AI Transformation in the Public Sector: Ongoing Research

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Abstract—**Real-world application of data-driven and intelligent systems (AI) is increasing in the private and public sector as well as in society at large. Many organizations transform as a consequence of increased AI implementation. The consequences of such transformations may include new recruitment plans, procurement of additional IT, changes in existing positions and roles, new business models, as well as new policies and regulations. However, it is unclear how this transformation varies across different types of organizations. We study the effects of bottom-up approaches, such as pilot projects and mentoring to specific groups within organizations, and aim to explore how such approaches can complement the top-down approach of strategic AI implementation. Our context is the public sector. Our goal is to acquire an improved understanding of how and when AI transformation occurs in the public sector, which are the consequences, and which strategies are fruitful or detrimental to the organization. We aim to study public sector organizations in Sweden, Norway, New Zealand, Germany, and The Netherlands to learn about potential similarities and differences with regard to AI transformation.**

I. INTRODUCTION

The digital transformation of society has been steadily increasing during the last five decades. The Internet era of the last two decades has boosted this development and it has made possible the information sharing between individuals and organizations, and across nations, that we experience today. The early industrialization, later industrialization, and the digital transformation along with the introduction of renewable energy sources, are referred to as the first, second, and third industrial revolution. We are now entering the era of the fourth industrial revolution.

The advent of social media and electronic commerce platforms, such as Amazon, Facebook, and Twitter – along with the development of cheaper and more powerful hardware – has significantly increased real-world application of connected, data-driven and intelligent systems (AI) in the private and public sectors as well as in society at large. As was the case in earlier societal revolutions, old systems, schools of thought, organizations, jobs, and cultures will change or disappear. However, we argue that the AI revolution – the shifting of the cognitive workload from humans to computers – may have characteristics and consequences quite unlike the earlier revolutions.

We are interested in understanding how and why organizations are transformed as a consequence of AI introduction, implementation, and increased readiness. We believe strategic planning, organizational culture, and decision making processes differ significantly between typical public and private sector organizations. The most prominent explorations of AI transformation have arguably been carried out by and for the private sector. In particular, the focus has been on the information technology industry. Two notable developments in this respect represent fitting illustrations:

- **Landing.AI**: Andrew Ng – founder of Coursera – released the AI Transformation Playbook[1] on December 14, 2018. The playbook draws from experience of AI transformation from the Google Brain team and the Baidu AI Group. The purpose of the playbook is to deliver insights to organizations that can help them to transform into strong AI actors. It specifically addresses large private enterprises.
- **ML-Ops**: In 2015, a paper about the technical debt of ML systems was published at the influential Neural Information Processing Systems (NIPS) conference [1]. The paper, which was written by a number of Google employees, reported that it was common to incur massive ongoing maintenance costs in real-world ML systems. As a consequence, initiatives such as ML-Ops have

[1] AI Transformation Playbook, https://landing.ai/ai-transformation-playbook/

been started to establish effective practices and processes around designing, building, and deploying ML models into production[2].

It is conceivable that the rules of the AI playbook and the guidelines and principles of ML-Ops can be adapted successfully to suit small and medium sized private enterprises. Similarly, the rules and guidelines may provide insights that could benefit non-information technology actors or public sector stakeholders. The question is which rules and guidelines will apply in such contexts, and to what extent. Another question is whether insights gained from AI transformation in the public sector carries across nations the same way such insights would from AI transformation in the private sector.

II. OUTLINE

This abstract seeks to sketch and motivate our long-term AI transformation research agenda and international collaboration, and to describe an ongoing case study of bottom-up AI transformation approaches in the Swedish public sector.

We first provide a brief background on organizational change, digital transformation, and the relationship to AI implementation.

III. BACKGROUND

Organizations change and develop their business models in relation to digitalization. Organizations are operating in a complex environment where new technologies require continuous change. The introduction of AI represents one important type of change. The new age of AI will change the composition, business models, and tasks required in an organization. New business models can be a result of strategy or a strategizing action [2]. AI significantly changes the composition of the resources, operations, and structure that an organization can employ in order to become more efficient and to create value. AI is viewed by many as a revolutionary and societal change agent, which will affect organizational strategy. It will involve economical, psychological, technological, political, and ethical aspects. This change will directly and indirectly affect the business models, including the purpose, process, strategies, infrastructure, organizational structures, and operational processes and policies.

The theory of dynamic capabilities implies that organizations are experiencing constant change, which force them to adapt, integrate, and reconfigure their internal and external competences in order to maintain their competitive advantage [3].

AI technologies affect regulations and policies. From an institutional point of view, some aspects need to receive special consideration:

1) **Governance**. Governance concerns the responsibility for the risks involved in AI technologies. Governance should be the bridge of information and knowledge to society in regard to AI. It should ensure that AI technologies that have an impact on human lives should communicate in a transparent, fair, and accountable way [4].
2) **Accountability and Responsibility**. The legal issues concerning AI requires more discussion to determine who should be responsible for the consequences of AI actions and behavior, and to define rules and guidelines for privacy, safety, and integrity.
3) **Economy of Scale**: AI may create imbalances in the economy of scale or disrupt small companies [5]. This is a situation that can lead to the increased monopoly of large organizations.

The introduction of smart technologies creates ambiguity and uncertainty. AI may cause *destructive creation* in the future organization. However, from the nature of capitalism it may also create paths to growth [6].

According to the Cambridge Dictionary, *transformation* refers to a complete change in the appearance or character of something or someone, especially so that that thing or person is improved. However, in the area of business administration, transformation usually refers either to radical change or to incremental change in organizations. Organizational Transformation (OT) has been discussed in the organization and management literature from various perspectives. It has been considered as a form of radical change [7]–[9], strategic change [10], revolutionary change [11], continuous and confluent organizational change [12], and organizational discontinuous change [13], [14]. The discussion in the literature about OT dispels ambiguity. However, we consider OT as a consequence of changes happening due to AI technology use.

In our view, AI transformation is an interdisciplinary research topic, and we believe that researchers should opt for new, innovative approaches when exploring this phenomenon. The diverse aspects of the topic can be psychological, socio-cognitive, socio-technical, economic, and political. Research on the topic therefore needs to consider the relevant aspects for the context [15].

In order to strategize AI, it is important to quantify and understand the organization's AI maturity, since maturity is a measure that relates to the organizational readiness and AI capability. The organizational inertia is a vital aspect that makes OT an important theoretical and practical problem [16]. In terms of AI-enabled OT research, the existence of organizational inertia raises the question where the focus should be put: Which are the relevant aspects and which unit of analysis should be considered? (individual vs. departmental, organization vs. sector, and so forth) [16].

We are unable to find much empirical research concerning AI-related OT in the public sector. Meanwhile, public sector companies and authorities face a multitude of challenges related to digital and AI transformation of society. We therefore argue that AI-related OT deserves more attention from the research community. This attention needs to be interdisciplinary in nature.

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[2]ML-Ops, https://ml-ops.org

A. Related Work

We are unable to find a concise and useful definition of AI transformation [17]. The available research that brings up this phenomenon is often focusing on digital transformation. There is a substantial scientific discussion around digital transformation but very few works focus on AI. The digital transformation phenomenon refers to the relationship between three domains: data, digital technology, and people [18]. Transformation of an organization or a network of organizations occurs in a variety of contexts, such as: cultural, technological, and governance strategy [19], Various definitions related to digital transformation are presented [20], however, we observe the need to provide a definition of AI transformation specifically. The reason for this is that, unlike other forms of digital transformation, AI will shift cognitive work from human actors to computers. The consequences for many organizations will be significant. Organizations often recognize the need to implement AI as part of their vision and strategy but training and tutoring regarding AI and its capabilities must be a first anchor in all levels in the organization. AI is affecting organizations in at least two directions. It results in increased digitization of the economy and it enables the automation of existing processes [21]. In addition, AI has a disparate effect on organizations: on the one hand it creates promising opportunities for the future, but on the other hand it involves challenges, uncertainties, and risks. Defining and explaining AI transformation is therefore crucial, since a useful definition will support organizations to adapt to AI.

IV. Ongoing Projects

This section describes ongoing projects and collaborations regarding various aspects of AI transformation research and real-world state-of-practice.

A. AI Strategy Development

AI is an important tool to handle strategic issues which also affects the ability of the organization to achieve strategic change [2]. AI can be both a narrow, specific strategic issue or broad and general. For example, if AI is viewed as a technology, a strategic issue might be to procure an AI system. However, if AI is viewed as a revolutionary and societal change agent, the strategic issue will be broad and involve economical, psychological, technological, political, and ethical aspects. We believe it is important to learn about various organizations' strategic planning processes and their view on how to properly adopt AI so that it fits the strategic planning process. We assume that adaptation of AI is inevitable. However, we observe that few sectors and industries understand AI and its potential impact on organizations.

We have supported Jönköping Municipality (Sweden) in developing an AI strategy. The city director and official management are now implementing the AI strategy. We refer to this implementation as a *top-down approach* for AI transformation.

B. Systematic Literature Review

We have conducted a systematic literature review [17]. The aim of the SLR was to aggregate the body of knowledge on the relationship between AI and organizational transformation, to map the field, and to identify the gaps in research that represent an opportunity for future study. We have used three databases (Science Direct, Scopus, and IEEE) and found 966 papers related to the topic. We have followed the procedure and guidelines of Kitchenham [22] and narrowed the article selection to a final number of 52 relevant articles, which help us to explore AI transformation.

C. Interviews with Jönköping Municipality

We have performed interviews with 23 officials from the official management of Jönköping Municipality. The purpose is to understand how AI implementation transforms public sector organizations. The municipal organization represents an interesting context. The aim is to contribute to the knowledge of how the municipal board and civil servant management and other management groups create, formulate, and implement digitization and AI strategies. A special focus will be put on how AI can contribute to the municipality's work to improve the organization's efficiency.

D. Bottom-up AI Transformation

We have asked Jönköping Municipality to define use cases or challenges within its respective branches and municipal companies. We have then supported the municipality in developing the most mature use cases into research and development projects. We are now assigning students and researchers to develop prototypes and experiments related to four of the use cases:

UC1 **Contact Center**. The goal is to learn from a data set of historical incoming citizen requests and responses to generate a decision support system that can recommend categorizations of requests and formulation of responses human operators.

UC2 **Technical Office**. The goal is to learn from a data set of historical citizen incident reports to generate a model that can recommend actions to human operators (for example, to file a police report or provide a specific response).

UC3 **Technical Office**. The goal is to learn from a data set of historical citizen incident reports about winter weather consequences to generate a model that can formulate automated answers to citizens and prioritize planned actions.

UC4 **City Planning Office**. The goal is to find discrepancies between a high-precision digital base map of the geography and built environment of the municipality and actual aerial footage.

We aim to perform an intervention study in which we explore the effects of conducting these types of AI-student projects as well as other bottom-up approaches, such as mentoring and competence development courses, in the public sector.

E. Ongoing Work in New Zealand

We asked Waikato Regional Council to find environmental use cases where AI can help to improve decision making. They provided four use cases, and now we have researchers from the TAIAO project working on these cases. The *Time-Evolving Data Science / Artificial Intelligence for Advanced Open Environmental Science (TAIAO)* is an AI program over seven years, funded by the New Zealand Ministry of Business, Innovation, and Employment (MBIE). It is a collaboration between the Universities of Waikato, Auckland and Canterbury, Beca and MetService.

F. Ongoing Work in Norway

We have been collaborating with several municipalities within Norway on developing their AI capabilities, and accumulating the necessary resources to commence their AI transformation. An early study revealed some of the main challenges municipalities face in their quest of deploying AI applications [23]. The current work examines the role of technological, organizational, and environmental enablers and inhibitors of AI deployment in municipalities, as well as the realized organizational value from such investments. This work, as well as ongoing research examining a process view of AI deployment, aims to understand how the value of novel technologies such as AI can be maximized.

V. JOINT RESEARCH AGENDA

We are aiming for an innovative research approach. We view AI transformation as an interdisciplinary phenomenon, and we aim to investigate how organizations change due to AI technology maturation and implementation. In this particular research agenda, our main interest is in organizations which operate in public sector. We aim to collaborate in an international setting, and to perform joint studies and comparative studies across various contexts, as well as different public sector organizations and countries, including: Sweden, Norway, New Zealand, Germany, and The Netherlands. We believe that the interdisciplinary and international collaboration will yield a comprehensive understanding of AI transformation and its impact on the public sector. Also, we intend to establish a foundation for decision and policy makers, so that they are able to engage fruitfully in AI transformation.

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