Sustainable Upscaling: The Role of Digitalization in Providing Health Care and Health Insurance Coverage in Developing Countries

Jens Geissler

1 Sustainability and Increasing Demand in the Health Sector

In a report published by the World Commission on Environment and Development in 1987, sustainable development is defined as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs.'[1] The document stresses need, but also acknowledges limitations posed by such environmental issues as climate change, loss of biodiversity, and pollution. In the health sector the term 'sustainability' is often applied in the very narrow sense of financial sustainability,[2] but the relation between environmental challenges and health[3] and waste produced in the medical sector are also factors.[4] Conservation of energy[5] and recycling of materials like personal protection equipment[6] are only slowly catching on in the health sector.

In 2015 the United Nations General Assembly agreed upon a set of Sustainable Development Goals.[7] Goal 3 (good health and well-being) focuses on basic health

[1] See United Nations (1987).

[2] See, for example, Hardcastle et al. (2017).

[3] See, for example, van der Vliet et al. (2018).

[4] See Carnero (2015). For a literature review on sustainability in the health sector, see Marimuthu and Paulose (2016). A more recent aspect appears to be the sustainability of the supply chains in the health sector. See Subramanian et al. (2020).

[5] There is currently one hospital in Germany which aims to become a 'Zero Emissions Hospital' by 2030. See, for example, KMA-Online (2020).

[6] See, for example, Kimberly-Clark (n.d.).

[7] See UN (2015).

J. Geissler (✉)
FOM University of Applied Sciences, Hamburg, Germany
e-mail: jens.geissler@fom.de

T. A. Herberger and J. J. Dötsch (eds.), *Digitalization, Digital Transformation and Sustainability in the Global Economy*, Springer Proceedings in Business and Economics, https://doi.org/10.1007/978-3-030-77340-3_5

needs like reducing the maternal mortality rate, preventable deaths of newborns and children under five, as well as combating diseases such as AIDS, tuberculosis, and malaria. One target is to 'achieve universal health coverage, including financial risk protection, access to quality essential health care services and access to safe, effective, quality and affordable essential medicines and vaccines for all."[8] Currently there is no indication this target will be reached.[9]

Researchers estimated as early as 2018 that half the world population can be considered as middle class.[10] For this section of the world population—at that time some 3.8 billion—the question is not only to meet basic health needs, but to benefit from advanced health services and technologies. While some may argue for limiting consumerism to achieve sustainability—there is no human right to own an SUV or to go on long-distance holiday trips—it is difficult to argue that the global middle class should not have access to the same health services and technologies as people in industrialized countries. And it is equally difficult to argue that people in industrialized countries should reduce their access to high-standard health services in order to redistribute resources. So how can sustainability be achieved in a situation where the poor (rightly) demand access to basic health services, the growing global middle class (rightly) demand the right to spend more of their resources on health services, and people in industrialized countries (rightly) demand continued access to high-quality health care?

There is no simple remedy, only a *combination* of different measures will help. Focusing on one of these, I will argue for the role of digitalization in meeting increasing demand without a corresponding increase in resources.[11] IT systems are often difficult and expensive to design and implement, but the marginal costs of providing additional services are negligible. This is what makes digital health services so powerful in achieving universal health coverage. Digitalization can improve access to health care services, and it can support health insurances in processing large numbers of claims and payments. Both are essential to upscaling health services especially in developing countries.

The following section provides a brief discussion of the general role of IT in the health sector, specifically in relation to quality, access, and efficiency of health care and services. Section 3 gives examples of IT in the health sector, both in relation to health care services (e.g., electronic patient records and digital health services), and in relation to health insurances (e.g. business process automation and self-services used by insurees). In Sect. 4 I discuss different risks which may prevent digitalization from supporting health sector sustainability, like lack of digital literacy and access which may prevent patients from utilising services, as may nonacceptance by medical doctors acting as gatekeepers to these services; technical risks which

[8] See UNDP (2015).

[9] World Bank (n.d.), for example, indicates that out-of-pocket health expenditures have increased in many regions of the world.

[10] See Kharas and Hamel (2018).

[11] For a broader discussion on the relation between innovation and sustainable development, see McGahan et al. (2014).

are especially large in the design and implementation of large-scale data-exchange platforms, while financial risks may result from changing regulatory requirements. Sections 5 and 6 explain how international collaboration can support health sector digitalization, and what role governments have in setting the regulatory framework. In the concluding Sect. 7 I argue for an approach to digitalization in the health sector based on organisational needs and capabilities. This will ensure that digitalization can actually fulfill its role in supporting the sustainability of health sectors especially in developing countries.

2 The Role of IT in Satisfying the Demand for Health Care

IT systems are usually characterised by rather high initial costs, resulting from the initial development and from setting up the infrastructure to run them. There are also considerable costs in maintaining and running the systems, as well as adapting them to changing needs. The actual number of users, however, is a minor cost factor because of scalable cloud infrastructure services which make it easy and rather inexpensive to 'grow' the infrastructure in line with the number of users. Once the system has been set up, expanding the user base is inexpensive. This is important in terms of both the availability of staff and the costs of running a health care system.

Practically all areas of the health sector, including health insurance, are highly labour intensive. Lack of staff or the lack of financial resources to pay for staff are major obstacles in meeting health care demand. The health care demands of the poor and the growing middle classes cannot be met by simply hiring as many staff as in industrialized countries. Even in industrialized countries there is strong pressure to increase the efficiency of health care systems.

IT in the health sector includes a wide variety of technologies and systems. Broadly speaking, these fall into three areas. All three are relevant for health care services, as well as the administrative services provided by health insurances.

- Quality of care/services (e.g., higher level of accuracy in diagnostics)
- Access to care/services (e.g., video consultations or online service centers)
- Efficiency of care/services (e.g., through automation of procedures).

There is a certain interdependence between the three. For example, better diagnostics of (potential) tumors not only constitutes an improvement in the quality of care but will also increase efficiency in terms of treatment resources well spent. Likewise, improved access to specialist care through video consultations will also increase the quality of care provided.

It is quite challenging to assess and compare the status of health sector digitalization in different countries. In its Smart Health Systems project, the German Bertelsmann Foundation developed an index that takes into account not only the political system and digital health governance but also digital health infrastructure and the actual implementation of digital health services. The benchmarking of 17 primarily European countries (as well as Canada, Israel, and Australia) shows Estonia, Canada,

and Denmark in the top spots, while France, Germany, and Poland received the lowest score.[12] A similar approach is the Global Digital Health Index (GDHI), a tool which helps countries benchmark and monitor their investments in digital health. In the first GDHI annual report, the 22 participating countries are ranged in five digital health maturity phases. Only Malaysia is ranked in the highest maturity level 5, while Sierra Leone, Uganda, Afghanistan, Pakistan, and Lao PRD have reached level 2.[13]

In the context of sustainability, the focus is on digital health systems which either fully replace human resources or through which human resources can be used in a much more economical way. Examples for this are illustrated in the following section of this text, without attempting to give a full overview of health-related IT. Most examples are from Germany, complemented by some from other, especially developing, countries.

3 Examples of IT in the Health Sector

3.1 Access to Information by Patients

People turn to available and trusted sources when they need information about medical issues. This information (often based on personal experience or coming from a family member) is used to decide if professional support is needed. Today, the internet has become a major source of this information, and especially 'Dr. Google' plays an important role.[14] But the main criterion for presenting content at the top of the Google list is not necessarily the quality of the content. Additionally, there is usually too much information rather than too little,[15] and much of it is directed more to health care professional than to patients. To address this gap, the German Ministry of Health launched and funds the 'National Health Portal' website, populated with patient-oriented content created by a team of independent health care professionals.[16]

This kind of information can improve the efficiency of health care systems. Patients can make an informed decision to seek professional care, thus reducing the number of unnecessary consultations and saving resources for the necessary ones. And it can reduce the risk of seeking professional care too late which may lead to complications and much higher demand for medical care.

The challenges in setting up such systems are less related to technology than to content and marketing. Establishing the professional consensus for treatment options is notoriously difficult, although this may be easier in the case of basic everyday medical needs. Secondly, the information must be presented in a way which is easily

[12] See Thiel et al. (2018).

[13] See Mechael and Edelman (2019), p. 12.

[14] See Waschinski (2019)

[15] For a list, albeit incomplete, of English-language sources, see HCF (n.d.).

[16] See Nationales Gesundheitsportal (n.d.).

understandable for nonprofessionals without compromising the quality of content. And thirdly, the information must be easy to find considering the vast number of sources on the internet. To address this, the German Ministry of Health has only recently begun to collaborate with Google. The material from the National Health Portal is presented in separate 'Knowledge Panels' which are visually separated from the usual search results.[17] In this way, the National Health Portal can use Google's large user base to reach its target audience. In terms of sustainable upscaling this means that the number of users may grow exponentially without a corresponding increase in the costs of running the portal.

3.2 Digital Health Services

Providing better access to information is certainly a positive step, but its impact on the resources needed for treatment is limited. It would be quite different if digitalization could be used not only to inform about diseases, but to treat them. Advances in artificial intelligence (AI) are rapidly increasing the treatment options of such digital health applications. Germany was—to my knowledge—the first country to establish a standard process for the accreditation of digital health apps—and their reimbursement through health insurance. Previously, reimbursement had been through individual health insurances for individual applications. Now, all insurees of the social health insurance system have access to an increasing number of applications which health care providers can prescribe and their insurance will reimburse. Inclusion in the benefit package depends on proof of medical benefits (similar to pharmaceuticals) or benefits in terms of patient empowerment and self-management, for example. Since early 2020, the start of the new process, 43 companies have sought approval for their digital health applications.[18] As of December 2020, six have been approved, covering tinnitus, insomnia, obesity, arthritis, and different types of phobias.[19]

It remains to be seen which range of diseases will at some point be treatable by digital health applications. The new approval and reimbursement process in Germany currently acts as a stimulus for the development of new applications, offering the prospect of access to a fully funded market of about 75 million potential customers. Indications from the approval process suggest that digital health apps are not focused on a small number of use cases but cover an extensive range of diseases. Digital health services will not replace the traditional health care system. But they may offer additional treatment options for an increasing number of diseases. And since they are digital, they can be offered to increasing numbers of patients without increasing the need for additional health care staff.

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[17] See BMG (2020). Currently, there are Knowledge Panels for more than 160 diseases covered by the National Health Portal.

[18] See BfArM (n.d. a).

[19] See BfArM (n.d. b).

3.3 Access to Information by Health Care Provider/Insurance

Data plays an important role in the health sector. Data is generated and stored in the process of diagnosis and treatment: to document services provided, to determine the patient's insurance status and eligibility to receive certain services, and to verify claims either by patients or health care providers. Much of this data is generated at one point by one institution and used at a later point by another. With increasing digitalization of the health sector, more data is generated (e.g., by diagnostic imaging systems), must be stored, transferred, and made available to a user at the right point in a specific business process. Electronic records management systems are used to achieve this. Depending on the specific situation and data, the health care providers, the patients, or a health insurance—or all of them—could use electronic records.

In the context of sustainable upscaling, electronic patient records management systems serve different functions. For diagnosis and treatment, for example, the timely access to all available information prevents duplication of diagnostic activities, thus saving physical and human resources. For patients, they support patient empowerment and informed decision-making by giving them real-time access to all their health records. For health insurances, they save labour otherwise used for storage and retrieval of files and they are the basis for automating business processes. Digitalization can also be important in training health care staff. Digitalized training materials can be made available to larger numbers of training participants, including those in remote locations.

The data stored in electronic patient records also supports the further development of digital health services based on AI. The more data available in a digital and ideally well-structured form, the better the prospects of using AI-based systems to detect patterns in the data. Today, AI is successfully used in highly specific tasks like dermoscopic melanoma image classification.[20] But with more data stored in digital form and with further advances in AI technologies, AI-base solutions will become more available in a wider range of complex tasks in diagnostics and treatment.

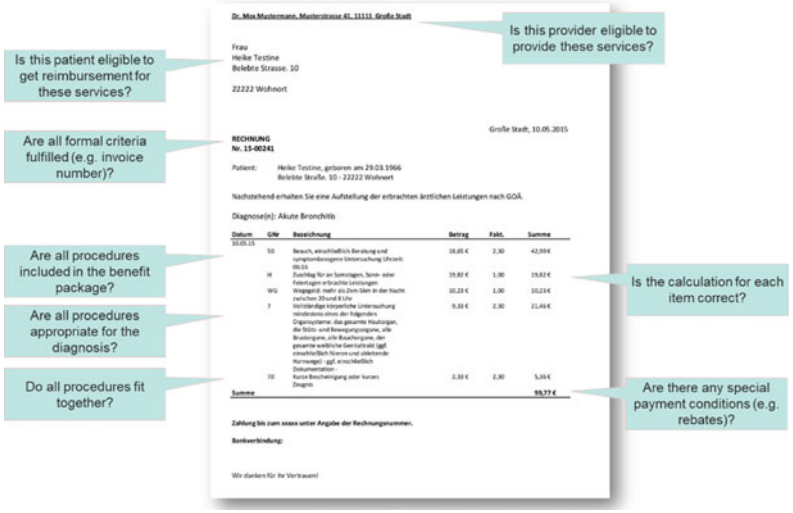
3.4 Automation of Business Processes

When health insurance coverage increases, it increases both the number of insurees and the number of health care services covered. The result is an exponential increase in the workload for health insurance. A simple calculation may serve to illustrate this:

[20] See Brinker et al. (2019).

Insurees	1 million	2 million	3 million
Claims per insuree	1 per year	2 per year	3 per year
Workload of health insurance	1 million claims	4 million claims	9 million claims

Each claim must be verified by the health insurance. The following graph shows what this includes.



The time and skill required to verify the claim depend on the number and complexity of procedures involved. They may be very simple (an outpatient visit) or extremely complex (major surgery). Quite likely, as the benefit package increases, the number of complex procedures will increase as well. In any case, the administrative burden on health insurance will be immense. Covering this purely by increasing the number and qualifications of the workforce will not be viable. This is where the automation of business processes comes in: an IT system can electronically check data the providers submit electronically. This can be any individual or all aspects of the verification process indicated above. It can also be either for all claims of a certain type or only for selected ones. The systems are typically built up over time, i.e., starting with simple claims and/or only selected verification steps, all the way to a more or less completely automatic verification process. There will always be a certain number of claims which cannot be verified automatically. These are routed to staff members for manual verification.[21]

There are no standard figures to indicate what degree of automation is possible. Practical experience shows it depends very much on the complexity of the verification

[21] See Geissler (2017) for a detailed discussion on the automation of business processes in health insurances. In Geissler (2018) I argue that (almost) fully automated health insurances are generally possible.

process and on the organizational capacities of the health insurance. But very generally speaking, automation rates between 65 and 95% are possible. Looking at the example above, one can calculate which automation rate would be required to manage increased coverage with the same number of staff (assuming that the original workload was handled without automation).

Workload of health insurance	1 million claims	4 million claims	9 million claims
Automation rate (%)	0	75	88.9

3.5 *Administrative Self-services*

The increased number of health care users and health insurance members will also increase the number of routine administrative requests hospitals and insurance must deal with, like making appointments, changing addresses, storing payment data or questions about available services. Without digitalization, staff members answer these requests, either in service centers or via a telephone hotline; both are rather labour intensive. Of course, there are very specific requests which do require the attention of a qualified staff member. But digital self-service systems can cover most of the above-mentioned routine issues, for example, through online service centers. Essentially, these are password-protected websites which registered users can access to update personal information or submit data relating to claims or other services. This not only saves resources for the hospital or health insurance, it can be a service to insurees or patients who don't have to travel to service centers or write letters.

Chat bots are currently less commonly used in the health care and health insurance sector but are certainly a way to augment call center staff in the future. Like online service centers, they are not meant to fully replace human staff at call centers but primarily to handle routine activities. Both online service centers and chat bots can play an important role in the sustainable upscaling of health care systems. Both are examples of digital systems which—once set up—can handle large volumes of transactions without an increase in staffing.[22]

3.6 *Robotics*

Robotics is the replacement of physical labour by machines. The more complex the activity, and the less standardized the sequence of movement, the bigger the difficulties in implementing robotics solutions. In health care—in a hospital, for example—most activities involving the patient's body have a high level of complexity

[22] See Geissler (2018) for a more detailed discussion of changes and strategic challenges for health insurances by digitalization.

and a low level of standardization. After all, all patients have special medical needs and specific physical characteristics. For this reason, examples of robotics at the point of patient care are rare. And even some systems which are usually called 'robotics' are more accurately speaking systems to support and guide the physical movement of the surgeon, without actually replacing the movement.[23] The surgery system DaVinci is one example. There are pilot projects to replace nursing staff by robots in order to meet increasing demand. But there is very little evidence that existing robots can perform nursing activities. Only in support activities like transporting food, linen, or medication from service areas to the wards do robots currently play a larger role. In an example from a German university hospital, autonomous systems replace the labour of about a hundred staff members.[24]

These examples illustrate that robotics is certainly no solution to shortages of nursing or medical staff. This is due not only to the lack of available systems, but also to the extremely high costs and liability issues in case of malfunction. Even so, there are some areas in the health sector where robotics does play a role, as the current Corona pandemic shows. The upscaling of test capacities could only be achieved by using automated lab systems.[25] And the production of hundreds of millions of vaccine doses likewise depends on the automation of production processes.[26]

4 Risks and Risk Management

4.1 Digital Literacy and Digital Access

There are numerous hurdles preventing patients from using digital health services, especially in developing countries. For this paper, only a short summary of these hurdles is possible. The key point is that all the obstacles must be overcome—even one is enough to prevent the utilization of digital health services.[27]

- Literacy: Most digital health services are based on written language. However, especially in areas with low literacy, it would be possible to put more emphasis on pictures, speech or videos.
- Access to hardware: Generally, a simple smartphone is sufficient to access digital health services. Without one, access would be severely limited.
- Access to electricity: Power outages may be a problem in remote locations, but smartphones have batteries which should be able to cover the periods without electricity.

[23] See Intuitive Surgical, Inc. (n.d.).

[24] See Fuest (2018).

[25] See Wiener Zeitung (2020).

[26] See Macdonald (2020).

[27] See van Deursen and van Dijk (2015), p. 380f for a more general discussion of the digital divide.

- Network access: Most digital health services will require internet access. For very simple services (e.g., those based on text messaging) very limited internet access would be sufficient. But for more advanced services (e.g., video consultations or tutorials) much more data and better connectivity would be needed.
- Digital literacy: Users will most likely have to choose between different digital services. Making informed decisions requires a good understanding of how digital services work and how data is used.

All aspects (except, perhaps, basic literacy) are equally relevant for health care practitioners and for patients.

One should certainly be careful in trying to apply the findings about the digital divide drawn from studies done in industrialised countries to the situation in developing countries. Nonetheless, one should certainly consider the work of van Deursen and van Dijk who found that in the Netherlands, younger men with higher educational levels and higher income are, over all, most likely to have better digital access.[28] If this is the case in developing countries—and there is little to suggest that it would be different—then there is a great risk that investment in digitalization of the health sector would actually increase disparity in access to and use of health services. This is not an argument against digital health services but more of a call to consider program design as a way to explicitly address the causes for the digital divide.

4.2 Nonacceptance by Health Care Providers

Health care providers act as gatekeepers in terms of market access of health care innovations. With pharmaceuticals, for example, even if regulators and the insurance have approved them, a medical doctor still needs to prescribe them. The same is true with innovative diagnostic or other treatment options. Digital innovations in the health sector face the same hurdle. Even if they are technically available and have regulatory approval, they may still not gain widespread use if health care providers do not accept them.

Health care providers will probably not integrate digital solutions into their treatment if they perceive a given solution as increasing their administrative workload. For example, when health care providers are required to upload documents into a patient's digital health records, rather than just storing them in their own IT system or on paper. Only a high degree of usability and integration in existing systems and workflows will ensure acceptance. Ideally, digital systems should even reduce the administrative workload. A problem-based approach is the most likely option to lead to positive results: addressing the deficiencies health care providers deal with every day in managing their practice and caring for patients. IT systems will only be accepted if they help to solve real-life problems.

[28] See van Deursen and van Dijk (2015), p. 388.

Another aspect to be considered is payment. If health care providers see the use of digital tools (e.g., providing video consultations) as additional workload, there must be a corresponding reimbursement. New activities like explaining the workings of a digital health application must also be included. After all it is quite likely that if health care providers prescribe digital health applications, they will also be asked by their patients when they need support.

4.3 Technical Challenges

The level of technical challenges depends on the type of application. In implementing (and perhaps adjusting) standardized applications with limited integration in digital data-exchange networks, the challenges are quite limited. Many applications such as video consultations have been around for a long time. The challenges are greater for customized systems in larger institutions like health insurances or hospitals where the IT systems are used not only to store and process data but also to manage work. Weaknesses in business process management (e.g., in terms of documentation and standardization of processes) will make it that much more challenging to implement adequate IT systems.

The greatest challenge—and risk—is the design and implementation of large-scale data-exchange platforms. The level of risk depends on the number and heterogeneity of users. The large number of users (hundreds of hospitals, thousands of health care providers, millions of patients/insurees) with very different technical capacities and professional expectations will make it very difficult to create a common understanding about what the system is supposed to do and how it should be set up. And this type of system can never be off-the-shelf. One can learn from the experiences of other countries, but it is not possible to simply implement an existing system.

4.4 Financial Risks

It is extremely difficult to estimate the costs of custom-made IT systems, and there is no direct relation between the costs of a system and the benefits it brings. The normal paradigm of ‘pay more and get more’ does not necessarily work, as the recent development of Corona tracing apps shows. The technical requirement was for an application which helps trace personal contacts and informs people at risk of having contact with a person infected by Covid-19. Based on media reports, actual development costs in Germany were €20 million, ten times as much as in Switzerland, Austria and Norway. In Iceland and Italy, companies and free-lance developers

developed the apps for free. One IT consultant in Germany estimated potential development costs at €450,000 based on standard rates.[29] The UK spent about £35 million, including about £10 million for a version which was later abandoned.[30]

Clearly, very similar features can result in vastly different costs. One reason is that there are different requirements (e.g., in terms of data protection and interconnection with other systems), in addition to the contracts negotiated with the developers/service providers. Another factor is time: it will certainly cost considerably more to develop a system in a short time span. Changes in regulatory requirements, (e.g., in terms of data protection) will also lead to increases in costs.

5 International Collaboration

It is certainly more difficult to transfer digital health systems from one country to another than—say—use pharmaceutical products in another one. But considering the high initial costs of developing digital solutions and the low costs of extending the use to additional users, international collaboration can be especially beneficial. We can identify different types of collaboration in the digital health sector, ranging from exchange of information and experiences and adoption of international standards like SNOMED CT[31] to international collaborations in which tools are developed and shared. There are networks of digital health institutions at the global level and in different regions of the world. The WHO plays an important role in this regard and in 2019 established the Department for Digital Health and Innovation which has produced two guidelines on the topic: *Recommendations on Digital Interventions for Health System Strengthening*[32] and *Digital Implementation Investment Guide*.[33] One of the largest nongovernmental international networks is the International Society for Telemedicine and eHealth (ISfTeH) which aims to facilitate the international dissemination of knowledge and experiences in telemedicine and eHealth.[34] The mapping of regional and national associations in the field of digital health would be a subject for a separate paper. To mention only two very active regional initiatives, there is the Asia eHealth Information Network (AeHIN)[35] and the European Connected Health Alliance (ECAlliance).[36]

There are fewer international initiatives where actual digital solutions are jointly developed. This is due to the need for localized solutions in line with specific requirements, regulations and needs. The most remarkable and successful one is probably

[29] See Bott and Gill (2020).
[30] See Downey (2020).
[31] See SNOMED (n.d.).
[32] See WHO (2019).
[33] See WHO (2020).
[34] See ISfTeH (n.d.).
[35] See AeHIN (n.d.).
[36] See ECHA (n.d.).

the District Health Information Software 2 (DHIS2), an open-source, web-based health management information system platform which is in use in 73 low- and middle-income countries. The Health Information Systems Program (HISP) at the University of Oslo manages the development of the core DHIS2 software. HISP is a global network of 13 in-country and regional organizations, providing direct support to ministries and local implementers of DHIS2.[37] A similar although more recent and smaller collaboration is openIMIS, an open-source software for managing health-financing systems like health insurances. Features include enrollment of insurees, patient verification at the point of service and claims management.[38]

6 The Role of Governments

The successful use of digitalization in the health sector is never a bottom-up activity. It requires a strong regulatory framework and strong institutions. Setting up and maintaining digital health solutions require political leadership and legislative activities. To achieve data exchange between different institutions, there needs to be regulation on semantic and syntactic interoperability. For this reason, the German federal government recently acquired a license for the international SNOMED CT standard and passed legislation requiring the use of this standard in digital health activities.[39] But the need for legislation goes much further, including standards on data security, licensing of products/services, reimbursement for digital health services, and patient rights. Apart from legislation, there is also a need for governance structures—institutions bringing together the different players in the digital health sector. This can be public companies in charge of setting up and maintaining digital health systems at a national level,[40] or networks of experts and stakeholders to stimulate innovation.[41]

The political framework is critical to successful digitalization in the health sector, both in a positive and negative sense. Strong political leadership can boost developments. This is certainly the case with the German Minister of Health who has made digitalization one of his policy priorities from the very start of his tenure in 2018, stimulating a pace of progress so far unknown in Germany. Conversely, a lack of political leadership will most likely prevent much meaningful progress. Even worse, inconsistency in regulatory requirements or the selection of projects based on the possibility of political prestige rather than on the needs of the health sector will lead to large expenditures and little actual benefits for patients or providers.

[37] See DHIS2 (n.d.).

[38] See openIMIS (n.d.).

[39] See Krüger-Brand (2020).

[40] The German example would be the company gematik. See gematik (n.d.).

[41] In Germany, this function is performed nationally by the health innovation hub which was set up in 2019; see BMG (n.d.).

7 Conclusion and Best Practices

Covid-19 has been a catalyst for the digitalization in the health sector. The pandemic has stimulated the use of video consultations, electronic prescriptions, contact tracing, and monitoring of health care resources like hospital beds.[42] Not all innovations piloted during these special times will necessarily withstand the test of time. First experiences show that the use of video consultations will not remain at the level achieved during the height of the pandemic. But in a 'new normal,' digital health applications will certainly play a more important role than before. The crisis has also stimulated international networks in the digital health sector.[43] Without being cynical, the pandemic came at the right time as far as digitalization of the health sector is concerned: systems to help fight the pandemic were already available or rather easy to adjust in a short time.

Building on the extensive experience of health-sector digitalization before Corona, one can draw conclusions for the time after the pandemic. There should be a focus more on standards and interoperability of individual systems, rather than trying to cover large parts of health-sector needs in a few large-scale IT systems. This will reduce the complexity of the systems and provide more flexibility in adjusting to changing needs and technological developments. Modular systems are also more open to development and maintenance by local or regional IT ecosystems. They have the flexibility and knowledge of the local situation and needs to design, implement, and maintain acceptable solutions.

Taking a needs-based approach means starting from the real-life challenges in the health sector and developing solutions for these challenges. High-tech solutions will not be accepted if they are not in line with the actual operational needs. This is especially the case in the health sector where medical professionals will act as gatekeepers to digital innovations. If they do not see the benefit of the innovations, the new tools will most likely not gain widespread acceptance and use.

Existing institutions must take up and implement new digital solutions. It is important to consider the managerial capacities of these institutions. One should neither try to solve managerial problems through IT, nor should weak institutions be overwhelmed by large IT systems. The development of new IT systems (e.g., digitalization and automation in health insurance) may be a starting point to clarify business processes and procedures. But that will take time, and it will certainly delay the implementation of IT systems.

Digitalization in the health sector holds significant promise to delink the increase in health care demand from the poor and the growing middle classes around the world from the use of resources in the health sector. Better access to information and new digital treatment options will reduce needed resources in health care delivery, while the automation of business processes will support the upscaling of health insurances. Considering the limited application of robotics in the health sector, more health care

[42] See, for example, Deutsches Ärzteblatt (2020); GTAI (2020).

[43] See, for example, ISfTeH (2020) for a collection of Covid-19 information and resources.

users will always mean an increase in health care staff and resources. But IT will play an important role in achieving the sustainable upscaling of the health sector in order to achieve universal health coverage.

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