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Digital transformation of healthcare

Strategies and challenges / Data center technologies
Cloud computing / Data management
Financing of it investments

Computerworld survey

The COVID-19 pandemic accelerated the digitization of the healthcare sector. It became a catalyst for change that for decades had been successively creating new and better processes in hospitals, medical facilities or laboratories. Doctors and patients understood that through the use of digital technologies, certain activities, and procedures, such as appointment registration, digital documentation workflow, monitoring of patient's health, or providing services via online doctor consultations, could be carried out more efficiently, without affecting the standard of treatment or diagnosis.

The dynamics of change would not be so considerable if it were not for new local and European regulations, which, on the one hand, impose new obligations on healthcare entities and, on the other hand, generate a new pool of financial resources for the digitization of medical entities, e.g. in the area of integration of domain systems with central medical records regarding the transfer of documentation and service billing.

The COVID-19 pandemic accelerated the digitization of the healthcare sector.

Effective exchange of information between medical, research, and commercial entities requires creating common data spaces. Actions in this direction, with the support of regulators and preserving the interests of each stakeholder, significantly contribute to the development of medicine and building an information society. In addition, they allow entities operating in the European Union to remain competitive in the global markets, mainly with regard to the United States and China.

But at the same time, it is important not to forget about the current challenges for the entire IT industry: the rise of cyber threats, geopolitical uncertainty, and the energy crisis. Adjusting to the new situation requires taking further steps toward the digitization of healthcare entities. A survey conducted in 14 European countries by Computerworld, HPE and Intel was intended to find answers to the question regarding the current level of use of digital technologies and solutions in healthcare entities, including the level of cloud computing adoption and understanding of the data economy.

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Executive summary

IT strategies and technolgies

In the post-pandemic era, with a high degree of geopolitical uncertainty, the priorities for the healthcare sector remain aligned with the challenges facing IT departments of entities in other industries. 92% of survey participants emphasized the need to uphold a high level of cybersecurity. The healthcare sector remains a highly regulated market, which means that national and European legal requirements and industry regulations should be taken into account when conducting its digitization (93% of indications). While heading toward digital transformation, it is also necessary to keep in mind the function of healthcare as a service to citizens. Hence the need for measures designed to meet the growing expectations of the system's beneficiaries (75%).

More extensive use of IT innovations is the way to address current challenges. 54% of healthcare entities rely on cyber security solutions to protect themselves from network attacks or data leakage. Meanwhile, virtualization-based solutions dominate data centers. 47% of organizations use virtual machines for handling computing resources, and 38% also use virtual desktops, which are growing in importance in multi-branch organizations as well as those promoting hybrid work. The digitization of healthcare has accelerated in the last decade. 34% of organizations are using data-sharing solutions, 26% are using SaaS-delivered applications, and 28% are using various types of multimedia solutions.

Data management

The health sector processes enormous amounts of very valuable but extremely sensitive information. Using and sharing them in a skillful manner opens up new opportunities for cooperation between different establishments, including leveraging them to advance medicine and build an information society. 79% of organizations report a high level of maturity of processed data.

26% of entities in this group use a business intelligence (BI) system, 17% have an analytical system installed to tap into unstructured data, and 18% feed the analytical system with real-time data. The rest (18%) know how to use their data to build organizational insights and make decisions.

Among the most significant obstacles in data sharing, 46% of respondents cited insufficient regulations. In turn, 38% of respondents are clearly concerned about handling sensitive and protected data. However only 24% of survey participants raised the issue of possible loss of data sovereignty should it be shared with external entities.

Cloud computing

In the healthcare sector, there is a kind of polarization in the approach to cloud computing. 31% of healthcare entities are already using cloud computing today, and exactly the same proportion - 31% of organizations are not doing so. More specifically, the cloud usage figures are as follows: 37% of entities rely on the private cloud, 34% on the public cloud, and the remaining 29% on a hybrid cloud which combines the resources of the other two computing models.

According to half (50%) of the survey participants, the most important factor that motivates healthcare organizations to move their IT systems and resources to the cloud is the potential for increased agility in service delivery. 48% of respondents admitted that the cloud would enable them to deploy new applications faster. Simultaneously, 43% of respondents see the cloud as an opportunity to reduce IT expenses.

On the other hand, obsolete business applications (LOB) constitute a factor that significantly blocks the migration of systems and data to the cloud. 30% of participants admitted that they operate applications in their data centers that do not meet the conditions for running in the cloud. However, 45% of entities are successively rewriting and upgrading older applications to take advantage of current cloud technologies, while another 24% use virtualization and containerization to run LOB systems in the cloud.

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IT priorities

In the post-pandemic era, with a high degree of geopolitical uncertainty, the top priorities for the healthcare sector remain aligned with the challenges facing IT departments of entities in other industries. 92% of survey participants emphasized the need to uphold a high level of cybersecurity, with as many as 63% of respondents in this group identifying issues related to ensuring business continuity or protecting sensitive data as crucial to the efficient functioning of the organization in the digital world.
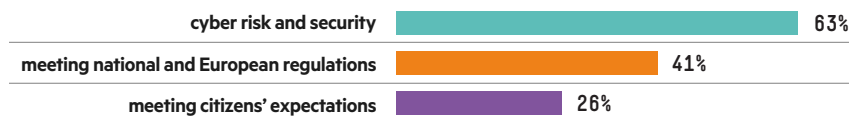
The healthcare sector remains a heavily regulated market. Consequently, its digitization must be carried out with due consideration for national and European legal requirements and industry regulations. 41% of respondents identified these issues as a key priority for the IT department, while another 52% considered them very important or important at least. The COVID-19 pandemic has catalyzed a number of initiatives at the government and European level in an effort to accelerate the digitization of healthcare entities.

The healthcare system's service function to the public must also be taken into account in the digital transformation efforts. The galloping development of technology comes with increasing expectations from the part of the system's beneficiaries. Meeting citizens' expectations is a key (26% of responses) or a significant (49%) aspect of IT development for 75% of organizations. The list of priorities for IT that survey participants rated overwhelmingly as important, though not necessarily crucial, is rounded out by boosting the efficiency of creating shared data spaces, striving to gain agility in developing new applications, and developing data analytics methods for use in decision-making, for example.

However, the survey results show quite a neutral attitude among participants toward the issues of increasing energy efficiency or reaching sustainability in the health sector.

Maintaining a high level of cybersecurity remains the top IT priority for 92% of healthcare organizations

What are your strategic IT priorities?

TOP3: most important

cyber risk and security	63%
meeting national and European regulations	41%
meeting citizens' expectations	26%

TOP3: important

effective data sharing	68%
agility in deploying new applications	60%
data analysis	52%

TOP3: neutral

sustainability goals	42%
energy efficiency	34%
agility in deploying new applications	21%

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Data center technologies
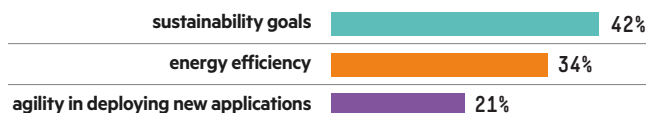
47% of organizations have implemented a virtual environment to support computing resources
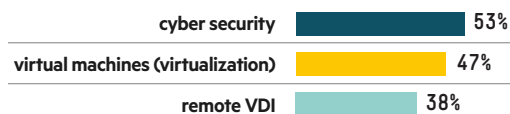
The healthcare sector seems to be catching up in terms of technology. Advanced cybersecurity, virtualization, and virtual desktop infrastructure (VDI) solutions are predominant in data centers. There is also an apparent rise of interest among healthcare entities regarding artificial intelligence, high-performance computing (HPC) systems, and modern Wi-Fi6 and 5G communication solutions.

54% of healthcare entities use cyber security solutions to protect themselves from network attacks or data leakage. Virtualization-based solutions dominate data centers. 47% of organizations use virtual machines to host computing resources, 22% are currently migrating existing physical servers to a virtualized environment and another 17% plan to do so soon. Quite popular are also virtual desktops (38% of indications), which are significantly gaining ground in multi-branch organizations and those promoting hybrid work.

Given the current backdrop of geopolitical uncertainty, professionals in the healthcare sector perceive an increase in cyber threats. As a result, the list of the most frequently deployed data center technologies today starts with wide-ranging cyber security solutions (30%). An ongoing trend in healthcare remains that of big data analytics (28%) used in research, for example. Entities in the sector also invest in upgrading data solutions toward 5G and Wi-Fi6 (same number of responses).

Which data center services and technologies are or could be applied in your organization?
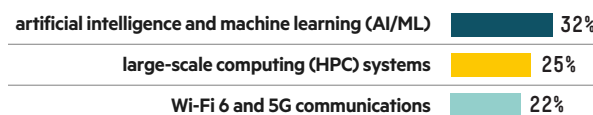
TOP3: we are using

cyber security	53%
virtual machines (virtualization)	47%
remote VDI	38%

TOP3: we are in implementation

cyber security	30%
Wi-Fi 6 and 5G communications	28%
big data analytics	28%

TOP3: we are planning to implement

artificial intelligence and machine learning (AI/ML)	32%
large-scale computing (HPC) systems	25%
Wi-Fi 6 and 5G communications	22%

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IT embedded in processes

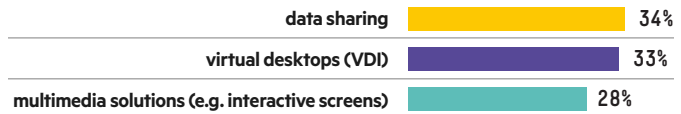**34% of organizations use advanced data sharing technologies**

The digitization of the healthcare sector has accelerated in the last decade, and the list of solutions and technologies supporting business processes looks encouraging. 34% of organizations are already using data-sharing solutions, and another 46% are at various stages of their deployment. As mentioned, big data analytics remains a trending topic, although only 9% of entities are currently using dedicated graphics processing units (GPUs) to increase the speed of data processing.

Another category of solutions that remains in a rising tide comprises applications delivered through the SaaS model. 26% of organizations are already using this application delivery model, and another 25% are in the process of implementing them. On the one hand, SaaS applications provide a means of replacing outdated solutions with more modern ones, and on the other, an opportunity to meet the growing expectations of system beneficiaries - patients and citizens as well as other organizations.
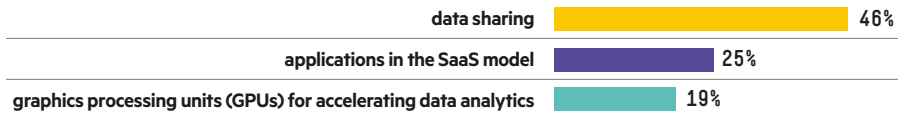
In the technology aspect, there is a lot of interest in various types of multimedia solutions, which are currently used by 28% of the entities in the surveyed category. What may come as a surprise, however, is that the adoption rate of mobile end-user solutions is still low (12%), including wearables, which seem to offer a wide range of potential applications in the healthcare sector. Internet of Things technologies are gaining ground. 14% of organizations are implementing such solutions, and another 21% plan to do so in the near future.

Which IT solutions support business processes in your organization?

TOP3: we are using

data sharing	34%
virtual desktops (VDI)	33%
multimedia solutions (e.g. interactive screens)	28%

TOP3: we are in implementation

data sharing	46%
applications in the SaaS model	25%
graphics processing units (GPUs) for accelerating data analytics	19%

TOP3: we are planning to implement

biometrics and hardware-based identity-proofing solutions	32%
multimedia solutions (e.g. interactive screens)	26%
mobility edge solutions (e.g. wearable devices)	21%
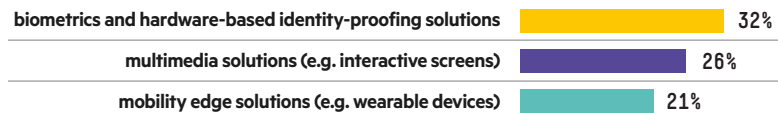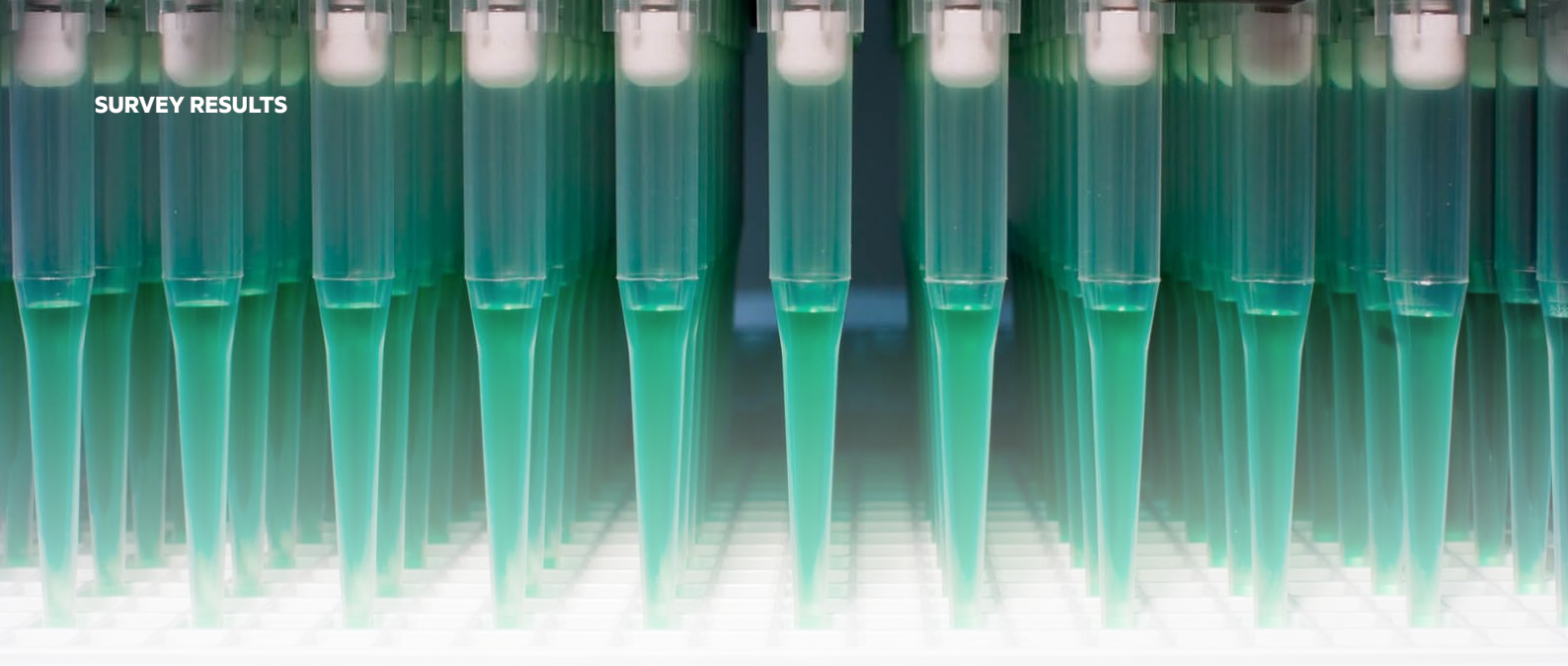
Digital healthcare

Digitization of the healthcare sector entails the implementation of modern technological solutions to improve the efficiency of internal processes. 80% of organizations have implemented and provided patients with a dedicated portal that allows electronic appointment registration or online access to medical test results.
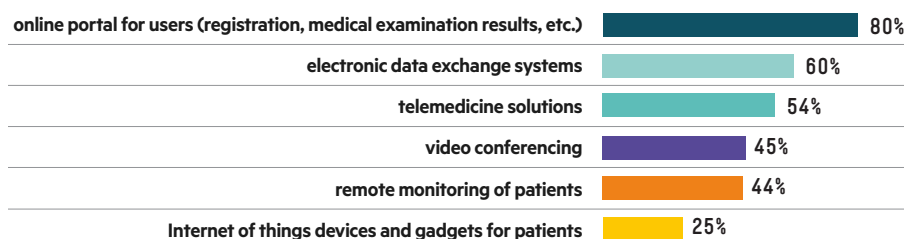
Second place among the most frequently digitized processes is occupied by those related to electronic data exchange. 60% of healthcare entities have implemented various types of data-sharing platforms. By using appropriate tools and standardized data exchange protocols, organizations can increase the efficiency of the information exchange process while adhering to the procedures required when transferring sensitive data.

In the wake of the COVID-19 pandemic, all telemedicine solutions have gained importance. Indeed, 54% of surveyed organizations already use such solutions in medical practice today. Looking at specific solutions, 44% of medical entities are reaching for devices to remotely monitor patients' health, while another 25% are using various types of Internet of Things gadgets. It is quite a broad category of devices - from digital wristbands to vital life processes monitors.

A high level of technology use for video conferencing can be observed in the healthcare market. 45% of organizations are actively using video communication tools for contact between doctors, colleagues and patients to facilitate processes across the white (medical) and gray (non-medical) segments.

80% of organizations have deployed and made available a portal dedicated for patients

Which IT solutions have been applied in the organization?

Solution	Percentage
online portal for users (registration, medical examination results, etc.)	80%
electronic data exchange systems	60%
telemedicine solutions	54%
video conferencing	45%
remote monitoring of patients	44%
Internet of things devices and gadgets for patients	25%

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Data management

The essential value of any organization resides in data. The health sector processes enormous amounts of valuable but highly sensitive information. Their skillful use and sharing open up new opportunities for cooperation between different institutions, including their use for the progress of medicine (diagnostics, drug research) and building an information society. The value of the generated and stored data depends on their level of maturity and the ability of organizations to create shared data spaces for their exchange.

Exactly one in five (20%) healthcare entities has silos of structured data with ad-hoc reporting implemented. As a result, data is not correlated across domain systems. However, 79% of organizations indicate a higher level of maturity in the data they process. 26% of entities in this group can analyze and share data using Business Intelligence (BI) system.
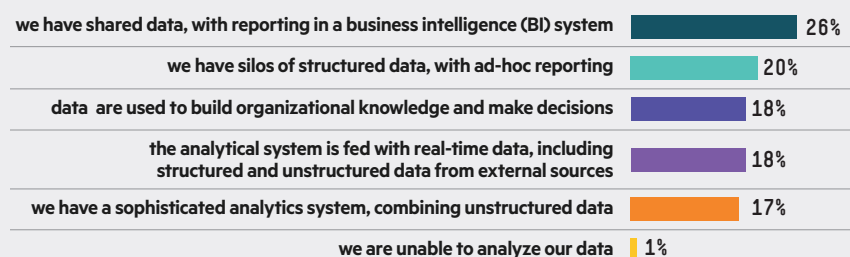
17% of respondents have an analytics system deployed to tap into unstructured data, and 18% of health sector entities use an analytics system fed by real-time data, including unstructured data from external sources. Exactly the same number of survey participants (18%) admitted that they are processing data to build organizational insights and make decisions.

Leveraging data to build the value of the entire health sector requires the creation of shared data spaces between institutions of the same or similar business profiles, supervisory bodies or, eventually, commercial entities. When handling sensitive data, such as personal and medical data, there are numerous factors that realistically limit the creation of shared data spaces. 46% of respondents cited inadequate regulations as the most significant hindrance to data sharing. In turn, 38% of respondents were clearly concerned about handling sensitive and protected data. However, it should be added that only 24% of respondents raised the topic of the possible loss of data sovereignty if it were to be shared with external stakeholders.

Technological limitations and lack of digital skills among employees are also reported to be obstacles to creating shared data spaces. 43% of survey participants admitted that data in their organizations is kept locally, outside the cloud. In turn, 42% pointed to insufficient employee knowledge and skills in data sharing.

26% of organizations share data between domain systems with business intelligence (BI) reporting

46% of survey participants considered insufficient legal and industry regulations as the biggest barrier to data sharing

At what level of maturity are the data produced, stored, and shared within the organization?

we have shared data, with reporting in a business intelligence (BI) system	26%
we have silos of structured data, with ad-hoc reporting	20%
data are used to build organizational knowledge and make decisions	18%
the analytical system is fed with real-time data, including structured and unstructured data from external sources	18%
we have a sophisticated analytics system, combining unstructured data	17%
we are unable to analyze our data	1%

Which factors limit the creation of shared data spaces?

|	
insufficient regulations	46%
data is stored locally, outside the cloud	43%
insufficient knowledge and skills	42%
fear of handling sensitive and protected data	38%
quality and integrity of stored data	31%
lack of data sovereignty	24%

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Cloud in the healthcare sector

In the healthcare sector, just like in government and business entities, a kind of polarization in the approach to cloud computing is discernible. 31% of healthcare entities are already using cloud computing today, while exactly the same number - 31% of organizations are not. The survey shows that interest in the cloud is growing, and its adoption in the health sector is expected to continue. 25% of the surveyed organizations are at various stages of cloud implementation, while 13% intend to take steps toward migration to the cloud sometime in the future.

The details of cloud usage are as follows: 37% of entities use a private cloud, 34% use a public cloud, and the remaining 29% use a hybrid cloud, combining the resources of the other two data processing models.

According to your answer above - which type of cloud computing?

29%
Hybrid Cloud

34%
Public cloud
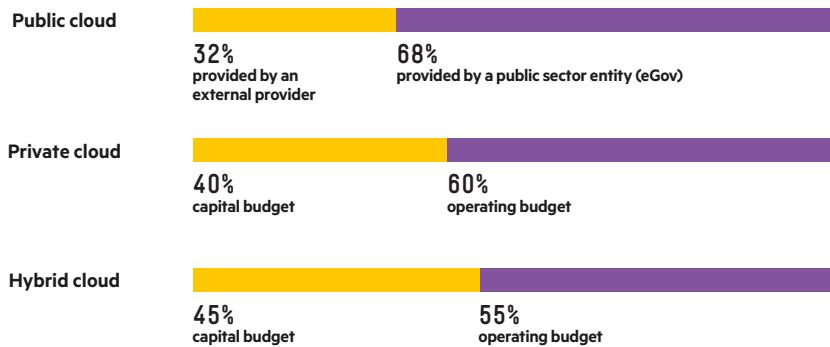
37%
Private cloud
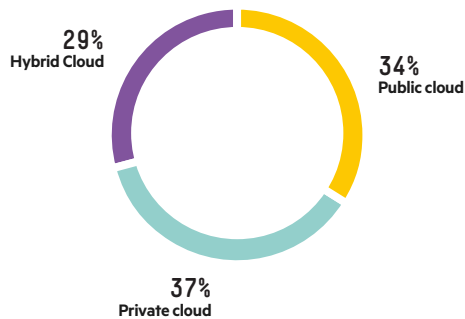
In the case of private cloud and hybrid cloud deployments, there is a certain balance between organizations that have chosen to fund such projects with investment (capital) funds and those that finance the cloud with operational funds, with a slight predominance of the latter.

In the case of the public cloud, 68% of organizations have chosen services provided by public or government entities (eGov) while the remaining 32% have moved their IT resources to an external provider.

31% of health sector organizations use cloud computing

What kind of cloud solutions do you use?

Public cloud

32%
provided by an external provider

68%
provided by a public sector entity (eGov)

Private cloud

40%
capital budget

60%
operating budget

Hybrid cloud
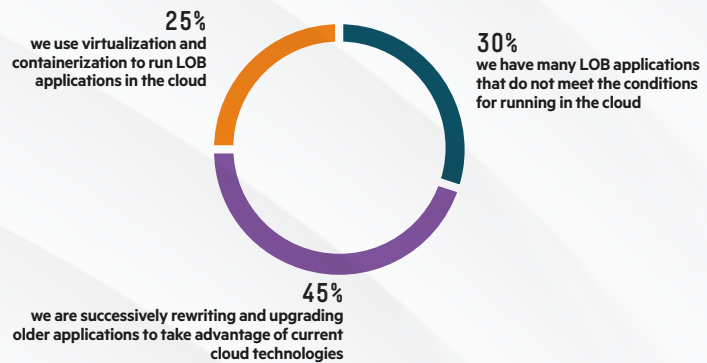
45%
capital budget

55%
operating budget

Advantages and constraints of migrating to the cloud

50% of organizations perceive cloud as an opportunity to increase agility in their service delivery

In the opinion of half (50%) of the survey participants, the most important factor that motivates healthcare organizations to move their IT systems and resources to the cloud is the opportunity to increase agility in service delivery. 48% of respondents admitted that the cloud would enable them to deploy new applications faster.

At the same time, 43% of respondents see the cloud as an opportunity to reduce IT expenses (smaller budgets), and 39% perceive an opportunity to take advantage of the cloud-specific billing model, i.e. paying for services based on their use (pay per use).

Are branch-office (LOB) and obsolete applications blocking the transfer of systems and data to the cloud in the organization?

25% we use virtualization and containerization to run LOB applications in the cloud

30% we have many LOB applications that do not meet the conditions for running in the cloud

45% we are successively rewriting and upgrading older applications to take advantage of current cloud technologies
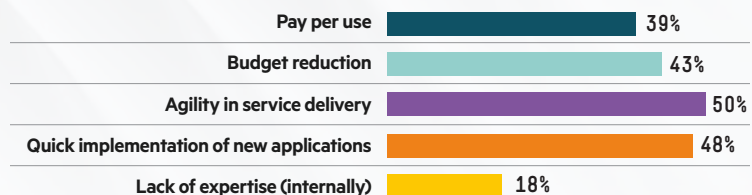
45% of entities are successively rewriting and upgrading older applications to take advantage of current cloud technologies

On the other hand, what significantly blocks the migration of systems and data to the cloud are outdated business applications (LOB). In the healthcare sector, as well as in government and business sectors, two approaches to this issue can be observed.

30% of participants admitted that they operate applications in their data centers that do not meet the conditions for running in the cloud, so they do not see any possibility of moving them out. The second approach involves taking steps to enable the migration of LOB applications to the cloud. 45% of healthcare entities are already successively rewriting and upgrading older applications to take advantage of current cloud technologies. Another 24% of entities use virtualization and containerization to run LOB systems in the cloud.

What factors would make you move to the cloud?

Factor	Percentage
Pay per use	39%
Budget reduction	43%
Agility in service delivery	50%
Quick implementation of new applications	48%
Lack of expertise (internally)	18%

Data in the cloud

What prompts healthcare entities to move data to private or public cloud computing? At the top of the priority list are security concerns. 79% of survey participants agreed that the cloud allows for raising the level of cyber security in general. Another 66% of respondents have migrated to the cloud or would be willing to do so because of its ability to provide a higher level of IT business continuity. In detail, the figures are as follows. Nearly one in four fully agree with the arguments cited here. Regarding cyber security, 55% of survey participants tend to agree, and in terms of business continuity, 43% rather concur.
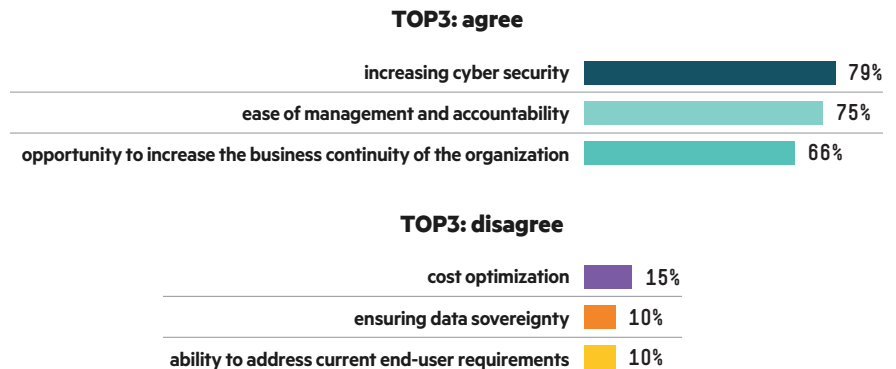
75% of organizations have moved or will move to the cloud because of its ease of management and ability to delegate responsibility for assigned tasks. Another 57% of healthcare entities see the cloud as an opportunity to address current end-user expectations.

At the same time, respondents expressed divergent opinions on whether the cloud commits to IT budgets for the long term and whether it preserves data sovereignty. About one in three respondents had doubts and preferred to hold a neutral position on both issues.

Analyzing the results as a whole, it can be concluded that participants overwhelmingly perceived more advantages of the cloud than doubts about this data processing model. However, if we were to attempt to enumerate the most frequently indicated arguments and factors against moving data to the cloud, it would be the possibility of optimizing costs (15%), the possibility of preserving data sovereignty (10%), and the possibility of satisfying the current expectations of end users in a more comprehensive way (10%).

In the opinion of 79% of respondents, the cloud helps increase the level of IT security

Which factors and arguments are good reasons for moving data to a private or public cloud?

TOP3: agree

increasing cyber security	79%
ease of management and accountability	75%
opportunity to increase the business continuity of the organization	66%

TOP3: disagree

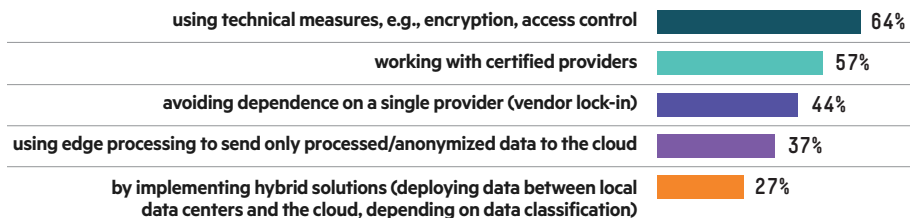|	
cost optimization	15%
ensuring data sovereignty	10%
ability to address current end-user requirements	10%

64% of respondents believe that the fundamental approach to maintaining data sovereignty is to use the right technical measures, such as encryption

The survey found that organizations realize that by using currently available technologies and solutions, they can maintain control over data moved to the cloud. 64% of survey participants believe that organizations can use technical measures, such as encryption and access control systems, to effectively secure data processed in external server rooms.

To maintain control over data, it is necessary to use certified providers (this is the opinion of 57% of IT managers) and to design the architecture of the cloud environment in such a way as to avoid dependence on a single provider, the so-called vendor lock-in (44%).

According to the survey respondents, using the proper technical measures and reaching for the services of certified providers is more important than choosing the cloud solution architecture. And only one in four (27%) believes that the way to preserve data sovereignty is to implement hybrid solutions, meaning processing data locally or in the cloud, depending on its classification.

According to you, how can organizations use the cloud so that they don't lose control of their data?
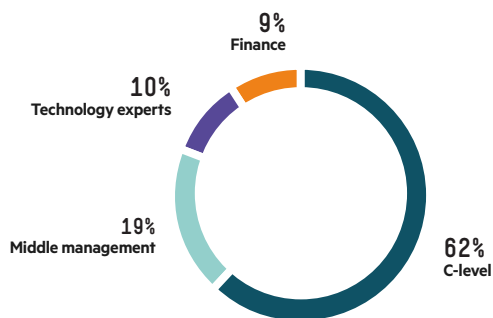
using technical measures, e.g., encryption, access control	64%
working with certified providers	57%
avoiding dependence on a single provider (vendor lock-in)	44%
using edge processing to send only processed/anonymized data to the cloud	37%
by implementing hybrid solutions (deploying data between local data centers and the cloud, depending on data classification)	27%

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In 62% of healthcare organizations, IT purchasing decisions are made at the top management level
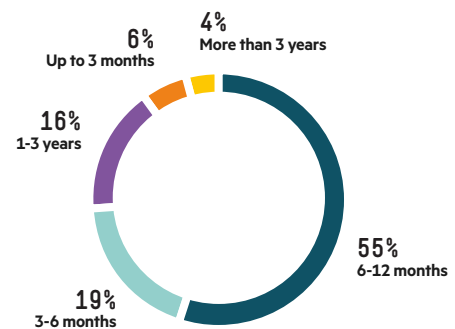
Purchasing process and financing

In 62% of healthcare sector organizations, IT purchasing decisions are made at the level of top management, i.e., those with executive titles in the organization. For another 19% of entities, middle-level managers have the most influence on purchasing, and only in the remaining 10% of entities do people directly involved in IT. What is noteworthy is that in the healthcare sector, the finance department has a lot of say in IT purchasing (9%).

The timeframe of the procurement process appears to be balanced. The largest number, 54% of healthcare units, said that, on average, it takes 6 to 12 months from the time a purchasing need is identified to the time an order is placed. For 16% of organizations, the purchase process takes between 3 and 6 months, while for 22% it takes more than a year.

Who makes decisions regarding the purchase process?

9% Finance

10% Technology experts

19% Middle management

62% C-level

How long is your buying cycle, from interest to purchase order?

6% Up to 3 months

4% More than 3 years

16% 1-3 years

55% 6-12 months

19% 3-6 months

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92% of organizations seek external funding for technology upgrades or purchases
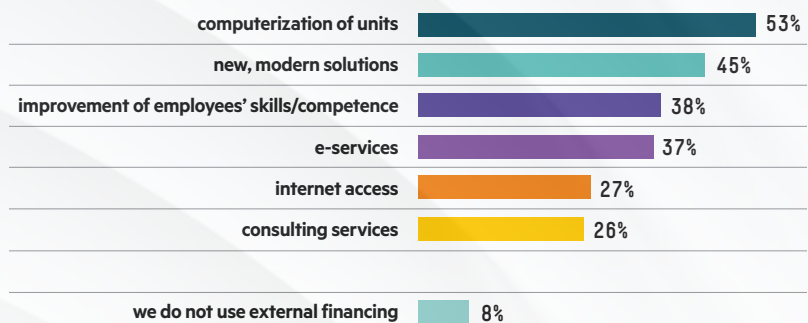
Do healthcare entities have sufficient funds to develop and upgrade their IT resources? 61% of organizations say they do have funds for IT upgrades, but only 8% of entities in this group have sufficient own funding for planned projects.

30% of organizations will have to reduce ongoing activities in this area, focusing on meeting the most pressing needs, while another 23% of institutions will have to reach for external funding. 16% of survey participants say outright that without the European funding they will not be able to modernize their IT, while 12% are counting on national or government financial support in this regard.
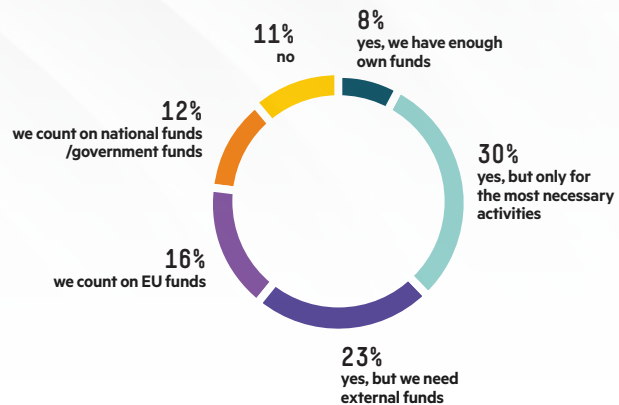
Regardless of their budgets, as many as 92% of organizations are turning to external funding for technology upgrades or purchases. Most, as many as 53% of the entities in this group, allocate additional funds for the computerization of units in general, 45% for the implementation of new solutions, and another 37% for implementing various types of e-services for internal use or the development of the information society.

Although nowadays additional funding from national or European funds is less relevant when it comes to financing Internet access and the purchase of consulting services, still more than one in four healthcare organizations will try to raise money for this purpose from national or European funds.

How are you going /do you plan to use national programs and European funds? *

computerization of units	53%
new, modern solutions	45%
improvement of employees' skills/competence	38%
e-services	37%
internet access	27%
consulting services	26%
we do not use external financing	8%

Does your organization have a budget planned for modernization?

- 8% yes, we have enough own funds
- 30% yes, but only for the most necessary activities
- 23% yes, but we need external funds
- 16% we count on EU funds
- 12% we count on national funds /government funds
- 11% no

HPC transforming health and life sciences from edge to cloud

Together, Hewlett Packard Enterprise and Intel® provide an end-to-end turnkey solution—hardware and software—that accelerates and simplifies high-performance computing (HPC) for these organizations.

Let HPE and Intel help you put HPC to work

HPC can accelerate genomic research and facilitate faster realization of translational and information-driven medicines. But to be able to tap into HPC capabilities from edge to cloud has historically been a high barrier for health and life sciences organizations. Designing, acquiring, configuring, and tuning all the hardware and software is often outside their domain of expertise, and it takes time, which is something researchers do not have.

That is where the last few years of collaborative work between HPE and Intel shine. The two companies have co-innovated an HPC platform that provides flexibility and scalability, as well as cost and time efficiency. By making HPC capabilities available in a cloud-like platform, health and life sciences organizations can quickly adopt the newest hardware and software because HPE and Intel have already done most of the performance optimization. This in turn provides an opportunity for organizations to run larger workloads and increase the amount of data available for future research and insights that may indeed change the world. By working together, HPE and Intel go beyond just developing a new CPU or providing a new server rack—they are now putting their heads together to build a workload-optimized architecture that is specifically designed for health and life sciences HPC workloads. And organizations can use the system immediately to gain new insights.

HPE and Intel have worked together to create a reference design and a sizing methodology to help health and life sciences organizations determine how much compute, memory, and storage they need, based on workload volume (for example, how many whole-genome sequencing [WGS] samples they process each month). And while the reference design and sizing methodology were created originally for genomics workloads, they can be extended to apply equally well to other health and life sciences, for example, HPC workloads in drug discovery.

The basic hardware components of the HPE and Intel Genomics Analytics solution consist of
- 3rd Generation Intel® Xeon® Scalable processors
- HPE servers such as the HPE Apollo 2000 Gen10 Plus system and the HPE ProLiant DL360 Gen10 Plus server
- Storage, using HPE Parallel File Storage System (PFSS) or Cray ClusterStor E1000, along with HPE Data Management Framework (DMF).

Technology collaboration leads to better outcomes

HPE and Intel have been working closely for several years to develop specialized knowledge of how technology can be tuned for specialized health and life sciences workloads such as genomics, cryo-EM, and more. By going beyond the technology, itself and taking a broader, long-term view,

HPE and Intel are making it easier for scientists to focus on what they do best—finding new drugs and therapeutics that can improve lives around the globe—while HPE and Intel focus on delivering the best technology possible in a cost-efficient, scalable, and secure manner.

HPC transforming health and life sciences from edge to cloud