Tensions in Digitalization in Higher Education: Learning from the Past to Guide Digital Transformation

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***Abstract*—This study examines the critical role of university IT departments in the digital transformation of higher education institutions. Despite their expertise, these departments often face challenges in facilitating digital transformation. Through a historical case study of a prominent research university, this paper explores the evolution of technology and organizational logic within the university's IT governance and its shortcomings in supporting digital transformation. It presents an in-depth analysis of the co-evolution of technological advancements and the organization responsible for technology support and maintenance. The paper traces the transition from the early era, dominated by academic logics, to contemporary IT organizations driven by bureaucratic and internal market logics. It further investigates the preference for specific technological solutions under different organizational logics. Crucially, the paper highlights a misalignment between the traditional logic of IT organizations and the demands of digital transformation, demonstrating that conventional IT approaches and logics are insufficient for addressing the challenges of digital transformation.**

I. Introduction

At the heart of the fourth industrial revolution, digital technologies are fueling a global surge in efficiency and innovation and reshaping the fabric of industries, including the realm of higher education. This transformative wave, characteristic of Industry 4.0, heralds a new era where academia must adapt or risk obsolescence. Despite coping with high costs and traditional operational methods, higher education institutions stand at the forefront of shaping societal changes, underscoring their indispensable role in the fabric of society. Historical approaches in higher education have shown resistance to technological advancements, with initiatives like MOOCs failing to achieve the transformative impact they promised [1-3]. The COVID-19 pandemic has further underscored the urgency for digital transformation in higher education, presenting a crossroad for institutions in determining their future approach [4-6]. External pressures, such as the need to be perceived as modern, cope with rapid technological changes, and address new demands like lifelong learning, diversity, and inclusion, add to the complexity of digitalization in higher education. However, obstacles like institutional resistance to change, integration issues, and cybersecurity concerns make this transition challenging. Despite these hurdles, the potential benefits of digitalization are widely recognized, prompting strategic and adaptive efforts to overcome them [7].

Higher education institutions, like many other organizations, struggle with digitalization, often treating it as a purely technical task while viewing business development as separate, centered around process enhancement, making digitalization the realm of the IT department due to its technical expertise and role as the organization's IT provider. Assigning digitalization to the IT department typically indicates a perception within the business that digitalization is separate from other business operations. This narrow technical focus frequently results in solutions not aligning with or improving the targeted business processes and operations. This issue arises from a segmented approach to digital transformation that focuses on specific technologies or limited organizational aspects like processes, culture, and strategy [4, 8, 9]. A broader approach is necessary to fully leverage the diverse impact of digital technologies across the organization [4]. Central to this transformation is the need for a holistic approach that transcends mere technological adoption. To fully leverage the potential of digital tools, higher education must reimagine its business models, educational delivery, and administrative processes. This means integrating digital technologies into the core of institutional strategy rather than treating them as peripheral add-ons [7].

The rapidly growing field of digital transformation and digitalization within organizations has garnered significant attention in recent academic literature. Scholars [10-14] have delved into identifying the essential capabilities and practices that organizations must cultivate to digitalize their processes or undergo a digital transformation successfully. A common thread in these studies is the emphasis on the necessity for organizations to possess the agility to adapt and evolve rapidly in the face of digital change. This need for adaptability is particularly poignant in the context of higher education institutions, which, as highlighted by Magnusson, Kizito and Nilsson [15], Liljeblad, Lilliesköld and Hetemi [16] often find themselves underprepared for the challenges of digitalization and digital transformation.

Central to this discourse is the role of IT governance. Weill and Ross [17] underscore the significance of effective IT governance, deeming it the most crucial predictor of the value an organization derives from its IT investments. Supporting this view, Bowen, Cheung and Rohde [18] identify critical elements for delivering IT business value, including the creation of a shared understanding of business and IT objectives, active involvement of IT steering committees, a balance of business and IT representatives in decision-making processes, and the development of comprehensive, well-communicated IT strategies and policies. Going forward, we define IT governance as “IT governance is the preparation for, making of and implementation of IT-related decisions regarding goals, processes, people and technology on a tactical or strategic level” [19].

This paper aims to explore the intricate interplay between the evolution of digital technology and the organizational structures that have emerged to govern, maintain, and support this technology. By examining the historical developments in digital technology and technology governance, the paper seeks to unravel how these developments have shaped the prevailing logics of IT governance. Furthermore, it investigates the ways in which these logics influence an IT department’s capacity to facilitate digitalization effectively. This exploration is critical in understanding the dynamic relationship between technological advancement and organizational adaptation in the digital era. This is done by investigating the question, "How have historical developments in digital technology and technology governance shaped the prevailing logics of IT governance, and in what ways do these logics influence an IT department’s ability to facilitate effective digitalization?"

II. Conceptual Background

In this paper, we draw from the "Structurational Model of Technology" [20], which creates an interrelationship between human agents, technology, and institutions (See Fig 1). Where "(a) technology is an outcome of such human action as design, development, appropriation, and modification," but also that "(b) technology facilitates and constrains human action through the provisions of interpretive schemes, facilities, and norms." “(c) Institutional properties influence humans in their interaction with technology…" and the that "(d) Interaction with technology influences the institutional properties of an organization …".

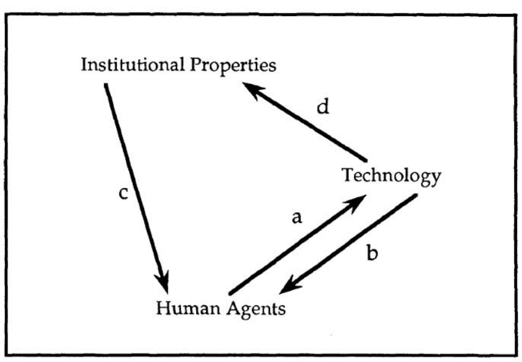

Fig. 1. Structurational Model of Technology [20]

A. Institutional Complexity and institutional logics

The institutional properties represent the culture, values, and structures and are conceptualized within the institutional theory framework. Institutional theory has seen a lot of development since its conception in the late 1940s with the work of Selznick [21] dealing with the role of institutions in society and later developed into the new institutionalism by DiMaggio and Powell [22] and Meyer and Rowan [23] focusing on culture and cognition in the study of institutions. Friedland and Alford [24] state that Western society has *"a set of material practices and symbolic constructions – which constitutes its organizing principles,"* i.e., an institutional logic. Thornton and Ocasio [25] have extended this concept and define institutional logics as "*the socially constructed, historical pattern of material practices, assumptions, values, beliefs, and rules by which individuals produce and reproduce their material subsistence, organize time and space, and provide meaning to their social reality*." With this definition, we have a relationship between individuals' agency and the socially constructed institutional structures.

III. Method

To study the implications of historical developments of digital technology and technology governance and how they have shaped the prevailing logics of IT governance, an inductive approach was taken using an explanatory case study [26] to study the parallel development of technology and culture over time. The case study methodology allows for an in-depth examination of the specific context, which allows for deep understanding of the complex dynamics at play as well as creating a nuanced contextual understanding of the factors that have shaped the university’s approach to digital technology and IT governance.

The use of a single holistic case approach is motivated by several factors: The single case study allows for a longitudinal [26] approach of studying the development of the case at several points in time and observing the changes; the single case here is also a common case [26], since the development studied is one of many higher educational institutions existing in the same regulatory environment, the single case also allows for a deep holistic understanding of complex organizational processes [27] and a contextual analysis which is difficult to achieve in a multiple case study.

The case selection criteria were to select a large national higher education institution with a long-documented history of computer use. There are several Swedish higher educational institutions that have pioneered computer use in education and research. After evaluation, the institution selected was the Royal Institute of Technology in Stockholm, Sweden, where the first Swedish computer was built. There was also ample documentation available from both primary and secondary sources.

The research question posed is, “How have historical developments in digital technology and technology governance shaped the prevailing logics of IT governance, and in what ways do these logics influence an IT department’s ability to facilitate effective digitalization?" To investigate this within the case study framework, the following case study questions were asked: “What digital technology has been used within education, research, and administration at KTH?”, “How has the technology been governed?”, "What work organizations have been established for the digital technology?", and “What has been the aim of each?” With these questions, we can begin to deduce the historical development of the logics governing IT governance and extrapolate what these mean for the organization's ability to face the current demands of digitalization.

The Royal Institute of Technology (sv. Kungliga Tekniska Högskolan, referred to as KTH) is Sweden's largest technical university. Located in the Stockholm region with currently five campuses, 5000 employees, and 14 000 full-time equivalent students. The case was selected for two reasons: Firstly, the studied university was, if not the first, one of the first universities in Sweden to develop computer technology and has since been at the forefront of the area. Second, it is a representative setting for examining the evolution of IT governance due to its long-documented history and complex organizational structure.

The historical development has been studied using archival studies of documents such as decisions, protocols, and reports from the time studied, as well as contemporary historical summaries and documented witness interviews. This data has also been enriched by current interviews with people who had key roles in the development of the technology and organization.

TABLE I. PRIMARY SOURCES

Document Source	Years	Nr. of documents
Protocol from the Computer Committee	1977	1
Protocols from the Computer Council	1979-1993	79
Protocols from the IT Council	1997-1999	14
Internal IT management memorandums	2009-2022	335
Organizational decisions on establishing the different governance groups	-	15

TABLE II. INTERVIEWS

Interview sources	Active years
School IT manager	2003-2023
University IT manager	2000-present
University IT manager	1996-2000
Department IT-responsible	1982-2019
IT-technician	1993-present
Pro-rector and head of the Computer- and IT Council	1992-2000
IT-project manager	1981-present
Head of the computer group and secretary of the Computer- and IT Council	1988-2008

Summary of secondary sources:

- Historical review of computer usage at the case university [28]
- Historical essay on computer usage at a department of the case university [29]
- Historical review of the Internet in Sweden [30]
- Witness interviews and reports from the project "From Computing Machines to IT" [31]

The period from 2000-2009 to the present has been reconstructed from the interviews and internal memorandums since no formal protocols exist within the archives.

The interview selection was based on people identified from the written sources as having decision-making roles or having been part of larger changes. This selection was made to achieve as broad a picture as possible over the time span, especially in the period 1990-2000 when a significant shift in IT was made (see case description). Some people who had key positions during the time are now deceased, and second-hand sources must induce their contributions and motivations.

The analytical methodology employed in this study was designed to ensure a rigorous and comprehensive understanding of the historical evolution of events and the underlying institutional logics. This process was executed in a systematic, multistep approach, with each phase building upon the preceding one to construct a robust and detailed historical narrative.

The interviews (table II) were semi-structured interviews [32] based on an interview protocol covering the interviewees' roles and responsibilities over time. The semi-structured format also allowed for follow-up questions to explore events in-depth. Each interview ranged between 90 to 120 minutes. The interviews were recorded and then transcribed using AI speech-to-text and manually reviewed and corrected for accuracy. Both the interviews and primary document sources were imported into the NVivo software for processing. To catalog the historical events over time to create a timeline the software “Aeon Timeline” was used. The study was conducted over the time period of August 2023 to January 2024.

Initially, the analysis focused on establishing a detailed historical timeline, delineating key events and organizational changes. This phase involved an extensive coding of primary and secondary sources, cataloging every mention of technology, projects, organizations, governance models, and their corresponding time. To ensure the accuracy and reliability of this timeline, a method of data source triangulation was employed, integrating the coded findings with the written sources and interviews. This approach, grounded in the methodologies advocated by [33, 34], provided a robust framework for establishing a chronological order of events.

Subsequently, the analysis progressed to the second phase, which aimed at contextualizing the events within the established timeline. This phase was pivotal in uncovering the prevailing institutional logics - encompassing material practices, assumptions, values, beliefs, and rules - that influenced and motivated these events. Events were grouped by decade to facilitate a more manageable and meaningful unit of analysis. Each event, characterized by organizational changes or technological implementations, was then meticulously examined to discern the underlying rationale. This examination primarily relied on an analysis of protocol and decision documents, supplemented by interviews, to validate or amend the inferred motivations. In the final stage of this phase, the contextualized events were reinterpreted through the lens of institutional logics specific to higher education [35].

This methodological approach, characterized by its systematic and multi-layered analysis, results in a comprehensive and in-depth understanding of the historical events under study and the institutional logics that has shaped them.

IV. The Case

The Royal Institute of Technology (sv. Kungliga Tekniska Högskolan, referred to as KTH) is located in the Stockholm region and currently has five campuses, 5000 employees, and 14,000 full-time students. The university is Sweden's largest technical university. It was established in 1827 as a technical institute and was awarded university status in 1877. The university is a single-faculty research university with 2/3 of its funds dedicated to research.

The case will be described with the two parallel developments of technology and the organization of technology, starting with the first computers used by the university from 1950 to 2020. The core of the data for the historical development is based on the report by Graham and Sundblad [28], who were driving forces of computer usage in the university.

Sweden realized in the wake of the Second World War that the nation had a use for computers, inspired by the American development of ENIAC and similar computers. The computers were intended for military use, for example, ballistics calculations, as well as researchers with massive computational needs, such as meteorologists, chemists, etc. [28]. After the negotiations with the US to purchase a computer stranded, Sweden decided to initiate its own computer program to develop and build a computer. An organization was set up in 1948 to manage this program called the Mathematics Machine Board (sv. "Matematikmaskinnämnden"). The first computer developed was the BARK – Binary Automatic Relay Calculator (sv. "Binär Automatisk Relä-Kalkylator"). It was finished in 1950 and was built using mechanical relays, inspired by the Harvard Mark II, since electrical vacuum tubes were not available for the Swedish market at the time. It was superseded by a fully electronic computer in 1953, the BESK (Fig. 2) – Binary Electronic Sequence Calculator (sv. "Binär Elektronisk SekvensKalkylator"), sporting the world's first "hard drive" based on a drum memory of 20 Kilo Bytes. The design of BESK was inspired by the IAS machine (von Neumann machine).

Fig. 2. BESK (Museum of Technology, Sweden (CC BY 4.0))

Mathematics Machine Board was initiated and funded by the Swedish government and staffed by members from the Navy and the Royal Institute of Technology. The machines were designed and built by staff from the university. The organization around the computer design and operation was based on highly skilled researchers and PhD students.

This was the first part of the computer pioneering era, where researchers constructed and built computers as research infrastructure. The BARK was in use until 1955 and BESK to 1966. At the end of the 1950s, there were four computers available to researchers at KTH [28].

As one of the pioneers of the BESK machine stated, the need for computers would be ever-increasing:

"When the electronic numerical machine Besk was being planned, many believed that such a fast machine would solve all of Sweden's numerical problems within fourteen days and that it would only be used occasionally thereafter. This prediction has proven to be completely incorrect: since Besk was put into use in December 1953, it has increasingly been used by industry, defense, and universities." - Germund Dahlquist, 1956

The early 1960s saw the introduction of commercially available computers and the start of shared computer centers. In 1965, the Uppsala Computer Central (UDAC) was the first regional data central to be established and provided researchers with access to newly acquired Control Data CD3600 mainframe computers. At the same time, the Defense Research Agency (FOA) and KTH jointly acquired an IBM 7094 computer. These computers were based on batch processing of punch cards.

In 1967 KTH purchased its first commercial computer, a Control Data 3200, to be used for the newly started education in "Administrative data processing" (sv. Administrativ databehandling ADB) that was given jointly with Stockholm University.

In 1968, the Stockholm Regional Data Central (QZ) (Fig. 3) was established, and the first computer resource offered was an IBM 360/75. The primary users for the data central were the large Stockholm universities and the defense research agency.

The regional computer centers were staffed with personnel dedicated to maintaining and running the advanced machines. The focus was as much on the technical machinery as their application to use cases.

After the regional data centers were established, the Swedish government declared that all academic computer use was to be organized within the regional data centers. In practice, this creates a computing monopoly and blocked academic institutions from purchasing new computers. The situation was not ideal since the available computer time at the data centers was insufficient for the ever-increasing need for computation. Universities were instead forced to purchase computer time from, for example, the industry to satisfy its needs. Technological development was also a factor. In the US, Stanford and MIT were now working with interactive computing using time-sharing on Digital Equipment DEC-10 machines. The resulting pressure from the Stockholm universities to stay current resulted in QZ acquiring a DEC-10 in 1973.

KTH introduced a mandatory course in computer programming for all students of master of science in engineering programs in 1970. The programming was done via punch cards submitted for batch computing on the IBM360/75 computer at QZ. At that time, KTH had high-speed terminals that read the punch cards and produced the output onto line printers.

The limited time on the interactive computers caused KTH to break the government-mandated computer monopoly by buying an HP2000A minicomputer for use in education with BASIC programming.

This was followed by several more purchases of computers for research and education in 1972 and 1975, two PDP-11/45 computers were purchased for electrical engineering education and research, and in 1979 and 1983, three Digital Equipment (DEC-2020, DEC-20) were installed to support the new masters program in computer science. This ended the regional data centers' monopoly on computation.

In 1975, the university created the first governing body for computers named the Computer Council (sv. Datorrådet). Its first task was to coordinate the university's time-sharing of computations, both within the university and with the external parties with which the computers were shared. The council members were the users of the regional data centers (approx. 20 people).

The purchase of computers for the university also introduced the first people at the university employed solely to maintain computers. These new computer technicians were employed in the academic groups. Up until this point, the computer systems at the university were run by academic staff, such as professors or PhD students.

In the late '70s and early '80s, computers were starting to be used for administrative tasks such as payroll and accounting. The first purely administrative system was an ND-100 system from Norsk Data acquired by the Department for Mining Engineering. These systems were used to prepare data for the national systems that managed payroll and accounting for the whole government sector via DAFA (The Computer Center for Administrative Data Processing).

Fig. 3. QZ (Photo: Gullers, Peter / The Nordic Museum, Sweden (CC BY-NC-ND))

One of the large projects undertaken by the Computer Council in the early '80s was the build-out of a university-wide terminal network (KTHNET). The network allowed terminals to connect to almost any other computer at the university. At its peak, the network had approximately 2000 connected computers.

The 1980s saw a vast expansion of computers in education and research through the introduction of the personal computer, first via expensive workstations and later with the IBM PC and the Apple Macintosh. Several computer labs were built, and the number of computers grew enormously.

In the mid-'80s, the terminal networks were being replaced with data networks. Several standards were used in parallel, such as TCP/IP, DECnet, X.25, and BITNET—first over specific physical interfaces but standardized on Ethernet. The new network, KTHLAN, connected all the university's academic departments and made the first connection to the Internet.

This vast expansion required new structures to steer and support the computers and their usage; the first structure was established in the early '80s when The Computer Council was remade as a strategic steering group with representation from the departments, support organizations, and staff appointed by the university rector. This group identified and funded development projects, such as new computer networks.

A new group, the Computer Coordination Group, was also created to manage the tactical planning of computers and computer networks, with attached reference groups for computer use in education, research, and administration. A separate group, The Computer Secretariat, was also created to maintain the university's shared computer network, administrative systems, and university shared computer labs.

Also, during the mid to late '80s, several departments with high computer usage started to create groups of people to manage the many computers and computer systems. This saw a shift from single individuals tasked with the upkeep of a computer system to groups of people responsible for a department's use of computers. This also saw the first managers in this area since the groups needed a manager.

In the late '80s, the structure was remade again, having found that the coordination between the strategic and tactical groups was lacking. The new group was named The New Computer Council and replaced both the Computer Council and the Computer Coordination Group. The group was tasked with the educational and research needs of computing infrastructure. The introduction of information systems such as Gopher and the World Wide Web also added to the shared infrastructure.

The Computer Secretariat was replaced with a new Data Administrative Agency responsible for administrative systems, terminal networks, and telephony networks.

The '90s saw a shift in the organization's focus from building computer infrastructure for research and education to focusing on the administrative use of computers and supporting the increased use of computers by staff and students. Students had previously used computers in the context of coursework in computer labs. With the prevalence of personal and home computers, students used computers in other contexts. To help students with computer use, projects were started to create help desks where students and staff could turn to get help with their computer usage. The university also started distributing CDs to students with most of the software needed for education. Each helpdesk specialized in the computer systems that were dominant for the department, for example, Sun Solaris and Apple Macintosh for computer engineering, DEC Unix for electrical engineering, and Microsoft Windows for most other departments.

The regional data center for Stockholm (QZ) was decommissioned in the early 90s, replaced with the university's own computers, and by investments in supercomputers for high-performance computing.

From 1994, the Data Administrative Agency was incorporated into a new organizational unit called Technical Service, which was responsible for all infrastructure support, such as facilities, book printing, IT, and so on. The new unit responsible for common IT infrastructure and administrative systems was named the Technical Service Computer Department or, for short, TS-Data.

In the late '90s, an extensive overview of the IT organization was made using an external consulting company, which recommended creating a new IT council with full responsibility for the organization's IT development, reporting directly to the university management team. To deliver on the projects decided by the IT council, a separate group, the IT office, was created as a project coordinating organization, commissioning projects from the different IT groups within the university.

During the mid-'90s, the national government stopped providing government agencies with payroll and accounting system services. Instead, these responsibilities had to be taken up by the agencies. Consequently, the university was tasked with acquiring and implementing a new administrative system. This included taking on new organizational responsibilities, such as managing payroll and accounting functions and overseeing the operation of these newly introduced systems. The new systems were based on the prevalent model of '90s computer systems, the client-server model. This meant that the users of the new software needed a thick client program running on their computer. The organization soon realized that the administrators in the different departments had different computers, both in age, specification, operating system, and architecture. This called for a standardized environment to run the new clients.

The Computer Council started an extensive change program to implement new administrative systems as well as a new computer platform to run them. The project started in 1997 and went live in 1999.

TS-Data was tasked by the IT office to implement the new administrative systems and to create the new computer platform. Specific governance teams were created to manage and operate the administrative systems. This meant that the responsible administrative function and dedicated system administrators planned and operated the systems. Although efficient, it created small, isolated islands around each system.

Managing the extensive change program from a project organization was soon found to be arduous, which led to the creation of the university's first IT department in 1998. This department was created by joining the IT office with the administrative data organization (TS-Data). This also created the role for the university's first CIO. With the creation of the IT department, the organization did not see a need for the IT Council group. Instead, the new CIO was given the responsibility of both running IT and developing IT.

During the 2000s, the focus shifted from computer hardware to mobile computing and networked information services. Computers and systems had previously been diverse and with different manufacturers, architectures, and operating systems. During the 2000s, technology matured, and computers and systems started to be standardized. The previously so dominant Unix-based systems began being replaced by Linux and Windows systems. Desktops were still running the same software as before, but the systems were now being standardized to allow for remote management. The large technical shift was the introduction of virtualization technology and storage area networks, allowing for the expansion of IT services and information management.

In the early to mid-2000s, the university underwent a significant reorganization of its education and research. The university went from having ~30 departments to having nine schools, inspired by the then-current Stanford University model. The new schools were given a mandate for self-governance and a high degree of autonomy. This also included how IT was managed. This gave rise to local system groups at each school with a new managerial role of "IT responsible" per school. The systems groups developed during the decade into professional IT groups consisting of groups of up to 15 people per school, responsible for the whole IT infrastructure. New roles emerged and were formalized, such as IT support technician, System administrator, network technician, Systems developer, etc.

The central IT department continued to deliver the administrative systems via the standardized computer platform and incorporated the helpdesk for Microsoft Windows to support the new platform. This created a situation where the administrators at each school, working with HR, finance, or study administration, used a different computer system and different IT services than the academic staff, creating problems with communication and filesharing.

Since there was no university-wide governing body to represent the collected needs from education and research, no large projects were started in these areas. IT for research was left to the schools, but the university had shared IT systems and IT infrastructure for education administration and computer labs for education. To facilitate the steering of these shared resources, a new governance method was introduced for the areas of education administration, educational IT (e.g., computer labs and educational software licensing), and the university web platform. The new governance method created "maintenance objects" [36], which included both processes and IT systems.

These were similar to the teams created for the administrative systems but introduced a more collaborative structure with roles for strategic, tactical, and operational levels both within the business and IT. The development within the maintenance objects during this time delivered several advancements, all of them with an administrative focus. An example was a system for planning courses and educational programs as well as allowing students to select elective courses.

Where the hardware and computing platforms had been standardized within the previous decades, the 2010s saw a standardization of IT services. Several new services were introduced, most of them in the educational area.

The organizational development of IT saw the switch from running IT systems to providing IT services. The impetus for this was the centralization of IT from the schools to the central IT department. The reasons behind the centralization were multifold: a wish to have common IT systems within the university to facilitate interaction and cooperation, the increased complexity of IT challenging the local system groups economy, and an aim to save money by gaining an economy of scale for the new common IT services. This centralization also brought with it the necessary standardization of the IT systems as well as a standardization of IT work. The chosen model for this was the ITIL framework [37], which frames IT as IT services supported by processes and functions.

An evaluation of the university administration (AAE) in 2014 identified that the university's IT support for education and research was lacking, with too high a focus on administrative systems and basic IT. This led to first a new management object for educational IT in 2015 and the creation of a platform concept in 2016. The platforms were a new form of steering groups responsible for IT development within the three main areas of the university IT (i.e. Education, Research and Administration). This development has been described in detail in the paper by Lilliesköld, Liljeblad and Hetemi [38]. The first platform to start was the educational platform, which was responsible for IT services for students, teachers, and study administration.

The platform steering concept was shown to be very effective during the COVID-19 lockdown and the switch to remote teaching. The platform was then tasked not only with the development of IT but also with coordinating the whole digital effort for remote teaching. The excellent track record of the platform led to a renewal of the platform concept to include both the development and operation of IT within the three areas. A new steering model was created based on portfolio management, where each of the three working areas managed a portfolio of IT services to support education, research, and administration. The 2000s also focused on digitalization and digital transformation by the development of both a digitalization policy and a digitalization strategy.

V. Institutional Logics in IT Governance

Analyzing the documentation, together with the interviews, a classification can be made of the dominant institutional logics for each time period. The classification is derived from the governing form, who is represented in the governing bodies, the aim and reason for the initiatives started, the target groups for the initiatives, and what technology is being created. From these, we identify three distinct logics: academic, bureaucratic, and internal market.

Academic logic values the pursuit of knowledge, academic freedom, and intellectual rigor. It encompasses norms like peer review, tenure systems, and publication practices, which are fundamental to academic work. The organizational structure of academic institutions, including their hierarchical and departmental arrangements, plays a significant role in decision-making and resource allocation. Governance and policy, including adherence to research ethics and funding protocols.

Bureaucratic logic is characterized by a strong emphasis on hierarchy, where authority and responsibilities are clearly defined, and a rule-oriented approach that ensures consistency, predictability, and impartiality. Bureaucratic organizations prioritize standardization of processes for efficiency and uniformity, and their operations are marked by a high degree of formalization, including extensive documentation and adherence to established protocols. Decision-making and interactions within these organizations are intended to be impersonal, focusing on roles rather than individual preferences. Professionalism is key, with employees often chosen for their qualifications and expertise. Bureaucratic logic also tends to be risk-averse, favoring predictable and established methods over innovative or untested approaches.

Internal market logic mimics external market mechanisms but operates within the confines of an organization. It emphasizes the importance of internal competition, where different departments or units act like distinct entities competing for resources, budget allocations, and internal clients. The focus is on efficiency and cost-effectiveness, encouraging units to optimize their performance and resource utilization as if they were independent businesses. Pricing mechanisms may be used internally to allocate costs and resources, fostering a sense of accountability and financial discipline. This approach aims to enhance overall organizational efficiency by promoting a more market-oriented culture internally, driving innovation and responsiveness.

These identified logics are in line with the ones defined by Cai and Mountford [35] in their review of institutional logics in higher education research, where they find 18 "ideal type field-level institutional logics." Academic, bureaucratic, and market are among them.

As presented in Table III, we find that the early periods from the 1950s to early 1990s adhere to the academic logic: the driving force is the academic staff, and the aim of the use of technology is to foster research and education. The technology itself and its use are also the object of research and education. In the mid-'90s, there was a sea change when the dominant logics for governing and using IT within the university switched from an academic logic to a bureaucratic logic. The change is driven by the introduction of large administrative systems into the university. Where these systems previously had been provided by the government via DAFA (The Computer Center for Administrative Data Processing), they were now the responsibility of the university. This mandated large internal change projects seem to have allocated all available resources towards creating and then maintaining the administrative systems. In the 2000s, we saw the addition of internal market logic. Where IT is seen as services provided to internal customers by an IT department, this reinforces the standardization of IT. The shift from having an IT council responsible for the whole university to focusing on an IT department, being responsible for both the demand and execution, also refocuses how IT is viewed. From earlier being developed within research and education, it is now a service provided to administration, research, and education.

The kind of systems that were created during the 50s-80s are driven by an academic logic and give rise to systems that are aimed towards research and education. If we try to categorize these systems, we see that they can be grouped into "shared computational resources" and/or "computer infrastructure." Some of this is driven by the expense of computers at the time, requiring them to be shared resources. Also, the nature of research grants drives the investments of larger infrastructures, where funders are more likely to support a larger visible change. Terminal networks were also common infrastructure, and the same is true for data networks and computer labs. A solution pattern emerges of creating shared infrastructure.

When the shift in the 90s came, we saw that these patterns were not replaced but reinterpreted in the new dominant institutional logic. First, the bureaucratic logic and then later combined with an internal market logic. The systems created are standardized, centralized, and tightly controlled for administrative use. Then, with the internal market logic, systems are aiming for economies of scale to create standardized IT services. These are all using the same patterns of creating common infrastructure, now for the administrative work instead of research and education. When in the 2000s-2010s, these systems are rolled out to the whole organization, the patterns and governing institutional logic is still the same.

VI. Reinforcement of Technological Design Patterns

The structure of the systems being developed and deployed within the organization builds upon previous choices and reinforces the organization's knowledge, routines, and practices within them. This can be interpreted within the research literature on path dependence. Organizational path dependence refers to the concept that the decisions and strategies of an organization are significantly influenced by its historical actions and established processes. Once an organization starts down a particular path, previous investments, established routines, and institutional norms can create a self-reinforcing mechanism, making it increasingly difficult to change course. In the article by Schreyögg and Sydow [39] on organizational path dependence, they identify four self-reinforcing mechanisms that can occur within an organization.

Coordination effects: These arise from the adoption of specific rules or routines in organizations, leading to more efficient interactions and predictable behavior. As more actors follow these guidelines, coordination costs are significantly reduced.

Complementary effects: This concept involves synergies from interacting resources, rules, or practices, where their combination creates an additional surplus. This leads to self-reinforcing processes that increasingly dominate certain activity patterns.

Learning effects: This theory posits that repeated performance of an operation leads to increased efficiency and skill, reducing costs per unit and making the approach more attractive while discouraging shifts to new methods.

Adaptive expectation effects: These effects stem from preferences evolving in response to others' expectations, often resulting in a dominant solution through a self-fulfilling prophecy driven by social belonging and the desire to conform with the majority.

In this case, we have examples of all four of the effects. The use of standardized systems, IT services, and operation models such as ITIL contribute to coordination effects. Complimentary effects are also present in the aim to create economies of scale. Standardization also has learning effects since knowledge acquired can be reused in multiple contexts. Since the organization is performing on its goals of standardizing, building infrastructure, and economies of scale to have an efficient use of IT and keep costs low, they are rewarded for it, and that contributes to the adaptive expectations.

This strong reinforcement of the technological solution patterns creates a structure that is hard to change. This is an example of what Vial [13] identifies as *inertia* - "*existing resources and capabilities can act as barriers to disruption*" and is poised as "one of the most significant barriers to digital transformation."

IT departments have traditionally demonstrated remarkable proficiency in developing large-scale, efficient infrastructures. This success has been attributed mainly to their ability to deploy standardized IT services, thereby maintaining cost-effectiveness. Until now, this approach has been central to their operational strategy, enabling them to establish a robust and reliable IT environment.

However, the rapidly evolving digital landscape presents new challenges and demands. The current environment necessitates not only swift adaptation but also experimentation and innovation in digital business strategies. This shift marks a significant departure from the previous paradigm. The methodologies and structures that once underpinned the competitive advantage of IT departments are now facing obsolescence. In this new era, the agility to respond to changing demands, the capacity for continuous innovation, and the ability to drive digital transformation are paramount.

This transformation underscores a growing chasm between the traditional, stability-focused IT approaches and the dynamic, agility-centric strategies required today. This dichotomy is often conceptualized as an “ambidextrous” approach [40-42] or “bi-modal” strategy. In these frameworks, the exploration of innovative technological applications is seamlessly integrated with the optimization of existing technologies. This creates a continuous cycle of discovery and integration, a concept further elaborated by Lohoff, Schäfer and Hess [43]. As such, IT departments must undergo a fundamental cultural and structural shift, moving away from their established practices and longstanding culture to embrace a more fluid, responsive, and innovative culture. This evolution is critical not only for maintaining the relevance of the IT department but also for the future of the university.

VII. Conclusion

Conway [44] states that "organizations which design systems (in the broad sense used here) are constrained to produce designs which are copies of the communication structures of these organizations." This is known as Conway's law. This case study suggests that it is not only the

TABLE III. DOMINANT GOVERNING LOGICS

	Governance org	Work org	Research	Education	Administration	Dominant governing logcis	Technology design patterns	Reinforcement effects
1950	Mathematics Machine Board	Academic personnel	BARK BESK		-	Academic logic	Shared computational resources	-
1960	Computer committee	Academic personnel Regional Computer Centers	UDAC CD-3200 QZ		-	Academic logic	Shared computational resources Computer Infrastructure	Learning Adaptive expectation
1970	Computer committee Computer council	Academic personnel Regional Computer Centers	QZ HP2000A PDP-11/45 DEC-2020, DEC-20 Terminal switches/networks		-	Academic logic	Shared computational resources Computer Infrastructure	Learning Adaptive expectation
1980	Computer council, Computer coordination group, The Computer Secretariat	Academic personnel Computer technicians Small computer groups Data Administrative Agency	KTHNET Personal computers KTHLAN		ND-100 BUS / S SLÖR / PIR Personal computers	Academic logic	Shared computational resources Computer Infrastructure	Learning Adaptive expectation
1990	Computer council IT council IT-department	Academic personnel Department computer groups Technical Service	Workstations and personal computers. Networked services.	Software to students Computer labs	New HR, Finance, and study adm. systems Standardized desktops	Academic logic Bureaucratic logic	Computer Infrastructure Standardized computers	Learning Adaptive expectation Complementary
2000	IT-department	Department system groups IT-department	Personal computers with Linux, Mac, and Windows. Server virtualization	Software to students Computer labs LMS	HR, Finance, and study adm. Systems CMS Standardized desktops	Internal market logic Bureaucratic logic	Computer Infrastructure Standardized IT-systems Standardized computers	Learning Adaptive expectation Complementary
2010	IT-department & IT-platforms	IT-department	Standardized desktops with Linux, Mac, and Windows. IT-services (VPS etc.)	Software to students Computer labs New LMS	HR, Finance, and study adm. Systems CMS Standardized desktops	Internal market logic Bureaucratic logic	Standardized IT-systems Standardized computers Standardized IT-services	Learning Adaptive expectation Complementary Coordination
2020	IT-department & IT-portfolios	IT-department	Standardized desktops with Linux, Mac, and Windows. IT-services (VPS etc.)	Software to students Computer labs LMS	HR, Finance, and study adm. Systems CMS Standardized desktops	Internal market logic Bureaucratic logic	Standardized IT-systems Standardized computers Standardized IT-services	Learning Adaptive expectation Complementary Coordination

organization's communication structure that shapes how technology is being structured but also that the governing culture of the organization shapes the technology.

To answer the questions posed in the beginning, "How have historical developments in digital technology and technology governance shaped the prevailing logics of IT governance, and in what ways do these logics influence an IT department's ability to facilitate effective digitalization?" we have shown that the values and institutional logics governing IT are transferred to what technological solutions were being developed. As cultural rules and cognitive structures shape organizational structures [22], here we have shown an example of how culture and cognition also shape technological structures. An academic logic in governing IT leads to the development of large-scale shared computer resources and networks. The change in governing logics to a bureaucratic logic facilitated the development of standardized large-scale systems or infrastructure, and the addition of an internal market logic promoted standardization of IT services, cost efficiency, and economies of scale. The governing logic changed, but the way technology was being developed only reinforced the practice of building large-scale common infrastructure. Over time, these patterns reinforce the behavior of the IT organization and limit their options in developing new solutions, creating a path dependence.

This research contributes to the understanding of digital transformation within higher education, mainly through its in-depth historical case study of IT governance. A key contribution is the description of the evolving institutional logics – from academic to bureaucratic and internal market – that have shaped the IT governance of the university over decades. This study traces the transition of technological and organizational paradigms within a major research university and critically examines how these paradigms have influenced the preference for specific technological solutions. Significantly, it highlights a persistent misalignment between traditional IT approaches and the dynamic requirements of digital transformation, underscoring the need for a paradigm shift in IT governance. By demonstrating the path-dependent nature of IT development in higher education, the research provides a nuanced understanding of how historical successes and established practices can inadvertently create barriers to innovation and adaptation in the face of digital imperatives.

This pattern of technological evolution, driven by underlying cultural logics, has broader applicability. It suggests that any organization, be it in healthcare, government, or private sector, can exhibit a similar trajectory where historical legacies and established institutional logics lead to path dependence, potentially constraining innovation and adaptation in the rapidly evolving digital landscape.

In reframing IT governance for a digital age, organizations must recognize the power of their ingrained cultures and institutional logics. They must consider how these factors can both facilitate and impede digital transformation. This understanding is crucial for breaking free from path dependence's limitations and fostering an environment conducive to the continuous innovation necessary to realize the benefits of digital transformation.

The broader contribution of this research lies in its articulation of how historical, cultural, and structural dimensions combine to chart the course of technological development. By learning from these insights, leaders, and policymakers across various sectors can anticipate and mitigate the challenges posed by legacy systems and entrenched practices, enabling a more agile and responsive IT governance that aligns with digital transformation needs.

VIII. Limitations

While this study offers valuable insights into IT governance evolution and digital transformation in higher education, it has limitations. It focuses on a single case study of a Swedish public sector university, which limits the generalizability of the findings. The unique aspects of the studied university may not be representative of other higher education institutions, especially privately owned institutions, or colleges without a strong research focus. The absence of a comparative analysis of IT governance and digital transformation with other institutions also limits the scope of the study. Also, the paper does not investigate the mechanisms driving the observed shift in institutional logics, which could contribute to understanding the broader applicability of the findings. Future research could overcome these limitations by including multiple case studies from varied educational contexts, enriching the understanding of this critical subject.

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