Developing your digital maturity for competitive advantage:
From models to practices in enabling digital transformation

Edwin L.S. Lee
Michael Barrett
Karl Prince
Eivor Oborn

cdbb
Centre for Digital Built Britain

UNIVERSITY OF CAMBRIDGE
Judge Business School

INDUSTRIAL STRATEGY

UKRI
UK Research and Innovation

CONSTRUCTION INNOVATION HUB

CDI
CAMBRIDGE DIGITAL INNOVATION

HUGHES HALL
UNIVERSITY OF CAMBRIDGE

wbs
WARWICK BUSINESS SCHOOL
THE UNIVERSITY OF WARWICK

Authors

Dr Edwin L.S. Lee

Edwin is a Postdoctoral Research Associate in Digital Innovation and Policy at the Judge Business School and Centre for Digital Built Britain, University of Cambridge. He has also worked with the United Nations International Telecommunication Union on innovation projects. Edwin holds a PhD in Management from Bayes Business School, University of London, and has been a visiting PhD at Harvard University. Edwin holds a BA and MPhil in Music from the University of Cambridge, where he also held the Basil Shone Organ Scholarship.

Dr Karl Prince

Karl is the Director of Knowledge Innovation at Cambridge Digital Innovation, Hughes Hall. At CDI he aims to advance research on digital innovation as well as promoting the translational impact of such research through knowledge hubs and education outreach programmes. Karl has previous experience in industry and academic contexts, holding consulting and management positions in the Cambridge cluster and research positions at the University of Cambridge, Warwick Business School and Leeds Business School. He also holds a PhD from Cambridge Judge Business School.

Professor Michael Barrett

Michael is a Professor of Information Systems and Innovation Studies at the Judge Business School, University of Cambridge. He is also Academic Director of Cambridge Digital Innovation and Distinguished Visiting Professor of Innovation at the Stockholm School of Economics. Michael is Editor-in-Chief of the *Information & Organization* journal, and is on the Advisory Board of the *Journal of the Association of Information Systems*. He has served as Head of the Organisation Theory & Information Systems group, Director (Associate Dean) of Programmes, and Director of the MPhil in Innovation, Strategy & Organisation (ISO) programme at Cambridge Judge Business School.

Professor Eivor Oborn

Eivor is a Professor of Healthcare Management in the area of Innovation and Organisational Change at Warwick Business School, UK. She earned her PhD at Cambridge Judge Business School, University of Cambridge in 2006, and is currently an honorary Fellow at Cambridge Judge Business School and Fellow at the Cambridge Digital Innovation Centre (CDI). Eivor is also a Visiting Professor at Stockholm School of Economics (SSE) in Sweden. She is Senior Editor at MISQ and has published work in leading journals, including Academy of Management Journal, Organization Science, Information Systems Research and MISQ.

Contents

Executive Summary

With the global spend forecast to reach $2.8 trillion in 2025, digital transformation remains at the forefront of organisations' strategic goals. To realise it, however, is complex and difficult with the ever-shorter innovation cycles of new emerging technologies. Relatedly, the concept of digital maturity has become intimately connected to digital transformation. A number of frameworks have been developed which identify different levels or stages of digital maturity to meet digital transformation goals.

Recent work has emphasised, however, that digital maturity is not static or an end-state but is instead dynamic and evolves – in tandem with the ongoing journey of digital transformation. In this paper, we build on Cresswell et al.'s (2019) digital maturity framework, which emphasises the shifting of digital maturity states over time and contextualised settings. Our processual perspective adopts a longitudinal approach to examine the digital maturing practices of a UK healthcare organisation (EyeHosp) over three time periods around the COVID crisis. Beyond the development of existing capabilities afforded by digital maturity, timing and creative agency are important for meaningful digital transformation to happen. We identify six digital maturing practices and their associated activities that can help organisations develop competitive advantage and enable digital transformation.

1. Digital Transformation and Digital Maturity – Overview and key features

Digital transformation has consistently been at the forefront of organisations' strategic goals. According to the International Data Corporation (IDC), global spending on digital transformation activities is forecast to reach $2.8 trillion in 2025 – more than twice of the allocated amount in 2020 (IDC, 2021). It is also the first time that global digital transformation spending is forecast to exceed $10 trillion over a five-year period.

Digital transformation in organisations entails the "combined effects of several digital innovations bringing about novel actors (and actor constellations), structures, practices, values, and beliefs that change, threaten, replace or complement existing rules of the game within organisations, ecosystems, industries or fields" (Hinings et al., 2018: 53). While attention is often put on the adoption of digital technologies – such as the Internet of Things, artificial intelligence, or cloud computing – (Gimpel et al., 2018; Berger et al., 2020), digital transformation can also refer to digital optimisation, new digital business models, and more modest initiatives such as legacy modernisation or putting services online (Gartner, 2021a). The specific technologies and activities that fall under the term 'digital transformation' are broad; however, they are united in that the integration of such digitisation initiatives fundamentally changes and impacts how organisations operate and deliver value to customers, ultimately resulting in value-add and improved profitability (Schallmo and Williams, 2018; Jäfvert and Parnefjord Gustafsson, 2019; Savié, 2019). As such, digital transformation often involves structural changes and requires organisations to "rethink old processes and reimagine new processes and decisions" (Schallmo and Williams, 2018: 7; Strömberg et al., 2020).

Achieving competitive advantage via digital transformation, however, is made more complex and difficult by ever-shorter innovation cycles and the rapid emergence of new technologies (Chanias et al., 2019; Berger et al., 2020). With this in mind, the concept of 'digital maturity' has become particularly helpful "for organisations seeking to understand how to engage effectively with a fast-moving and continuously changing environment" (Rader, 2019: 29).

Digital maturity can be defined as the alignment of "an organisation's people, culture, structure and tasks to compete effectively by taking advantage of opportunities enabled by technological infrastructure, both inside and outside the organisation" (Kane et al., 2017: 5). As such, the notion of digital maturity is centred around how organisations can adapt, and apply digital technology, to compete effectively in an increasingly digital environment (Kane et al., 2017; Rader, 2019). A key component within the digital maturity concept is the emphasis on continuity. Instead of being a time-boxed programme of work, digital maturity is a continuous and ongoing process of adaptation – a learning journey; as such, the notion of digital maturity provides organisations with an awareness of their progressions in an ongoing journey of digital transformation (Kane et al., 2017; Jäfvert and Parnefjord Gustafsson, 2019; Rader, 2019; Strömberg et al., 2020). Digital maturity is therefore not an end-state, but an operation that continuously grows and evolves (Rader, 2019), and Kane et al. (2017) intentionally use the term 'maturing' instead of 'mature' when describing the most advanced companies they studied.

Digitally mature organisations are more likely to be agile, risk tolerant, open to cross-functional collaboration, and more capable of driving digital change (Kane et al., 2019). Additionally, scholars have identified certain advantages that digitally maturity companies have over less advanced ones (Rader, 2019: 29; Kane et al., 2019), including:

- The rate at which new digital technologies can be identified and assimilated
- Ability to uncover and capitalise on the value of new digital technologies
- Attracting and retaining the right digital talent

Some of these capabilities are dependent on the foundational and operational systems being developed and integrated with, such that the new technologies are able to connect to the wider ecosystem. The advantages gained mean that digitally mature organisations tend to be better at driving revenue through existing assets, and are also able to gain and manage more volume with existing physical capacity (Westerman et al., 2012). In their study of nearly 400 companies, Westerman et al. (2012) find that digitally mature companies can be up to 26% more profitable than their average industry competitors. In short, digital maturity enables digital transformation. Putting it in another way, Berger et al. (2020: 3) state that organisations strive for digital maturity, "because immaturity contributes to the risk of digital disruption".

Digital maturity models

Notwithstanding the benefits that digital maturity can bring, organisations face the complex challenge of how to become digitally mature (Ochoa-Urrego and Peña-Reyes, 2021). To this end, researchers have identified and categorised the different elements that constitute 'digital maturity', from which digital maturity models have then been developed. Broadly, a model for digital maturity depicts "a sequence of discrete levels, i.e., dimensions and capabilities...that represents an anticipated or desired evolution path from an initial state towards a future target state" (Berger et al., 2020: 4). As explained by Berger et al. (2020), a wide variety of digital maturity models have been developed, that serve multiple purposes:

(i) describe (help assess the status quo and derive a future target state);

(ii) compare (for benchmarking purposes); and

(iii) prescribe (to help develop a roadmap).

Descriptive digital maturity models help organisations with the first step in their digital transformation process – i.e. where and how to start –, by providing a method to assess the current capabilities and state of digital development in an organisation, against a desired or ideal state (Ochoa-Urrego and Peña-Reyes, 2021; Anderson and William, 2018). In other words, these maturity models are "useful tools to understand the status-quo of the organisational abilities with the purpose to construct measures towards their improvement" (or towards the 'perfect' state in a given framework) (Ochoa-Urrego and Peña-Reyes, 2021: 2).

To enable this, researchers typically first identify and define the factors – or 'capability dimensions' (Berger et al., 2020: 4) – that constitute and together define digital maturity in each model. For instance, in Strömberg et al.'s (2020) literature review, they note that research have mainly clustered around four areas that can influence organisation's digital maturity goals:

(i) strategy (aligning business and IT strategies);

(ii) technology (evaluation and adoption of disruptive technologies);

(iii) organisational culture; and

(iv) leadership.

Another example can be found in a digital maturity model developed by Deloitte and TM Forum, that includes five core dimensions, that are divided into 28 sub-dimensions (Anderson and William, 2018). Within these 28 sub-dimensions are a further 179 individual, accessible criteria, which can be used by organisations to evaluate their digital capabilities across the different internal business dimensions (see Figure 1).

Going beyond the identification of capability dimensions, models typically integrate such dimensions into a digital maturity scale – with a description of different 'levels' of maturity in each of the dimensions –, against which organisations could benchmark themselves against. Chanias and Hess' (2016) description of the five maturity levels in their digital maturity model provides a good illustration (see Table 1).

Valdez-de-Leon's (2016) digital maturity model provides an example of how the dimensions and levels of maturity can form a useful framework for particular industries. He develops a digital maturity model for telecommunications service providers – drawing on a combination of existing models, a literature review, and input from experienced practitioners via the Delphi method. Initially, seven dimensions were identified as important for digital maturity in the telecommunications sector (see Figure 2).

Figure 1. Deloitte and TM Forum's digital maturity model structure.
Reproduced from: Anderson and William, 2018.

The five core dimensions are divided into 28 sub-divisions, which in turn breakdown into 179 individual criteria on which digital maturity is assessed.
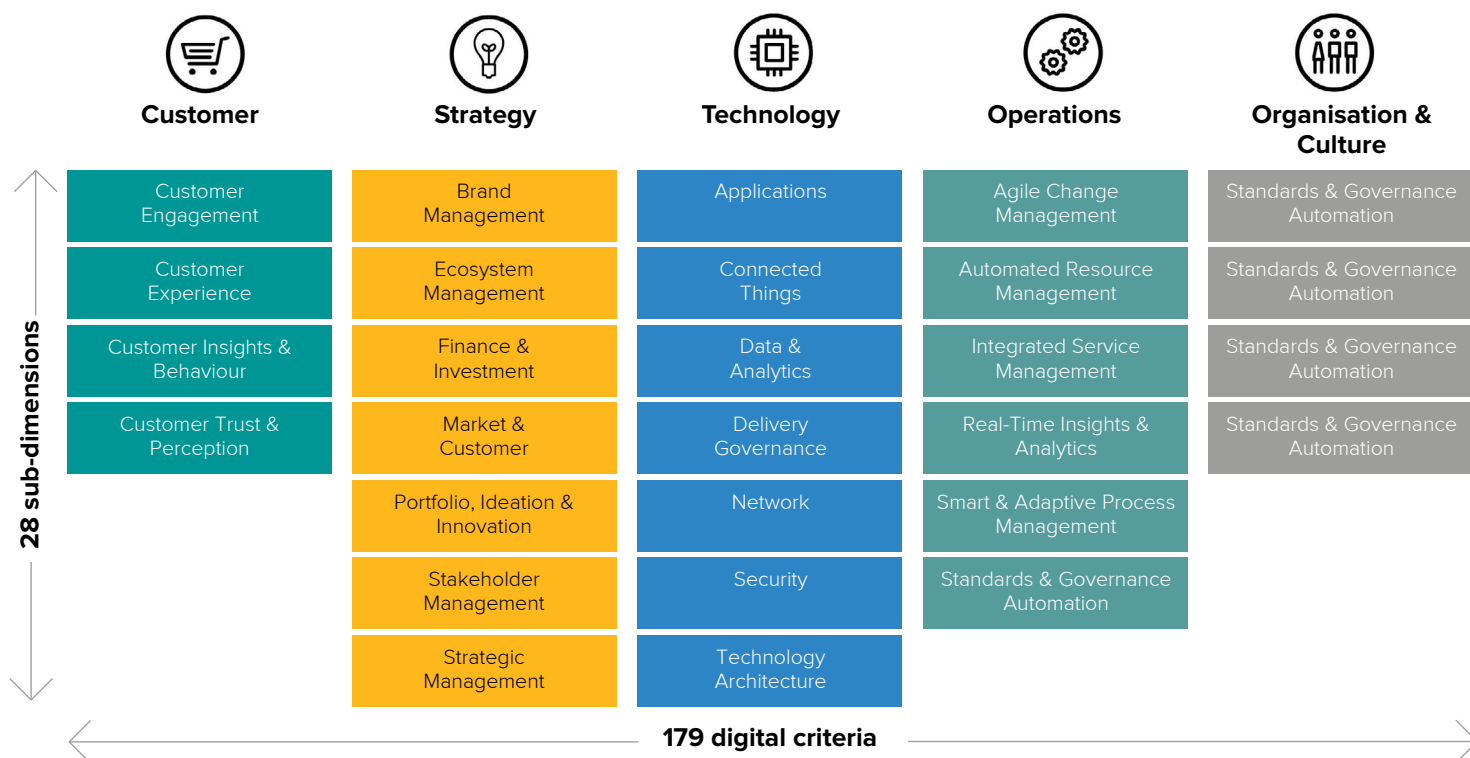

Customer	Strategy	Technology	Operations	Organisation & Culture
Customer Engagement	Brand Management	Applications	Agile Change Management	Standards & Governance Automation
Customer Experience	Ecosystem Management	Connected Things	Automated Resource Management	Standards & Governance Automation
Customer Insights & Behaviour	Finance & Investment	Data & Analytics	Integrated Service Management	Standards & Governance Automation
Customer Trust & Perception	Market & Customer	Delivery Governance	Real-Time Insights & Analytics	Standards & Governance Automation
	Portfolio, Ideation & Innovation	Network	Smart & Adaptive Process Management	
	Stakeholder Management	Security	Standards & Governance Automation	
	Strategic Management	Technology Architecture		

28 sub-dimensions

179 digital criteria

Table 1. Chanias and Hess' five stages of digital maturity.
Reproduced from: Chanias and Hess, 2016.

Level	Description
Level 1: Testing	The need to act has been recognised by top management and first resources have been provided in order to pursue digital activities. Further, first experiments with digital products and services have been conducted.
Level 2: Establishing	The company has gained an over-departmental understanding of the necessity to digitally transform and digital projects have a high priority.
Level 3: Consolidating	Management has defined strategic targets for the digital transformation and drives the transformation as a strategic change project. Digital and mobile channels have been integrated into core processes
Level 4: Structuring	A digital roadmap and dedicated digital transformation strategy is in place. New technologies are regularly evaluated at an early stage. Processes are automated and advanced analytics are used.
Level 5: Optimising	Certain functional areas are being expanded. Digital transformation is a predetermined business objective for the management and has been translated into measurable, operative goals. The digital potential in core activities and processes is fully utilised.

Furthermore, six levels of maturity (from 0-5) were determined: from (0) – Not started; (1) Initiating; (2) Enabling; (3) Integrating; (4) Optimising; to (5) Pioneering (Valdez-de-Leon, 2016: 23). Together, the levels and the dimensions form a digital maturity model for telecommunications service providers (see Figure 3).

Beyond the determining and benchmarking of capability dimensions, other digital maturity models have gone further, in identifying 'action fields' that organisations can draw on to reach digital maturity. For instance, Gimpel et al.'s (2018) framework includes six action fields, and a further four specific action items within each field (see Figure 4).

Figure 2. Seven dimensions of digital maturity for telecommunications service providers.
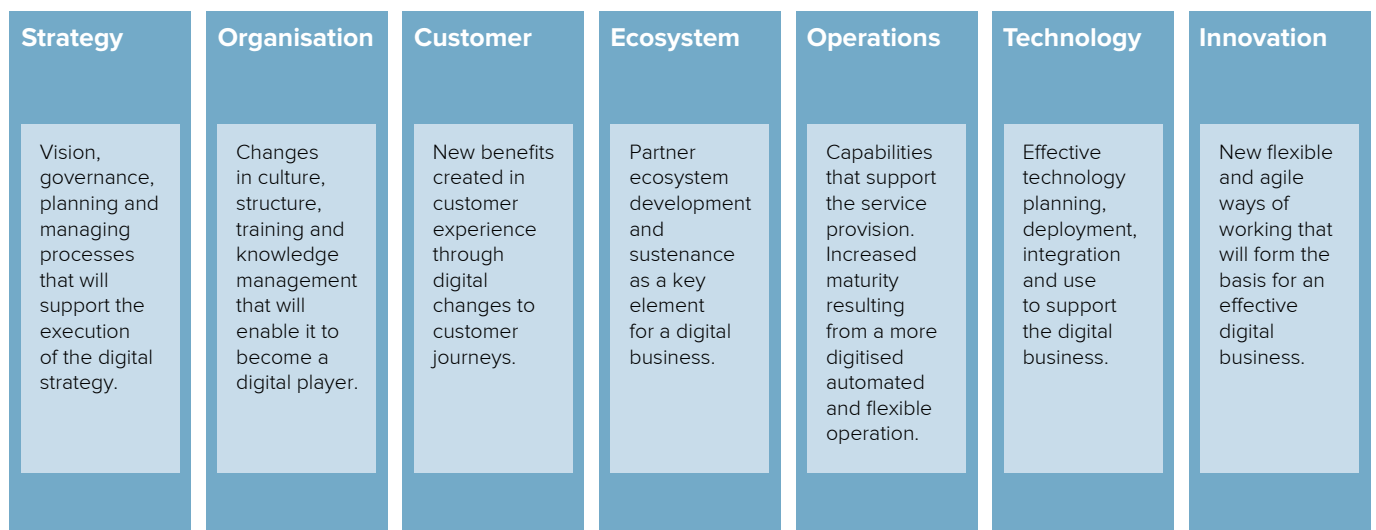Reproduced from: Valdez-de-Leon, 2016.

Strategy	Organisation	Customer	Ecosystem	Operations	Technology	Innovation
Vision, governance, planning and managing processes that will support the execution of the digital strategy.	Changes in culture, structure, training and knowledge management that will enable it to become a digital player.	New benefits created in customer experience through digital changes to customer journeys.	Partner ecosystem development and sustenance as a key element for a digital business.	Capabilities that support the service provision. Increased maturity resulting from a more digitised automated and flexible operation.	Effective technology planning, deployment, integration and use to support the digital business.	New flexible and agile ways of working that will form the basis for an effective digital business.

Figure 3. Outline of Valdez-de-Leon's digital maturity model
for telecommunications service providers.
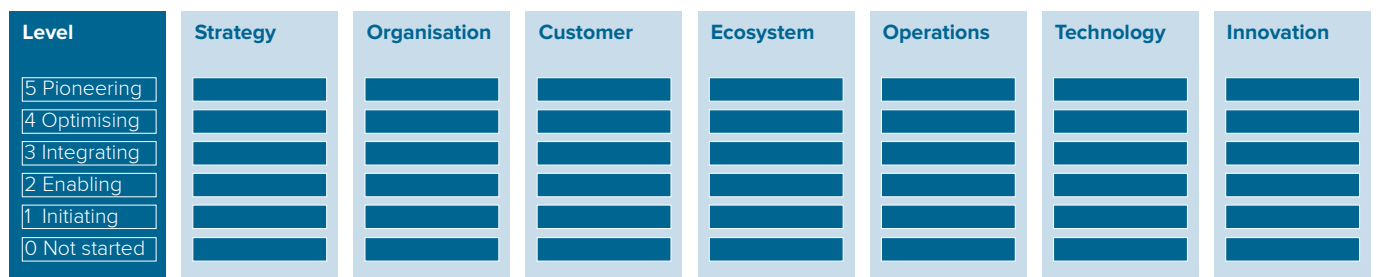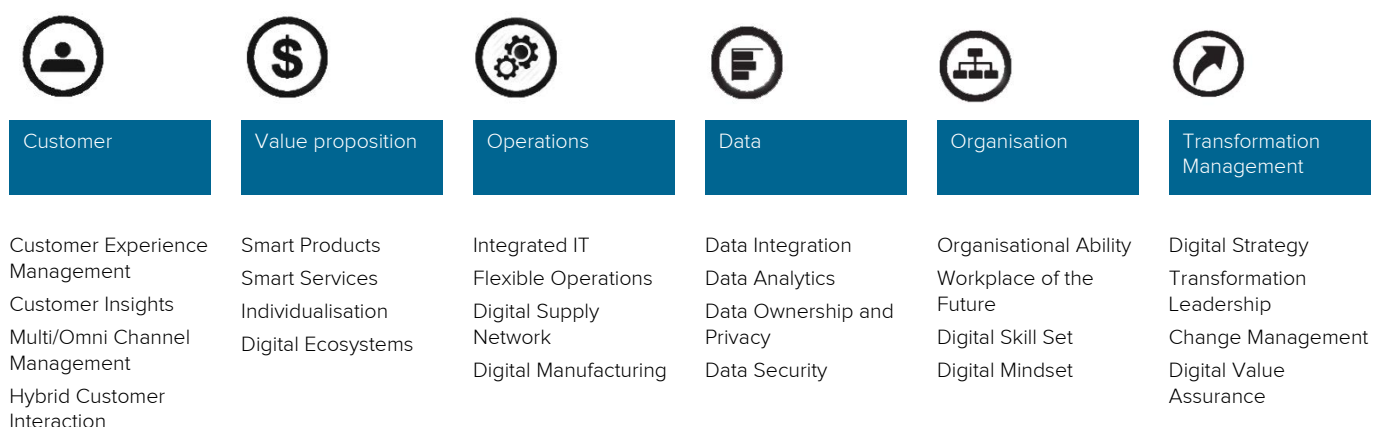Reproduced from: Valdez-de-Leon, 2016.

Level	Strategy	Organisation	Customer	Ecosystem	Operations	Technology	Innovation
5 Pioneering							
4 Optimising							
3 Integrating							
2 Enabling							
1 Initiating							
0 Not started							

Figure 4. Six action fields for 'mastering digitalisation'.
Reproduced from: Gimpel et al., 2018.

Customer	Value proposition	Operations	Data	Organisation	Transformation Management
Customer Experience Management	Smart Products	Integrated IT	Data Integration	Organisational Ability	Digital Strategy
Customer Insights	Smart Services	Flexible Operations	Data Analytics	Workplace of the Future	Transformation Leadership
Multi/Omni Channel Management	Individualisation	Digital Supply Network	Data Ownership and Privacy	Digital Skill Set	Change Management
Hybrid Customer Interaction	Digital Ecosystems	Digital Manufacturing	Data Security	Digital Mindset	Digital Value Assurance

Frameworks such as Gimpel et al.'s point towards the more 'prescriptive' types of digital maturity models, which attempt to develop a roadmap to digital maturity, that organisations can follow. For instance, a digital maturity model developed by Forrester *"allows you to plot your organisational maturity, offers comparative benchmarks, and helps guide your actions to elevate your digital capabilities"* (Gill and VanBoskirk, 2016: 1). Within it, activities within three functions are highlighted: developing digital strategy, governing digital activities across their firms, and driving operational excellence into their digital execution. Gartner provides a more recent example in 'The IT Roadmap for Digital Business Transformation' (Gartner, 2021b), and is a good example of how advisory firms also tend to leverage their digital maturity models to further offer their related digitalisation services (as can be found in the Deloitte, Forrester, and Gartner examples listed above).

Beyond digital maturity models

The above sections have summarised the concepts of, and relationship between, digital transformation and digital maturity, and have also highlighted the various types of digital maturity models created to help organisations assess, benchmark, and improve their digital maturity. However, there is almost an underlying assumption that being highly rated on digital maturity scales corresponds with possessing the competitive advantages typically associated with digitally mature organisations. That is, existing research tend to focus on how organisations can gain the capabilities relevant to their desired digital maturity state, with the view that these will lead to the benefits and advantages associated with digitally mature organisations. In contrast, scholars have more recently highlighted how changes in setting and environmental context over time may induce changes in both the over-arching digital maturity vision in an ecosystem, as well as an organisation's digital maturity in relation to it (Cresswell et al., 2019). A processual and more in-depth understanding of whether and how digital maturity levels lead to competitive advantages is lacking. Given this, understanding how organisations can best exercise their digital maturity potentiality for digital transformation becomes a pertinent matter of consideration.

We investigate this conundrum in our longitudinal and qualitative case study of a digitally mature healthcare organisation (EyeHosp — a specialist eye hospital) based in the UK. We take a processual analytical approach and explore — over three time periods — the relationship between EyeHosp's existing digital maturity state and the actions they took to leverage them for competitive advantage. We show that while traditional digital maturity models may help in benchmarking existing capabilities in an organisation, and identifying areas that require further improvement, such capabilities need to be further exercised and enacted in practice — at the correct instances — in order for successful and meaningful digital transformation to ensue. We illustrate how EyeHosp exercised their existing digital maturity capabilities via specific digitally maturing practices. Together, we add nuance to the understanding of digital maturity levels, illustrating that high digital maturity does not in itself give organisations a competitive advantage, but is instead more of an indication of the potentiality and ability for organisations to further leverage and carry out timely digital transformation.

Before introducing the case, we first provide some contextualisation of digital maturity in healthcare in the following section.

2. Digital Maturity in Healthcare

With rapid developments in technologies such as AI, machine learning, robotic surgery, and telemedicine, the concept of digital maturity has also become an increasingly pertinent area of focus in healthcare organisations. Digital maturity in healthcare has been defined as the extent to which organisations can use digital technologies as enablers to deliver and improve healthcare (Flott et al., 2016; Johnston, 2017).

Johnston (2017) highlight three key themes that are important for digital maturity in healthcare, particularly for federated, nation-wide healthcare systems such as the NHS:

    (i) interoperability;

    (ii) digital architecture; and

    (iii) digital strategy and literacy.

First, in order to be able to transfer care effectively between different units, departments, and organisations within the NHS, interoperability across developed digital systems is key. Interoperability benefits care providers across different settings, in allowing for the usage and sharing of information, as well as the integration of health and social care services. Second, for this to happen, a robust digital architecture is critical. This not only determines how information systems are individually and collectively designed to interact; it also impacts how patients and care providers engage with services. Johnston (2017) further highlights NHS England's aim to use 'building blocks' in creating open data architectural environments, which will then allow emerging innovations and new models of care to be supported (supplemented with sufficient clinical data), while ensuring that patient privacy remains intact. Third, it follows then, that a digital strategy complementary with the above digital/data architectural requirements and the wider health system's digital transformation agenda is paramount. To achieve this, eHealth and digital literacy is therefore crucial; that is, individuals need to have sufficient e-literacy and the ability to use information and communications technology to improve/enable healthcare, and to align a

digital strategy to patient outcomes. As Johnston (2017) explains, NHS' digital evolution is forging new 'learning health systems' that will be capable of reducing error and improving patient safety/quality.

Akin to the wider digital maturity and transformation literatures' emphasis on continuity, researchers describe digital maturity in healthcare as a construct that is constantly in flux, can improve/worsen over time, and one that seldom reaches a final stage (Mettler and Pinto, 2018). To this point, Cresswell et al. (2019) create a framework of digital excellence, which takes into account the complexities that accompanies a continuous evolution of digital maturity over time (see Figure 5). Their continuous model is targeted at helping local health service providers identify their own priorities and maturity levels periodically, against shifting desired outcomes. Specifically, they recognise that over time, 'goalposts' of what is defined as digital excellence or maturity change, and so a shifting endpoint needs to be integrated into conceptions of digital maturity. Moreover, they also emphasise how different localised settings and contexts may impact digital maturity goals in organisations. As such, their framework is targeted at helping local healthcare providers identify their own objectives against a locally defined and desired digital maturity outcome, and also helping them understand how periodic adjustments and re-assessments are made over time in those specific contexts, where the goalposts for digital excellence are continuously changing.

Figure 5. Cresswell et al.'s (2019) 'evolve in context' model of digital excellence in healthcare.
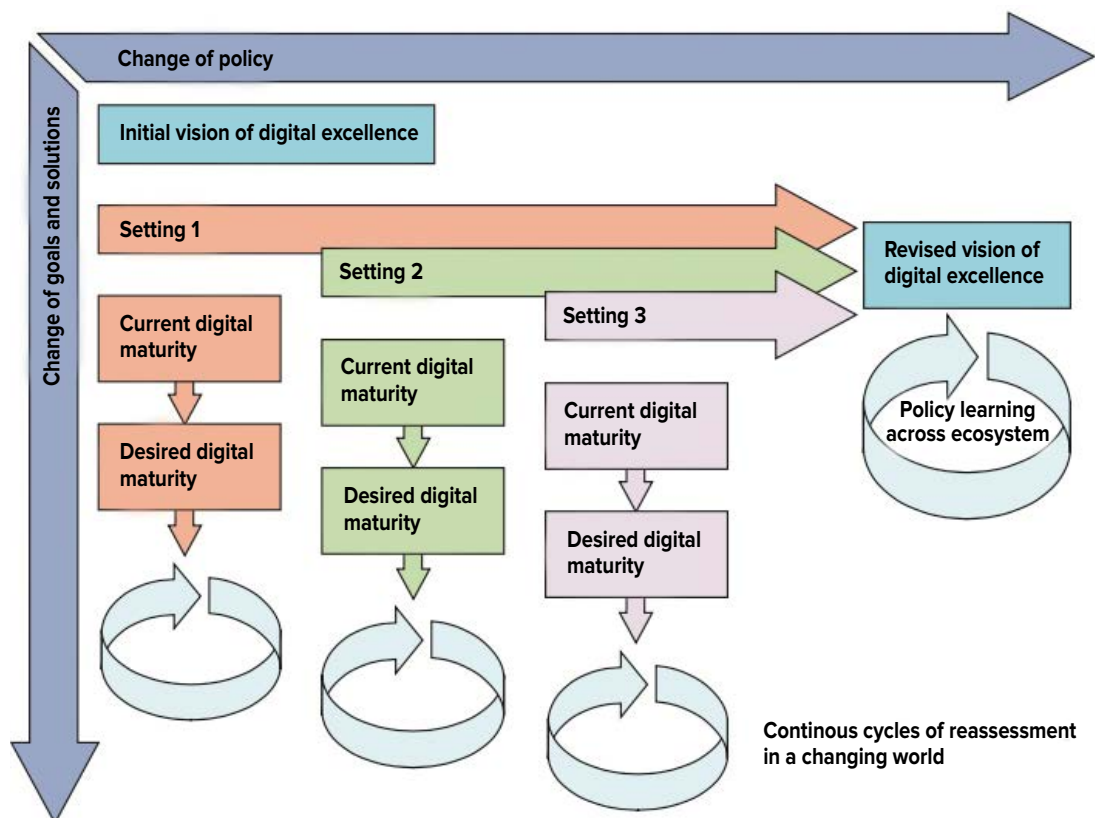
We find Cresswell et al.'s conceptual framework to be well-suited for a processual and in-depth exploration of how organisations can gain and exercise their digital maturity capabilities over time. In particular, their emphasis on the continuous evolution of what is defined as digital maturity in a specific context, alongside the consideration of shifting desired digital maturity states in a localised setting, provides a helpful analytical framework beyond other more static and prescriptive digital maturity models. As such, we take inspiration from Cresswell et al.'s framework in our longitudinal investigation of EyeHosp.

3. The EyeHosp Case – Digitally maturing practices across shifting settings

This study adopts a processual analytical lens towards digital maturity and digital transformation, aligning with scholars' broad consensus of perceiving digital maturity as an ongoing process of adaptation. An in-depth longitudinal interpretive case study (Walsham, 1995, 2006) is taken to explore the adoption and scaling up of digital technologies – in particular AI and telemedicine – for service innovation at EyeHosp. Two rounds of data collection were conducted between March 2019 and November 2020 comprising of a total of 41 semi-structured interviews, that on average lasted between 45 and 60 minutes. Interviewees included clinicians responsible for digital innovation, eyecare technicians working with consultants, software developers building clinical and healthcare research information infrastructure, researchers building state of the art algorithms for ophthalmic services, professionals responsible for service innovation and improvement, and senior hospital and data managers. Further interviews were conducted with informants from pharmaceutical and healthcare software companies as well as with clinicians responsible for implementing telemedicine pilots between ophthalmologists and optometrists. Having multiple phases of data collection allows us to longitudinally explore shifts to the understanding and use of digital technologies in relation to changing definitions and desired states of digital maturity.

Data analysis was performed in tandem and iteratively with its collection following an interpretive approach and a practice perspective to studying services (Barrett et al. 2015, Orlikowski and Scott 2015). Multiple coding techniques were used in analysing the data (Corbin and Strauss, 2014). We combined a mix of open coding to identify initial concepts with computer-assisted N-Vivo analysis to help provide axial coding to group related first-order concepts into more abstract conceptual categories, and to better conceptualise insights from the data in relation to digital technologies, service innovation, and future hospital design and ecosystem dynamics. In addition to coding, we also adopted narrative and visual mapping strategies to help with the theorising and further reconceptualisation of the findings (Langley, 1999).

Findings

Our case study of EyeHosp reveals the continuously shifting nature of digital maturity, and the practices that EyeHosp exercised to reach the changing desired states of digital maturity. We take a comparison across three different, chronologically-ordered settings (pre-COVID, COVID Peak, post-COVID Future), and find that defining visions of digital excellence and optimal digital maturity shifted significantly across them. Correspondingly, EyeHosp's prevailing state of digital maturity, as defined against the optimal desired digital maturity level at that time, was also continuously shifting. Finally, we find that EyeHosp exercised certain digitally maturing practices that (i) assisted them in reaching the desired digital maturity state in each of the three settings; (ii) provided them with a competitive advantage in reaching future optimal digital maturity states; and that (iii) paid off in future settings, by giving them the capability and readiness to digitally transform and innovate in the middle of a crisis.

The following sections are divided across the three chronologically-ordered settings (Pre-COVID, COVID Peak, post-COVID Future). In each section, we highlight the setting and policy context, continuously shifting visions of digital excellence, EyeHosp's localised desired state of digital maturity in relation to these visions, their prevailing state of digital maturity (as summarised in Table 2 below). More importantly, we also examine the practices that EyeHosp drew on to reach each setting's desired digital maturity, and how exercising these practices further strengthened the organisation's future potential and capabilities for digital transformation.

Table 2. Shifting digital maturity and digitally maturing practices across three time settings.

	Setting 1 – Pre-COVID	Setting 2 – COVID Peak	Setting 3 – Post-COVID Future
National policy & environmental setting	• £4.2bn allocated to support NHS digitisation • National Advisory Group established and report written • Further £595m committed to generate digitally outstanding UK NHS organisations	National lockdowns – meaning that essential health services were limited to emergencies and COVID-related cases	• Re-opening, post-COVID, with aim to integrate learnings from COVID into future work (e.g. hybrid working, new virtual consultation triage processes, telemedicine). • 48 new/upgraded hospitals in the UK, with EyeHosp transitioning to a new smart hospital
In-flux visions of digital excellence	• All NHS trusts to achieve high degrees of digital maturity by 2023 • Fully interoperable healthcare system by 2020 • Develop workforce of trained clinician-informaticists	To have a functional, digital/telemedicine service offering in healthcare that could help in limiting physical contact	• Increasing emphasis for technological developments in sustainability to be embedded in the NHS healthcare pathways • Aiming for full transitions to electronic medical records in the Clinical Commissioning Groups (CCGs)
Desired digital maturity state for EyeHosp	In line with the NHS Digital Maturity Assessment, high ratings in: (i) Capability (ii) Readiness (iii) Infrastructure	• To have leveraged existing capabilities already, such that a robust, efficient, virtual consultation digital infrastructure would have already been developed/in place • To have organisational readiness for transitioning to this service offering	To have developed infrastructure, readiness, and capabilities for the smart hospital of the future, to handle new ophthalmic care models post-COVID. Includes the integration of the burgeoning virtual consultation systems into services, as well as with future technology (AI, machine learning, digital twins etc.)
Prevailing digital maturity of EyeHosp	High maturity in infrastructure and readiness, average on Capabilities	Tests/pilots conducted for virtual telemedicine clinics – some readiness for it	• Newly-gained capabilities and expertise in virtual consultation, to be further refined for future processes • Exploration into more cutting edge technologies (e.g.digital twins) • Uncertainty over how sustainability will be achieved
Digitally maturing practices to reach desired state	• *Practice 1 – Strategic appointment of leadership* • *Practice 2 – Levelling up technological capabilities*	• *Practice 3 – Leveraging new gains for innovation* • *Practice 4 – Adapting to new environmental context*	• *Practice 5 – Taking stock of technological progress for future implications* • *Practice 6 – Preparing strategically for futuredefining technologies*

Setting 1 – Pre-COVID

National policy and environmental setting

In 2016, £4.2 billion was allocated by the HM Treasury to support the digitisation of the NHS. This was following the formation of the National Advisory Group on Health Information Technology in England in 2015. A large programme of work was created to reach this vision, as summarised in a report by the National Advisory Group (Wachter, 2016). Following this report, a further £595 million was committed to NHS England's Global Digital Exemplar (GDE) Programme, in order to generate a cohort of digitally outstanding UK NHS organisations, and a national learning ecosystem (Williams, Cresswell, et al., 2021; Cresswell et al., 2019).

The overall goal of digitising the NHS's health systems at this time was to promote
  (i) better health;
  (ii) better healthcare; and
  (iii) lower cost.

In-flux vision of digital excellence

The National Advisory Group on Health Information Technology in England recommended for all NHS trusts to "have achieved a high degree of digital maturity by 2023" (Wachter, 2016: 3). The National Information Board had the objective to achieve a fully interoperable health and care system by 2020 that is paper-free at the point of care (NHS England, 2017). Interoperability plays a core role in the vision of digital excellence at this time, with the Wachter report recommending interoperability to become a core characteristic of the NHS Digital Ecosystem – in so doing promoting clinical care, innovation, and research (Wachter, 2016).

Interoperability not only allows for seamless care delivery across health organisation boundaries, but it also ensures that patients can access all parts of their clinical record over time. However, simultaneously, effective data sharing and utilisation are critical to this end, and as such, data privacy and the development and enforcement of standards become important topics. Moreover, it was also critical that the future and interoperable IT systems being built will need to embrace user-centred design.

Finally, to help achieve the above and future digital objectives, it was deemed important to develop a workforce of well-qualified clinicians with advanced informaticists training in all NHS trusts (at least five), with appropriate resources and authority (Wachter, 2016).

Desired digital maturity state for EyeHosp

To help NHS organisations achieve the clear vision for digital excellence in the UK healthcare ecosystem at this time, the importance of digital maturity in the healthcare organisations was simultaneously recognised by NHS England, which conducted two 'Digital Maturity Assessments' in 2016/2017 as part of a comprehensive transformational programme. The aim of the Digital Maturity programme was to "examine [the] effective use of technology, with particular focus on capabilities such as digital care records, transfers of care & medicines management; and develop a framework that can be used across acute, mental health, community, ambulance and social care settings" (NHS England, 2017: 1).

Assessing its own digital maturity allows NHS England to "identify key strengths and gaps in healthcare providers' provision of digital services at the point of care and an initial view of the current 'baseline' position across the country" (ibid.). As such, a framework was created as part of these assessments to assess NHS trusts' digital maturity, which essentially projects the ideal digital maturity state for NHS trusts to reach. Their model breaks down digital maturity into three main themes (and a further nine sub-components) (NHS England, 2016, 2017):

- **Capability:** Extent to which digital technologies are being used effectively to support the delivery & improvement of core clinical/operational processes
- **Readiness:** Extent to which an organisation is set up to plan, deliver and run effective digital services that meet staff and patients' needs
- **Infrastructure:** Underpinning IT services that need to be in place to support the provision of reliable, high quality digital capabilities

Prevailing digital maturity of EyeHosp

Results from the NHS digital maturity assessment showed that a considerable number of the 240 assessed NHS trusts were not considered as particularly digitally mature (see Figure 7).

In relation to other trusts, and the ideal maturity state, EyeHosp scored highly on the Readiness and Infrastructure categories, and average on the Capabilities (see Figure 7 for approximate positioning on the visualisation).

Figure 6. Structure of NHS England's digital maturity model and assessment.
Reproduced from: NHS England, 2017.

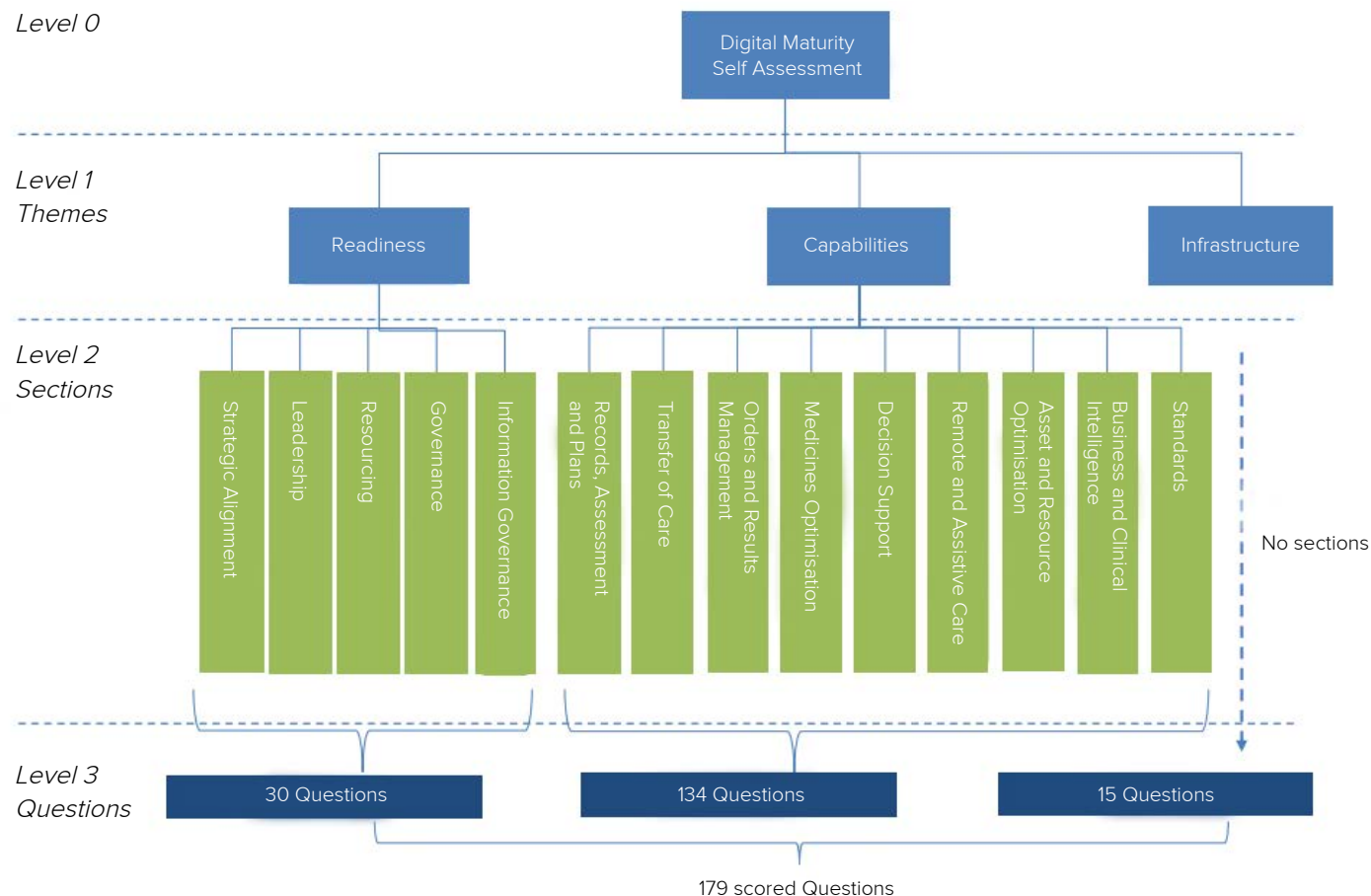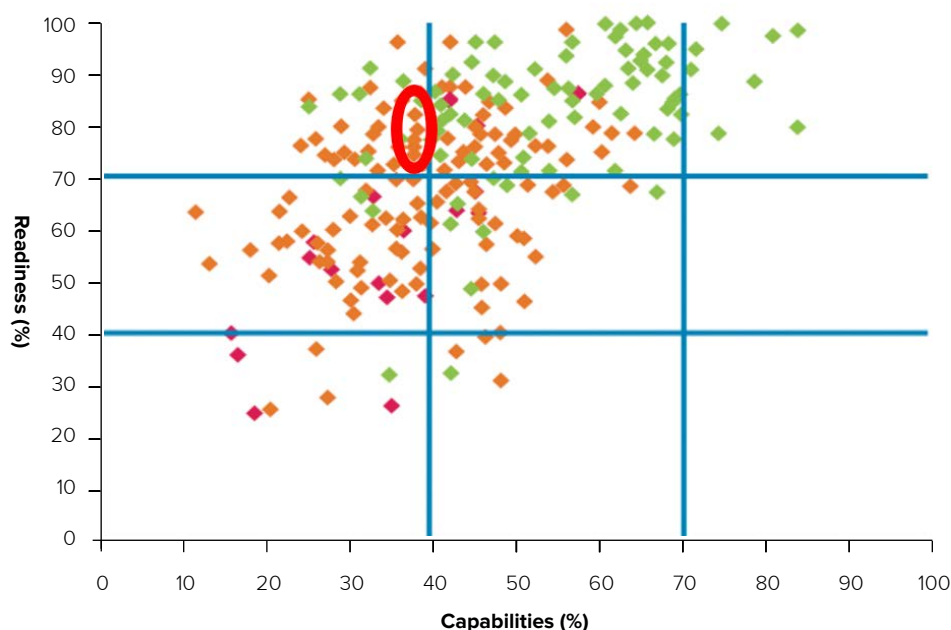**Digital Maturity Self-Assessment: Data Model | Structure**

Figure 7. NHS England's digital maturity assessment (with EyeHosp's positioning circled).
Source: NHS England, 2017.

- ■ Infrastructure score <40%
- ■ Infrastructure score 41-75%
- ■ Infrastructure score 76-100%
- ▬ Bandings applied by MyNHS

Digitally maturing practices to reach desired state

Due to our longitudinal data set, we were able to observe how EyeHosp enacted certain digitally maturing practices to aid them in reaching the desired digital maturity state. At this point in time (Setting 1), EyeHosp was looking to increase its digital 'Capabilities'. To this end, three main practices were enacted.

Practice 1 – Strategic appointment of leadership

The first digitally maturing practice identified was EyeHosp's appointment of a pioneering leadership team to be in charge of digital innovation activities, that also had a deep understanding of technology. Apart from being a consultant ophthalmologist, the Head of Digital Innovation, Pedro (pseudonym), also holds a PhD in computer science, which enabled him to have an expert level understanding of machine learning and AI capabilities. Pedro not only emphasised technological innovation, but was also seen widely as 'a leader in this field' by his peers in the industry.

"We took the lead from Pedro with [the virtual consultation platform] and his initial experimentation, piloting and model design. So I recall very early conversations at a STP-level, where we have a CIO working group and Pedro was invited. I was still at [another hospital] at the time, Pedro was at EyeHosp. And he was describing the journey he'd gone on to, to implement [the virtual consultation platform]…and everyone's vigorously writing notes …'okay so what do we need to do next' type of thing. So, Pedro is absolutely a leader in this field and I'm happy to be a part of it."

"…from Pedro's knowledge and previous pilot experience before the pandemic…where he said, "this is the way to go, we can implement this really quickly. Let's contract with this Australian company. We've got a product we can use. We know it will work". And that was great."

Chief Information Officer, EyeHosp

In addition, the EyeHosp CEO was also leading UK's digital consultations national project – which afforded the hospital the perspective from the nation's most cutting edge thoughts on future technologies. This further allowed EyeHosp to be strategically aligned with said technologies.

This strategic appointment served multiple purposes. First, it allowed for EyeHosp's alignment with one of NHS' over-arching goals to develop a workforce of trained clinician-informaticists, as outlined in the vision for digital excellence at this time. Second, having such a qualified person in a place of authority enabled well-informed strategic decisions to be made, to further digital maturity goals. This, in particular, can be seen in the other digitally maturing practices that EyeHosp enacted from 2017 onwards, which helped to further develop their technological capabilities.

Practice 2 – Levelling up technological capabilities

EyeHosp engaged in multiple activities between 2017-2019, that significantly improved their technological 'Capabilities' and allowed them to become more digitally mature. First, telemedicine – including digital consultations – was an area which was cutting edge, and not particularly necessary at the time. EyeHosp understood that telemedicine would become a core part of the future healthcare ecosystem, and therefore strategically aligned themselves to this future vision by actively engaging with those technologies, and creating pilots with their other London branch.

Second, they also began working with AI technology – another area that has become one of the core components of Industry 4.0. Specifically, they developed AI algorithms for diagnosing retinal conditions, which were then ultimately published in Nature Medicine in 2018. Again, this was not particularly 'necessary' at the time, as accurate human diagnosis percentages of diabetic retinopathy were already very high; however, EyeHosp's actions allowed them to gain strong and ground-breaking capabilities in AI.

In addition to developing their own technological expertise, EyeHosp also formed strategic partnerships that would amplify such capabilities. For instance, they formed a professional collaboration with Google DeepMind for AI development – where they provided 1 million OCT scans for DeepMind to develop deep learning algorithms from. Such partnerships allowed for EyeHosp to be connected to world-leading technological institutions, and to learn and improve their own technological capabilities through multi-disciplinary interactions.

Setting 2 – COVID Peak

National policy and environmental setting

By the end of March 2020, the UK declared its first lockdown in response to the global Coronavirus pandemic, COVID-19. Citizens were urged to remain at home, businesses were closed, and only essential services were permitted to function. The NHS was focused on dealing with the pandemic, and services were essentially limited to medical emergencies and finding ways to respond to the impact from the virus. Caring for vulnerable patients needed to be balanced against the risks to those vulnerable to COVID-19, including other patients and hospital staff.

In-flux vision of digital excellence

When the COVID-19 pandemic emerged, the majority of NHS trusts did not have sufficient digital maturity and capabilities to immediately adapt and transition their services digitally –and to react to the risks that physical consultations posed. The nation faced a healthcare crisis, with a record number of appointments being postponed due to the lack of resources and the inability to guarantee the safety of vulnerable patients.

As such, the UK healthcare system's focus on digital excellence shifted immediately to finding ways to continue providing healthcare during the pandemic – particularly, in finding ways to help determine who should attend hospital in person, who could be helped away from the hospital, and how this can be done. Doing this remotely was key, as it was important to stop patients from travelling during the pandemic – both to protect themselves and others. Additionally, many patients were concerned about attending hospitals as they would want to follow the government's instructions to stay at home, to limit their risk of exposure to the virus, and did not want to add to the burden of a healthcare service having to deal with an increasing case load.

Desired digital maturity state for EyeHosp

The CEO of EyeHosp and senior staff, including the Director of Digital Innovation and Service Director for Accident and Emergency (A&E), recognised the importance of maintaining EyeHosp's walk-in A&E services for unscheduled urgent eye care, which was the only unit in London that provided on-site ophthalmologists 24 hours a day during the first lockdown. The Service Director brainstormed and improvised with available clinicians to find a means of rapidly creating a video consultation service that would enable patients to seek medical attention remotely.

Prevailing digital maturity of EyeHosp

EyeHosp's services have always been guided by a clear and singular over-arching objective – to treat patients' eye conditions and prevent loss of sight. The service value has typically been achieved through physical examination, which is deemed critical in determining the eye condition a patient has and what subsequent treatment is needed.

Prior to the COVID pandemic, EyeHosp was in the early stages of development of technology-enabled service innovations. For instance, with the help of the digitally maturing practices 2 (levelling up technological capabilities) that were exercised in 'Setting 1', EyeHosp became internationally recognised for the research and development of AI algorithms to help with the diagnosis of eye conditions. They also developed several pilots for telemedicine, with the anticipation of new service delivery for its future hospital hub. The introduction of virtual clinics over the past few years had gradually diluted the reliance on physical examinations and replaced it with reliance on ocular imaging and tests of vision. While there was still a need for physical visits to the hospital, they were able to separate the interpreting clinician and the patient in time and space.

Despite these technological developments, however, there was no prevailing infrastructure or system in place to allow for fully digitally-enabled consultations to replace physical ones.

Digitally maturing practices to reach desired state

Through our research, we found that the previous digitally maturing practices exercised in Setting 1, provided EyeHosp with the ability and potential to quickly innovate and adapt to the pandemic. More specifically, EyeHosp's existing and progressing digital maturity allowed it to not only launch a functional virtual consultation system in a quick period of time, but perhaps even more importantly, to successfully transition its services and patients to a new, digitalised format.

The quickly developed and implemented video consultation service became a big success for EyeHosp, allowing them to continue offering its ophthalmic services digitally through the pandemic, and making EyeHosp a case study for successful digital innovation during COVID-19 within the NHS. The hospital reached the milestone of 10,000 virtual consultations within three months, alleviating the risk concerns that physical consultations would have brought, while still allowing patients to receive expert advice and consultations.

We found that EyeHosp was able to react and adapt to the pandemic so quickly and successfully, due to a combination of previously enacted digitally matured practices, and a further set of new practices to adapt to Setting 2. That is – previously enacted practices provided EyeHosp with the possibility and potential to innovate and digitally transform, albeit to do so, further practices were required that were specific to the new setting. The below practices illustrate this in more detail.

Practice 3 – Leveraging new gains for innovation

As highlighted in Setting 1, Practice 1 pointed to the appointment of pioneering leaders with strategic digital skills and understanding, while Practice 2 was in identifying impactful areas of future-defining technologies and gaining expertise in them (with the help of the newly-appointed digital leaders). These two practices had significant impact on EyeHosp's adaption to the pandemic.

In particular, prior to the pandemic, EyeHosp's Director of Digital Innovation and the Director of Telemedicine had already identified virtual clinics and consultations as an important area of opportunity for the hospital to focus on. As such, pilots had already been ongoing in relation to this new technology, and they had already started to explore digital infrastructure options to host this new technology (specifically, with the Attend Anywhere platform that NHS Scotland utilises). As a result, EyeHosp had a certain amount of digital readiness, infrastructure, and capabilities built up prior to the pandemic – which the Directors then leveraged to adapt into a video technology platform, and provide a new and digital-based consultation offering.

Practice 4 – Adapting to new environmental context

> " We were running a video consult pilot in advance of COVID but that's kind of what it was. It was very casual… it was a pull thing. You pulled if you wanted to play with it and there was no push. I think if we had carried on at that pace, we'd have been at that for probably two or three years before we managed to persuade people that this is a viable model, and particularly for ophthalmology because ophthalmology is image driven. It shouldn't work for video consults. So my honest belief … is that the COVID pandemic meant that in six months, we probably achieved, I would say, five to ten years' worth of transformation."

Chief Information Officer, EyeHosp

Despite the progress EyeHosp had been making up until the pandemic, in imagining how technologies could be used to deliver innovative eye services in the future, it was clear that these were innovative pilots. Getting from this stage of the innovation process into practice would typically take a few years just to get through any validation and approval process. Moreover, acceptance of new services by the clinician body was not a foregone conclusion. While it would ordinarily have taken a significant amount of time to evaluate, debate, and address, the many risks associated with delivering a new service using new technologies, the crisis expedited the process.

The new service had been implemented rapidly, significantly faster than would typically have been done before the crisis, which was only able to be achieved due to actions taken to accelerate development, and foster acceptance of both new technologies and a different way of working. Some of these include:

- Identifying digitally-skilled/inclined clinicians to form an innovation response team
- Creating a quick, working prototype based on the existing infrastructure they had (i.e. based off a virtual clinic platform, and leveraging existing NHS connections)
- Conducting quick trials and constantly refining the offering (e.g. in setting up virtual waiting rooms after the initial roll-out)
- Getting further buy-in by implementing insurance measures and maintaining flexibility to improvise (e.g. creating 'red flag' and 'safety netting' processes, fostering a wider sense of responsibility in the patients' mindsets)
- Being open-minded to change longstanding working traditions and practices (shifting emphasis to history-taking, to accommodate for the lack of physical examinations)

Setting 3 – Post-COVID Future

National policy and environmental setting

By the start of 2022, with the help of vaccinations and time to adapt to the COVID-19 pandemic, the UK government began to implement policies to gradually re-open the country. For instance, from 11 February 2022 onwards, incoming vaccinated travellers no longer had to take COVID tests either before or after their arrival into the country (BBC, 2022); the Prime Minister further eliminated all remaining COVID restrictions in England in March 2022.

Simultaneously, the UK government implemented a large programme of work to build and upgrade 48 hospitals by 2030. This building programme has a heavy emphasis on how cutting-edge technology can be integrated into future digitally-enabled hospitals. EyeHosp is included in this programme, and is working towards a future Smart Hospital (SmartHosp) – which is currently being built.

In-flux vision of digital excellence

In lieu of the new programme of work, the vision of digital excellence is further revised. In particular, there are objectives to integrate the digitally-enabled progress made during the pandemic into the future of healthcare, and to further integrate learnings for future crises. Electronic medical records are also becoming fully integrated within Clinical Commissioning Groups (CCGs). Beyond this, there is an increasing emphasis to embed and consider how technology can further sustainability goals in the NHS healthcare pathways.

Desired digital maturity state for EyeHosp

EyeHosp is now looking towards the future possibilities for the upcoming SmartHosp smart hospital. For instance, they are looking to develop the appropriate infrastructure, readiness, and capabilities for SmartHosp, such that it will be able to handle new ophthalmic care models post-COVID, and will also be even better-equipped for future crises. This includes the goal of being able to refine and integrate the newly-developed virtual consultation systems into the rest of the service provision, as well as other burgeoning technologies for healthcare such as robotic surgery and artificial intelligence.

Prevailing digital maturity of EyeHosp

EyeHosp made significant progress in digital innovation and transformation during the peak of the pandemic, which provided them with newly-gained, sector-leading capabilities and expertise in virtual, digital-based consultation systems. On the other hand, technological solutions and designs emphasising sustainability is becoming an increasing important conversation, and is an area that EyeHosp is starting to explore. To leverage the technological capabilities gained and to explore future-defining technologies, EyeHosp are enacting further digitally maturing practices, again building off previous practices and gained capabilities.

Practice 5 – Taking stock of technological progress for future implications

Having accelerated through a significant amount of digital transformation and innovation in their response to the pandemic, EyeHosp is now looking to reflect on the progress and consider implications for their future service provision. For example, they are exploring how the burgeoning virtual consultation systems may be integrated into future patient pathways. How would virtual consultations be integrated into the existing service pathway – would it replace any existing stages, or kept as an additional triage stage prior to physical consultations? How would clinicians get compensated and how would the business model look like?

Further, new contractual agreements are also being explored, to host the virtual consultation system, which may be more stable and customised to EyeHosp's needs.

Practice 6 – Preparing strategically for future-defining technologies

Similar with the practices taken in Setting 1, even before there is an urgent need for specific technologies, EyeHosp continues to align their growth in capabilities to state-of-the-art technologies that will be industry and future-defining. For instance, EyeHosp is developing its cloud-based platform infrastructure, which was also used for the virtual imaging clinics. More specifically, this technology combines cloud-based technology with physical OCT scan machines/rooms, which then allows the scans to be passed on to clinicians elsewhere – so that ophthalmologists can receive and review scans taken by high street optometrists at another place and time. This ensures that EyeHosp clinicians only see the patients that need to be seen, that they do not have to waste time with time-consuming scans, and that they can review OCT scans at times convenient to them. Such changes are deemed as rather innovative within the industry, as they have the potential to change ecosystem roles and relationships (particularly between ophthalmologists and high street optometrists).

EyeHosp also continues to venture into AI, machine learning, and robotic surgery. For instance, they are building an artificial intelligence assistant for patients – with ongoing public consultations having been conducted – that would bring AI technology to the patient-facing frontline. As part of this programme of work, they are also considering how service inclusion can be improved via technology; one stream of work is exploring how digital twin technology may have capabilities to enable patient navigation and improving patient experience in the future.

Finally, EyeHosp is also incrementally developing new partnerships with technology providers – which is pointing towards getting more of an ecosystem approach to how their work will look in the future. Being open to partnering and working differently will further open them to new perspectives.

Conclusion

This paper provides multiple nuances to the understanding of digital maturity and its role in enabling digital transformation. First, we showcase the importance of the policy context and a localised setting for the understanding of digital maturity. The COVID-19 crisis serves as a salient exemplification of the importance of context and the environmental setting; when the pandemic began, the over-arching vision of digital excellence within the healthcare setting immediately transitioned to how technology can enable the continual offering of different healthcare services, while limiting physical contact. In addition, the digital requirements of EyeHosp – as an eye hospital that relies primarily on physical eye examinations – furthers Cresswell et al.'s (2019) emphasis on localised settings and localised visions of digital maturity, as in those moments digital maturity meant different things to different trusts and specialisms within the NHS.

Second, through our longitudinal case, we show how taking a continuous perspective to digital maturity can unveil new understanding of how it evolves through time and context. In addition to seeing how the visions and definitions of digital maturity shifted so dramatically across the three time periods, the EyeHosp case illustrates how digital maturity capabilities and practices acquired in earlier settings ultimately led to advantages in subsequent settings. In this way, there seems to be a snowball effect to how organisations can continuously build and evolve their digital maturity through time.

Third, and most importantly, our findings show that acquiring and possessing digital maturity capabilities is not enough – organisations must also engage in digitally maturing practices, in order to leverage the acquired capabilities for (flexible and adaptive) digital transformation. In this particularly dramatic case of the COVID-19 pandemic, it was clear how earlier practices taken by EyeHosp provided them with a distinct advantage in being able to adapt and react quicker and better than their peers, in leveraging their digital capabilities for service innovation and transformation. In this sense, engaging in digitally maturing practices

(1) allows organisations to more easily turn capabilities into successful innovation and digital transformation endeavours when required; and

(2) is helpful for building organisations' subsequent/future digital maturity state over time.

To further synthesise the digitally maturing practices highlighted above, the below table summarises the activities that constitute each practice.

Table 3. EyeHosp's digitally maturing practices and constituent activities over three time settings

Digitally Maturing Practice	Activities Comprising the Practice
1. Strategic appointment of leadership	• Identify and appoint a leadership team that has digital and technological expertise • Provide them with space and authority for strategic decision-making
2. Levelling up technological capabilities	• Actively engage in research on cutting-edge technologies • Form strategic partnerships
3. Leveraging new gains for innovation	• Leverage leadership expertise and decision-making • Build on newfound capabilities • Create pilots to explore new possibilities
4. Adapting to a new environmental context	• Gather organisational acceptance and leverage organisational readiness for experimentation during crises • Adapt and improvise for innovation, using newfound capabilities • Accelerate digital transformation according to contextual needs
5. Taking stock of technological progress for future implications	• Reflect on accelerated technological progress • Explore how new technological developments can impact future service provision
6. Preparing strategically for future-defining technologies	• Develop technological infrastructure geared for the future (e.g. cloud-based infrastructure) • Venture into cutting edge technology (e.g. AI assistant for patients) • Develop new partnerships aimed at future technologies

References

Anderson, C. and William, E. (2018) 'Digital Maturity Model: Achieving Digital Maturity to Drive Growth.' *Available at: https://www2.deloitte.com/content/dam/Deloitte/global/Documents/Technology-Media-Telecommunications/deloitte-digital-maturity-model.pdf (accessed 16 December 2021).*

BBC (2022) 'What Covid tests do I still need to travel abroad?' *BBC News.* Explainers. [Online] 11th February. [Accessed on 14th February 2022] https://www.bbc.com/news/explainers-52544307.

Berger, S., Bitzer, M., Häckel, B. and Voit, C. (2020) 'Approaching Digital Transformation-Development of a Multi-Dimensional Maturity Model.' *In ECIS Proceedings.*

Chanias, S. and Hess, T. (2016) *How Digital Are We? Maturity Models for the Assessment of a Company's Status in the Digital Transformation.* LMU Munich.

Chanias, S., Myers, M. D. and Hess, T. (2019) 'Digital transformation strategy making in pre-digital organizations: The case of a financial services provider.' *The Journal of Strategic Information Systems.* Elsevier, 28(1) pp. 17–33.

Cresswell, K., Sheikh, A., Krasuska, M., Heeney, C., Franklin, B. D., Lane, W., Mozaffar, H., Mason, K., Eason, S., Hinder, S., Potts, H. W. W. and Williams, R. (2019) 'Reconceptualising the Digital Maturity of Health Systems.' *The Lancet Digital Health,* 1(5) pp. 200–201.

Flott, K., Callahan, R., Darzi, A. and Mayer, E. (2016) 'A Patient-Centered Framework for Evaluating Digital Maturity of Health Services: A Systematic Review.' *Journal of Medical Internet Research.* JMIR Publications Inc., Toronto, Canada, 18(4) p. e75.

Gartner (2021a) *Digital Transformation.* Gartner. [Online] [Accessed on 13th December 2021] https://www.gartner.com/en/information-technology/glossary/digital-transformation.

Gartner (2021b) *The IT Roadmap for Digital Business Transformation.* [Online] [Accessed on 13th December 2021] https://www.gartner.com/en/publications/the-it-roadmap-for-digital-business-transformation.

Gill, M. and VanBoskirk, S. (2016) T*he Digital Maturity Model 4.0.* [Online] [Accessed on 13th December 2021] https://dixital.cec.es/wp-content/uploads/presentacions/presentacion06.pdf.

Gimpel, H., Hosseini, S., Huber, R. X. R., Probst, L., Röglinger, M. and Faisst, U. (2018) 'Structuring Digital Transformation: A Framework of Action Fields and its Application at ZEISS.' *Journal of Information Technology Theory and Application,* 19(1) p. 3.

Hinings, B., Gegenhuber, T. and Greenwood, R. (2018) 'Digital Innovation and Transformation: An Institutional Perspective.' *Information and Organization.* Elsevier, 28(1) pp. 52–61.

IDC (2021) 'New IDC Spending Guide Shows Continued Growth for Digital Transformation as Organizations Focus on Strategic Priorities.' IDC: The premier global market intelligence company. [Online] [Accessed on 12th December 2021] https://www.idc.com/getdoc.jsp?containerId=prUS48372321.

Jäfvert, A. and Parnefjord Gustafsson, C. (2019) *Digital Transformation in Digitally Mature Organisations: Managers' Perspectives on Challenges in Progressing in Digital Maturity.* Lund University School of Economics and Management.

Johnston, D. S. (2017) 'Digital maturity: Are we ready to use technology in the NHS?' *Future Healthcare Journal.* Royal College of Physicians, 4(3) p. 189.

Kane, G. C., Palmer, D., Nguyen-Phillips, A., Kiron, D. and Buckley, N. (2017) 'Achieving Digital Maturity.' *MIT Sloan Management Review.* Massachusetts Institute of Technology, Cambridge, MA, 59(1).

Kane, G. C., Phillips, A. N., Copulsky, J. R. and Andrus, G. R. (2019) *The Technology Fallacy: How People Are the Real Key to Digital Transformation.* MIT Press.

Mettler, T. and Pinto, R. (2018) 'Evolutionary Paths and Influencing Factors Towards Digital Maturity: An Analysis of the Status Quo in Swiss Hospitals.' *Technological Forecasting and Social Change,* 133, August, pp. 104–117.

NHS England (2016) *Digital Maturity Assessment 2015/2016 - NHS England Data Catalogue.* [Online] [Accessed on 6th August 2021] https://data.england.nhs. uk/dataset/digital-maturity-assessment-2015-2016.

NHS England (2017) *Digital Maturity Assessment 2017 - NHS England Data Catalogue.* [Online] [Accessed on 6th August 2021] https://data.england.nhs.uk/dataset/digital-maturity-2017.

Ochoa-Urrego, R.-L. and Peña-Reyes, J.-I. (2021) 'Digital Maturity Models: A Systematic Literature Review.' In Schallmo, D. R. A. and Tidd, J. (eds) *Digitalization.* Springer International Publishing (Management for Professionals), pp. 71–85.

Rader, D. (2019) 'Digital Maturity – The New Competitive Goal.' *Strategy & Leadership,* 47(5) pp. 28–35.

Savié, D. (2019) 'From Digitization, through Digitalization, to Digital Transformation.' *Online Searcher,* pp. 36–39.

Schallmo, D. R. A. and Williams, C. A. (2018) *Digital Transformation Now! Guiding the Successful Digitalization of Your Business Model.* Switzerland: Springer International Publishing.

Strömberg, J., Sundberg, L. and Hasselblad, A. (2020) 'Digital Maturity in Theory and Practice: A Case Study of a Swedish Smart-Built Environment Firm.' *In 2020 IEEE International Conference on Industrial Engineering and Engineering Management* (IEEM). IEEE, pp. 1344–1348.

Valdez-de-Leon, O. (2016) 'A Digital Maturity Model for Telecommunications Service Providers.' *Technology Innovation Management Review,* 6(8).

Wachter, R. (2016) *Making It Work: Harnessing the Power of Health Information Technology to Improve Care in England.* National Advisory Group on Health Information Technology in England.

Walsham, G. (1995) 'Interpretive Case Studies in Is Research: Nature and Method.' *European Journal of Information Systems,* 4(2) pp. 74–81.

Walsham, G. (2006) 'Doing Interpretive Research.' *European Journal of Information Systems.* Springer, 15(3) pp. 320–330.

Westerman, G., Bonnet, D. and McAfee, A. (2012) 'The Advantages of Digital Maturity.' *MIT Sloan Management Review.*

Williams, R., Cresswell, K., et al. (2021) *Beginning a Joint Digitally Enabled Transformation and Learning Journey in the English National Health Service. Final Report - Global Digital Exemplar Evaluation Programme.* Edinburgh: The University of Edinburgh, p. 11.

2022