Review Article

Strategic Framework for Medical Technology Management in Healthcare Institutions: Enhancing Planning and Efficiency

ABSTRACT

Today, the provision and management of healthcare services is becoming increasingly complex, and technology has a major impact on change and development in this field. The study can cover various aspects such as the role, processes, challenges and opportunities of technology planning in the organization of healthcare services. In addition, how healthcare organizations accept, implement and manage technology can also be investigated. It covers issues such as the inability to properly formulate technology investments and budget strategies in healthcare organizations, the difficulties and obstacles encountered in the technology planning process, and the effectiveness of technology use in healthcare services. The aim of the study is to create a framework model for understanding, evaluating and improving the planning process related to the use of technology in healthcare services. It allows us to determine how healthcare organizations organize technological infrastructure and processes, how they plan technology investments and how to improve the quality, access and effectiveness of healthcare services. The general objectives of the study can be stated as investigating the technological planning process, evaluating technology investments, investigating effective technology use, identifying obstacles and problems in the strategic technology planning process, and creating future strategies. In the research, strategic plans were developed based on the life cycles of medical technology products used in healthcare institutions. Then, a strategic technology framework model was proposed to improve the technological planning process in healthcare organizations and ensure the impact of future technological developments on improving the quality of healthcare services. This research develops a specific framework model for strategic planning in medical technology management in healthcare institutions, introducing innovative approaches to technology management. Unlike other studies, this model integrates both managerial and technical perspectives by considering the economic efficiency, operational effectiveness, and long-term sustainability of technologies. This approach offers comprehensive and sustainable solutions to support decision-making for healthcare managers.

Keywords: biomedical engineer, clinical management system, medical technological planning, strategic planning, biomedical technologies.

1. INTRODUCTION

The further increase of healthcare costs in the future has begun to have a significant impact on the available resources of our country. Various reasons such as high medical technological products developed based on the requirements of the times, social welfare of people, and access to information have increased the average life span of people. The increase in the age range has led to an increase in the number of individuals consuming healthcare resources. Many of the high healthcare costs resulting from population growth have focused on issues of supply and implementation of high-tech solutions in healthcare. Planning in the management of health services: It should be noted that the main function of health services is the creation and improvement of the planning organization, formation of human resources, coordination, control, and decision-making mechanism. Planning in healthcare is a set of activities designed to guide the operation of any medical procedure or service. Planning is a technical activity and a factor that acts as a bridge between the current situation and the future situation. Based on the studies conducted, the main features related to planning have been determined.
Future related to action: In the future, it shows the future achievements of the healthcare institution and the way to achieve these achievements.

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1. It is a decision-making process: It is the mechanism for determining when, where, in what form, and for what purposes the future works (according to the action plan) will be executed, and what decisions to make in situational situations.
2. It is a dynamic and constantly evolving process: Planned activities are affected by internal and external influences and undesirable events. For this reason, planning is a dynamic process that requires constant attention and does not adapt to these conditions.
3. There is no doubt that modern healthcare cannot be imagined without technological products. From a simple medical intervention to any type of surgical intervention, the quality of the work performed depends fundamentally on the technological products used by the medical personnel providing the service, as well as the ability to work. Undoubtedly, the quality of health care services requires a proper organization and management strategy. However, an important issue here is the proper management of technological products.

Therefore, strategic technological planning is an activity direction of planning. Technological planning plays the role of a driving force in determining strategic goals and at the same time in shaping the competitiveness of the healthcare institution. It should be noted that strategic planning is a management process used to define the goals of a healthcare organization and to determine the strategies to be applied to achieve these goals.Technology is a tool that is used at every stage of strategic planning and provides organizations with more effective strategic management. Technology also increases the competition among healthcare institutions, so healthcare institutions use technological solutions to increase the quality and variety of medical services provided. For example, a healthcare organization adapting to the digital transformation process uses technological capabilities to provide automated patient-physician interactions and faster information exchange. In addition, thanks to technological solutions, healthcare professionals can better determine the needs of patients and increase user satisfaction. Strategic technological planning model: (1) referring to the literature, it is important to determine the mechanism and management policy that implements the issue related to new technology adaptation and updating of existing technologies by health institutions.

- Research and analysis of technological products intended to be used in the future.
- Evaluation of the impact of high-tech products (new type) on the quality of health services and hospitals.
- It should be taken into account that specific technological products will affect the health care of medical personnel and the physical structure of the health institution.
- Risk analysis on whether the new technology is used instead of the old model technology.
- Evaluation of real technological strategy using economic evaluation methods.

Healthcare institutions are obliged to invest capital to provide better quality, productive healthcare services to society and to acquire new skills. In addition to day-to-day management activities, analysis, selection, decision-making and implementation activities related to technological products that provide a competitive advantage in line with the enterprise's long-term strategy and meet the requirements of the future must also be planned. Health managers must create a predetermined policy landscape that takes into account environmental factors, normative governance, and other activities.

2. THE PROBLEM STATEMENT

Directions for improving the technological capabilities of healthcare institutions: The strategic technology planning process in healthcare involves creating a strategy that will enable a healthcare organization to achieve its goals through the effective use of technology. This process aims to enable healthcare organizations to improve their information technology infrastructure, increase efficiency, improve patient care, and optimize healthcare services in general. The general steps of the strategic technology planning process in healthcare are:

- Defining Strategic Goals: The overall strategic goals of the healthcare organization should be determined. These goals are usually defined in accordance with the organization’s mission and goals.
- Needs Analysis: A needs analysis is conducted to assess the current state of the organization. This analysis includes the existing technology infrastructure, employee skills, business processes, and current challenges.
- Overview of Technology Trends and Innovations: It is important to monitor technological trends and innovations in the healthcare industry. This includes assessing the opportunities for new technologies and solutions that can be used to improve the quality of healthcare services.
- Defining a technology strategy: A technology strategy is defined to support the organization’s goals based on a needs analysis and trend assessment. This strategy includes what technology solutions will be used and how they will be implemented.
- Budget and resource planning: The technology planning process determines the budget and resources. This includes the cost of new technology investments, how much the organization can budget for them, and how resources will be allocated.
- Integration: The defined technology strategy is implemented and integrated into existing systems. This phase involves installing new technology solutions, training staff, and successfully implementing the

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process.

- Monitoring and evaluating performance: After the implementation phase, the performance (usefulness) of technology use is monitored regularly. This is essential to assess whether the strategy is successful.
- Continuous improvement: Technology planning is a dynamic process. Healthcare organizations must constantly update and improve their technology strategies to meet their goals and respond to new challenges.

The strategic technology planning process in healthcare helps organizations adapt to changing needs and technological advances so they can deliver more effective and sustainable healthcare services.

3. MATERİAL AND METHOD

The authors have developed a framework model for the management of unintelligible technological products in healthcare institutions. The model is an invariant, low-level element of strategic planning. It is also a driving force for target achievements.

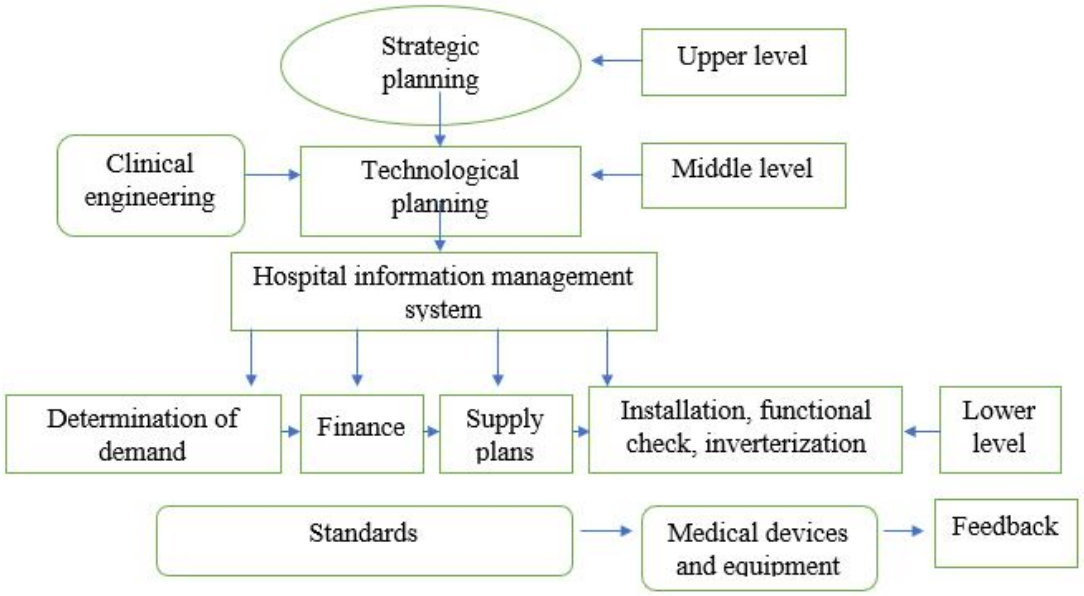

Fig. 1. Framework model of the strategic technological planning process

The model consists of 3 main levels and most of the communication mechanisms. Strategic planning is carried out at the top level. Special technological solutions for the effective achievement of the target goals are determined by conducting technological planning. Technology planning is now a middle level component of the framework model. As is known, information exchange within the institution is organized through the Hospital Information Management System (HIMS). In HIMS, the relationship between middle-level elements and low-level elements in the basic objective framework model creates a new information relationship. A requirement determination component has been added as an initial step in the management of new technological medical products. The selection of medical and technological products is carried out in accordance with the market demand and the mission of the Healthcare system. The financial issue as a selection criterion is mainly indicated that here the purchase, transportation, distribution of the product, issues such as technical service and product details should be considered. Therefore, supply planning is taken as a sub-component in the framework model. The next issue is the installation of the medical technological product within the approximate conditions, functional checks of the product are carried out. It should be noted that the above works should be carried out within the framework of standards. Therefore, a feedback mechanism is designed. Feedback technology planning is important for the next tactical move. At the same time, the evaluation of the product's life activity and period is an important factor for accreditation. During the application of a medical technological product in healthcare services, the need for maintenance, repair and calibration arises. Maintenance and repair are important to organize the reliable and safe operation of the technological product during its operation. This factor, which has a direct impact on the quality of healthcare services, is preventive maintenance, prevention of malfunctions, and repairs designed to eliminate the malfunction. These 2 procedures ensure the operation of the technological product within the framework of technical norms. Periodic maintenance of technological products during operation, it is included in the main job instructions of the department of clinical engineers involved in the internal organization of the hospital for the management of the repair and calibration process. Technological planning is carried out with the participation of clinical engineers in the process. It is for this reason that the suggestions of mid-level

clinical engineers in fashion should be considered.

5. RESULTS AND DISCUSSION

Strategic technological planning was carried out in 4 stages or levels. The first stage forms the general goal of the enterprise. This stage plays the role of a ground, strategic, direction of technological planning is determined. The first stage of technology planning is the identification of requirements. In the second step, the production dates or purchase dates of the medical devices should be obtained from the hospital information management system. In the third stage, renewal dates should be determined based on the service life recommended in the service life table with the international classification code of the technological product that needs to be replaced. At the final stage, according to the planning reflecting the internal financial capabilities of the enterprise, a 5-year strategic plan should be prepared with reference to the operational period. Table 1-2 provides an example of the renewal dates for some medical devices designed to cover the next five years (2020-2024) in order to replace existing medical devices in the inventory with new medical devices.

Table 1. Form for inventory of medical devices (continued).

N	GMDN code	UMDNS device group	UMDNS description	Production date	Estimated lifespan	Update date
Radiological imaging devices						
1	12	16260	MRI	2013	7	2020
2	12	16560	Digital X-ray	2014	7	2021
3	12	15956	Computed tomography	2015	7	2022
Laboratory equipment and materials						
4	6	16260	Blood storage device	2015	8	2023
5	6	16560	Centrifuge, benchtop	2016	8	2024
6	6	15956	Bilubirinometer device	2010	10	2020
Surgical and operating room instruments and equipment						
7	4	17002	Endoscope-videocamera	2014	7	2021
8	4	12647	Passive monitor	2012	10	2022
9	4	10145	Ventilator integrated into the anesthesia device	2010	10	2020

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Table 2. Form for inventory of medical devices.

INVENTORY OF MEDICAL DEVICES						
0-5 years old materials						**Additional information**
№	**Department/Service**	**Material**	**Model**	**Production date**	**Quantity**	
1.	Laboratory	Automatic painting system	LEİCA MARKA ST 5020	01.01.2014	1	Devices that are unsafe, lack adequate spare parts support, frequently break down, or are out of service will be identified. It will be completed by clinical engineering/technical staff.
2.	Inpatient	Passive monitor	PETAŞ/KMA 900	01.01.2016	1	
3.	Dentistry	RVG (radiovisio-	KODAK RVG 5100	01.01.2015	1	
4.	Anesthesiology and intensive care	graphy	TMS MAXİ 2200	01.01.2014	1	
6-10 years old materials						
5.	Intensive care	Pulse oximeter		01.01.2008	1	“-----“
6.	General surgery	Surgical aspirator	ÜZÜMCÜ CA10 -BİLSER	01.01.2010	5	
7.	Anesthesiology and intensive care	Patient monitor	DRAGERİNFİNİTY VISTAXL	01.01.2011	3	
11-15 years old materials						
8.	Anesthesiology and resuscitation	Anesthesia apparatus	DRAGERJULİAN PLUS	01.01.2007	2	“-----“
9.	Cardiology	pacemaker	NİHON KOHDEN	01.01.2003	1	
10.	Stomatology	Dental x-ray	SİEMENS	01.01.2005	1	
11.	Physiotherapy and rehabilitation	Electrotherapeutic means	PAGANİ DT20	01.01.2006	1	
16+ old material						
12.	Eye diseases	Optical biometry device	ALCON OKUSKAN	01.01.2001	1	“-----“
13.	Dentistry	Ultrasound drainage apparatus	EMS PİEZON S-PİEZON	01.01.2000	4	
14	Plastic and reconstructive surgery	electric dermaton		01.01.2001	1	

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For biomedical devices, which are a significant cost driver in healthcare services, planning and programming activities can be carried out at both the hospital level and the national healthcare system level. Healthcare institutions' procurement and supply policies should be reviewed and the possible impacts of procurement policies on the widespread use of medical devices should be examined. Given that national procurement policies can support the efficient and timely procurement of new medical devices, regulatory mechanisms should be established to influence and control nationwide procurement and tendering activities.
Consequently, in terms of today's modern management approach, technology plans based on the life cycle of medical devices and equipment that directly affect the provision of healthcare services should be prepared by hospital management, regardless of whether they are public or private. This can be used in economic, administrative and medical studies for future action. Strategic technological planning can be presented as alternative decision options in medium and long-term device procurement and renewal plans of healthcare institutions..

6. CONCLUSION

Strategic technology planning is currently one of the most effective methods that managers or coordinators can use in healthcare institutions. Thanks to technology plans prepared with a comprehensive perspective, healthcare institutions can optimize medical technology needs while achieving quality, clinical staff satisfaction, and organizational goals. Medical device lists, especially for high-tech medical products, can be based on strategic planning that includes a strategy that can resolve budget uncertainty and inadequacy, and can achieve efficiency in centralized supply planning by using financial system adjustments. In addition, the economic scale that will be achieved through five- or ten-year strategic technology planning can contribute to the production and resource planning of the medical device industry and offer new opportunities.

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