Opening the Door for Digital Transformation in Hospitals: Management's Point of View

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1   Introduction

In 2018, there were around 1900 hospitals in Germany under private, municipal or non-profit ownership, which treated a total of more than 19 million patients (Destatis 2020). Most of these facilities have joined to form hospital associations. Except for university hospitals, there are hardly any single hospital locations left. All hospitals pursue the goal of providing their patients with the best possible care, but the framework conditions for the individual facilities vary. Even though the refinancing of treatment costs in Germany is regulated on a nationwide basis via the German Diagnosis-Related-Group System (G-DRG), subsidies for investments in buildings and facilities are the responsibility of the federal states. There is great heterogeneity here in the provision of investment funds. In essence, two aspects are of importance here. Firstly, the amount of funds made available for the existing infrastructure of hospitals is not sufficient to adequately reflect progress in healthcare. The German Hospital Federation (Deutsche Krankenhausgesellschaft) speaks of an annual investment gap of 3.7 billion Euros for German hospitals (DKG 2017). Secondly, the amount of investment made available by the federal states has fallen significantly in the last two decades. At 3.3%, the investment ratio of hospitals is well below the economic investment ratio of 19.9% (Fig. 1).

To implement investments in the digital infrastructure of a hospital, it is necessary to tap additional sources of financing. Depending on the corporate structure, different financial framework conditions arise for the individual hospital. For example, access to the capital market is only available for a few, usually private, hospital companies. This heterogeneity also reflects the current state of the digital infrastructure in German hospitals.

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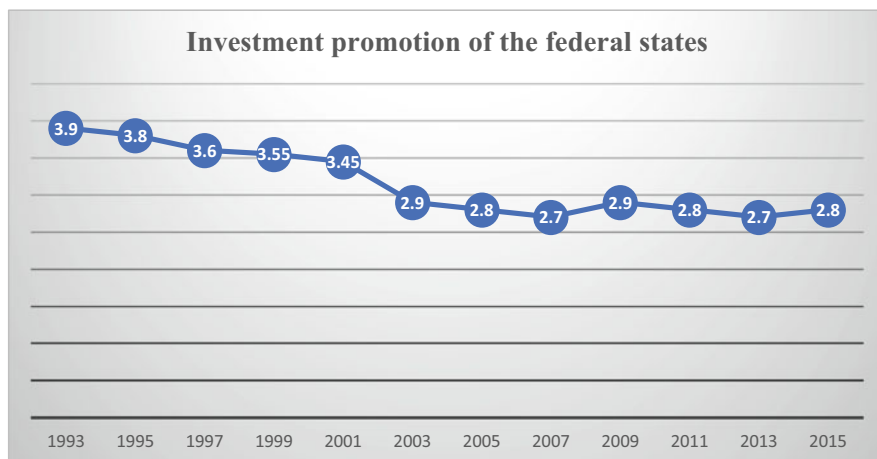
Fig. 1 Investment promotion of federal states (billion Euros per year). Data from (DKG 2017). Source: author

Another aspect is the regulatory component of self-administration in the German healthcare system. In this structure, the representatives of statutory health insurances, the National Association of Statutory Health Insurance Physicians and the German Hospital Federation are called upon to find answers to the requirements of the healthcare of the citizens. Each of the three parties primarily represents its own interests, which often leads to difficult compromises and a high complexity of decisions. There is insufficient openness to innovation within self-government (Stiftung Münch 2016). Innovations in the German healthcare system can only ever be successful if they are also reimbursed. This requires that applications are included in the health insurers' catalogue of services. However, there are sometimes major hurdles to this inclusion. The Innovation Fund of the self-administration is an aid to improving the process. Test phases of new methods and processes are financed directly via the fund; if the evaluation is positive, they are to be transferred to standard care.

It is therefore not surprising that Germany is only in penultimate place in the Digital Health Index ranking (Thiel et al. 2018). Although none of the countries examined has a perfect level of digitalisation, most of them are far ahead of Germany in their efforts—and that applies to all three dimensions examined: the political-strategic approach, the technical prerequisites and the actual use of data.

The potential for digitalisation of healthcare is huge. For example, McKinsey (2018) estimated in a widely acclaimed study that if the digital tools already available today were fully exploited, up to 34 billion euros could be saved annually in the German healthcare system, simply by increasing efficiency. Around 18 billion euros of this could be achieved by using paperless data and the conversion of communication to online interactions alone, and a further six billion through the automation of work processes. Such projections are currently based on several

assumptions. It is therefore questionable whether the sum mentioned represents an underestimation of the potential that can be achieved. This refers in particular to the short-term perspective. In addition to the financial aspects, the benefits of the digital transformation also include improvement of the quality of care, which benefits every patient.

2   Digitalisation Strategies

Many hospital managers are very aware of the need for a digitalisation offensive, but implementation is often terribly slow. This is not just a matter of a lack of financial resources, but also of sticking with tried-and-tested processes and structures by employees, a lack of know-how, as well as concerns about inadequate data security (Kaltenbach et al. 2018). This is the only way to explain why the fax continues to be used as a means of communication between outpatient and inpatient care. The paperless hospital has not yet been achieved to any significant extent in many institutions. Compared to other industries, hospitals are in many cases still far behind in the application of digital infrastructures.

In many hospitals, data is stored in different systems that cannot yet be brought together centrally. Digital interfaces and uniform data communication would be required to bundle the information.

Digitalisation in hospitals is not an end but a beginning. All processes must be oriented towards the benefits they can offer. For example, digital processes should always be geared to the primary goals of patient care, or to the goals of the health system—such as improving the quality of care services or reducing the burden on care structures (Fig. 2). As a rule, digital applications are always cross-cutting issues that help to meet the increasing challenges at various levels and to improve the quality of care (Dahlweid and Roccaro-Waldmeyer 2019).

Not to be forgotten is the improvement of cost-effectiveness for the institution, which can save resources and thus costs through better process chains and
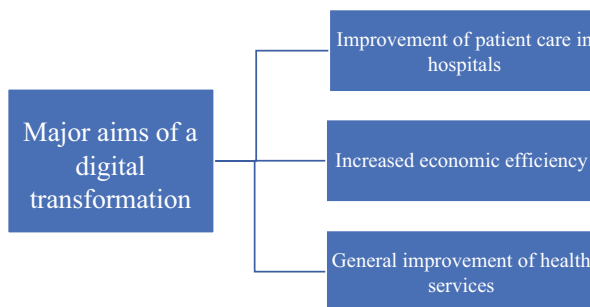
Fig. 2 Major aims of a digital transformation in hospitals (Topol 2019). Source: author

automated procedures. Ultimately, this is the "return on investment" from the management perspective.

Digital solutions are mostly accepted because of the benefits they bring to patients, doctors, nurses and other healthcare professionals. Digital processes and the solutions themselves should therefore be tailored to the users' needs. In the institution, digitalisation should not be a burden, but rather the goal of process improvement or simplification.

3　The Development of a Digitalisation Strategy

There is no universal solution for the transformation strategy of an institution. Every hospital must find a way to approach digital transformation on its own. Basically, it is a matter of describing a vision of how the hospital wants to operate in the short, medium and long term, in order to position itself successfully in the healthcare market. Without the implementation of a digital agenda, the successful economic positioning of a hospital will become more difficult in the future, as competitors will be able to operate more efficiently and will be more attractive for employees. Employee surveys conducted in our company in recent years have shown that the introduction of digital infrastructures and software solutions is highly appreciated by employees and represents a competitive advantage in the battle for employees. Moreover, digital applications such as the electronic patient file are merely the foundation for the use and analysis of other key technologies (e.g. artificial intelligence and big data) (Topol 2019).

Even if there is no single approach to the development of digital transformation, certain key points in the approach have proven to be successful. It is self-evident that process changes in hospitals must not only be tolerated, but actively shaped. Therefore, when developing a digital agenda, it is not only the managers who should exchange ideas. Rather, those directly affected must be involved in the development of the agenda. Ideally, this also applies to the patient, who is best placed to judge the sense and nonsense of process changes. Depending on the orientation of the hospital, there will be different emphases on how digital processes must be developed over time and how they interact with each other. Therefore, every hospital needs a specially aligned project chain with a timescale, to make the transformation process a success.

The first step is the establishment of a working committee, which must be composed of interdisciplinary members. This necessarily includes representatives of the works council. There must be no "top-down" specifications in this committee that would prevent any discussion process. At our facilities, we have set up a hospital-related IT commission that defines the digital agenda from the perspective of each facility. At a higher level, there is an IT steering committee in the parent company, whose task is to steer the respective local transformation processes at a superordinate level (Fig. 3). Ground-breaking decisions on hospital information systems and software providers are made there, to establish a common framework
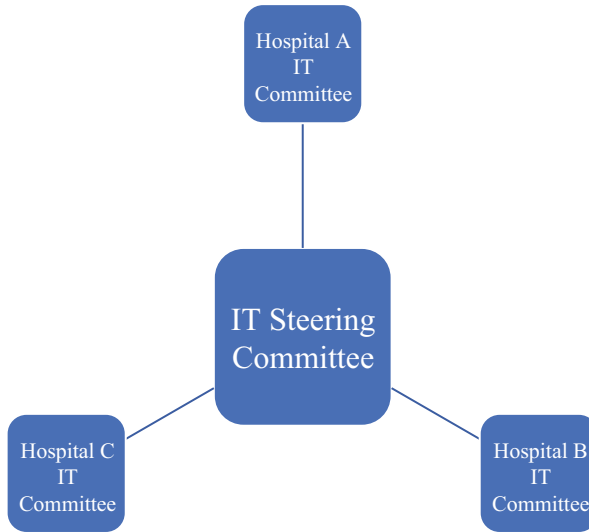
Fig. 3 Organisational structure for the implementation of a digital agenda in our hospital group. Source: author

for all facilities in the company network. Only in this way can processes be designed in a uniform and cost-effective manner within our hospital group.
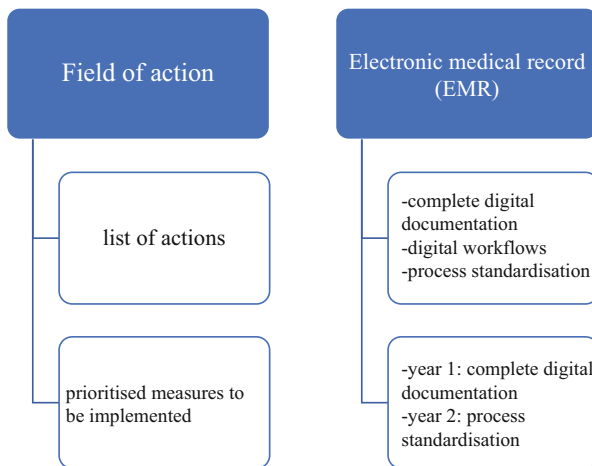
The respective implementation and accentuation then take place in the individual hospital. In the same way, the timeframe for the implementation of process solutions is thus left to the respective institution. Representatives from the respective IT commissions of the individual hospitals are also members of the higher level IT steering committee.

Considerations on how to build a digital strategy should start with considerations on the definition of digital fields of action. As an example of a digital field of action, the electronic medical record is mentioned here (Fig. 4).

Each hospital defines its own digital fields of action. Depending on the orientation of the hospital, digital fields of action can be prioritised differently, but there are cornerstones that every hospital should work on, e.g. digital workflows and processes.

In a second step, measures must be developed for the fields of action. Each measure must be checked against the following four criteria: benefits, feasibility, costs and timeframe. Conflicts often arise at this point, as the costs and benefits of the application can contradict each other. A management veto is often unavoidable here.

Nevertheless, these criteria should be used to prioritise. A differentiation according to the Eisenhower matrix (Fig. 5) can be helpful in this task. When prioritisation has taken place, the action plan for the digital agenda can be decided upon in the institution. Once the decision-making bodies have also approved the proposed strategy, the agenda should be presented to all employees. This is an important step

| Field of action	Electronic medical record (EMR)
list of actions	-complete digital documentation -digital workflows -process standardisation
prioritised measures to be implemented	-year 1: complete digital documentation -year 2: process standardisation

Fig. 4 Definition of fields of action and prioritisation of measures in the development of a digital agenda. Source: author

in creating transparency for the employees. It is not unusual for critics to be won over by a transparent presentation of the plans. For this reason, early involvement of members of the works council is crucial.

However, it must not be concealed that theory and practice can differ here. It is not uncommon for a decision that has been made to be adjusted because legal requirements or billing processes have been modified. In such cases the category "urgent" often wins over "important". Especially in the long-term strategies one or the other important point can fall victim to unimportant but urgent matters.

Ideally, implementation and monitoring of the measures should be carried out by the same working body. Depending on the level of development and the available financial and human resources of the institution, the implementation period of the digitalisation strategy varies, and may often take 3–5 years.

At regular intervals, the committee must examine the extent to which the digital agenda plan can be adhered to, or whether deviations are necessary, e.g. due to technical innovations. Even if the plan is delayed by financial aspects, it is important not to lose sight of the overall strategy.

Important and urgent	Important but not urgent
Not important but urgent	Not important and not urgent
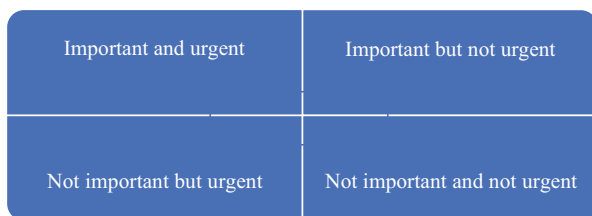
Fig. 5 Prioritisation of measures using the Eisenhower matrix. Source: author

This transformation will never be complete, the road for the hospital of the future will not end. There will be new technologies that build on each other. The hospital of the future will continue to change. The digital transformation will comprehensively link the hospital organisation with other care structures in the healthcare system. A problem arises only if one does not start the transformation.

## 4   How Can Measures Be Successfully Implemented?

In the past couple of years, I have been involved in several digitalisation projects—sometimes successfully, sometimes less successfully. Most projects followed a certain pattern. To be able to realistically assess a project at the beginning, the following passages might be helpful for IT working groups and hospital management.

4.1   Planning

After an often lengthy planning phase, in which the requirements were agreed upon in a working group and a degree of target achievement was determined, the exact timing of the implementation of the new application must be planned in a second step. To ensure future success, the time planning for the implementation requires the views of the institution to be aligned with the respective external companies, but also with the representatives of the IT department. Misunderstandings can only be resolved later with a great deal of effort. Often the expectations of the end users and the providers of the technology lie far apart, so that an intensive exchange in advance can avoid later conflicts. This includes visiting hospitals where the technology has been successfully applied. The honest answers of staff in other hospitals who are already using the technology are important for your own decision-making process and may already revise some decisions. An "in vitro" presentation of the technology alone is not sufficient. Everything that must be adapted afterwards and deviates from the current project plan entails costs that may delay a project and endanger it.

4.2   Implementation and Setbacks

Users often hope for full functionality at the start of implementation, which can be very deceptive. In practice, the functionality of the application is achieved gradually. Incorrectly adjusted configurations can even lead to a reduction in functionality in the first days and weeks of the application. Only after further support does the functionality of the application develop over time. A second setback in functionality is also not uncommon and again requires the attention of those responsible for the process. The path to complete functionality can be long and time-consuming. Nevertheless, it is worth the effort, because in the course of time processes lead to new functionalities that are of great importance for the transformation strategy (Fig. 6).
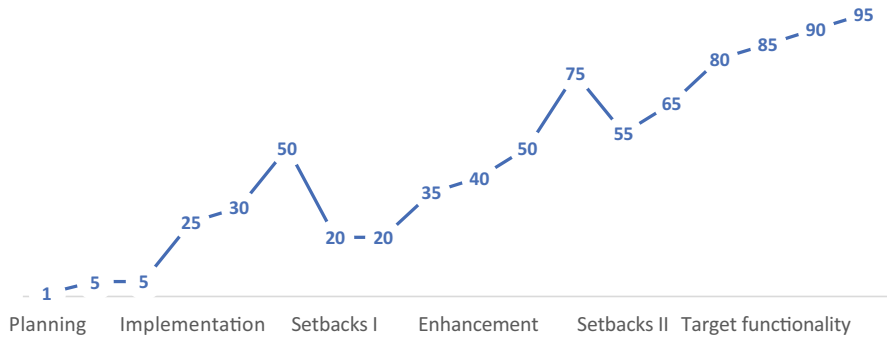
Fig. 6 The implementation of digital applications in hospitals over time (degree of functionality between 0 and 100). Source: author

5 Defining a Digital Strategy Is Only the First Step

With the implementation of the digital agenda, a first transformation step for the hospital is underway. The hospital of the past is developing into a networked hospital of the future. It should be transformed into a digitally supported, intelligently functioning control platform that is oriented to the patient's medical needs. It starts even before the inpatient stay and ends long after it. The hospital then becomes a cog in the network of healthcare facilities that are geared to the patient's problem. The previously closed system of an inpatient facility is abandoned. The hospital is part of a supply chain for the sick person.

Although the concept of the hospital of the future is initially linked to the availability of basic technologies, it requires at least as great a change in thinking and action from the people involved (Werner and Struchholz 2019). The way in which hierarchies and communication behaviour are lived in hospitals will change radically. In the future, medical services will be embedded in integrated processes and much more work will be done at interfaces. Expert knowledge will be disseminated, as it will be available transparently to everyone. This requires a new open corporate and communication culture.

6 Interaction Between Supply Structures in the Healthcare Sector

The hospital of the future will have to network with other healthcare providers. Ideally, a uniform supply chain will be focused on the patient. In concrete terms, this means barrier-free communication of patient data. Regardless of which care level the patient receives, data can be exchanged in a uniform and comprehensible manner. Whereas purely technical specifications, standards or unstructured docu-

ments (e.g. in PDF format) are of marginal help, so-called semantic standards enable largely automated processing and correct interpretation from one IT system to another. All without the respective specialist personnel, who formerly had to rework the data manually. One can compare these new terminologies with a dictionary of diseases and symptoms agreed upon by international experts and used in different countries. This ensures that electronic patient records not only consist of a free text with notes, but also contain the medically required data according to a certain pattern in a machine-readable form.

The term "interoperability" describes the ability of different systems to work together as seamlessly as possible. As soon as healthcare professionals—be they general practitioners or hospitals—work with IT systems that are semantically interoperable, they can exchange their patients' health-related data with clear and precise meaning (Fig. 7). This interoperability not only enables physicians to share electronic patient records with other physicians and hospitals, but also to structure them according to a specific medical terminology: artefacts (objects, processes, properties) provide a standardised meaning of human language. These are expressions used within a specific disease area. Only uniform, agreed semantics make it possible to interpret data in terms of content and thus process it at all—a central prerequisite for creating real added value for healthcare.

If the cross-sectoral digitalisation of the healthcare system is to be promoted, a machine-readable exchange of patient data between all participants in the healthcare system is essential. Medical knowledge in healthcare is traditionally exchanged using clinical coding, represented by specialist terminology, to transport information and translate it in a meaningful way.

Once this step of cross-sectoral digitalisation has been achieved, a further milestone in patient care can be reached through targeted data analysis. A strong analytical basis ensures that health data improves the decision-making process. It
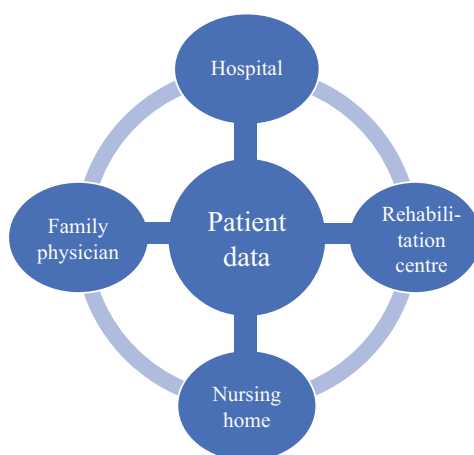
Fig. 7 Patient data in a digitally networked supply chain. Source: author

Table 1 Adoption model for analytics maturity (AMAM classification)

Stage	
0	Fragmented stand-alone solutions
1	Foundation building: Data aggregation and data governance
2	Core data warehouse workout: Centralised database with an analytics competency Centre
3	Efficient, consistent internal and external report production and agility
4	Measuring and managing evidence-based care, care variability and waste reduction
5	Enhancing quality of care, population health and understanding the economics of care
6	Clinical risk intervention and predictive analytics
7	Personalised medicine and prescriptive analytics

Source: HIMSS (2019)

is a clinical decision-support tool that can bring many economic advantages for the hospital, but also for any other participant in the healthcare system.

The Healthcare Information and Management Systems Society HIMSS has summarised the maturity of the available analysis data in the AMAM classification (Table 1). From a single fragmented solution in stage 0 to the availability of personalised medicine in stage 7, the scale provides the perspective for the coming years (HIMSS 2019). A successfully implemented digital transformation thus leads to the next step of a deeper use of patient data. The analysis of big data and the availability of personalised medicine will move the transformation of the healthcare system to the next level.

7 IT and Data Security

Despite all the opportunities that digitisation brings with it, we must not lose sight of the risks in terms of data and IT security. Health care facilities were and remain a popular target for hackers and criminals. Attacks on the IT network structure in hospitals were used to generate patient data which is then illegally resold. But also extortion of funds by directly influencing the control of hospital processes (radiology, intensive care unit, etc.) with the consequence of endangering patients has occupied hospitals in the past. The attack on the IT infrastructure of the Lukas Hospital in Neuss in February 2016 should be mentioned here as an example of how a hospital can be threatened in its core processes from one moment to the next.

The European data protection regulation has strengthened the rights in handling patient data in the past couple of years. From the hospital's point of view this has advantages and disadvantages. On the one hand, individual data are better protected against access by third parties, on the other hand, regulations are often an obstacle to an institution's digitisation strategy.

If we set out to drive forward digitisation in hospitals, it is by no means enough to limit the strategy to the development of hospital processes. It is equally necessary to provide adequate financial resources for IT and data security. A restrictive allocation of financial resources may have serious consequences in the event of an attack on

the IT infrastructure or the loss of patient data. This has also been recognised by the Federal German Government. In a new law proposal the allocation of funds for the digitisation of hospitals will be linked to the investment in IT security (KMA 2020).

I would not deny that IT security is equally important in other economic sectors, but the lives of patients depend on the functionality of IT processes in hospitals as digitisation progresses. This is what makes this sector so vulnerable and important. Hospital management must always be aware of this responsibility and act vigorously.

8 Conclusions

The digital transformation of hospitals will lead to far-reaching changes in process chains, all of which will benefit treatment quality and patient safety. As treatment costs continue to rise, greater process efficiency will make it possible to achieve cost efficiency at the same time. Classical ideas of a hospital in which doctors, nurses and administration work side by side will be replaced in the future by a new healthcare infrastructure. The future hospital will become an important part in an entire process chain for the patients' benefit.

It will incorporate a review of the entire current "hospital business system" and of determining where opportunities and risks arise through new technologies in diagnostics, therapy and communication. The relevance of this broader approach becomes clear when considering the use and integration of artificial intelligence, sensor technology, augmented reality, big data, health clouds or robotics. These topics will cause massive changes in hospital processes—with serious consequences for today's structures. This will also radically change hospital management.

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