

# The Healthcare Industry and Medical Devices in Environmental Sustainability: Medical Device Industry is Going Green

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**Abstract.** In the whole world there are several developments in order to make a more sustainable and qualified environment to handle the increase costs of the healthcare services industry. The changes in health sector also affect the medical device sector directly as the medical device sector is the most important key of health sector and that is why the concepts element such as environment, sustainability and green are very important in medical sector. The main purpose of the research is to point out the applications of medical device firms concerning environment and sustainability. The research has been planned and carried out as a cross sectional field work in defined type. The medical device firms running in the city center of Ankara are involved in research population. The research is carried out on 60 medical device firms which accept the research within a months of time. Compared with other sectors, it has been concluded that producing sustainable products in medical sector will be more effective, energy applications will be reducing the treatment costs in healthcare, some medical firms in Turkey are ready for energy efficiency applications and energy efficiency applications will reduce 50% energy costs and will protect 50% the environment according to the medical firm's opinions.

**Keywords:** First keyword · Second keyword · Third keyword

## 1 Introduction

The healthcare industry sector in Turkey is proportionally developing according to the supporting developments related to the healthcare sector and increasing purchasing power resulted from positive economic improvements and increasing accessibility. The changes in health sector also affect the medical device sector directly as the medical device sector is the most important key of health sector and that is why the concepts element such as environment, sustainability and green are very important in medical sector. Subsequent paragraphs, however, are indented.

Medical device sector is a sector that contain many different product groups and high level technologies and it may be different from countries to countries. Hospitals, laboratories, outpatient clinics, drugs and medical devices compose the health industry.

Generally drugs, cosmetics, living animal cells and human cell, organs out of transplant organs and most every instruments used in the hospitals are all within the scope of medical devices. Imaging devices, prostheses, cardiac pacemakers, defibrillators, lighting devices and many devices and product groups can be classified in medical device sector.

In the whole world there are several developments in order to make a more sustainable and qualified environment to handle the increase costs of the healthcare services industry [3]. Although it is hard to difficult to say the total expense of R and D expenditures in the world, in global label, the total budget for R and D for the most biggest firmd that have a 60% or more part in market is 19.808 USD and this amount is greater than 10% of total income. This total is indicates that the significant amount of income in the sector is used to R and D activities and with compared other sectors, this amount is the indicator of this rate is much greater than the average amount [4].

### 1.1 Medical Device Sector in the World

Since 2010, world medical device market is reached to 250 million USD and more. If the medical device market ordered according to size, in 2010, the biggest markets in the world are; USA, Japan, Germany, France, England, Italy, China, Canada, Russian, Spain and Switzerland [3]. In Fig. 1, medical device sector market share according to countries were given.

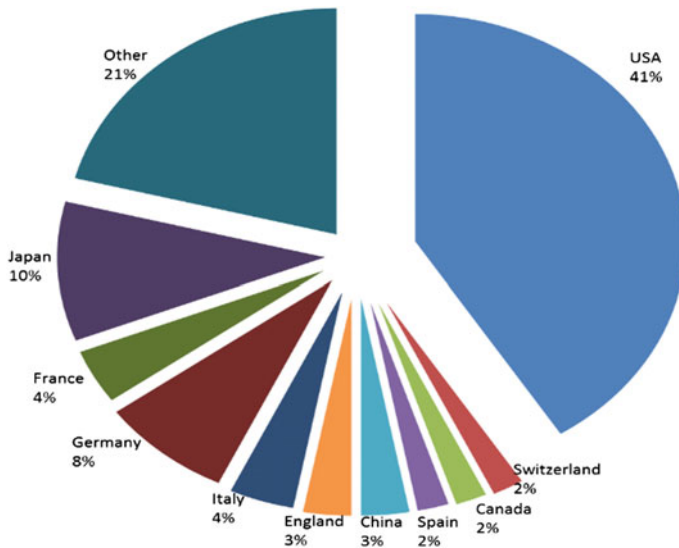


Fig. 1. Medical device sector market share according to countries—2010 (%)

In medical device sector especially USA, West European and Japan are coming to the forefront when the market sizes and researches and investments are considered [3].

If value added perspective in the world between the countries is considered, China is the country that the annual rate of increase is the maximum with the rate of 15.8%. Turkey with 6.0% annual rate of increase has value added parallel to the world average. Turkey is in the 19th order in the world sector with 1.9 million USD value added. Turkey is a country that progress consistently and important economic developments were existing in recent years. With economic improvements, health expenditures are increasing and parallel to this, the position of our country in health sector is growing with big acceleration compared with other countries.

## 1.2 Medical Device Sector in Turkey

Turkey medical device market has been growing gradually and is ranked as the largest in the region of the Middle East and Africa. According to BMI Espicom, the Turkish medical device market reached over USD 2.2 billion in 2012. Moreover, it is forecasted to grow at a CAGR of 8.5% through 2018, buoyed by strong imports. The expansion of healthcare facilities and rising health expenditure will be the main drivers of projected fastpacked growth. There are 6000 medical device company as small, medium and large scale. The number of suppliers are greater than 2500. 100 of 450 medium and large scale company are producer and supplier. According to 2012-year data's, the number of producer firm is 1548 [4].

The medical device sector has shown a stable growth rate between years 2005 and 2008. As a result of global crises after 2009, turkey medical device sector is reduced parallel with world medical device market. In 2010, the market again was recovered and at the end of 2010 the market size was reached to 1.9 billion USD [1].

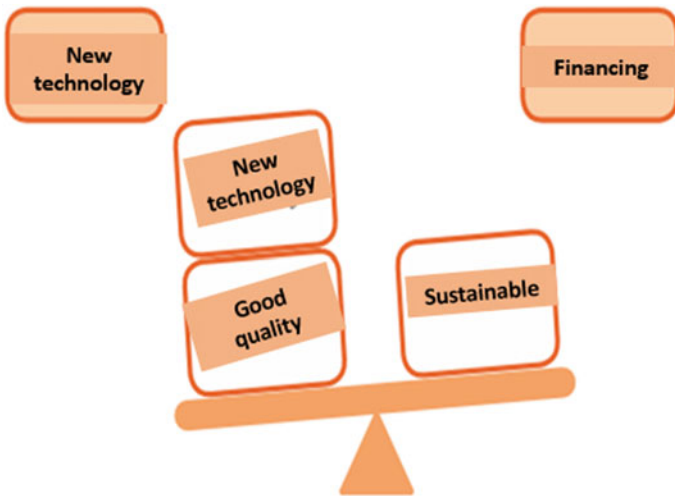
By the end of year 2010, Turkey medical device market is the one in the 20 biggest medical device market in the world [3]. As Turkey's medical device sector grows, so does the need for high technology medical devices in parallel with the planned expansion in healthcare infrastructure. The number of MRI and CT devices per 1 million populations is 12.2 and 15.1, respectively. Although Turkey is above many of the upper income countries, it still lags behind the OECD average. Considering the projected growth potential, it is expected that Turkey will follow global trends and increase the number its MRI and CT devices to satisfy increasing need.

The Ministry of Health (MoH) sets targets and objectives to improve capacity, quality and distribution of health services as well as ensuring that both infrastructure and technology is sustainable and up to date. It also ensures accessibility, safety, efficacy and the effective use of medical devices. These areas are of the utmost importance to the Ministry. Since the production of medical devices is limited in Turkey, a large share of medical devices is imported. Therefore, the MoH aims to increase the export/import coverage ratio gradually from 12.7% in 2011 to 17% in 2017 and to 22% in 2023 [3]. Leading global medical device producers have chosen Turkey for their regional headquarters, R&D center(s) and/or for their production facilities. Globally renowned companies are among the major players of medical device industry of Turkey as supplier. Construction of new, city hospital complexes provide significant opportunities for medical device companies that are being commissioned to equip the [3].

### 1.3 Environmental Sustainability in Health Industry and in Medical Devices

The healthcare sector is a whole that include hospitals, outpatient clinics, laboratory, drugs and medical devices. The purpose of health services is to better the quality of life. The development of countries not only cover the economic indicators but also cover education, health, culture, social structure and technology indicators. In addition, sustainable development cover being healthy in longtime. Health expenditures are also development indicators therefore, healthy people and qualified human resources are very important for sustainable development.

The main equation of health sector is providing healthcare services in a qualified, sustainable and easily accessible. The balance between technology and finance is the main building block of sustainability. In Fig. 2, this balance is given.



**Fig. 2.** Health sector in the context of financial and new technologies

Environmental sustainability in health sector is a connection between environmental operations and enhanced healthcare services. It can be easily said that environmental sustainability can decrease the operational cost in the health industry. In recent years, hospitals go green and although in health sector made major strides in sustainability, worldwide major strides will be needed to improve the health services.

Sustainable preventions designed to decrease the energy and water wastes provide direct financial return. For this reason, the importance of environmental sustainability in terms of finance is very much. Medical devices that comprise less chemicals, healthier foods, destruction of chemicals and toxic gases accepted as sustainable initiatives results in healthier results in terms of patients. If the complexity and diversity of health systems are considered, it is very difficult to construct sustainability into the clinical operations and to the hospitals. But the environmental friendly green hospital

buildings and efficient usage of resources and using less chemicals in the products enable the sustainable healthcare services [5].

Medical device sector is the initiator sector of R and D an innovation activities and is the big actor of the innovation. The innovation of new product process is very long in medical device sector but the lifecycle of products is very short. Since 1990, the works of green firms on sustainability has been derived a profit to the firms and it has been seen that well conducted and strong firms have a strong environmental administrative systems and programs [2].

If price competitive products are a matter, consumers prefer sustainable products. But it is known that the percentage of consumers who prefer sustainable products to cost and more qualifications are very low. Successful firms and firms have a profit and have global purchasing and have significant voice on marketing have to take on a task on sustainability [2]. There is defined standards and directives to increase the value of medical devices designs in the world. According to European and international environmental standards, actions to be taken for environmental problems occurred during the design of products are standardized. Lean production and quality management systems in medical device and health sector decrease the production costs and support the environment performance.

## 2 Material and Method

The main purpose of the research is to point out the applications of medical device firms concerning environment and sustainability. The research has been planned and carried out as a cross sectional field work in defined type. The medical device firms running in the city center of Ankara are involved in research population. The research is carried out on 60 medical device firms which accept the research within a months of time. Field survey is carried out at R and D medical device firms and firms that sales medical devices and products in technicities of universities in Ankara, Turkey.

Data are collected by a questionnaire constructed by literature review. Questionnaire is consisting of two part. In the first part, questions about the properties of firms are exist and in the second part questions about the environmental sustainable applications of firms and questions about general responses to sustainability are exist. The name of the firm, foundation year of the firm and total number of employee, field of activity and the qualifications are questioned in the first part. In the second part, generally the environmental and sustainable applications of firms and their opinions about these subjects were questioned. Questionnaire was applied by face to face application. The average duration of questionnaire is approx. 20 min.

## 3 Findings

Findings of the study are given in three headings. Firstly, the general firm properties and then sustainable environmental properties of medical device firms are given.

### 3.1 Findings About the Properties of Medical Device Firms

Founding years of firms are changing between 1979 and 2016. Number of employees is at least 10 and large companies with 2000 employees are also exist. 51% of firms were established after the year 2000. The number of employees is under 25 in 64% of the firm. 83% of the firms have quality certificate. The most of the firms have ISO quality certificate (53.3%). 31.2% have CE certificate. Less stated certificates are FDA, GOHST-R, HSEQ. Most of the firm’s field of activity are selling a product (88.3%) and 43.3% of firm’s field of activity are product development.

### 3.2 Findings About Environment and Sustainability Properties of Medical Firms

71.6% of firms are indicated that they undertake environmental problems and 43.3% of these environmental issues are energy conservation issues. 59.3% of firms are defined their firm as partially environmentally friendly. 43.3% are applying managerial system considering the environmental risk factors (Fig. 3).

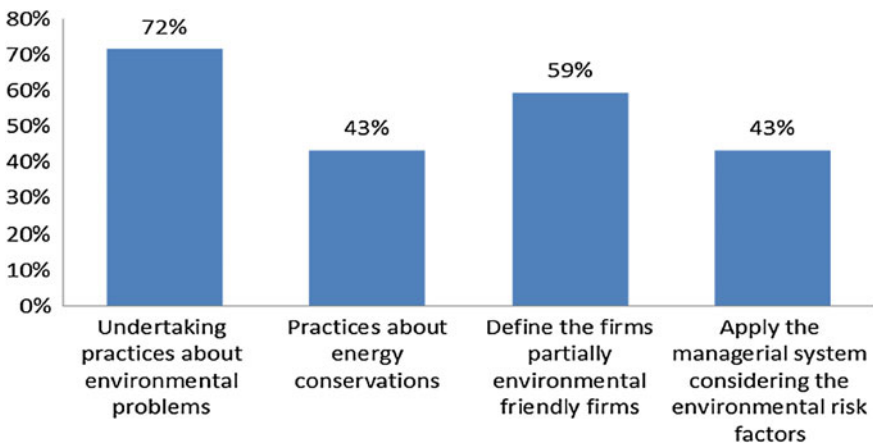
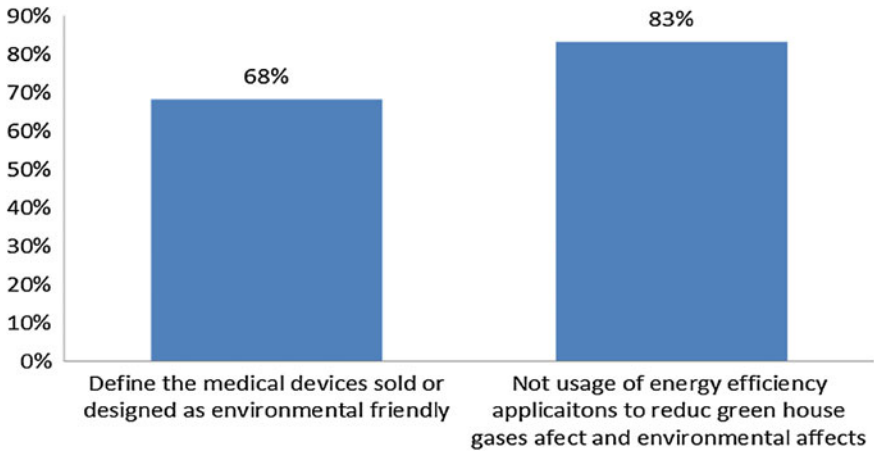


Fig. 3. Undertaking environmental issues of medical device firms

29.1% of 24 medical device R and D firms are stated that they are not applying eco design. But 16.6% of R and D firm are stated that they are targeted to apply in next years. Some of the firms not applying eco designs are stated that they have no ideas about these subject and some of them are stated that they have no financial resources and some of them stated that priority is sale in their firms.

63.3% of firms are defined their medical devices sold or designed as environmental friendly. 83.3% of firms stated that they are not using applications that reduce the greenhouse gases affect and energy efficient applications. In 16.7% of the firms, recycling of packing wastes, waste water discharge emission measurement and avoiding some toxic gases before spread to the air by exhausted filter line (Fig. 4).



**Fig. 4.** Environmentally friendly medical device firms

Sustainability concept is very important for 86.7% of firms and 65% of them stated that sustainability would be effect According to results, sustainability and increasing the operational efficiency and reducing the cost is the most important factors in accomplishing the environmental sustainability of medical devices designs. Increasing the value of the firm is the other important factor according to them. their firm after 5 years. According to 65% of firm, green industry would be change the biomedical innovation studies in near future. In the questionnaire, the importance of some conditions accomplishing the environmental sustainable friendly medical devices are evaluated by giving them a score between 0 and 100 and then taking the of the scores. “0” is the less important factor and 100 is the most important factor. Results are given in Table 1. Sanctions of non-governmental organizations competition and individual preferences of designers are the less important factors according to medical firms in accomplishing the environmental sustainability of medical devices designs (Table 1).

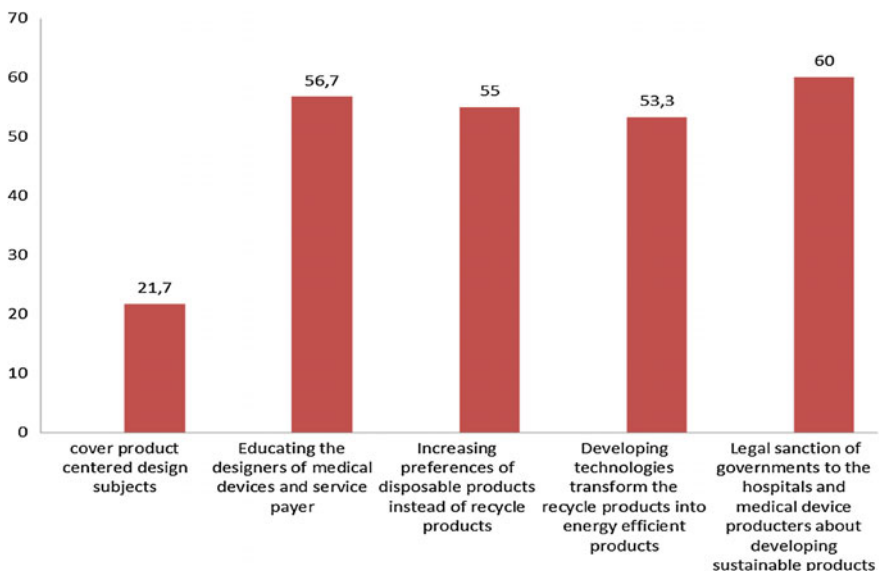
**Table 1.** Opinions about the important factors in accomplishing the environmental sustainability of medical devices designs

Important factors in accomplishing the environmental sustainability of medical devices designs	Average
Satisfying the target of companies	60.0
Individual preferences of designers	51.5
Satisfying customer expectations	64.0
Sustainability	77.5
Increasing the operational efficiency and reducing the cost	77.2
Not commercial concern in environmental products due to the technologic developments	67.5
Increasing the value of firms	71.1
Sanctions of Governmental corporations	68.6
Legal sanctions	71.2
Competition	59.5
Sanctions of non-governmental organizations	59.0

In the same way barriers in accomplishing the environmental sustainability of medical devices designs are coded between 0 and 100 and averaged. Lack of education about these subjects and cost is the most important barrier according to medical firms. Priority of other designs and Risks (e.g. hygiene risk of recycle) are found as less important barriers in the study (Table 2). 48.3% of firms stated that lack of environmental sustainable products is the most important barrier in purchasing of these products in hospitals and financial factors are the most important barriers of green products usage in hospitals according to 68.3%. The most emergent subject in designing environmental sustainable products is legal sanction of governments to the hospitals and medical device producers about sustainable products. 60% of the firm stated this subject the second emergent factor is educating the designers of medical devices and service payer and increasing the preferences of disposable products instead of recycle products (Fig. 5).

**Table 2.** Opinions about the barriers in developing sustainable medical device design

Barriers	Average
Cost	72.3
Lack of education	77.6
Priority of demand and customer	65.9
Risks (e.g. hygiene risk of recycle)	52.5
Reliability of disposable products	57.8
Priority of other designs	52.0
Legislations	57.7



**Fig. 5.** Emergent subjects in designing environmental sustainable products



Opinions of firms about the importance of defined situations in the context of sustainability in health are scored between again 0–100 and then averaged. Cost is the most important situation and then productivity, energy efficiency, patient safety are the other important situations in the context of sustainability in health (Table 3). Sustainable solutions are more effective in medical device sector compared with other sectors according to 43.3% of firm. 58.3% of firm stated that, “green” concept has an important affect in purchasing diagnostic and treatment healthcare products decisions. 35.1% of firm stated that, the other important factor in purchasing medical products is the nonincluding of heavy metal in products. According to 29.8% of firm, energy efficiency of medical devices is important factor in purchasing these products.

**Table 3.** Opinions about the importance of defined situations in the context of sustainability in health

	Average
Long term care without giving any harm to the patient	68.1
Minimum cost medicine	69.7
Decreasing the harmful effect to environment	76.5
Usage of high technology devices	71.1
Productivity	78.7
Energy efficiency	76.8
Quality of life of employees	63.0
Recycle of medical devices used in diagnose and treatment	60.5
Patient safety	75.1
Improvement of health and life conditions	74.9
Cost	79.6
Design of medical devices	56.4
Less usage of materials	62.6
Legal applications	70.6

There is a direct utility of sustainability to humanity according to 86.7% of firm. About 72% of them stated that, sustainable products protect the hospital personnel. Opinions about green product usage in hospitals are very optimistic. 71.7% stated that green hospitals enrich the value of the hospitals and 65% stated that green products improve the health outputs and approximately half of the firm stated that green products effect the hospital choices of patients (Table 4). According to 65% of participants,

**Table 4.** General opinions about sustainability and green products

General evaluations	Agree %
There is a direct utility of sustainability to humanity	86.0
Sustainable products protect the hospital personnel	71.7
Green products improve the health outputs	65.0
Green products effect the hospital choices of patients	46.7
Green hospitals enrich the value of the hospitals	71.7

investments of hospitals to sustainable solutions is very important for hospital's success and also 85% stated that, in deciding purchasing products the energy considering the lifetime energy costs of medical devices and equipment's, energy strategy must be defined to accomplish the objective of energy conservation and efficiency in hospitals. Also 85% of them indicated that, in hospitals the purchasing units must be canalize to healthy products and devices in health sector. In addition, without legal sanctions, it is impossible to canalize to green products and eco designs and sustainable products in hospitals and also in medical device producer firms according to 80% of firm. But 66.7% are thinking that quality management system and lean production would be decrease the costs of product and would be increase the environmental performance.

#### **4 Conclusions and Suggestions**

The main purpose of the research is to point out the applications of medical device firms concerning environment and sustainability. Executives at all levels see an important business role for sustainability. According to executives, sustainability is becoming a more strategic and integral part of their businesses. Operational efficiency and reducing the cost is the most important factors for sustainable products. They believe that sustainability would be increase the value of the firm. Green industry in healthcare and especially in medical device sector would be the main actor in near future according to the medical device firms.

Most of the firms are undertaking environmental problems especially energy conservation and are managing the environmental risk factors. Although 65% see their firm as environmentally friendly but eco designs are not common in R and D medical device firms and 83.3% of firms stated that they are not using applications that reduce the greenhouse gases affect and energy efficient applications. Only 30% of R and D firms are applying eco designs. Lack of education on these subjects were given as primary reason for not using eco designs. Sanctions of non-governmental organizations and competition and individual preferences of designers are the less important factors according to medical firms in accomplishing the environmental sustainability of medical devices designs. Most of the firms stated that, there is a direct utility of sustainability to humanity and sustainable products protect the hospital personnel. Compared with other sectors, it has been concluded that producing sustainable products in medical sector will be more effective, energy applications will be reducing the treatment costs in healthcare, some medical firms in Turkey are ready for energy efficiency applications and energy efficiency applications will reduce 50% energy costs and will protect 50% the environment according to the medical firm's opinions.

"Green" concept has an important affect in purchasing diagnostic and treatment healthcare products decisions. According to their opinions, the purchasing units must be canalizing to healthy products and devices in health sector especially in hospitals. In addition, without legal sanctions, it is impossible to canalize to green products and eco designs and sustainable products in hospitals. Quality management system and lean production would be decrease the costs of product and would be increase the environmental performance according to the most of the opinion of firms. Healthcare costs in all industrial nations have increased and payers are starting to look at new ways to

contain costs and at new funding models. The business model of medical device companies is also undergoing rapid changes. R&D costs have increased year on year, pressures on purchasing decisions and the efficacy and safety of devices and products are mounting. Change is therefore inevitable and already ongoing in healthcare systems and medical device companies alike. Even though medical devices are considered to be heterogeneous and classified in many other sectors such as chemicals, textiles and electronics, they have common features sufficient to be considered as a special product group and being an important part of the healthcare system, they are subject to common regulations. Medical devices sector also suffers from regulations that put cost on innovative activities, reimbursement policies that aim at cost containment, lower degrees of consumer support (in terms of user-producer relationship), high marketing costs due to the specific market they act in, in addition to the general obstacles such as scarce finance and human resources. Nonetheless, the ambiguity in entrance and allowance to reimbursement lists is also found to be a blocking factor on innovation.

Medical devices (MDs) are not only an innovative industry but also a key contributor to healthcare supply. Albeit unseen in daily routines, the medical devices are crucial to accurate diagnosis, treatment and even for prevention of diseases. Being able to prolong human life, medical technologies are also an item of expenditure with rising costs. Even though publicly it is normal to wish for the best healthcare possible, yet how to fund for these ever-increasing costs is a question hard to answer. Moreover, increasing healthcare expenditures are often related to innovation and R&D expenditures in medical devices and pharmacy. Mostly reimbursed by governments, health industry becomes an issue of importance that needs to be appropriately regulated.

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