cross-case patterns.

Table 2
Analytical framework

Dimension	Focus	Guiding question	Main indicators

Co-creation and knowledge integration	Interaction through which actors combine and transform distributed knowledge.	How did actors contribute to problem definition and solution development?	Participation; dialogue; joint decisions; problem reframing; experimentation; feedback; revision.
Learning level	Locus at which learning became observable.	Where did learning manifest and did it move across levels?	Individual, team, organizational, and interorganizational learning; sharing; collective competence; routines or structures.
Learning depth	Extent to which learning changed actions, criteria, or interpretations.	Did learning refine existing actions or alter assumptions and problem definitions?	Technical correction; procedural change; revised criteria; questioned assumptions; expanded repertoire.
Learning reach	Circulation, retention, and reuse beyond the original episode.	How far and for how long did learning extend?	Cross-unit circulation; documentation; retention; reuse; standards; workflows; subsequent projects.
Conditions and barriers	Factors enabling or constraining learning.	What supported or restricted broader organizational effects?	Mediation; shared language; governance; support; user appropriation; silos; resistance; discontinuity.
Dynamic capabilities	Interpretation of outcomes as sensing, seizing, or transforming.	Did learning recurrently influence recognition, decisions, resources, routines, or structures?	Signal recognition; assessment of alternatives; resource mobilization; changes in responsibilities, routines, structures, or criteria.

The analysis proceeded in two stages. First, each case was examined individually, considering actors, interactions, learning processes, and outcomes. Cross-case comparison was then used to identify recurring patterns, contrasts, and conditions associated with the expansion or containment of learning (Eisenhardt, 1989; Miles et al., 2014). Dynamic capabilities were applied in a subsequent interpretive stage to assess whether recurrent outcomes supported sensing, seizing, or transforming through changes in problem recognition, resource mobilization, routines, structures, or decision criteria.

Participation was voluntary and preceded by information about the study and the academic use of the data (Israel, 2015). Interviewees' names and identifying personal information were omitted or replaced with analytical labels (Kaiser, 2009). The cases were also presented under analytical labels, although the University-Court Case may be identifiable through the public documents. Interview excerpts were translated from Portuguese into English by the authors.

4 Results and Discussion

As summarized in Table 1, the empirical corpus comprised seven interviews associated with five digital transformation initiatives in organizational and interorganizational settings. The cases varied in organizational context, technological maturity, formalization, and governance arrangements. This diversity provided theoretically relevant contrasts between initiatives in which learning remained primarily technical and localized and those in which it began to shape broader workflows, standards, criteria, and organizational practices (Eisenhardt, 1989).

The findings combine cross-case comparison with closer examination of episodes that reveal the processes and conditions associated with different learning outcomes (Langley, 1999; Miles et al., 2014). Rather than assuming a linear sequence between interaction, knowledge production, and organizational change, the analysis examines how problem reframing, knowledge integration, experimentation, feedback, and mediation produced different outcomes across the cases. The discussion is organized around three themes: co-creation and learning in the course of action; the level, depth, and reach of learning; and the conditions shaping organizational adaptation and reconfiguration.

4.1 Co-Creation, Knowledge Integration, and Learning in the Course of Action

A recurring pattern across the cases was the reframing of problems as different actors became involved in developing, adopting, or adapting digital solutions. Needs, requirements, and priorities were revised through interactions among technical teams, managers, users, suppliers, and institutional partners. Co-creation therefore influenced not only the proposed responses but also how the problems and criteria guiding those responses were understood.

This reframing was particularly visible in the University-Court and Educational Games cases. In the former, observations from lawyers with low vision and motor impairments were recorded and discussed by the technical teams, making accessibility a central criterion for evaluating the solution rather than an additional requirement. As E1 summarized, “we made decisions together.” Public documents corroborated the partnership, the use of user-centered innovation methods, and user participation in defining demands and developing the solution (Araújo, 2023; OECD, 2023). In the Educational Games Case, successive prototype validations revealed that the initial proposal was poorly aligned with the client’s learning objectives. Direct interaction consequently changed both the solution and the team’s understanding of the problem, illustrating how learning may emerge during development through experimentation and feedback (Sjödin et al., 2020).

Knowledge integration also required translation across organizational and professional contexts. In the Digital Court Case, knowledge of judicial routines and local conditions was combined with the experience of courts that had already implemented the electronic system. Training, documents, observation, and conversations allowed knowledge to be adapted rather than simply replicated. Similarly, in the Banking Automation Case, internal analysts contributed knowledge of applications and operating conditions, while supplier specialists translated generic technical knowledge into locally applicable guidance. These cases show that complementary knowledge produces learning when actors can connect specialized expertise to the particular context of application (Ivcovici et al., 2025).

Experimentation occurred at different stages of digital adoption. In the Banking Automation Case, it was concentrated in a proof of concept conducted before implementation, through which the technology was connected to existing applications and work processes. In

the Banking AI Case, limitations became visible after implementation through actual use, leading to iterative redesign of the interface and AI agents. Although the timing differed, both initiatives generated knowledge by confronting initial expectations with operating conditions. Experimentation therefore supported learning both before adoption and through subsequent use (Sjödin et al., 2020; Thomke, 1998).

The cases also differed in how co-creation was organized. The University-Court Case relied on scheduled meetings, records, user participation, and formal prioritization procedures. The Educational Games Case depended more strongly on emergent interaction and successive validation with the client. The banking initiatives combined predefined organizational arrangements with adjustments identified during experimentation and use. These differences indicate that co-creation may be formalized or emergent, but learning depends less on the degree of formalization itself than on whether the arrangement supports dialogue, knowledge translation, feedback, and revision.

Across the cases, co-creation generated learning through three interconnected mechanisms: problem reframing, integration of complementary knowledge, and experimentation with feedback. These mechanisms enabled actors to revise interpretations and actions, but they did not determine how far learning would circulate or whether it would become embedded in broader organizational practices. Those outcomes depended on the level, depth, and reach of the learning generated.

4.2 Levels, Depth, and Reach of Learning

Learning varied across three analytically independent dimensions: the level at which it became observable, the depth of the change produced, and the reach of its effects. These dimensions did not develop uniformly. Learning could cross organizational levels while remaining incremental, substantially change participants' interpretations while remaining localized, or persist through structures and artifacts without being evenly appropriated across the organization.

Regarding level, knowledge initially developed by individuals became collective when actors shared interpretations, jointly applied what they had learned, and developed common criteria for action. In the Digital Court Case, exchanges with courts that had already implemented the electronic system connected professionals across organizations and supported the adaptation of knowledge to local conditions. E4 summarized this reciprocal relationship by stating that the organization "received it and contributed to it as well." Learning therefore crossed individual, team, organizational, and interorganizational levels, although some tacit knowledge remained dependent on direct interaction with experienced professionals.

Collective learning followed a different path in the University-Court Case. Legal requirements, technical possibilities, managerial priorities, and users' experiences initially represented distinct forms of knowledge. Successive discussions enabled participants to negotiate differences between formal requirements and everyday practice, producing a shared interpretation of the problem and the criteria that should guide the solution. In this case, movement across levels depended on mediation among professional languages and on the legitimation of user knowledge rather than on straightforward knowledge transfer.

The other initiatives revealed more restricted movements. In the Banking Automation Case, learning was concentrated among technical professionals and external specialists. In the Banking AI Case, it originated through interaction between users and the development team

and later reached a specialized cross-unit structure. In the Educational Games Case, lessons initially developed by the project team began to inform broader managerial decisions. These differences confirm that knowledge sharing does not automatically constitute organization-level learning. Movement across levels requires opportunities for collective interpretation, application, and incorporation into organizational arrangements (Crossan et al., 1999).

The cases also differed in depth. The Banking Automation and Banking AI initiatives primarily generated technical and operational refinements. The proof of concept enabled analysts to understand and adapt the automation technology, while actual use of the AI solution revealed usability limitations and supported interface and agent redesign. These changes improved actions within the existing objectives and assumptions of the initiatives, corresponding mainly to incremental or single-loop learning (Argyris & Schön, 1978).

Deeper learning became more visible when experience changed the criteria used to understand a problem or evaluate future action. In the University-Court Case, accessibility moved from an initially peripheral concern to a central criterion of technological adequacy. The initiative demonstrated that a technically functional solution could still be inappropriate when evaluated from users' actual conditions of use. Learning consequently changed not only the solution but also the assumptions through which its suitability was assessed.

In the Educational Games Case, difficulties related to project scope, underestimated iteration time, and financial return altered how the company evaluated subsequent opportunities. The experience led to more careful assessment of available capabilities, technologies, internal capacity, pricing, and project organization. It also became a reference for later projects and calls for proposals. Learning thus extended beyond correcting the original product and expanded the organization's collective repertoire and possible fields of action. Nevertheless, deeper learning in both cases remained partly dependent on the professionals who had participated directly in the initiatives.

Reach varied according to whether knowledge circulated, persisted, and was reused beyond the original episode. In the Banking Automation Case, specialized knowledge was retained mainly in the automation code and among the immediate participants. Embedding knowledge in the technological artifact reduced repeated interventions, but organizational silos, bureaucracy, and incompatibilities limited its circulation.

The Banking AI Case presented broader but uneven reach. The creation of a specialized generative AI unit made expertise available to other internal initiatives. This structure reduced dependence on the original project team, but its existence did not ensure that knowledge was accessed, understood, or applied uniformly by other areas. The initiative therefore expanded the availability of learning without demonstrating organization-wide appropriation.

Greater continuity was observed when knowledge influenced subsequent practices and decisions. In the Digital Court Case, repositories, courses, documents, scripts, technical roles, and workflow changes supported retention and reciprocal exchange among courts. In the Educational Games Case, lessons were reused in project selection, planning, pricing, work organization, and the formalization of Scrum. In the University-Court Case, accessibility knowledge extended beyond the original initiative by informing criteria applied to other digital solutions. These mechanisms increased reach, although documentation and formal structures did not by themselves guarantee continued application (Huvila, 2026).

The comparison shows that level, depth, and reach should not be treated as stages of a single linear process. The Banking AI Case expanded learning across units while its depth

remained mainly incremental. The University-Court Case produced deeper changes in evaluative criteria, but some learning about collaboration and project management remained tied to participants. The Banking Automation Case retained knowledge in a reusable artifact, although its organizational circulation was limited. The Educational Games and Digital Court cases combined reuse with changes in practices, but still depended partly on key actors and situated experience. Distinguishing these dimensions therefore prevents participation, technical improvement, knowledge circulation, and organizational embedding from being treated as equivalent outcomes.

4.3 Conditions Shaping Organizational Adaptation and Reconfiguration

The broader organizational effects of co-creative learning depended on mechanisms that connected situated experience to subsequent action. Across the cases, mediation, governance, knowledge retention, user appropriation, and opportunities for reuse influenced whether learning remained confined to immediate participants or affected later decisions, routines, and structures. These conditions operated jointly rather than independently.

Mediation was especially important when actors worked with different professional languages, responsibilities, and criteria of legitimacy. In the University-Court Case, accessibility specialists and users helped translate everyday experiences into requirements that technical and judicial actors could evaluate and prioritize. In the Digital Court Case, professionals with previous implementation experience connected general knowledge about the electronic system to local judicial routines. Mediation therefore supported learning by making distributed knowledge interpretable and actionable across contexts, not merely by increasing the amount of information available.

Governance arrangements influenced whether contributions were recognized, assessed, and incorporated. Scheduled meetings, formal records, validation procedures, and assigned responsibilities supported continuity in the University-Court Case. In the Digital Court Case, courses, repositories, scripts, technical roles, and interorganizational exchange provided channels through which knowledge could be retained and mobilized. The Banking AI Case also showed how the creation of a specialized unit could expand access to expertise beyond the original project. Formal structures, however, did not guarantee broad appropriation. Knowledge could remain difficult to access, weakly connected to local practices, or dependent on professionals capable of interpreting it.

User appropriation also affected the learning generated through digital initiatives. Actual use exposed limitations that were not fully visible during initial development. In the Banking AI Case, interaction with users revealed usability problems and supported the redesign of the interface and AI agents. In the University-Court Case, the participation of users with disabilities changed the criteria through which technological adequacy was assessed. These findings indicate that user participation contributes more strongly to organizational learning when experience is treated as legitimate knowledge and translated into decisions, rather than collected only as feedback about a nearly completed solution.

Retention and reuse distinguished temporary adjustments from learning with broader organizational consequences. The Banking Automation Case retained technical knowledge in the code and among the professionals involved, but organizational silos and limited circulation constrained its effects. In contrast, lessons from the Educational Games Case influenced later decisions concerning project selection, pricing, technological feasibility, internal capacity, and work organization. The formalization of Scrum also provided a routine

through which part of the experience could be reproduced in subsequent projects. Retention therefore became strategically relevant when learning was not only stored but recurrently mobilized in new situations.

From a dynamic capabilities perspective, evidence of sensing was present when interaction helped actors recognize needs, limitations, and opportunities that had not been adequately understood at the beginning of the initiatives. Seizing became visible when these interpretations informed the evaluation of alternatives, prioritization of changes, allocation of expertise, or mobilization of resources. These processes appeared in all cases, although with different intensity and organizational reach.

Evidence of transforming was more restricted. Technical correction, interface redesign, or successful experimentation improved the initiatives but did not necessarily alter the organization's resource base, routines, or structures. Transforming became more plausible where learning recurrently influenced later practices and organizational arrangements. This occurred in the Digital Court Case through changes in workflows, technical roles, repositories, and interorganizational exchange; in the Educational Games Case through revised project criteria, pricing practices, work organization, and the formalization of Scrum; and, more cautiously, in the Banking AI Case through the creation of a specialized unit. In the University-Court Case, the reuse of accessibility criteria in other digital solutions suggested an emerging reconfiguration, although part of the learning remained dependent on the actors directly involved.

These findings reinforce that co-creation is not itself a dynamic capability. It creates an interaction setting in which distributed knowledge can support sensing and seizing, while transforming depends on whether learning becomes sufficiently recurrent, broad, and durable to modify how the organization mobilizes resources, responsibilities, routines, and decision criteria. Table 3 summarizes the cross-case patterns.

5 Conclusions

This study examined how co-creation processes in digital transformation contexts generate learning at different organizational levels, with varying depth and reach, and under what conditions such learning contributes to organizational adaptation and reconfiguration. Across the five cases, co-creation generated learning through problem reframing, knowledge integration, experimentation, feedback, mediation, and user appropriation. Its effects became broader when knowledge was legitimated, retained, translated across professional and organizational contexts, and reused in later decisions, routines, or projects.

The first contribution is the analytical distinction among the level, depth, and reach of learning. Level identifies where learning becomes observable; depth concerns the extent to which actions, evaluative criteria, or underlying interpretations change; and reach refers to how far and for how long learning circulates, persists, and is reused. The findings show that these dimensions do not necessarily develop in parallel. Learning may be deep but localized, broadly circulated but incremental, or visible across several levels without durable embedding. This distinction clarifies why participation, technical refinement, documentation, and knowledge sharing should not be treated as equivalent evidence of organizational learning.

Table 3
Cross-Case Synthesis of Learning and Dynamic Capability Outcomes

Case	Learning level	Learning depth	Learning reach	Dynamic capability interpretation
University-Court	Team, organizational, and interorganizational.	Deeper change in accessibility and technological evaluation criteria.	Criteria reused in other solutions, but some learning remained participant-dependent.	Sensing and seizing; emerging transforming through broader use of accessibility criteria.
Banking Automation	Mainly individual and technical-team levels.	Incremental technical and operational learning.	Retained in code and among participants; limited cross-unit circulation.	Sensing and seizing; insufficient evidence of transforming.
Banking AI	Team and cross-unit levels.	Mainly incremental redesign based on actual use.	Expertise extended through a specialized unit, with uneven organizational appropriation.	Sensing and seizing; limited transforming through structural specialization.
Digital Court	Individual, team, organizational, and interorganizational.	Procedural and contextual adaptation of implementation practices.	Retained through repositories, courses, scripts, roles, workflows, and reciprocal exchange.	Sensing and seizing; stronger evidence of transforming through recurrent changes in workflows and roles.
Educational Games	Team and organizational levels.	Deeper changes in project evaluation, pricing, capabilities, and work organization.	Reused in later projects and partially embedded through Scrum.	Sensing and seizing; evidence of transforming in routines and decision criteria.

The second contribution concerns the role of learning in co-creation. Learning operated both as a mechanism and as an outcome. As a mechanism, it enabled actors to reinterpret problems, combine heterogeneous knowledge, test alternatives, and revise solutions through feedback and actual use. As an outcome, it became visible in new competences, criteria, coordination arrangements, routines, and possibilities for action. Whether these outcomes extended beyond the original initiative depended on mediation, governance, knowledge-retention arrangements, user appropriation, and opportunities for subsequent application. Specialized units, repositories, technical roles, and formal procedures increased the potential for circulation and reuse, but did not by themselves guarantee organizational embedding.

The third contribution is the distinction among localized learning, adaptation, and organizational reconfiguration from a dynamic capabilities perspective. Co-creative learning contributed more readily to sensing and seizing by improving problem recognition, the assessment of alternatives, and resource mobilization. Evidence of transforming was more restricted. Technical corrections, interface redesign, and isolated adjustments represented

relevant learning, but stronger evidence of reconfiguration required recurrent and durable changes in decision criteria, routines, structures, responsibilities, or patterns of resource mobilization.

Managerially, digital transformation initiatives should be assessed not only by technology delivery or immediate performance. Organizations also need to examine whether the knowledge generated through development and use is retained, made accessible, translated across units, and mobilized in later initiatives. Mechanisms for listening to users, experimentation, mediation, documentation, assigned responsibility, and post-implementation learning can help connect situated experience to broader organizational action.

The study is limited by the small number of cases, their contextual particularities, and the predominance of participants' accounts. Three cases relied on a single interviewee, documentary corroboration was available for only one case, and the absence of longitudinal follow-up restricted the analysis of the durability of observed changes. Future research could follow digital initiatives over time, include multiple informants and documentary sources across cases, and compare different governance and co-creation arrangements. Further studies could also examine how leadership, trust, organizational memory, team stability, and artificial intelligence influence the movement of learning across levels and its conversion into enduring capabilities.

Digital transformation does not generate organizational learning merely by introducing new technologies or increasing participation. Broader effects arise when co-created knowledge changes action and is subsequently retained, circulated, and reused. Co-creation therefore provides an important setting for learning, but its contribution to adaptation and reconfiguration depends on the organizational conditions that connect experience, knowledge, and collective action.

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