

Efficiency of the Capital Invested in Oncological Care Measured by Social Affordability

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Summary:

A major problem in investments in the healthcare and social systems is the efficiency of the investment, the optimization of the social infrastructure, whether people (consumers) will be able to afford the services offered by the new assets - subject of the investment. To answer these questions the following should be considered: ways of forming cash flows to calculate the cost of services, pricing of services, analyzing the purchasing power of the population, affordability and financial sustainability.

Keywords: social cost, social price, cash flow, NPV, IRR, affordability and financial sustainability

JEL Classification: H430 Project Evaluation; Social Discount Rate

1. Introduction

To improve the quality of life, measures for the optimization and modernization of the social infrastructure are taken, which will contribute to the human capital of the labour market in conformity with the goals of the Lisbon convention. Communications from the Commission to

the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions, Action Against Cancer: European Partnership, Brussels, 24.6.2009 and resolution at the 58th World Health Assembly resolution on prevention and control of cancer, WHO 2005. All these documents ensure social sustainable development in terms of social and health infrastructure. Basic prerequisite for deciding whether to make such investments is how effectively the capital will be invested in healthcare, whether this capital will be socially tolerated by all households or they will rely on different donor programs.

The main purpose of this article is: to examine the possibilities of capital investment made to modernize and reconstruct the medical institutions, to investigate how effective the invested capital will be.

In the study the principles of economic assessment are observed. Resources invested in a project are valued at their opportunity cost and output - on consumers' willingness to pay for them. It should be pointed out that the opportunity cost does not necessarily correspond to the observed financial cost; similarly, willingness to pay is not in all cases accurately revealed by observed market prices, which may

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be distorted or even absent. Economic analysis is undertaken from the perspective of society.

2. Investment costs

The National Health Strategy envisages investments in equipment and infrastructure. This will greatly improve the healthcare in the regions. It is expected that the investments in infrastructure will induce energy savings due to the renovation of the buildings, energy efficiency and use of renewable energy sources.

The following main stages have to be implemented in order to achieve sustainable social development are the following: 1) **Renovation and enlargement** of the health institution; 2) Provision of **equipment** related to the treatment of socially significant cancer diseases; 3) **Measures for Energy efficiency**; 4) Improving the **microclimate and working environment parameters** in reference to hygiene requirements, medical standards and specifications in order to provide better and standard conditions of the medical-diagnostic process and the working environment; 5) Increasing the **energy efficiency** and decreasing the operating costs of the hospital as a whole; 6) Complete **satisfaction of the needs of the patients** and providing a comfortable environment for quality rehabilitation process; 7) Accomplishment of diagnostics, medical cure, treatments and procedures in accordance with the "**Standards for Good Clinical Practice**".

There are stipulated investment costs for the reconstruction, modernization and taking actions for efficiency of the building of the medical institution and purchasing of new equipment. The investment is provided in the National Health Strategy. By their nature, the costs are as follows: costs for organization and management amounting to 182 617 BGN; consulting services amounting to 234 400 BGN.; costs for construction

and assembly work – building of 4-pieces bunkers amounting to 8,915,158 BGN as well as supply and installation of equipment (accelerators, CT, etc. [1].) amounting to 14,807,861 BGN. **The total investment amounts to 28,914,612 BGN including VAT.** The implementation of this strategy in a particular health facility – a hospital will be illustrated in the presentation.

The expected results of the investment are: 1) Increase in the number of patients, diagnosed by CT and MRI [1] and treated by high-tech radiotherapy (linear accelerators); 2) Building of 4-piece bunkers and infrastructure for accessible environment.

3. Calculating the cost and making/issuing reports

The formation of the cost of the offered services employing the apparatuses examined below applies the method of calculating "ABC" in processes. The costs include:

- Maintenance costs - which by their nature are costs of spare parts, costs of service and subsidiary software.
- Variable operational costs: Costs for medication and diet food; costs for food per day; cost of disposal of hazardous hospital waste. There are also other stipulated costs for external services, such as internet access, delivery of various basic materials required for the normal course of the treatment, costs for medical supplies during the treatment, costs for X-ray films, energy costs, material costs, costs per one medical day.
- Regular costs of operation,: labour expenditure, social and healthcare insurance costs, heating expenditure, administrative costs and other expenses.

The formation of the cost of the procedure prescribed for a patient is presented in the Table 1:

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Table.1 Cost of treatment and diagnosis for one procedure

Cost of treatment and diagnosis for one procedure - respectively first course of treatment for a patient		1 number accelerant	MRI	CT
Number of completed patients (capacity of the machine) for day	Number	60	20	20
Energy costs for the procedure	BGN.	0.70	0.33	0.40
Daily wage of doctors	BGN./day	70.91	70.91	70.91
Living wage ray technicians	BGN./day	43.64	43.64	43.64
Daily wage of technicians	BGN./day	27.27	27.27	27.27
Daily wage of physicists	BGN./day	70.91		
All labour expenses	BGN./day	212.73	141.82	141.82
Wages per hour	BGN/hour	26.59	17.73	17.73
Labour costs for the procedure	BGN./ procedure	6.65	2.95	2.95
Expenses for medical supplies	BGN./ procedure	6.22	3.11	2.07
Expenses for X-ray films	BGN./ procedure	0.09		
Costs for heat	BGN./ procedure	0.13	0.13	0.13
Other material costs	BGN./ procedure	10.50		
Service of the system and utility software	BGN./ procedure	22.97	20.83	13.89
Suspected depreciation	BGN./ procedure	62.66	25.97	13.58
Other expenses	BGN./ procedure	29.24	54.55	28.52
Cost of procedure	BGN./ procedure	346.60	146.14	90.80
Cost of treatment procedures	BGN./ procedure	3,702.95	146.14	90.80
Stay in hospital - 20 days	BGN / day / patient			
<i>Expenditure on medical products and health foods</i>	1.11	22.20		
<i>Food costs for patient</i>	0.86	17.20		
<i>Costs of hospital waste</i>	0.09	1.80	1.80	1.80
<i>Other costs</i>	1.07	21.37	1.07	1.07
Cost of treatment in hospital 1 patient.	BGN./day	62.57		
Administrative costs	8%	296.24	11.69	7.26
Other	5%	185.15	7.31	4.54
Cost of one course of treatment of one patient with an average stay of 20 days	BGN./ procedure	4,246.90	168.01	105.47

Source: Project information and NSI

Energy consumption is calculated according to the capacities of the machines and the duration of a review. Costs of heat are formed on the basis of the heat energy consumed for procedures. The cost of procedure (3702,95) is formed, including

the mandatory CT and in MRI tests at the beginning and end of the treatment, and there are approximately 10 procedures accelerator. On that basis, account is taken of the 10 procedures with an accelerator, and a procedure with CT and MRI is launched.

Table 2. Indicators

INDICATORS	1 st year	2 nd year	3 rd year	4 th year
Total cash receipts	1,195,794.81	1,287,871.01	4,686,034.53	4,817,243.50
Revenue from inpatients, diagnosis and treatment	1,083,572.12	1,167,007.17	4,264,244.21	4,383,643.05
Revenue from outpatients using ambulatory care and diagnosis	0.00	0.00	147,826.64	151,965.79
Revenue from Computed Tomography diagnosis	112,222.69	120,863.83	252,363.68	259,429.86
Revenue from sale of electricity	0.00	0.00	21,600.00	22,204.80
Revenue from the residual value	0.00	0.00	0.00	0.00
Total income:	3,817,611.55	3,817,611.55	10,963,051.25	4,763,520.68
Increasing the number of cured patients (from accelerator)	1,023,828.14	1,023,828.14	3,071,484.42	3,157,485.99
Future cost savings for the treatment of cancer (early diagnosis and cure - reduced costs dispensary and home care)	489,783.41	489,783.41	979,566.83	1,006,994.70
Avoid production losses resulting from treatment	2,304,000.00	2,304,000.00	6,912,000.00	599,040.00
Increasing life expectancy and reducing death rate	146,938.78	146,938.78	440,816.33	436,408.16
Saving costs for treatment abroad	-	-	0.00	0.00
Total expenditure	1,915,412.00	1,963,297.30	4,418,948.64	4,889,016.75
COSTS radiotherapy				
Variable costs	308,665.60	316,382.24	1,135,021.29	1,185,106.93
RUNNING COSTS	1,462,069.74	1,498,621.48	2,556,393.45	2,958,187.56
Cost diagnostic MRI				
VARIABLE COSTS OF PROCEDURE	-	-	9,611.94	9,852.24
RUNNING COSTS	-	-	262,701.92	269,269.47
COSTS diagnostic CT				
Variable costs	22,546.75	23,110.42	47,376.36	48,560.77
RUNNING COSTS	122,129.91	125,183.16	407,843.68	418,039.78
Net cash flow (revenues - costs)	-719,617.20	-675,426.30	267,085.90	-71,773.24
Net cash flow (benefits + income) - (cost)	3,097,994.36	3,142,185.26	11,230,137.15	4,691,747.44

Source: Project information and NSI

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So described Prime Cost of a course for treatment (20 days) for one patient using:

As a result of the expenditure made, the relevant cash flows are formed aimed to forecast the efficiency indicators of the invested capital.

The revenues are formed on the basis of the number of completed sick items, taking into account only the amount of revenue that the medical establishment realized due to clinical pathways for each encountered sick item.

The "net present value" index amounting to 27,808,132 BGN is deductible from the formed cash flow.

On this ground it can be concluded that the medical institution can invest capital only if there is funding from the state budget (NZOK) or the European Community. The second efficiency index is financial - the Internal rate of return. The simplest way to assess profitability is to measure the internal rate of return on the investment, i.e. the discount rate at which the sum of the discounted cash flow of costs and revenues of the project is zero. Its size is 22.24 percent, which means that the funding can be performed solely and only in the case of support from the State budget or funding from the European Community.

To assess the efficiency of the capital invested in the health sector, it is necessary to take into account the economic benefits of the project. Upon deducting the indices

of effectiveness, the economic net present value is 28,432 913.84 BGN and the economic internal rate of return is 16.38%.

For the purposes of this study an analysis of the social tolerance of the patients should be carried out. An essential aspect of arriving at social affordability is the profitability of the households, as well as their expenditures.

4. Household Incomes

According to NSI data, in 2013 the households had an average income of 2,557 BGN per person from salary, while in 2012 these funds amounted to 2,281 BGN, i.e. the income from salary rose by 12.1%. In nominal terms the income of households from salary has increased.

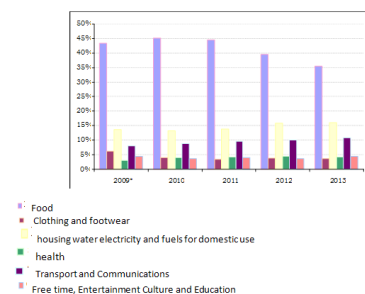
In the past year the percentage of the income from home economy was approximately equal to the 2012 level and it is 1.6% from the total income of households.

5. Dynamics and structure of the expenditures of the households

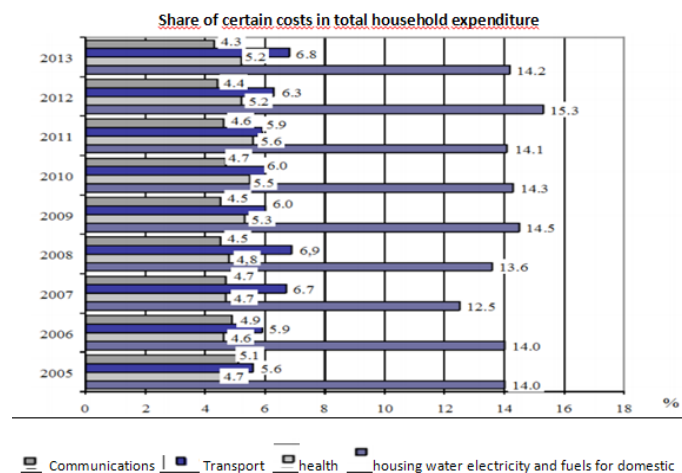
The total household spending on goods and services in 2013 in nominal terms was 42% higher in comparison with 2007.

The percentage of consumer expenditure in the total household spending in 2013 for the region of Russe was 86.5%, equal to that for Bulgaria.

Chart 1. Distribution of total expenditure per household by expenditure groups



Sources: NSI – Statistic agency 2014



But in contrast to the established growing trend for the country, at regional level it fell by around 1-2% per year during the analyzed period.

During the analyzed period, the share of the expenditures for healthcare increased from 2.9% in 2007 to 4.2% in 2011.

Last year the costs of housing, water, electricity and fuels have increased by 1.8% in comparison with 2012. An increase in the expenditure for health (by 9.9%), transport (by 19.2%) and communications (by 7.3%) was observed.

6. Social Affordability

The investment aims to guarantee the delivery of equipment and to provide good working conditions in the hospital in accordance with the European standards for hospital institutions. The implementation of the project will help to achieve this goal. The target groups will receive high-quality medical services, as for their diagnosis and treatment will be used modern technologies and their treatment will take place in renewed and modern premises.

The main users of the equipment will be: the growing number of patients diagnosed with cancer, and the population in the region where the hospital is situated, all patients from the country, who can not get modern radiotherapy by residence, the sick people that are in unequal social situation (for example, patients with cancer disease from Roma origin are more often with advanced cervical cancer and cancer of the

lungs, in a stage where radiotherapy is the leading treatment or the single oncologic medical method, when radiotherapy should be included in the treatment up to 30 days from its prescription).

- Patients over middle age

Within the range of the assessment of the investment, such an analysis facilitates the examination of the objectives set by the politicians, if they for some reason could not be included in the financial and economic analysis, for example social justice (social affordability).

Justice is a particularly important goal of the project. As a result of the implementation of the project in addition to the advantages listed above in the article there will be also social affordability, which is calculated and analyzed on the basis of the household profitability, consumption and social affordability. (Application to the project).

The analysis shows that the project is socially affordable during the whole analyzed period.

Another way to expose social affordability is to take into consideration not only the prime cost but also the different types of decile groups.

To display the social affordability the following is taken into account:

- 1) The full reimbursed costs for each procedure, as displayed in the calculation of the prime cost;
- 2) Household incomes per month (it should be pointed out that the households allocate up to 9.9.% of their incomes for healthcare);

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Table 3. Affordability

	1 year	2 year	3 year	4 year	5 year	6 year	7 year	8 year	9 year	10 year
Number of patients served	60,000.00	60,000.00	138,283.72	137,592.30	136,904.34	136,219.82	135,538.72	134,861.03	134,186.72	133,515.79
Average income per citizen per year	3,360.00	3,444.00	3,530.10	3,618.35	3,708.81	3,801.53	3,896.57	3,993.98	4,093.83	4,196.18
Average income per year	201,600,000	206,640,000	488,155,367	497,857,455	507,752,372	517,843,950	528,136,098	538,632,803	549,338,130	560,256,226
Payment of treatment fees	1,195,795	1,287,871	4,686,035	4,817,244	4,966,578	5,115,575	5,269,043	5,427,114	5,589,927	5,757,625
Relative percentage of affordability for treatment	0.59%	0.62%	0.96%	0.97%	0.98%	0.99%	1.00%	1.01%	1.02%	1.03%
Affordability for resident in BGN / year	19.93	21.46	33.89	35.01	36.28	37.55	38.87	40.24	41.66	43.12

Table 4. Full cost

Affordability		2014	2015	2016	2017	2018
Refund full cost - linear accelerator	BGN./ procedure	60.87	60.87	60.87	60.87	60.87
Refund full cost - computed tomography	BGN./ procedure	90.00	90.00	90.00	90.00	90.00
Refund full cost - MRI	BGN./ procedure	146.00	146.00	146.00	146.00	146.00
Total refund full cost		296.87	296.87	296.87	296.87	296.87
Refund full cost with VAT	BGN	356.25	356.25	356.25	356.25	356.25
Household income (9.9) per month	BGN.	795	815	843	877	906
Number of patients having treatment procedures with linear accelerator	Number	42.33	42.33	42.33	42.33	42.33
Number of patients having diagnostic procedures with computed tomography	Number	236.42	236.42	236.42	236.42	236.42
Number of patients having diagnostic procedures MRI	Number	60.50	60.50	60.50	60.50	60.50

Table 5. Costs of procedure

Costs of procedure		2014	2015	2016	2017	2018
Costs of treatment with linear accelerator	BGN.	15,081.22	15,081.22	15,081.22	15,081.22	15,081.22
Cost diagnostic CT	BGN.	84,223.30	84,223.30	84,223.30	84,223.30	84,223.30
Cost diagnostic MRI	BGN.	21,553.09	21,553.09	21,553.09	21,553.09	21,553.09

3) The capacity of the machines determines the number of patients that can take advantage from the appliances.

On the basis of all the factors

the total reimbursable expenses by the number of the procedures are calculated.

The costs for treatment with a linear accelerator for procedure and

Table 6. Social affordability

Social affordability		2014	2015	2016	2017	2018
Social affordability of patients to fully cover the linear accelerator	%	5.27%	5.40%	5.59%	5.82%	6.01%
Social affordability of patients to fully cover the costs of computed tomography	%	0.94%	0.97%	1.00%	1.04%	1.08%
Social affordability of patients to fully cover the cost of MRI	%	3.69%	3.78%	3.91%	4.07%	4.20%
Limit of Social affordability (9.9%)	BGN	78.71	80.67	83.50	86.84	89.70
Maximum Social affordability - therapy linear accelerator	BGN./Number	1.86	1.91	1.97	2.05	2.12
Maximum Social affordability - diagnostic CT	BGN./Number	0.33	0.34	0.35	0.37	0.38
Maximum Social affordability - diagnostic MRI	BGN./Number	1.30	1.33	1.38	1.44	1.48

mentioned above the costs for treatment with a linear accelerator per one procedure and the costs for diagnosis with KT and nuclear magnetic resonance, by multiplying

costs diagnosis with CT and MRI, by multiplying the total number of reimbursable expenses in procedures are calculated on the basis of the above factors.

Table 7. Social affordability

Social affordability		2014	2015	2016	2017	2018
Household income (2.4) per month - a minimum level of poverty	BGN.	556.50	570.41	590.38	613.99	634.25
Members of the same household	number	2.4	2.4	2.4	2.4	2.4
Procedures average household/month	number	5.28	5.28	5.28	5.28	5.28
Household expenditure for the procedure/month	BGN.	1881.00	1881.00	1881.00	1881.00	1881.00
Limit of Social affordability (9.9%)	%	338.00%	329.76%	318.61%	306.36%	296.57%

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As a result of presence of deduced costs for treatment and diagnosis and the presence of monthly household income the affordability of patients can be deduced as follows:

Conclusion:

On the basis of the analysis it can be concluded that the invested capital is socially unbearable for the population living at the minimum level of poverty. Therefore the procedures for the patients that are from this decile group, should be paid entirely or from the National Health Insurance Fund or the State budget.

Provided that affordability is examined only for the population with incomes at the minimum level of poverty, the situation is significantly different.

Following the studied option for investment of capital in the modernization and reconstruction of medical institution, as well as identifying the problems in the part where capital efficiency is achieved, as a result from the decision taken, it can be asserted that the investment in this area will be rational only if the National Health Insurance Fund or the State budget take some of the financial burden related to the exploitation of the equipment and the treatment of the patients. To display the effectiveness of this decision the following indicators shall be considered:

- Financial net present value and the financial internal rate of return, which are unsatisfactory, if funded entirely by the medical institution.

The investment intention is possible only if there is support from the State budget (NHIF) or the European Community.

- Economic net present value and economic internal rate of return value are positive and satisfactory, which means that the investment intention is of extremely high importance.
- Social affordability at an average statistical incomes of households: the invested capital is socially affordable, since the procedures can be paid and acceptable for the people's incomes. The sources used to cover the expenditures are both the revenues, that are allocated by the national health insurance, and from the additional payments of the people.
- Social affordability of the population, which is at the minimum level of poverty: the invested capital is socially intolerable. Therefore, for the patients from this decile group, the procedures should be paid entirely from the National Health Fund or the State budget.

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