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ADOPTING A 'SEARCH' LENS IN EXPLORATION OF HOW ORGANISATIONS TRANSFORM DIGITALLY

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Research Paper

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Abstract

As new forms of digital technologies continue to proliferate, Information Systems (IS) scholars argue that we are witnessing a paradigmatic shift in the nature of technologies and their potential in profoundly changing organisations and ways of working. Such technological shifts have also given rise to consumerisation of IT and thus creating more endowed consumers with changing expectations and practices. The black-boxed nature of digital platforms and their algorithms have imposed challenges for scholars to understand these changes. In this paper, we draw on the notion of 'search' and its use in the organisation and management literature to propose a new analytical approach in studying digital transformations. Unlike the existing use of search in enhancing organisational performance or introducing new products, we use search as an approach that organisations renew their offerings, processes and practices in redefining their value proposition. Through different reconfigurations of material enactments, search becomes the underlying logic of organising and the centralised control shifts to a de-centralised autonomy, which facilitates the ongoing adaptations of practices as organisations transform digitally.

Keywords: Digital platforms, algorithms, digital transformation, digitalisation, organisational search.

1 Introduction

Despite many waves of digital transformation, it is widely pointed out in the Information Systems (IS) literature that the current wave has brought about a "paradigm shift" (Urbach, Drews and Ross, 2017; Gregory et al., 2015). This fundamental shift has two drivers: Information Technology (IT) consumerisation, and algorithmic and dynamic behaviour of emerging platforms. The consumerisation of IT has been encouraged by the advent of digital and Web 2.0 platforms and their ubiquitous and pervasive connectivity (Yoo, 2010; Gregory et al., 2018). Such platforms are very dynamic in nature and driven by algorithms such as Instagram explorer algorithm, Google page rank algorithm, etc. (Introna, 2015; Faraj, Pachidi and Sayegh, 2018). Due to the continuous changing of their configuration and increase in data availability, these new technologies' material affordances are distinctive from earlier types of IT (Kallinikos, Aaltonen and Marton, 2013).

These dynamic and algorithmic types of information technologies are penetrating everyday lives of consumers and subsequently, empowering and making them more informed comparing to the past (Granados and Gupta, 2013). Large groups of these empowered and well-informed consumers have a presence on social media, and extensively interact with and connect to organisations. Subsequently, the focus on digitalised consumers has contributed to shifting digital technology materiality from merely information processing and organisational task performing which have been researched significantly by IS scholars (Yoo, 2010). In addition, new information technologies' unique

capabilities and affordance (Kallinikos, Aaltonen and Marton, 2013) which are beyond traditional IT use have paved the way for a change in conceptualisation of work and organisation.

Despite the above-mentioned shift's implications, the literature does not yet provide significant insights on how these new forms (i.e. dynamic and algorithmic-based) of technologies lead the changes in organisational operations and processes due to more informed consumers or even drive organisations to make changes in their business models. The extant literature has a gap to theorise these changes in addition not to having a road map for studying and exploring them. For example, it is not clear whether the approaches used by IS scholars to study conventional information technologies within the context of organisations can be helpful.

In this paper, we aim to address this issue in the literature by proposing the theory of search as an analytical approach in understanding digital transformation phenomenon within organisations. We believe search can offer a methodological template for scholars in studying the ways that organisations and work are digitalised as they are evolving dynamically in practice. Search has been mainly used in the organisation and management literature focusing on product innovations but can be influential in studying such shifts as digital transformation can be about innovations in products/services, processes, customer experiences, and value creation (Wessel et al., 2021) which are about learning the ability to unlearn (Stark, 2011) and creating productive disturbances by moving away from existing practices and routines and becoming more reflective (Hafezieh and Pollock, 2018a).

In addition to proposing the lens of search as an analytical approach, the paper contributes to digital transformation literature that highlights its distinction from former technological changes. We suggest that search acts as an organising logic and is beyond the scope of problemistic search as it does not necessarily begins with problem definition and is generative. This shows how organisations act dynamically in "algorithmic phenomena" (Orlikowski and Scott, 2016). In the following sections, we first review the literature on digital transformation and discuss how the new technological paradigm is different from the previous IS paradigm dominated by traditional forms of IT such as enterprise systems. Then, we introduce the theory of search, propose our search-based analytical approach and its characteristics, and discuss how it can be used in scholarly IS research. Finally, we explain our contributions and areas for future research.

2 Digital Transformation and the Rise of a New Paradigm

Information and digital technologies have been significantly employed in different processes and operations of organisations such as design, manufacturing, business support, etc. since its prevalence in the business and corporate world (Niederman, Brancheau and Wetherbe, 1991). No matter how digitalised an organisation is, information and digital technologies can change its relationships with its stakeholders internally and externally (Kim and Mukhopadhyay, 2011) such as the relationship with customers or the relationship with suppliers in addition to processes internal to the organisation (Dechow and Mouritsen, 2005). Nonetheless, the malleability of new digital technologies such as editable and reprogrammable digital platforms has contributed to more flexible organisational processes and relationships (Kallinikos, Aaltonen and Marton, 2013; Yoo, Henfridsson and Lyytinen, 2010).

Digitalisation has been defined by Yoo (2021, p.137) having taken the malleability of new digital technologies (e.g., digital platforms) into consideration as follows: "the encoding of analog information into a digital format and the possible subsequent reconfigurations of the socio-technical context of production and consumption of the product and services". The phenomenon of digitalisation has resurfaced the discussions and debates surrounding digital transformation and especially digitally driven innovations in the context of developing new products, offering new services, improving customer experience, modifying organisational processes and generating new business models at the centre of which are digital technologies (Nambisan et al., 2017). Gong and Ribiere (2021, p.12), based on an analysis of 134 definitions in the literature define digital transformation as "[a] fundamental change process, enabled by the innovative use of digital technologies accompanied by the strategic

leverage of key resources and capabilities, aiming to radically improve an entity [an organization, a business network, an industry, or society] and redefine its value proposition for its stakeholders".

Digital transformation (DT) has been frequently used interchangeably with IT-enabled organisational transformation (ITOT). However, nascent discussions by IS scholars indicate that there is a key distinction between these two organisational changes in terms of their activities but also their results (Wessel et al., 2021; Gong and Ribiere, 2021). According to Wessel et al. (2021, p.120) "DT involves using digital technology in order to (re)define a value proposition and to change the identity of the firm, whereas ITOT involves using digital technology to support an existing value proposition and reinforce an existing organizational identity". Similarly, Gong and Ribiere (2021) echo this perspective highlighting that DT is about a "fundamental change of a whole new form, function, or structure" driven by adoption of digital technologies focusing on creating new value.

In comparison, traditional IT such as Customer Relationship Management (CRM) systems, Human Resource Management (HRM) systems and Enterprise Resource Planning (ERP) systems helped a then-new vision in the IS research emerge which was supported by the integration paradigm (Dechow and Mouritsen, 2005; Robey, Ross and Boudreau, 2002). Despite the dominance and prevalence of the integration paradigm in IS research, the advent of new digital technologies such as digital platforms and the transformations followed which were significantly distinct from changes imposed by then conventional forms of IT, this dominance has been challenged. Scholars have pointed out that the current wave of DT amounts to a 'paradigm shift' in how organisations use and are shaped by their IT (Urbach, Drews and Ross, 2017; Gregory et al., 2015). The new paradigm is influencing and transforming consumers the same time as organisations. In addition, digital platforms are being changed, reprogrammed and reproduced continuously.

In this new IS paradigm, organisations cannot exercise any control over new emerging digital platforms contrary to the integration paradigm, based on which organisations had the possession of their IT systems and were able to fully be in charge of the technology (Hanseth, Ciborra and Braa, 2001). Considering the affordability and ubiquity of new digital technologies(Chae, Koh and Prybutok, 2014) and their consumerisation (Bygstad, 2015; Yoo, 2010), it is neither practical nor possible for organisations to have the possession of all the systems they might use in the context of their work. It is also worth mentioning new digital technologies can be considered more flexible and dynamic while having instability and trasfigurability (Kallinikos, Aaltonen and Marton, 2013). Moreover, they have been able to evolve social relationships in the context of consumersand organisations (Susarla, Oh and Tan, 2012).

The integration paradigm advocated for IT departments being in charge of main systems and digital technologies of an organisation (Bygstad, 2015), implementing software packages and addressing the issues (Sykes, Venkatesh and Johnson, 2014). Nonetheless, due to the speed of change and the extensive request from the business side of the organisation for digital novelty, IT departments are struggling to keep up (Tumbas, Berente and vom Brocke, 2017). As a consequence, the current debate favours incorporating the functions of information and digital technologies into business structures of an organisation more than before.

For example, Gregory et al. (2018) call for "a more holistic inquiry regarding the role of consumer technologies in ushering in more fundamental changes in organizations, such as the rise of consumer sovereignty" which "ultimately leading a fundamental rethinking of organizational IT beyond the IT function" (Peppard (2018) cited in Gregory et al., 2018, p.1247). In this respect, some studies show that how marketing specialists are more directly engaged with digital transformations and renew their expertise to have hybrid skills in both marketing and technology (e.g. data analytics) (Hafezieh and Pollock, 2018b). In the following, we focus on two trends leading to the shifts discussed in the literature: the malleable nature of digital technologies and IT consumerisation.

2.1 Algorithm-based platforms

The rise of algorithm-based platforms (e.g. Google page rank algorithm, Facebook newsfeed algorithm, Instagram explore algorithm etc.) are said to be fundamentally changing organisations in ways that are markedly different from previous generations of technology (Introna, 2015; Faraj, Pachidi and Sayegh, 2018). The underpinning sources of such shifts are the (learning) algorithms (Introna, 2015; Faraj, Pachidi and Sayegh, 2018), through which various digital platforms operate. These algorithms have highly performative impacts (Faraj, Pachidi and Sayegh, 2018). For example, we can see such performativity in how TripAdvisor's ranking algorithm has reconfigured the valuation practices of travel sector (Orlikowski and Scott, 2014), how Uber or Deliveroo's algorithms monitor and control drivers or couriers' performance (O'Connor, 2016), or how Facebook's algorithm makes people's content visible and invisible to others and how this shapes people's mental models of using the platform (Bucher, 2017).

The learning algorithms work and evolve based on growing sets of big data. It has been argued that the material affordances of these new technologies make them distinct from other types of information technologies (Kallinikos, Aaltonen and Marton, 2013), especially in relation to how their composition and content (data) is constantly changing. It seems that the distinctive functions and affordances of the new technologies (Kallinikos, Aaltonen and Marton, 2013) and their transformative power are changing conceptions of work and the nature of their organisations beyond the narrow IT function. Indeed, such transformations are not only due to the technology's intrinsic characteristics, but also some 'social considerations' (Fleming, 2019) such as consumerisation of IT that we explain below.

2.2 IT Consumerisation

Consumers have been increasingly using digital technologies in their day-to-day activities. The embedding of digital technologies in individuals' everyday lives has been referred to as 'experiential computing' (Yoo, 2010) or 'IT consumerisation' (Gregory et al., 2018) in the IS literature. This has created a new form of technology user, whom we term a 'digitalised consumer' (Yoo, 2010), whose everyday actions, experiences and relationships (e.g. through social media platforms) have been digitalised. The 'digital consumer' is key for the realisation of the digital organisation. Given the patterns of digitalisation over the past decade, organisations are said to be dealing with increasingly more endowed consumers who, through their ubiquitous access to diverse forms of digital technologies, are assumed to be well-informed and empowered (Granados and Gupta, 2013). IS scholars have defined this contemporary digitalisation of consumers as "changing practices and expectations of consumers, shaped by the wide adoption of digital technologies in every-day life" (Gregory et al., 2018, p.1242). To address the needs of this new form of consumer, IS studies have suggested that organisations enhance customer experience and engagement in their digital transformation agendas (Singh and Hess, 2017; Tumbas, Berente and vom Brocke, 2017).

Scholars have posited that IT consumerisation and the rise of new technology users, driven by the adoption of digital technologies in everyday life, brings forth changes in "IT-related activities of workers and managers in organizations" (Gregory et al., 2018, p.1225). In this regard, they have suggested the need for understanding how technology-related work and knowledge is diffused in an organisation (Gregory et al., 2018) in relation to fundamental changes such as the emergence of more empowered consumers.

As mentioned above, the new wave of digital transformation is about work that organisation do towards algorithm-based platforms and is concerned about organisations' links to external parties such as customers. Although the current debates in the literature of IS and enterprise systems are still dominated by research on integrating, standardizing and controlling, the focus on digital organisations is getting more attention (Urbach, Drews and Ross, 2017). As mentioned above, research on digital organisations includes how the role of information and digital technologies in organisations are evolving into new roles and subsequently how this evolution leads to new emerging structures and

mechanisms of coordination. However, the literature is disconnected in the sense that each strand has focused on some issues missing out others. Thus, it fails to use a holistic approach to offer insight about how organisations developing digitally in relation to algorithm-based platforms but also IT consumerisation.

3 Theory of Search

We have been inspired by the economic sociologist David Stark's (2011) conceptualisation that 'search' has become the new "watchword of the information age". According to Stark, the type of search that organisations need to engage in a digital era is not the information management type which has been traditionally their main focus. The concept of search has been discussed predominantly in management literature within the areas of knowledge management, organisational learning, and new product development. Huber (1991), for example, defines search as a mechanism for organisational learning through acquiring information in three ways: 'scanning', 'focused search', and 'performance monitoring'. While the aim of scanning and focused search is to search organisation's external environment widely or a combination of internal and external environments narrowly, respectively, the performance monitoring utilises both scanning and focused search in actualising organisational goals. Therefore, search can be externally initiated as the scanning and focused search or internally triggered as the performance monitoring.

In addition, Katila and Ahuja (2002) also follow this definition of search as a learning process in their study of search practices in new product innovations as organisations seek for answers to their identified problems they try to find answers for their problems in uncertain conditions (Huber, 1991). Feedback systems have been argued to play a role in this organisational learning as they support reflexive practice through cycles of learning and changing (Antonacopulou, 2004). Critique is a fundamental part of learning and changing and it is "about the search for new possibilities beyond assessments which see things as black or white, right or wrong, positive or negative". It also encourage individuals to move away "from existing assumptions and practices and provide the strength and conviction to search for new meaning, to search for new understanding, to search for new ways of living" (Antonacopulou, 2004, p.60).

In addition, search has been defined as a behaviour of an organisation or entity in seeking solutions within the proximity of their existing knowledge (Stuart and Podolny, 1996 cited in Rosenkopf and Nerkar, 2001). Rosenkopf and Nerkar (2001) explaining local and non-local search and the ways organisations integrate knowledge of different sources introduced a typology of exploration to show "how the various types of exploration affect the extent to which firms' knowledge is recognized by other firms and integrated into future technological developments" (Rosenkopf and Nerkar, 2001, p.288).

However, not only finding solutions to problems or opportunities can be an impetus for search, but learning from failure can promote search, which is called 'problemistic search' (Madsen and Desai, 2010). Because there is a degree of urgency in problemistic search it is more likely that it adopts new and more varied ideas and sources in searching for knowledge to address the failure or performance shortfall. Therefore, failure encourages the search too focus on new knowledge and acts as a roadmap that shows what activities should search processes focus on(Levinthal and March, 1981). Table 1 summarises the key works in the literature.

Author and Year	Type of Search	Focus of Search	Purpose of Search	Outcome	Role of Technology
Huber (1991)	scanning, focused search,	Knowledge acquisition	Organisational learning	Improving performance, Identifying solutions, legitimising decisions	Not discussed

	performance monitoring.				
Rosenkopf and Nerkar (2001, p.287)	Local and non-local search	Technological evolution	Organisational and technological boundary spanning	highest impact of exploration on technological evolution when the exploration spans organizational boundaries but not technological one. greatest impact of exploration on subsequent technological development when exploration spans both organizational and technological boundaries (2001, p.287)	Not discussed
Katila and Ahuja (2002)	Local and non-local search	New product introduction	Reusing existing knowledge or exploring new knowledge	independent and interactive effects of search depth and search scope determine a firm's ability to create new products (2002, p.1183)	Not discussed
Madsen and Desai (2010)	Problemistic search and local search	Improving organisational performance	Organisational learning	organizations learn more effectively from failures than successes	Not discussed
Stark (2011)	Interpretive search	Finding the unknowns	Creating value in radically destabilised environments	Creating organisational reflexivity Unlearning the lessons of early success (2011, p.175)	Social media and technologies of search
Laursen (2012)	Local and non-local search	Product innovation	accessing a variety of inputs for innovation	Creating trade-offs by firms having to balance local and non- local search (2012, p.1181)	Not discussed
Li et al. (2013)	External search	New product introduction	maximizing new product introductions	the location selection and intensity of search independently and jointly influence new product introductions (2013, p.893)	Not discussed
Laursen and Salter (2014)	External search	Product innovation	Making formal external collaborations	concave relationship between firms' breadth of external search and formal collaboration for innovation, and the strength of the firms' appropriability strategies (2014, p.867)	Not discussed
Bashir, Papamichail and Malik (2017)	External knowledge search	New product development	supporting new product projects	Informal use but generating more insights from various sources that exist both inside and outside the organization (2017, p.181)	Social media
Trantopoulos et al. (2017)	External knowledge search	Process innovation	Improving innovation performance	positive direct effect of IT investments on economic gains due to process innovation (2017, p.293)	data access systems and network connectivity
Martini, Neirotti and Appio (2017)	External knowledge search	Product innovation	Improving innovation performance	complementarity between external search and internal organization mechanisms (Idea Management Practices and Internal Integration	ICT (mentioned but their role is not explored in

				Mechanisms) (2017, p.200)	the research)
Posen et al. (2018)	Problemistic search	Learning from performance feedback	resolving the performance shortfall	strategic change and reorientation, risk-taking, organizational adaptation, knowledge generation, organizational learning, new resource creation, and innovation (2018, p.208)	Not discussed
Karhade and Dong (2021)	Collaborative Problemistic Search (CPS)	Product or service innovation	developing new products or services successfully	a cross-stream CPS effect—the interaction of CPS with customers (CPS-C) and CPS with suppliers (CPS-S) is beneficial for innovation when firms face IO-BSIS (2021, p.693)	boundary-spanning information systems (BSIS) (CRM or SCM systems)

Table 1. Illustrative examples of 'search' studies

Despite the valuable insight in the literature of search, one issue we identified is that extant literature has failed to present a comprehensive definition of search. This leads to lack of a clear understanding of not only nature of search practices, but also the diversity and nuances of those practices. In addition, the use of the theory in IS literature, despite its value, is very limited, which offers opportunities for the discipline. We address these issues first by providing a working definition of 'search' which we develop it further in the discussion (section 4.1) and second, offering a new search-based approach for IS scholars to advance our understanding of DT phenomenon.

Based on the above discussion of the literature (on organisational search) and Stark's suggestions, we define search as a spectrum ranging from of activities related to everyday information management and exploration of idea and solutions to more interpretive forms of inquiry and looking for the areas of ambiguity. Within this continuum, 'search' has the five dimensions that are depicted in Table 2.

Search Dimension	**Definition**	**Literature examples**	**Focus of search**
Scope	Scope can be defined temporally and spatially depending on the extent that organisations go to seek for knowledge and information in time and proximity. Spatial aspect of search has been the main focus of search scope exploring locality and distance to/from the boundary of existing knowledge or technology. This can also be categorised as internal or external search as the practices move beyond organisational boundaries.	Katila and Ahuja (2002), Rosenkopf and Nerkar's (2001), Zahra and Gerard (2002), (Argote and Miron-spektor, 2011)	Organisational learning
Range	Range of serach is defined based on the types of its practices and for different objectives. Organisations can engage in 'problem solving search', 'analytic search' or 'interpretive search'. The analytic type of search tries to define problems to find optimal solutions, while the interpretive search is a form of inquiry that the object of search is not defined and is uncertain.	(Rosenkopf and Nerkar, 2001), (Martini, Neirotti and Appio, 2017), (Lester and Piore, 2009) (Mina, Bascavusoglu-Moreau and Hughes, 2014).	New product development, service or product innovation
Depth	Depth of search is related to the intensity of	(Laursen, 2012),	Product

	activities involved in exploring internal and external sources. It also depends on the degree of focus on internal or external organisational knowledge and might indicate the level of resources organsiations assign to search practices.	(Trantopoulos et al., 2017), (Posen et al., 2018)	innovation, Improving performane
Mediation	Mediation of search is about intervention of different human or technological actors. When engaging in external search, various actors such as customers, suppliers and other organisations such as universities and competitors might be involved and depending on the nature of relationship for knowledge extraction, they would mediate the search processes. Similarly, technological actors (e.g. IT) can influence search processes.	(Laursen and Salter, 2014; Laursen, 2012), (Majchrzak and Malhotra, 2013; Joshi et al., 2010)	Product innovation, Process innovation
Process	Search involves different activities and resources orchestrated to a goal such as product innovation or improving performance that are ongoing. Focusing on problemistic search, Posen et al. (2018, p.71) highlight that a process perspective to search is needed from identifying the issues (e.g. diagnosing the reasons for performance shortfall, the search itself that lead to changes to restore the performance). Their call for "more process oriented theorizing reflects the observation that the literature has often been black-boxing the search process in the discussion of problemistic search, studying its antecedents and consequences without a rich connection to search itself".	(Paananen, 2012; Posen et al., 2018), (Martini, Neirotti and Appio, 2017)	Learning from performance feedback

Table 2. Dimensions of search

4 'Search' as an Analytical Approach in Studying Digital Transformation

Digital transformation has been described as organisational efforts to generate new business offerings in terms of products, services, and customer experiences (Yoo, Henfridsson and Lyytinen, 2010; Yoo et al., 2012) or new value propositions (Wessel et al., 2021; Gong and Ribiere, 2021) through new processes, business models (Nambisan et al., 2017), coordination mechanisms (Yoo et al., 2012), structures, actors and practices (Hinings, Gegenhuber and Greenwood, 2018). Through this process of transformation, organisation deal with a myriad of digital technologies constructed algorithmically, which create new forms of work as they are impenetrable and hidden (Introna, 2015, p.25), but also performative (Faraj, Pachidi and Sayegh, 2018). Therefore, there has been recent discussions that we need new approaches in studying digital work (Orlikowski and Scott, 2016; Gregory et al., 2018).

To address this, we introduce the notion of search as an analytical approach in examining the digital transformation phenomenon which can guide researchers and equip them with a methodological tool to study how organisations navigate their transformation journeys. Following Stark's (2011) idea and Hafezieh's (2019) conceptualisation of search, we propose search as a novel approach which involves the traditional search practices of exploration and information management, but moves more towards interpretative forms of inquiry and managing ambiguity and looking for unknowns. The search

addresses some of the current concerns that "our existing ways of conceptualizing digital formations (Latham and Sassen 2005) and the tools that we employ for studying "digital work" are not sufficient if we are to understand the generativity with which they are inextricably intertwined" (2016, p.93).

4.1 Generativity of Search in an Empirical Example

To demonstrate how search can be employed as an analytical and methodological tool, we analyse a secondary case based on Wessel et al.'s (2021) recent study of DT within a manufacturing context. In this section, we draw on their empirical case study to depict how we can explain DT through the lens of search. The case (anonymised as Beta) is an incumbent manufacturing firm which has traditionally focused on selling hardware products to its clients worldwide. Beta's aim was to transform to a 'digital service supplier' through "new revenue model, redesign its departmental structure, and change its organizational practices" (2021, p.111).

The genesis of Beta's digital transformation was emerging technologies such as smart/sensor-based hardware and associated software which intensified the nature of competition due to the advent of new entrants offering software systems for manufacturing hardware to deliver smart industrial machinery. Losing competition to smaller software providers triggered the broader issue Beta was facing. This issue, an external problem, was the impetus for search for a change. Beta experienced two types of search in its journey of digital transformation: external search and internal search. Therefore, Beta's overarching search practice involved a wide scope exploring locally and internally to identify areas of potential growth, while also searching for local and nonlocal areas (close and distant to its existing technology and knowledge) externally (Katila and Ahuja, 2002; Trantopoulos et al., 2017). Regarding the former, the internal local search aimed at building on the existing software capabilities (which were not the focus of Beta's business). With respect to the latter, the goal of broader search practices was to understand changes, patterns, and trends in the sector such as the rise of Industry 4.0 or Industrial Internet of Things (IIoT) and identify ways that these emerging digital technologies could offer opportunities.

In addition to scope, Beta's search was in-depth meaning it was intensively engaged with internal and external sources (Katila and Ahuja, 2002; Trantopoulos et al., 2017). Search practices within Beta were conducted across multiple levels of the firm. At the top management level, the focus was on looking for new business model, organisational structure, and work practices and processes to fulfil the requirements of this transformation. For instance, a 'digital strategy' document was developed to guide the redefinition of firm's offerings to digital services from hardware machines. Although the practice of search started at the top management level of the firm that initiated a 'digital strategy', it became a norm to search for areas to deliver new value to their clients. However, the actual implementation of fundamental changes was through the work practices of employees at other levels such as sales staff, which also involved active seeking for ways to sell new products and services.

In addition, Beta's search practices in digital transformation was multi-purpose focusing on a range of different areas (Martini, Neirotti and Appio, 2017; Lester and Piore, 2009). As Beta focused on searching new value pathways and business model (new products, services and pricing models), they were also searching for alternative organisational structures and new skills and expertise required within the firm. For example, a new department was created as 'digital business unit' led by a newly recruited chief digital officers (CDO).

Sales people needed to redefine their work practices from selling hardware to selling software and services (changing their roles from salespeople to consultants). A lot of this also involved changing expertise and learning (sales experts in selling machines to learn about sales of software and digital services) and raised tension between sales, management and digital department (due to lack of knowledge about the product and lack of understanding of new revenue models). This is because digital transformation of activities and work practices involve how to unlearn as the existing

knowledge might not be completely and directly useful. In this case, salespeople needed to shift to more of consultants which was not clear to them.

Another important dimension of digital transformation is the need to change expertise and knowledge about technology and work and perhaps more towards technical skills (e.g., one in six of the sales individuals post digital transformation were software engineers). In searching for providing the new knowledge and expertise required, organisations often offer extensive training for the existing workforce, but usually have to recruit new employees with those capabilities required for the new direction of the firm (Hafezieh, 2019).

Moreover, Beta's digital transformation required a change in the structure and composition of the organisation to enable the agility required for the shifts. This structural change which is usually a major one originates from the top of the firm: "They carried out a massive structural change to the whole organization and instituted a new digital business unit" (Wessel et al., 2021, p.115). In this regard, the new organisational form would require new skills, knowledge and expertise that would be addressed by recruiting new talent and offering training opportunities. Therefore, the new experts, teams, and departments are able to act more independently and have more autonomy and freedom to explore and experiment to redefine their work practices.

As we can observe from the above case, through various types and levels of search practices, organisations move away from their existing knowledge, learn to unlearn, create new knowledge and become a new organisation. Therefore, as it has been highlighted, digital transformation involves experimentations (Huang et al., 2017; Hafezieh and Pollock, 2018b), and thus, search does not have a fixed, predetermined form and it's emergent, fluid, and generative.

This type of search that organisations experience in their digital transformation is beyond problemistic search which focuses on problem definition and solving specific and defined problems. Rather, it's a search where organisations do not know what they are looking for and learn to live with that ambiguity to be able to innovate in their offerings, relationships with internal and external stakeholders, structures, and work practices and becoming increasingly more reflexive in this process. Therefore, it is through the generativity and fluidity of search that organisations cultivate their capacity to reflect, adapt, disrupt, and change.

4.2 How to study search

Together these four elements (value pathways, work practices, expertise and skills, structure and composition) drive the organisation to engage in reflecting and deflecting practices. This is because the organisations do not know what they are looking for and in the search for unexpected opportunities (Dewey, 1998), they need to develop interpretive capabilities (Lester & Piore, 2009) to work through the ambiguous situations. That's why organisations rely heavily on experimentations in their digital transformation activities. In this process, the organisation moves away from solving problems and closure, rather they create productive disruption and in doing so, they learn how to unlearn (Stark, 2011). Thus, through the entanglement of reflecting and deflecting, they adapt existing practices and constantly creating new routines and work practices. This is through the critique that the organisational actors move away from their assumptions and practices (e.g. the organisational actors continuously 'questioning their best practices and creating constructive disruptions'). Therefore, the organisation becomes more reflexive and is capable of generating new knowledge (Antonacopulou, 2004).

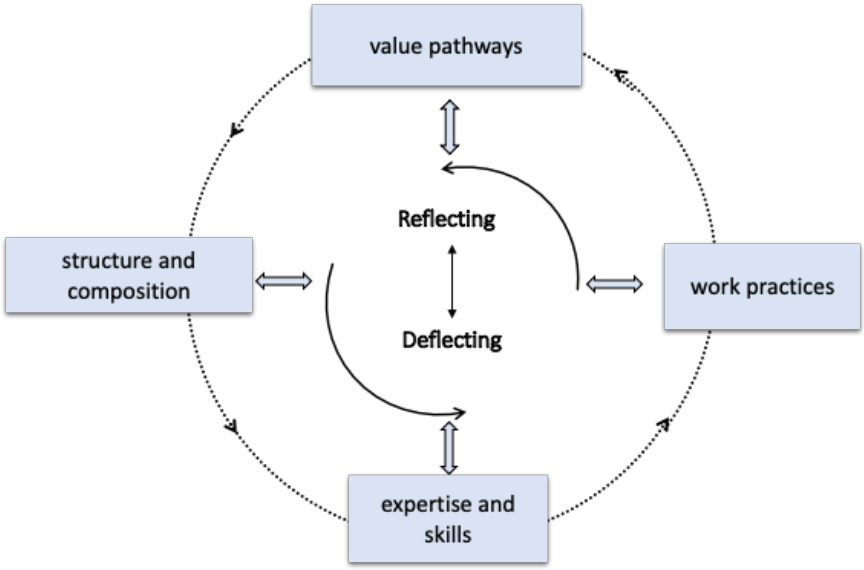

Figure 1. The Framework of Search in Digital Transformation

With regards to methods for studying this dynamic and complex process, we suggest qualitative research would be helpful in understanding how search activities unfold. In such studies, researchers might follow search spatially or temporally by looking into particular activities and interactions with different stakeholders (e.g., new teams or experts with the organisation) or in specific moments of technological developments. In addition, search can benefit from quantitative methods as to measure different dimensions of search or explore the influence of search practices on organisational reflexivity and the outcomes of digital transformation efforts.

5 Conclusion and Implications

Our paper makes two main contributions to the literature. Firstly, it contributes to the emerging body of knowledge about organisational DT that as pointed out is distinct from previous IT paradigm (Urbach, Drews and Ross, 2017; Mckelvey, Anderson and Yoo, 2016). As noted by Mckelvey, Anderson and Yoo, (2016, p.1), "[a]lthough intelligent computational algorithms powered by big data and analytics have great potential to augment human agencies, predicting the surprising outcomes of complex ecosystems could be infeasible unless the tools could accommodate nonlinear, dynamically changing interactions in the complex ecosystem". We demonstrated that occurrence of these 'dynamically changing interactions' are possible through dynamic and generative search practices across different levels. This is also aligned with Urbach, Drews and Ross' (2017) suggestions that such these interactions and practices have different implications from those former organisational IS that as we explained shifts the centralised control to decentralised autonomous actions, from confinement of IT to non-IT realms, and from strandardised processes to unconventional actions.

Secondly, we build on the nascent studies that highlight the distinction between DT and ITOT (Wessel et al., 2021; Gong and Ribiere, 2021) as we show the fundamental changes of DT can be understood employing the perspective of search. Through our framework of search we have explicated the significant changes as four dimensions of DT (value pathways, work practices, expertise and skills, structure and composition) can be realized by active and proactive reflection and deflection. This means search and its outcomes (at different levels, different purposes, and different depth) become the new logic of action forming the core of practices at experts, teams, and management levels. We believe this also addressed Orlikowski and Scott's (2016) research agenda on "algorithmic phenomena" that the platforms and dynamic algorithmic basis need to be understood "dynamically in action".

Despite the strengths of search as an analytical approach, it might involve certain limitations if not employed as defined and described. It should be noted that if we consider search as problemistic search or how it has been used traditionally in the literature, it will not have the explanatory power for digital transformation phenomenon. In addition, search might have other dimensions that we have not included in our framework and therefore, it requires further development. Based on our proposed lens of search and its nature, we suggest the following areas for future research on the use of search in DT.

Expertise and new roles. Search can have different orientations based on who performs search (e.g., product development, digital innovation, process innovation, etc.). This will provide insight through obtaining views from certain key roles such as CDOs, chief information officers (CIOs), chief marketing officers (CMOs), and chief technology officers (CTOs). Another aspect of search that is important for further research is in the intersection of product design, marketing and sales, and data science to understand how the organisation develops varied skillsets and expertise and it facilitates and coordinates this diversity. This would address how the heterogenous knowledge would be integrated and coordinated in DT (Yoo et al., 2012).

Locus of search. Search can be studies at different sites or places it occurs. As noted previously, it is often through the work practices of the organisational members in different departments and fields and hence, it can be used with a practice-oriented approach as it enables understanding "dynamic nexuses of connections" between practices (Nicolini, 2012, p.232). In addition, search can be studied at the interface of human and technological artefact entanglement as we showed that search practices are always mediated by technological actors. This would require the use of virtual ethnography method.

Boundary work. A lot of practices towards digital transformation requires skills and knowledge at the boundary of various disciplines and therefore, search requires boundary work. For example, there might be different groups of experts in conducting search practices and they need to redefine the boundary of their expertise recurrently (Hafezieh and Pollock, 2018b). Therefore, this boundary work which blurs the bounds of specialism areas and fields (such as marketing and data science, or sales and engineering, etc.) might be an interesting area for further research. According to Carlile (2002), there are three ways to explore boundaries across communities of practice: communication language, meanings and interpretations, and dependencies across boundaries. Therefore, we suggest future research can study boundary spanning practices in search, the changing nature of professions and hybrid types of experts, and the role of boundary objects in this process.

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