

Resistance vs. Modernization Pressure: How does Legacy Modernization affect the Well-Being of Mainframe Experts in the Transition Age?

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Abstract. Modernizing legacy systems is a strategic imperative for organizations seeking to remain competitive, efficient, and adaptable in a rapidly evolving technological landscape. As most remaining mainframe experts in organizations are in the transition age shortly before (or even after) formal retirement, and the successful execution of such modernization efforts strongly relies on their active contribution, it is crucial to ensure their well-being and professional alignment with modernization. Yet, little is known so far about how modernization initiatives affect the well-being and work satisfaction of this peer group. This study adopts a qualitative, interpretive research design to investigate how mainframe experts in the financial services sector experience and respond to modernization initiatives. Data were collected through semi-structured interviews with experienced mainframe experts, selected via purposeful sampling to ensure relevance and depth of expertise. We then integrated these dimensions into a process model explaining how structural constraints and perceived contract violations jointly shape resistance or engagement.

Keywords: Well-Being · Elderly People · Psychological Contract Theory · Path Dependence Theory · Legacy Modernization.

1 Introduction

Legacy mainframe systems require modernization due to a combination of technological, economic, and organizational pressures that accumulate over time [15, 22]. Many of these systems were designed decades ago with architectures that are difficult to scale, integrate, or secure in today’s highly interconnected digital environments. As businesses increasingly rely on cloud computing, real-time data analytics, and agile development practices, legacy mainframes can become bottlenecks that limit innovation and responsiveness [19].

Maintaining specialized software can be costly and inefficient, particularly as the pool of legacy programming language (e.g., COBOL) experts shrinks [19].

A legacy system [6], or legacy information system [7], refers to an outdated or aging information system, technology, or software application that remains in use despite the availability of newer alternatives. These systems are often deeply embedded within an organization’s operational processes and may continue to deliver critical business functions [15]. However, legacy systems are typically characterized by obsolete technologies, limited flexibility, and difficulty in integration with modern platforms. They are frequently maintained because replacing them is complex, costly, or risky, even though their continued use may hinder innovation.

In our study, we focus on legacy systems, in particular mainframe systems, which are an example of legacy information systems [25].

Mainframe systems are high-performance, large-scale computing platforms designed to process vast amounts of data and support mission-critical applications for organizations such as banks, governments, and large enterprises [11]. Unlike distributed systems, mainframes centralize computing resources, enabling secure and efficient management of sensitive data.

Resistance from employees, particularly experienced mainframe experts, often arises from a combination of psychological, professional, and organizational factors associated with legacy system modernization [19, 15]. Many employees developed deep expertise and professional identity around legacy technologies, making modernization efforts feel like a devaluation of their skills and contributions. Resistance may also stem from skepticism toward change initiatives, especially if previous modernization efforts were unsuccessful or poorly managed [23].

As a result, modernization is not only a technical transformation but also a social and cultural challenge that can trigger reluctance, stress, and reduced morale among affected employees.

Legacy information systems and the elderly workforce are closely interconnected through the historical development of computing technologies and the accumulation of specialized expertise [15]. Many legacy systems, particularly mainframe platforms, were developed and widely implemented several decades ago, meaning that the experts who designed, maintained, and operated them are now approaching or have reached retirement age. As a result, a significant proportion of the knowledge required to manage these systems resides with older employees and is often not well documented, e.g., internalized knowledge requiring externalization [18].

This creates a dependency on an aging workforce, making organizations vulnerable to knowledge loss as these experts retire. At the same time, these employees may experience increased pressure during modernization efforts, as they are expected to adapt to new technologies while simultaneously preserving critical legacy operations.

Modern research highlighted the relevance of AI [2] and XAI [28] in healthcare. While there is research focusing the well-being of the elderly population in general [8], or experts’ perspective on legacy modernization [15], so far there is no

research investigating the well-being of the elderly mainframe experts regarding modernization in mainframe environments.

Therefore, we address the following research questions: Are the job satisfaction and the general professional well-being of long-time mainframe experts affected by ongoing (mainframe) modernization efforts (RQ1), and does it impact their willingness to contribute to such efforts (RQ2)?

To do so, we adopt a qualitative, interpretive research design that is well suited to capturing subjective perceptions and complex social dynamics [13]. Grounded in Path Dependence Theory (PDT) [10] and Psychological Contract Theory (PCT) [21], our research integrates structural and individual-level perspectives on resistance and adaptation.

We collected data through semi-structured interviews with experienced mainframe experts in the financial services sector. The interviews, conducted in German and subsequently transcribed and anonymized, focused on themes such as legacy system constraints, perceived organizational expectations, and responses to ongoing modernization initiatives.

For data analysis we followed the Gioia methodology, involving iterative coding cycles that moved from participant-centered concepts to higher-order theoretical themes, resulting in a process model (see Figure 1) explaining change responses.

2 Theoretical Background

2.1 Path Dependence Theory (PDT)

Path Dependence Theory (PDT) provides a foundational lens for understanding how historical decisions constrain and shape present and future organizational outcomes [10].

PDT emerged in the context of economic history and the study of technological evolution, where scholars sought to explain why inferior or suboptimal technologies persist. Scholars further developed the theory by emphasizing mechanisms such as increasing returns, network effects, and learning effects as key drivers of persistent technological paths [4, 5].

The theory was adopted in organizational and management studies as well [17]. In this broader context, path dependence is no longer viewed as purely deterministic but as a process shaped by sequences of contingent events, institutional structures, and actor interpretations [12, 24].

Path dependence refers to the process whereby initial conditions and early choices disproportionately influence later outcomes, even when alternative options may be more efficient [10].

Lock-in, in turn, describes a state in which a particular technology, system, or organizational practice becomes dominant and resistant to change due to high switching costs and accumulated expertise [10].

Further, critical junctures are periods of significant change during which organizations face a broader range of strategic options than usual [10]. Decisions

made during these moments can set organizations on distinct developmental trajectories.

In the context of legacy system modernization, modernization initiatives themselves can be interpreted as critical junctures, as they challenge entrenched structures and open opportunities for transformation.

2.2 Psychological Contract Theory (PCT)

A psychological contract is an implicit understanding between employees and employers concerning mutual expectations that go beyond formal employment agreements [3]. These unwritten agreements shape workplace behavior and attitudes.

Building on this foundation, Rousseau [21] provided a formalized definition of the psychological contract as an individual's belief regarding the terms and conditions of a reciprocal exchange agreement between themselves and their organization [21]. Rousseau's work shifted the focus toward the cognitive and perceptual dimensions of the contract, emphasizing that psychological contracts are not shared constructs but rather individually held beliefs shaped by organizational cues and personal experiences. This perspective underscores the importance of interpretation and perception in shaping how employees respond to organizational actions [21].

A central aspect of PCT lies in the notions of expectations and perceived obligations [21]. Expectations refer to what employees believe they are entitled to receive from their organization. In turn, obligations represent what employees perceive they owe the organization. These reciprocal expectations form a binding relationship that guides employee behavior and attitudes. When these expectations are aligned, they foster stability; when misaligned, they can lead to disengagement [21].

Organizational change, such as legacy system modernization, can be interpreted by employees as a breach or violation of the psychological contract. A breach occurs when employees perceive that the organization failed to fulfill obligations, whether explicitly stated or implicitly understood [21, 15].

Trust and communication play a critical role in shaping and maintaining psychological contracts, particularly during periods of organizational transformation [29].

PCT provides a valuable lens for understanding user attitudes and resistance to technological change [1]. Individuals' reactions to IT implementations are shaped not only by technological factors but also by perceived organizational support and fairness [1].

3 Methodology

3.1 Research Design

This study adopts a qualitative, interpretive research design to investigate how mainframe experts in the financial services sector experience and respond to

modernization initiatives. Given the exploratory nature of the research question—specifically the tension between resistance and modernization pressure—a qualitative approach is appropriate to capture rich insights into individual perceptions.

Our study is theoretically grounded in PDT [10] and PCT [21], enabling a multi-level perspective that integrates structural constraints with individual cognitive and emotional responses. We employed a semi-structured interview approach, allowing for both theoretical guidance and openness to emergent insights. The research follows an abductive logic, iterating between empirical data and theory development.

To ensure methodological rigor, we followed established qualitative research criteria including credibility through the use of our theory-informed interview guide, iterative comparison between data and theory (abductive reasoning) and the inclusion of rich verbatim quotes. We ensured transparency through the clear documentation of our coding process and the development of a coding scheme and data structure. We ensured reliability through iterative coding and multiple revisits, resolving ambiguities through repeated data examination.

3.2 Data Collection

Table 1. Overview of Interview Partners

Interview Partner	Age	Employer	Occupation	Years Working with Mainframes
I1	64	Freelancer	Consultant	since 1988
I2	59	Bank	Senior Database Engineer	since 1987
I3	59	Bank	Mainframe Expert	since 1986
I4	70	Retired Freelancer	Consultant / Technical Architect	since 1977
I5	45	Consultancy	Consultant	since 2006
I6	55	Insurance	CICS System Administrator	since 2001
I7	57	Bank	Solution Manager	since 1988

We used purposeful sampling to recruit participants with deep experience in legacy systems and to construct our convenience sample. Particularly, we ensured, that interview participants were (1) mainframe experts (e.g., COBOL developers, system architects, operations experts), (2) working in the financial sector (e.g., banks, insurances, consultancies), (3) with significant exposure to ongoing or recent modernization initiatives, and (4) of the elderly population, mainly in the transition age.

Our sampling strategy ensured to include participants with variation regarding organizational contexts, roles, and years of experience. Thus, we ensure theo-

retical relevance and variation, rather than statistical representativeness. Table 1 provides an overview of our interview partners.

iven the sensitivity of organizational change contexts, particular care was taken to ensure confidentiality and anonymity. Table 5.3 provides a full version of the questionnaire translated to English, which we structured around the following three main areas:

- Path dependence (e.g., legacy systems, technological lock-in)
- Psychological contract perceptions (e.g., expectations, perceived contract breach, organizational support)
- Responses to modernization pressure (e.g., disengagement, acceptance)

With each interview partner we conducted one session lasting about 23 to 48 minutes. All of the interviews were conducted in German, recorded with participant consent and transcribed verbatim using GenAI-powered transcription tools (Microsoft Teams). All participants in advance were informed about the purpose of the study and provided consent for recording and anonymized use of their data.

3.3 Data Analysis

We analyzed the data using the Gioia methodology [13], which is well-established for inductive concept development in IS research.

The analysis was carried out in three stages. We began with open coding, closely examining interview transcripts and coding concepts using participants' own terminology (in vivo codes). One member of our research team independently performed this coding step. This stage resulted in a large set of first-order concepts capturing participants' experiences. Afterwards, we discussed the set of first-order concepts within the researcher team to establish a common understanding.

In the next step, we engaged in axial coding, grouping first-order concepts into theoretically meaningful categories. Here, we iterated between data and the theoretical lenses (PDT and PCT). This step reflects the transition from informant-centric to researcher-centric interpretation. Finally, second-order categories were distilled into aggregate dimensions, forming the basis of the theoretical model (see Figure 1). We provide an overview of the resulting data structure in Table 2.

These dimensions were then integrated into a process model (see Figure 1) explaining how structural constraints and perceived contract violations jointly shape resistance or engagement, and thus work satisfaction and well-being of senior mainframe experts.

We included review sessions within the researcher team, to ensure rigor and validate the coding of first-order concepts, axial coding, and the second-order concepts.

Table 2. Data structure obtained from the analysis of the interviews.

First-Order Concepts	Second-Order Categories	Aggregate Dimensions
Existence of Critical Junctures Non-Existence of Critical Junctures	Critical Juncture	Path Dependence
Risk Aversion Focus on Business Topics	Organizational Inertia	
System Interdependencies Legacy Constraints	Structural Barriers	
Knowledge Outside of Organization Lack of Investment	Economic Barriers	Lock-In & Switching Costs
Containerization Change of Programming Language Change of Database AI for Analysis	Technical Drivers	Modernization Pressure
Replacement of Mainframes Demographic Change	Structural Drivers	
Loss of Value Unmet Expectations Devaluation of Expert Identity	Perceived Contract Breach	Psychological Contract Breach
Curiosity / Interest In Modernization Working According to Client Requests	No Perceived Contract Breach	
Disengagement Statements Poor Communication	Psychological Withdrawal	Resistance / Withdrawal
Inconsistent changes of decisions Unclear or volatile Modernization Strategy	Behavioral Consequences	
Growing Skill Gap Loss of Knowledge Poor Communication	Organizational Challenges	Design Interventions

4 Results

We present the resulting tentative process model as emerged from the data analysis in Figure 1 in subsection 4.6.

We empirically derived the constructs of our proposed model from the analysis of the interviewees' statements as described in the previous section 3.3. In the following, the most relevant coded statements of the interviewees I1-I6 backing each construct are cited (including the German original as well).

4.1 Path Dependence: The Persistence of Historical Trajectories

Path dependence in the mainframe sector is defined by decades of "wild growth" and technical debt that constrain contemporary strategic options. The findings suggest that historical decisions, which often prioritized immediate functional needs over long-term technical health, have cemented a restrictive developmental path.

- **Monolithic Evolution:** **I6** characterizes the legacy environment as *"simply still a large monolith that was never really broken up"* / *"es ist halt immer noch ein großer Monolith, der halt niemals richtig aufgebrochen wurde"*. **I6** notes that *"there are simply no clean interfaces, no pure separation"* / *"Es gibt halt keine sauberen Schnittstellen, keine sortenreine Trennung"*. **I4** adds that this resulted in a *"relatively large wild growth of systems that were inhomogeneous"* / *"relativ große[r] Wildwuchs entstanden von Systemen, die inhomogen waren"*.
- **Accumulated Technical Debt:** **I2** identifies the depth of this path, stating *"there are, of course, in the software development lifecycle truly completely 40-year-old technical debts"* / *"es gibt natürlich auch im Software Development Lifecycle wirklich komplett 40 Jahre alte technische Schulden"*. **I1** observes that a *"concentration on the functional aspect has prevented changes... Technically, nothing was touched anymore"* / *"Konzentration auf die fachliche, auf die Fachlichkeit hat Veränderungen verhindert... Technisch hat man nichts mehr angefasst"*.
- **Missed Turning Points:** Experts identify specific "critical junctures" where the path could have been altered. **I6** admits *"there, one could and should have turned off differently in between"* / *"da hätte man zwischendurch mal anders abbiegen können und sollen"*. **I5** attributes these missed opportunities to conservative risk management, stating *"the majority of missed opportunities is due to risk management, that the decision against modernization was made"* / *"Der Großteil der... verpassten Chancen ist auf... ein Risikomanagement zurückzuführen, dass... die Entscheidung gegen eine Modernisierung getroffen worden ist"*.

4.2 Lock-In & Switching Costs: Structural and Economic Barriers

The logical consequence of path dependence is a profound "Lock-In" effect, where the structural and economic costs of switching to a new platform are prohibitively high.

- **Proprietary and Data Anchors: I3** highlights the depth of these dependencies: *"Data dependencies. You can't replace that within 5 years" / "Datenabhängigkeiten. Das kannst du nicht innerhalb von 5 Jahren ablösen"*. I3 argues that claiming platform independence is often *"more or less lying to your own pocket" / "mehr oder weniger in den eigenen Sack lügen"*. I2 points to *"IBM dependence" / "IBM-Abhängigkeit"* and notes that *"proprietary protocol is in use" / "proprietäre Protokoll im Einsatz"*.
- **The Reproduction Hurdle: I1** explains the massive initial effort required: *"if you want to replace an application... you have to first reach these 100 functions before you can even replace it" / "nehmen wir mal an, du willst 'ne... Anwendung ablösen... dann musst du erstmal diese 100 Funktionen erreichen, damit du überhaupt ablösen kannst"*. I7 adds that obtaining funding for pure modernization without functional changes is often difficult: *"Once I even managed to get a budget for it, but before we could start to spend it, it was already cut again" / "Ich habe sogar schon einmal geschafft, ein Budget dafür zu kriegen, aber noch bevor wir anfangen konnten, das auszugeben, war es schon wieder gestrichen."*
- **Risk of Failure ("The Half-Repaired Car"):** I1 warns of the added complexity of failed transitions: *"Risk of modernization is always that the project fails. That you've started and somehow stand around with such a half-repaired car" / "Risiko einer Modernisierung ist immer, dass das Projekt scheitert. Dass man angefangen hat und irgendwie mit so einer halb, mit so einem halb reparierten Auto in der Gegend rumsteht"*. I1 adds, *"Then it only gets worse. The applications become worse and worse because more and more technical components are added" / "dann wird's nur schlimmer. Also die Anwendungen werden immer schlimmer, weil immer mehr technische Komponenten dazu kommen"*. I5 summarizes the operational worry as *"the worry that the modernized function... behaves differently than the original application" / "die die Sorge, dass sich die die modernisierte Funktion... anders verhält als als die Ursprungsapplikation"*.

4.3 Modernization Pressure

Organizations frequently try to break the lock-in through modernization efforts, using various strategies. The main drivers for modernization are cost reduction, new regulatory requirements and a declining number of experts.

I6 points out that *"The pressure became significantly higher. We need to do many more things with fewer people. [...] I guess, all from the financial sector will have told you how high the regulation pressure from BaFin has become. We need to deal with many things nobody has spent a single thought on 20 years ago."* / *"Der Druck ist erheblich höher geworden. Also müssen wir mit viel weniger Leuten viel mehr Dinge bewirken. [...] Ich denke mal, alle aus der Finanzbranche werden erzählt haben, wie hoch der Regulierungsdruck geworden ist seitens der BaFin. Da müssen wir uns mit sehr vielen Dingen beschäftigen, für die es vor 20 Jahren nicht mal den quasi einen einzigen Gedanken über gab."*

I7 sees cost reduction as the main reason for modernization pressure: *"For us it is mainly financially driven. It is about cost reduction."* / *"Der ist bei uns hauptsächlich finanziell verursacht. Also es geht um Kosteneinsparung."*

4.4 Psychological Contract Breach: Devaluation of Expert Identity

When organizations attempt to break the lock-in through modernization, they often trigger a "Psychological Contract Breach" by devaluing the "lifetime's work" of long-tenured experts.

- **Insulting Legacy Contributions:** **I1** observes that *"many modernization programs start by saying everything that was before is bad... That insults those who put their lifetime's work into it"* / *"viele Modernisierungsprogramme fangen damit an, alles was früher war, ist schlecht... Das beleidigt diejenigen, die da ihre Lebensarbeitszeit reingesteckt"*. **I1** emphasizes that *"people want to have appreciation"* / *"Menschen wollen Wertschätzung haben"*.
- **Personalization of Change:** **I6** explains that technical updates are often perceived as personal critiques: *"those people... see a change of things... not as a reassessment... but as a critique of a former decision... and then it often gets into a personal level"* / *"diejenigen Menschen, die eine Veränderung von Dingen... nicht als Neubewertung einer damaligen Entscheidung ansehen, sondern als Kritik... und das dann auch persönlich, also oftmals in eine persönliche Ebene reingerät"*. **I6** notes that experts often feel a *"personal attack on his competencies"* / *"persönlichen Angriff auf seine Kompetenzen"*.
- **The Appreciation Gap:** **I2** suggests that management may not realize the breach is occurring: *"it's not necessarily the great appreciation... but maybe that wasn't so really transparent that one needs that"* / *"ist jetzt nicht unbedingt gerade die große Wertschätzung... Aber vielleicht war das auch nicht so richtig transparent, dass man das braucht"*.

4.5 Resistance / Withdrawal: Behavioral Consequences

The final stage of this chain is the manifestation of resistance or withdrawal—behavioral responses to structural barriers and perceived psychological breaches.

- **Active Persistence and Fear:** **I4** identifies a fundamental *"Persistence. So, the human as such is very resistant to changes"* / *"Beharrungsvermögen. Also, der Mensch als solcher ist sehr resistent gegen Veränderungen"*. **I3** attributes this to *"fear for one's job"* / *"Angst um einen Arbeitsplatz"* and *"fear of contact, that one might not be able to learn things"* / *"Berührungssängste, dass man möglicherweise Dinge nicht erlernen kann"*.
- **Passive Withdrawal and Fatigue:** **I6** describes a sense of exhaustion: *"some older colleagues are also simply tired"* / *"Manche ältere Kollegen sind auch einfach müde"*. **I5** adds that for these individuals, *"the motivation of modernization... is not necessarily pronounced"* / *"Die die Motivation"*

der Modernisierung... Nicht unbedingt. Ausgeprägt ist". **I7** points out that for many older experts, the motivation for modernization is not convincing: "There mostly sit people working with the mainframe as long as I or even longer. They see mainly the positive aspects of the mainframe. [...] Of course, one then says do I really need to change something, which afterwards becomes slower, less stable?" / "da sitzen Leute, die so lange wie ich oder noch länger mit dem Mainframe zu tun haben. Die jetzt vor allem einmal die positiven Sachen von Mainframes sehen. [...] Natürlich sagt man dann eh dazu, brauche ich da jetzt irgendwas umstellen, was noch verlangsamer, instabiler ist?"

- **Demographic Exit:** This withdrawal is cemented by the "demographic change" / "demografische Wandel". **I3** notes it is "becoming increasingly difficult with less and less personnel and one no longer gets personnel" / "wird immer schwieriger mit immer weniger Personal und man kriegt kein Personal mehr". Consequently, **I6** concludes, "The pressure has become significantly higher. So we have to achieve many more things with much fewer people" / "Der Druck ist erheblich höher geworden. Also müssen wir mit viel weniger Leuten viel mehr Dinge bewirken".

Thus, from the qualitative empirical data collected, we were able to derive a tentative causal model (see Figure 1) describing, how legacy modernization efforts in organizations affect the job satisfaction and the general professional well-being of long-time mainframe experts (RQ1), and their resistance or engagement with respect to such efforts (RQ2). In particular, evidence was gained that path dependence creates a structural lock-in, which, under modernization pressure, triggers psychological contract breach, resulting in resistance or withdrawal unless mitigated by inclusive modernization practices.

4.6 Proposed Process Model

We derive a tentative causal process model (see Figure 1) from our empirical study, describing how resistance or engagement are shaped not only by structural inertia but also by perceived shifts in professional identity and value.

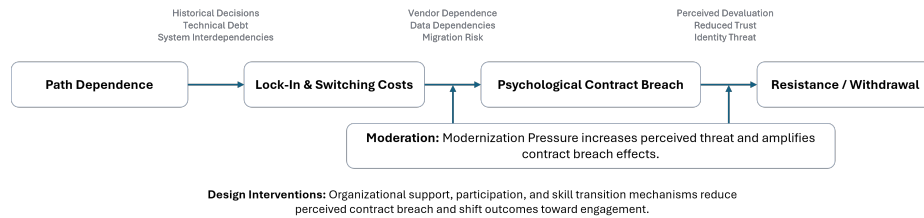


Fig. 1. Proposed Process Model of Modernization Resistance in Legacy Contexts

Path dependence represents the accumulated effect of historical technology decisions, organizational routines, and long-standing system architectures. Interviewees consistently described legacy environments as the result of decades of incremental extensions, technical debt accumulation, and missed opportunities for architectural renewal. This contributes directly to lock-in and high switching costs. Participants emphasized that extensive system interdependencies, proprietary technologies, data dependencies, and the risk of business disruption make modernization complex and costly.

When organizations attempt to overcome this lock-in through modernization initiatives, employees experience increasing modernization pressure. Interviewees reported that modernization efforts are often accompanied by expectations to learn new technologies, adapt established work practices, and support transformation programs while continuing to maintain existing systems.

Consequently, structural constraints generated by path dependence intensify the perceived pressure associated with modernization.

Further, the respondents frequently reflected on whether modernization initiatives acknowledged their past contributions, respected their expertise, and provided fair future career perspectives. If modernization initiatives are perceived as devaluing accumulated expertise or neglecting employees' expectations, a psychological contract breach may occur. Multiple interviewees described modernization narratives that implicitly portrayed legacy systems as outdated or deficient, which they experienced as a devaluation of their lifetime work and professional identity.

The resulting contract breach shapes the individual's change response. Participants reported several forms of resistance, including active skepticism, reluctance to adopt new technologies, reduced motivation, and psychological withdrawal.

Our findings also reveal an important moderating mechanism. Modernization design practices, such as transparent communication, recognition of existing expertise, participatory decision-making, training opportunities, and hybrid transition approaches, can weaken the negative effects of modernization pressure and perceived contract breach.

5 Conclusion

5.1 Theoretical Implications

A central theoretical contribution of this study lies in its rare empirical access to a population that has remained largely underrepresented in IS research: experienced mainframe experts. While much of the digital transformation literature relies on surveys, managerial perspectives, or generalized IT roles, our study draws on in-depth accounts from "real" legacy system experts who have spent decades maintaining mission-critical infrastructures. This allows us to surface nuanced, experience-based insights into how modernization initiatives are perceived, interpreted, and enacted at the operational core of organizations.

It also became clear from the interviews, that this specific target group due to their technological background is more open regarding new technologies compared to what has been previously observed for transition agers of the average population [8, 9].

Although prior research has treated technological lock-in and employee resistance as largely separate phenomena, our findings demonstrate that they are deeply intertwined. Structural constraints embedded in legacy architectures (e.g., rigid dependencies, risk sensitivity, regulatory demands) not only slow down technological change, but also shape how employees perceive organizational intentions. At the same time, perceived breaches of psychological contracts—such as the devaluation of long-standing expertise or uncertainty about future roles—intensify resistance behaviors. By integrating PDT and PCT, we provide a more holistic framework that captures both the material and interpretive dimensions of modernization. Thus, we are, to the best of our knowledge, the first to integrate the two theoretical perspectives of PDT and PCT for research on mainframe experts.

5.2 Practical Implications

This study makes tacit knowledge from experienced mainframe experts in modernization contexts accessible to a broader practitioner audience. It highlights that resistance is often rooted in professional identity concerns and perceived loss of value, rather than simple opposition to change. Practitioners can use these insights to better interpret and respond to employee reactions during transformation initiatives, ultimately to support employee well-being. This incorporates socio-technical considerations, emphasizing the need to align architectural change with workforce expectations and professional identities.

Our study translates these experiences into clear themes and an applicable process model. This helps managers anticipate typical responses, such as disengagement triggered by perceived contract violations, and adjust their strategies accordingly through more inclusive and transparent change processes.

5.3 Limitations and Future Research

One of the limitations stems from the used theories. While we chose PCT and PDT as our theoretical lense, other possible explanations for the interplay of resistance and modernization pressure regarding legacy information systems are possible. Future research could study alternative theoretical explanations for the phenomena at hand.

Further, another limitation of our study is the interview sample. While we carefully constructed the sample to derive rich insights from it for our exploratory study, one could imagine extensions of the sample going beyond our context of mainframe experts in the financial sector.

Furthermore, future interviews could broaden or sharpen the focus of the modernization approaches, e.g., highlighting AI or XAI-based modernization approaches [16], as AI [26] and XAI [27] use is widespread in the finance sector.

Appendix A: Full Interview Questionnaire (translated)

Section	No.	Topic	Questions / Guiding Questions
Introduction & Context	1	Professional Background	Since when have you been working with mainframe systems? What is your current role in the company?
	2	Context of Change	What modernization initiatives are you currently experiencing (e.g., cloud, APIs, microservices)? How would you describe the pressure to modernize?
Path Dependence Theory (PDT)	3	Historical Development	How has the IT landscape in your company evolved over the years? Which past decisions have particularly shaped your current system landscape?
	4	Lock-in & Path Dependence	Where do you see strong dependencies on existing systems/technologies today? What makes it difficult to deviate from established solutions?
	5	Critical Events (Critical Junctures)	Were there moments when technological change would have been possible? What factors prevented or enabled change at that time?
Psychological Contract Theory (PCT)	6	Expectations & Commitment	What unspoken expectations do you have toward your employer regarding your role and future? To what extent do you feel valued as a mainframe specialist?
	7	Change as Contract Breach?	Do you perceive current modernization initiatives as a breach of your expectations or contributions? Are there aspects that feel unfair or uncertain?
	8	Trust & Communication	How transparently is modernization communicated in your company? How does this influence your trust in management decisions?
Resistance vs. Modernization Pressure	9	Perception of Resistance	Why do you think some colleagues resist modernization? To what extent does this also apply to yourself?
	10	Motivations & Fears	What concerns or risks do you associate with modernization? Where do you see personal opportunities?
Design of Modernization (Design Perspective)	11	Success Factors	What would need to happen for you to actively support modernization? Which measures would increase your motivation and engagement?
	12	Competence & Identity	What role does your existing expertise play in your professional identity? How can this identity be preserved in a modern IT environment?
	13	Concrete Design Ideas	What forms of training, involvement, or transition models would be useful? How could modernization be designed without devaluing existing expertise?

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