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Managing two-speed innovation for digital transformation

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Abstract

In this study, we propose that the concept of two-speed innovation is a fruitful approach to understand and manage digital innovation and transformation. The main argument is that two-speed innovation leverages the new organisational forms of the digital age, such as infrastructures and platform ecosystems. Our research questions are, (i) how does two-speed innovation support digital transformation, and (ii) how can managers leverage two-speed configurations?

We developed an analytical framework to understand the managerial options of two-speed innovation. To assess it we investigated the digital transformation of four large organisations. We identified four two-speed configurations, describe how the two-speed dynamics unfold and discuss managerial options for managing them.

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1. Introduction

Digital transformation is a challenging task, involving reconfiguration of technologies, organisations, and people. It is common wisdom that change management may be more important than technology, but there are many unresolved issues in how to manage the transformation [1]. In this study, we propose that the concept of *two-speed innovation* is fruitful for understanding and managing digital innovation and transformation.

Two-speed innovation expresses the idea that (i) digitalisation requires that an organisation must both exploit existing resources and explore new ones [2], and (ii) digital infrastructures and ecosystems support this by having some stable core elements with slow innovation, and some user-oriented elements with fast innovation [3]. Examples are banking systems with web interfaces, airline booking systems with customer apps, and medical systems with clinicians' devices in front. Previous research has suggested naming the first *heavyweight IT* and the second *lightweight IT*, denoting two different knowledge regimes [4]. In developing the term, we build on two assumptions:

First, digitalisation is about technology [5]. Of course, it is the goal-directed organisational use of technology that enables the capture of value [6], but it is misleading to argue that digitalization is primarily about organisational issues. A modern car factory is about robots and logistics; a digital ecosystem is about platform, apps, and transactions - and the governance of them [7].

Second, the organisation and architecture of technology are essential, and the layered and combinable structure of digital technologies offers a set of previously unknown options for innovation [8]. However, even digital technology is not endlessly flexible, and some forms of technical organisation are better than others. Two such forms are platform-oriented infrastructures [9] and platform ecosystems [10], and both of them are supported by two-speed innovation.

McKinsey coined the term *two-speed IT architecture* for the digital enterprise [11], defining it as a fast-speed, customer-centric front end interacting with a slow-speed, transaction-focused legacy back end. Several authors have used the term two-speed innovation (see for instance Kessler and Buch [12]), but the term has not yet been developed theoretically. The ambition of this paper is to do so and to explore the managerial options in leveraging two-speed innovation for digitalisation.

Our research questions are:

- How does two-speed innovation support digital innovation in infrastructures and platform ecosystems?
- How can managers leverage two-speed configurations?

We proceed by reviewing the literature on two-speed innovation, related to digital transformation and the exploitation/exploration divide. Building on this we propose a framework to analyse the organisational and managerial options of two-speed innovation. We use the framework to describe and assess two-speed innovation in four large organizations, identified four two-speed configurations, and discuss managerial options for managing them.

2. Relevant literature

The idea of two-speed innovation has two main sources; the research on exploitation and exploration (and other related concepts) and the technical architecture of platform ecosystems.

2.1. Exploitation and exploration

It is acknowledged in management research that in order to compete and sustain, organisations need to both produce effectively and to innovate [13]. A car producer must produce a large number of identical cars at low cost, but also develop new models with electric motors and self-driving software. A hospital must treat a large number of patients professionally and efficiently, but also conduct research for new treatments and take new technology into use.

Research has dealt with this issue in various ways, for instance by March's influential concepts of *exploiting and exploring* [2]. Exploitation means to use your current resources efficiently, while exploration is to increase the search scope, aiming for discovering and leveraging new resources. Because the two approaches require different structures and capabilities, March argued that there is a trade-off between the two; i.e. an organisation must decide its focus and balance. Exploitation implies to reduce variability to optimise production, while exploration implies to increase it to stimulate innovation.

A suggested approach to resolve this challenge is *ambidextrous* organisations, which separate their exploratory units from their traditional, exploitative ones, allowing them to have different processes, structures, and cultures; co-ordinating them at the senior executive level [14]. A related idea is the concept of *dynamic capabilities* [13], which differentiates between the capabilities an organisation needs to produce its current products and services, and the dynamic capabilities needed to sense and respond to changing environments. How are such capabilities acquired? Augier and Teece suggested that, although firms are products of their own history, managers can play a significant role in shaping new capabilities [15].

These insights have highlighted that organisations need to combine productivity and innovation and that these capabilities require different structures and mindsets. What they contribute less to, is how the new digital organizational forms support this aim.

2.2. Digital infrastructures and platforms

With the rapid growth of the Internet in the 1990s, there was a transition from single IT systems in organisations to interconnected digital infrastructures [16] and later to platform ecosystems [10]. Digital infrastructures are defined as shared, open (and unbounded), heterogeneous, and evolving socio- technical system (the installed base) consisting of a set of IT capabilities and their user, operations, and design communities [16]. The main difference is that digital infrastructures are more heterogeneous than platform ecosystems, which have a clear structure of platform core and complements [3].

Digital infrastructures and platform ecosystems have some shared characteristics. They are large socio-technical structures, consisting of systems, networks, and users, transcending organisational and national borders, and have become key actors in modern economies. Examples of digital infrastructures are airline systems and health systems. Examples of platform ecosystems are Uber and Airbnb. They grow through innovation, adoption, and scaling [9], and it is their organisation of technology (their IT architecture) that provides their ability to support two-speed innovation [17].

The explanation is that platform structures allow for two loosely connected innovation processes; the core is characterized by a long-term perspective, standardized interoperability, and planned change, while the compliments (apps) allow for short-term innovation, local adaptation and emergent change. An illustrative example is how the car industry has approached modern media. A decade ago, car manufacturers developed (or bought) their own navigation and audio systems, at the same speed as they did new car development. Then, observing the rapid innovation at firms such as Apple and Samsung, they decoupled the innovation processes and integrated the quickly evolving media products into the (still) slowly developing car models [18]; [12].

2.3. Summing-up

The principles of two-speed innovation can be summarised this way:

- It is a process which combines exploitation and exploration, by a loosely coupled interplay.
- It is supported by the IT architecture of infrastructures and platform ecosystems, which differentiate between stable heavyweight IT and fast and agile lightweight IT, connected by boundary resources (APIs).
- Two-speed innovation allows organisations to leverage their existing resources to enable fast innovation.

Building on this, we will now suggest a simple framework allowing us to study the phenomenon empirically in digitalisation innovation processes.

3. Framework

Our framework is built on the premise that digital transformation is built on two key aspects; access to digital resources and the dynamic capabilities to leverage them for business purposes. Digital resources are identified as the primary component in digital innovation [19], because of their re-combinability, and the contingent relationship they have to other resources. In digital platforms and infrastructures, these resources are organized in four value spaces, i.e. devices, networks, services, and content, where various combinations create value [8].

Dynamic capabilities are needed to leverage digital resources for innovation. Capabilities refer to a “firm’s capacity to deploy resources, usually in combination, using organizational processes, to effect a desired end” [20] p.35. The dynamic capability perspective [13] has been extensively used in the strategic and change management literature to investigate how companies can create, extend, or modify their resources in response to a rapidly changing environment. The perspective specifies organizational processes, routines, and competencies that allow a firm to generate a new strategy in response to emerging requirements. Dynamic capabilities enable firms to transform through three capacities; sensing, seizing, and reconfiguring [21].

We combine these two dimensions – dynamic capabilities and digital resources - into a four-field matrix, as shown in Figure 1. We differentiate between dynamic capabilities for business, i.e. achieving competitive advantage, and professional dynamic capabilities, the last characterising non-commercial sectors. We also differ between digital infrastructures and platforms.

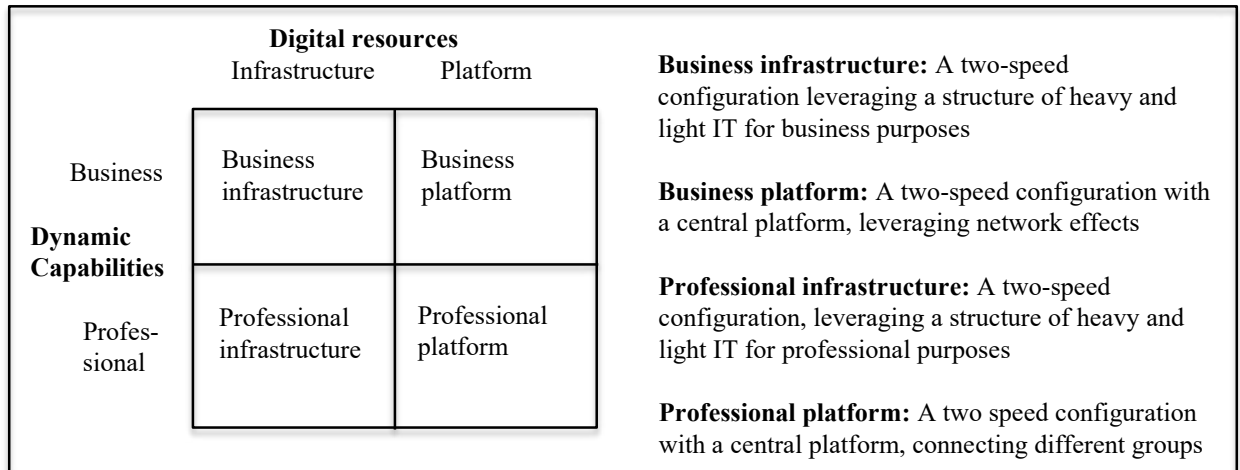


Fig. 1. Two-speed configurations

As shown in the framework, we identify and define four configurations. We will use the framework as an analytic lens for analysing the cases.

4. Method

To explore and validate the concept of two-speed innovation we chose a case study approach. In order to investigate the four configurations in our framework, we carefully selected four example cases, from our portfolio of on-going longitudinal studies of innovation in large interconnected structures. The selection criteria were as follows. Following Gerring [22] they should be relatively *typical* cases, in order to work as illustrative examples of two-speed innovation.

The four cases were chosen to illustrate the four configurations in our framework; they were reasonably successful, they were competently managed, and the solutions were taken into use. And most importantly, they offered the opportunity to analyse in-depth data over time, allowing us to understand the dynamics.

Data was collected over the period 2013-2019, consisting of interviews with key stakeholders, archival data and observations. Data analysis was conducted first for each case; we analysed the development of dynamic capabilities, then the deployment of digital resources, and finally the resulting two-speed configuration. Second, we conducted a comparative analysis, focusing on the shared characteristics, and the differences between them.

5. Illustrative cases

We selected four illustrative cases, to describe the process of two-speed innovation. Each case description is structured as follows, using the framework introduced in section 2; first, we describe how the dynamic capabilities

were developed and mobilized, then we describe the critical digital resources taken into use, and finally assess how the two-speed innovation process unfolded.

Table 1. Cases

CASE	Description	Configuration
Østfold Hospital	General hospital	Professional infrastructure
TSD – by USIT	Research platform for University of Oslo	Professional platform
Nordic Choice	Large Scandinavian Hotel chain	Business infrastructure
ViPPS	Mobile payment service	Business platform

5.1. Østfold hospital – professional infrastructure

In 1999, the Norwegian Parliament decided to build a new hospital in Østfold County, which is part of the South-East Regional Health Authority. The hospital opened in November 2015, with both somatic and psychiatric services and 4800 employees. It quickly became well-known as one of the most digitally advanced hospitals in Scandinavia.

Dynamic capabilities

Hospitals have historically been organized according to professional disciplines and been less concerned with the coordination of activities across these disciplines [17]. The CEO at Østfold hospital, Just Ebbesen, was a doctor and a pioneer in using IT to innovate and support clinical processes: “I had been engaged with the relationship of process innovation and IT the past 15 years, both theoretically and practically, and I knew what I wanted to achieve: hospital processes should be well defined and supported by information.” Ebbesen hired a CIO with experience from production and retail, a process director and a research director, and established a top management team. The management team decided to acquire process technology and contacted a new supplier. This process technology was not part of the regional portfolio of clinical systems.

Digital resources

The hospital management established an innovation project with around 25 clinicians working on redesigning the clinical processes, and a separate group that worked with the process technology. The IT systems had to relate to the process design, and since much of the information was stored in the existing digital infrastructure (consisting of over 300 applications, and managed by the central IT units), an interface that the process technology could use was created. The process technology consisted of check-in, mobile devices, and electronic whiteboards, i.e. user services that enabled clinical personnel to configure the information to fit with the process flow.

Two-speed configuration

The endeavors to implement lightweight process IT, and establish interaction with the digital infrastructure, has made Østfold a two-speed organization. A new analytics unit was established to monitor the performance, and new digital services were created. This digital competence gave Østfold a level 6 certification in HIMSS.

5.2. TSD – a research platform

The second case is taking place at the University of Oslo, which is the highest rated university in Norway, with 28.000 students and 6.000 employees. The unit of analyses is USIT, the University of Oslo's central IT organization with around 220 employees, and thus one of the largest state in-house IT organizations in Norway. USIT delivers a range of services including specialist services, both locally, nationally, and internationally.

Dynamic capabilities

USIT was originally an operational-oriented organization with a high level of expertise in local or national administrative solutions. Increasingly, there was a demand for a research platform where data could be stored and shared. A TSD group was established to work on the development of the research platform, and a competent project manager was appointed. The group was initially quite small but grew larger as TSD gained popularity. Stronger ties

were also established with important research groups. TSD eventually became central to USIT's innovation strategy and is now competing with other solutions in the higher education and healthcare sector.

Digital resources

Initially, the TSD group had to use the existing integration engine when developing new solutions. As the TSD research platform gained in popularity, the need to develop services faster was strengthened. Consequently, a new architecture was developed and implemented. The architecture consists of platform core, boundary resources, and loosely coupled app modules, and TSD offers a variety of application resources that allow services to be developed by the researchers themselves. For instance, the TSD group responded early to the corona crisis in March 2020, and quickly provided corona researcher with a secure service.

Two-speed configuration

With the TSD, USIT has established a two-speed organizational structure that enables USIT to have the capacity to both manage stable operations and resilient innovation. From a strategic perspective, TSD can be developed further into a general research platform, where the central resources enable (a very scalable number of) researchers to develop their research instruments quickly.

5.3. Nordic Choice – a business infrastructure

Nordic Choice is a hotel chain based in Scandinavia. It includes 193 hotels and 33,500 rooms and had a turnover of 13,360 billion NOK (around 1.384 billion euros) in 2018. There are 16,500 employees in Norway, Sweden, Denmark, Finland, and the Baltics.

Dynamic capabilities

In 2015, as a response to the increasing competition from the online travel agencies Booking.com and Expedia, and the fear of losing control with their distribution channels and the customer relationship, Nordic Choice initiated a digital business strategy. The hotel chain realised it lacked the resources to implement the strategy, and established a separate company, eBerry in 2016. The mandate of eBerry was to maintain the main share of the bookings of Nordic Choice in the distribution chain. A Chief Digital Officer (CDO) was hired with a background from one of the OTAs, and quickly established several teams to compete in the digital ecosystem.

Digital resources

eBerry immediately started to implement the strategy short-term by entering the digital competition arena (negotiating with OTAs, search optimization, continuous surveillance of digital traffic, etc.) and long-term by investing in new digital solutions. These included a technical platform to build new solutions on, but integrated with the legacy booking systems, a new website, and a loyalty app. These measures stabilized the Nordic share of bookings.

Two-speed configuration

The strategy established a fast-moving unit, eBerry, with specialised competence and a different culture. It innovated quickly a set of digital services, which were integrated relatively loosely with the legacy heavyweight solutions at the mother company. In managerial terms, there was also loose coupling, as the co-operation between the two units was mainly done at top management level.

5.4. ViPPS - a business platform

ViPPS is a Norwegian mobile payment application designed for smartphones developed by DNB, the largest bank in the country. Mobile payment is a highly competitive digital ecosystem, with many global players, such as Apple Pay and PayPal.

Dynamic capabilities

In 2014 Apple Pay was launched, creating a race on mobile payment around the world. In Norway, a service (mCash) was already launched, and a Danish service (MobilePay), was entering the market, but DNB decided to

launch a competing service. The ViPPS was developed in six months by Tata Consultancy Services, an Indian firm, and launched in June 2015. To quickly build a large customer base, DNB ran an aggressive marketing campaign during 2016. In February 2017 ViPPS had 2 million customers and invited the other banks to co-partner a new company, ViPPS Corp. The mCash competitor was merged into ViPPS, and MobilePay was withdrawn from the Norwegian market.

Digital resources

Tata developed the first version of ViPPS very quickly, with rudimentary integration with the central bank systems of DNB. The first version included only mobile payment between friends, conveniently based on mobile phone number and credit card account. This service was free, and to make more money DNB developed more services for business, such as payment on Internet and in shopping. These services followed the same principle as the first, namely to solve a concrete need and be very easy to use. The first version was technically very simple, and the basic architecture had to be redesigned later, to support further development and security.

Two-speed configuration

DNB succeeded in establishing a dominating position in the Norwegian mobile payment market, by fast development of dynamic capabilities and a two-speed approach to digital innovation. The two-speed innovation eventually led to the establishment of a new company, and an international strategy for the ViPPS product.

6. Discussion

In this section, we return to the research questions. Building on our framework and cases, we suggest that two-speed innovation can be defined as an innovation process that leverages the interplay between digital platforms/infrastructures and lightweight IT to enable agile user-oriented innovation.

6.1. How does two-speed innovation support digital innovation in infrastructures and platform ecosystems?

Our cases show that two-speed innovation supports innovation, explained by the key principles proposed in section 2. As illustrated by the four cases there are some shared characteristics of successful two-speed initiatives.

First, two-speed innovation requires that top managers understand and leverage the idea. Developing the necessary dynamic capabilities implies risk developing resources that the organization currently lacks [13]. Taking the example of Østfold Hospital the CEO initiated a process view of the new hospital and implemented a completely new solution. In the case of USIT, the CIO decided to allocate key resources from operations, and start building a research platform.

Second, to allow for fast innovation with lightweight IT, it is beneficial to establish a new organization, loosely coupled to the mother organization. The reason is that tight integration between the two will slow innovation speed, reducing it to the speed of heavyweight IT (Bygstad, 2017). In the case of Nordic Choice, the new unit, eBerry, established agile processes and culture very different from the hotel chain, enabling fast development of new digital resources.

Third, the power of two-speed innovation lies in the combination of dynamic capabilities and digital architectures, i.e. they reinforce each other. This is illustrated in the case of Østfold Hospital, where the process reengineering was supported by the new layer of lightweight IT, and the interplay with the large systems.

However, we also observed that two-speed innovation works differently in the four configurations. The business platform configurations, such as ViPPS, are easier to scale, because of network effects [10], while business infrastructures, such as Nordic Choice and eBerry, require more integration [9], and therefore take longer time to work. The professional platform configuration, as exemplified in TSD, uses a similar IT architecture as business platforms, but the network effect is more limited, while the professional infrastructure configuration, such as Østfold Hospital, is the most complex, and requires much more integration.

6.2. How can managers leverage two-speed configurations?

March [2] perceived that managing exploiting and exploring is a trade-off, with a potential risk of misjudging the balance between them. Our cases highlight that two-speed innovation is a challenging process, with several risks, both

managerial, technical, and public. Taking the example of Østfold Hospital the CEO envisioned and implemented a costly solution, not at all approved by the central health care authorities. A failure, which was clearly a possibility, would have been a disaster. In the case of DNB, launching an immature and technically shaky product such as ViPPS could have ruined the public confidence of the large bank, if it had failed.

Our analysis shows that leaders can manage two-speed innovation by leveraging the interplay of exploitation and exploration made possible by digital architectures. This implies to establish dynamic capabilities [15] and to develop the needed digital resources. For instance, in the case of Nordic Choice, the top managers lacked the needed insights in the OTA ecosystems and decided to recruit the CEO from eBookers, i.e. a platform company. She managed the establishment of eBerry and also became a member of the top management group of Nordic Choice.

It is clear that digital transformation is not an endpoint, but will be a continuous process. We have not dealt with how two-speed innovation will evolve over time, and further research should aim to shed light on this.

7. Conclusion

This paper introduced and discussed the term two-speed innovation, and used four illustrative cases to explore the forces in the process. We show that digital transformation is made possible by a particular interplay, where dynamic capabilities operate with new organizational forms, such as digital infrastructures and platform ecosystems.

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