

Engineering Concept Applied to Socio-Medical Management

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Abstract- The development and foundation of scientific management lead to extended content and scope of the management engineering concept. The wide range of theoretical and pragmatic approaches highlight the multitude of ideas in the socio-medical field, the specialists' insistence on conceiving accessible and efficient management systems.

This research work is oriented towards managerial engineering-specific activities carried out in a health unit of great importance for the intercommunity life.

Keywords- engineering concept, socio-medical management, Swatt analysis.

1. INTRODUCTION

The over-time development and crystallization of the management concept trace their origins back in the 15th-16th centuries, but most specialists in the field place the preoccupations with management around the year 1900. Thus did the concept of scientific management appear, a revolutionary event that contributed to rationalization of activities and reduction of losses. Frederick Taylor based all his conception on the idea that people's work can be rationalized. This "maximum prosperity" idea is mainly seen from the entrepreneur's perspective and Taylor establishes it as main management objective.

A step forward towards the development and foundation of scientific management was made by Henri Fayol who managed to extend the content and scope of the management engineering concept [Baldwin, S., Godfrey, C., Propper, C.(1990), Haring, R., Mook, J., Völzke, H., Dörr, M., Nauck, M., Wallaschofski, H., Kohlmann T. (2011), Lukkarinen, H., Hentinen, H. (1998), Lupu, I. (2006)].

Later, the scientific management engineering enjoyed the contributions of the Gilbreths who were inspired by Taylor's analyses on measuring the basic actions of the work process. Max Weber and Henry Mintzberg were very preoccupied with the strategy for activities, use of managers' work time, developing strategies and defining objectives.

Taking into consideration human factor, the relationships and the behavior in current activity is an important element that changed the orientation regarding the management. The research conducted by Mayo's group was a step forward in the evolution of the management concept and it marked the beginning of using sociological and psychological concepts and methods. The technical and the human factors were unified. Researchs by Minea Dana, Carmen Tereanu, Trifu Corina, (2009), Mățăuan, G. (1999), Mapes, D.L., Loopes, A.A., Satayathum, S., McCullough, K.E., Goodkin, D.A., Locatelli, D.A. (2003), McHorney, C.A., Jr.Ware, J.E., Lu, J.F., Sherbourne, C.D. (1999) enlarge the range of engineering methods and techniques in order to achieve set objectives with maximum efficiency.

Modern management engineering involves abilities related to program planning and statistical processing, use of information technology, process modeling and simulation, accountancy and mathematics. The emphasis is laid on rational approaches to problems and logical reasoning, use of modern mathematical methods in management and decision-making processes and of the instruments that have revolutionized managers' work and the organization orientation in business: computer, Internet, artificial intelligence etc. [Finkelstein,R.L., Liu, F.O. (2006), Turner, J.R., Simis, S.J. (2006)].

After 1990 year, efforts were increased to define the theoretical system of project management with the following benefits:

- a more efficient control of resources (material, financial, human and informational);
- better relationship with customers;
- shorter duration of development stages and lower research and development costs;
- increased quality of products / services offered;
- bigger profit;
- improved productivity;
- better activity coordination and timeliness in execution, delivery etc.;
- increased employee satisfaction and motivation;
- increased capability of implementing changes within organizations.

To conclude, management theory and practice had and still have, during the 20th century and at the beginning of the 21st century, a spectacular evolution that impact significantly on the life of all organizations. The wide range of theoretical and pragmatic approaches highlight the multitude of ideas in this field, as well as the specialists' insistence on conceiving accessible and efficient management systems.

According to the mentions above, the author's research work is oriented towards managerial engineering-specific activities carried out in a health unit of great importance for the intercommunity life.

2. ENGINEERING CHARACTERISCTICS OF PROJECT MANAGEMENT FOR A HEALTHCARE UNIT

Specific characteristics of the project applied to the healthcare unit (HU):

Well-defined scopes and objectives: the project should generate clear, well-defined and applicable results and solve problems arising from the preliminary analysis of needs. They target sustainable change by suggesting one or more solutions. This method used for setting objectives

identifies the following characteristics that are specific, measurable, achievable, realistic and limited in time.

Depending on different criteria, project typology, according to Roland Gareis' structure, this project presents the following specific elements:

- a. By project objectives:- organizational development project.
- b. By degree of implementation: - execution project.
- c. By repetitiveness: - one-time project.
- d. By type of project owner: - internal project.
- e. By complexity: - high complexity project.
- f. By relation with organization processes: - project for primary process execution.
- g. By definition of objectives and methods: Type 1 – well defined objectives and methods.

3. SPECIFIC APPLICATION TO HOSPITAL UNIT (HU)

A. Description of Hospital Unit (HU)

a. Unit profile. The hospital unit (HU) has been operating since 1993. 200 beds are available in 5 departments where around 7500 patients are treated every year. The activity is carried out in four adjacent buildings and one independent building.

b. Characteristics of the population served. The population is mainly formed of middle-aged (mostly over 55), rural, medium income people. The patients come from a 200 km area, from the neighboring counties and even from abroad.

c. HU structure, location, capacity and organization. HU provides complex and highly specialized healthcare services: cardiology, interventional cardiology and cardiac catheterization, coronary intensive care, cardiovascular surgery, anesthesia and intensive care, cardiovascular recovery and prevention, VC functional and electrophysiological examinations, cardiac pacemaker implant, non-invasive investigations and specialized ambulatory services grouped by competences.

d. Human resources. There are approximately 400 health professionals with direct health-related tasks and ancillary personnel.

The continual professional development of personnel has been pursued at managerial level. Doctors participate in national and international scientific activities. Professional recognition is supported by membership of several health professionals in prestigious national and international professional organizations and by direct collaborations.

Permanent healthcare services are provided through on-call duty performed in three departments: cardiology, cardiovascular surgery, anesthesia and intensive care. There are on-call specialized personnel for each of these departments. Consultations and hospitalizations, as well as unusual events happened during the on-call duty are recorded. Such aspects are discussed on a daily basis during handover meetings at clinic and unit level.

HU has been recently approved to provide a new on-call service: interventional cardiology.

In order to ensure the necessary healthcare personnel, contests are organized to fill the positions of medical specialist. Continual professional development of healthcare mid-level and

ancillary personnel has been ensured by participation in trainings organized by the Order of General Nurses, Midwives and Nurses.

B. Diagnosis-related group

HU treats patients with complex pathology and different comorbidities, besides CV pathology :

- a. cardiac insufficiency and shock,
- b. circulatory disorders except acute myocardial infarction with cardiac catheterization and complex diagnosis,
- c. other permanent cardiac pacemaker implants / percutaneous transluminal coronary angioplasty (PTCA) with coronary stent implant,
- d. arterial hypertension and atherosclerosis with CC,
- e. percutaneous cardiovascular procedures,
- f. circulatory disorders except acute myocardial infarction with cardiac catheterization without complex diagnosis,
- g. cardiac valve, coronary bypass, other major surgical procedures without cardiac catheterization,
- h. permanent cardiac pacemaker implant with myocardial infarction, insufficiency / cardiogenic shock / implant procedure for pacing leads / cardioversion devices – atrial defibrillation.

C. Management indicators

To get an image of HU activity, the activities in the 2nd semester of 2012 (Table 1) are shown as management indicators. The values are for activities at HU and department level.

These indicators correlate with Swatt analysis that presents HU “strengths” and “weaknesses”:

C1.Strengths:

- strategic location in a powerful urban area at a small distance from the Serbian and Hungarian borders,
- location in a geographical area little threatened by natural calamities and disasters,
- among the best functioning specialized single-specialty clinics in the Balkans,
- good accessibility: by air, road or rail;
- highly qualified personnel, outstanding equipment provided for certain activities,
- high level of comfort for patients and personnel,
- new buildings equipped according to modern standards,
- efforts to deploy a new wing,
- low rate of nosocomial infections,
- sustained research activity.

C2.Weaknesses

- lack of efficient / sufficient means of personnel motivation (unbalanced professional quality / remuneration ratio,
- obsolete and worn out equipment in some areas,
- ambulatory services not available – examinations are provided only at the emergency room.

C3.Opportunities

- large serviced area - Banat, Ardeal, Oltenia etc., monopoly on the market in that area,
- good relationship with local authorities,
- collaborations, national, regional and international partnerships for research projects.

C4. Threat

- privatization of medical activity in Romania, risk of unfair competition of private clinics,
- migration of healthcare personnel to other countries due to financial benefits,
- poor resources of own income, considering that this is a single-specialty hospital,
- continual reduction of budgetary income, despite the relatively constant number of cases in the last 4 years, greatly exceeding the funds,
- legislative changes that disadvantage the amounts of financings,
- very inflexible legislation on European funds raising.

D. Main problems that affect HU management indicators:

- insufficient funds, settlement failure for procedures performed on patients and for amounts resulted from the difference between the number of effective and contracted patients (Table 2).
- in some departments, obsolete, worn out or even inexistent medical equipment for investigations of maximum performance,
- invalidation of expenditures by the coordination bodies due to improper collaboration and lack of correlation between databases of health insurance funds,
- lack of a coherent personnel policy at national level to allow personnel to be employed as needed in each department,
- research activity insufficiently developed.

E. Managerial solutions implemented between November 2008 and December 2012

HU was ranked in 1 M category, the highest ranking for a single-specialty hospital unit.

High performance apparatus and equipment were purchased in order to support medical and administrative activity.

Continual increase of MCI from 1.5936 in 2008, to 2.1990 in 2012.

The core of young specialists with high research activity has been maintained and developed and that has permitted lately, besides the developed projects, many high complexity surgical interventions performed for the first time in our country.

The “mortality rate” percent was kept at the lowest national level (0.65% in 2009 – 1.16 in 2011) by extending the range of healthcare services offered to patients, as well as by a continually increasing level of demand from patients.

IT management and reporting programs were introduced in all departments of the institution.

Investments for extending spaces, as well as for modernizing and equipping medical spaces were completed.

The past debts of the institution exceeding 1,428,570 EURO were written off in November 2008.

4. HU MANAGEMENT SYSTEM ENGINEERING CONCEPT

Scope and mission: Consolidation of previous achievements, development of the entity by setting and achieving clear objectives within a coherent strategy. HU management should anticipate, facilitate and contribute to integration of medical activity, Romanian medical higher education and research in the European medical “family”, at international standards.

Set objectives:

- to find additional resources and incomes, including European funds, to use them efficiently and to adopt efficient management,

- to modernize technical and material resources through adequate equipment permitting maximum use of space.
- to improve material resources and to exploit medical devices according to their standard of performance,
- to use financial resources with maximal medical and economic efficiency,
- to improve professional capability of personnel at all levels,
- to consolidate and to develop the management system by providing modern informational support,
- to conduct systemic evaluation and to improve quality in all areas of activity,
- to continually maintain and develop an environment that provides favorable study and work conditions for all personnel of the unit, residents, PhD students, trainees and students, shows honesty, fairness, humanity, equal opportunities and responsibility and ensures harmonious development of future specialists and thorough professional development of all employees of the unit.

The following activities are oriented towards the achievement of competitive management objectives:

a. Regarding the management:

- to develop and improve internal decentralization of clinical and administrative management,
- to develop programs that facilitate a more efficient connection between financial and administrative structures,
- to review resource allocation to departments and services according to needs, performance, institution priorities, law, efficiency and competitiveness,
- to increase off-budget resources by raising Community funds,
- to process data from the quality core (reports, proposals) and to monitor their effects,
- to monitor the internal assessment system for the extent of achievement of professional standards,
- to monitor the quality of the medical act, research and management, through procedures,
- to develop programs for modeling and simulation of activity and hospital structure,
- to develop the strategy and procedure for management implementation in departments, based on results,
- to generate the procedure for monitoring performance indicators and continuous improvement.

b. Regarding the administration:

- to manage budget and off-budget resources and assets mainly at program / project level,
- to increase off-budget resources by raising Community funds,
- to develop a service for planning and assessing financial management and transparency of resource use,
- to monitor services by monthly / quarterly reports,
- to monitor administrative management quality assurance, according to defined criteria.

c. Regarding the medical act:

- to reduce costs that are not related to healthcare without affecting functionality,
- to increase efficiency of the Commission that analyses cases not validated in the DRG system,
- to conduct operative analysis of in-hospital infection cases, to provide proposals and to observe their effects,

- to develop a quality assessment system for the research-related medical act,
- to identify resources needed and allocated to each type of patient (real cost calculation).

d. Regarding human resources:

- to involve all personnel in judicious use and protection of assets,
- to improve criteria for selection, promotion and individual performance assessment,
- to define policies supporting personnel's professional development,
- to develop employee motivation policies,
- to develop the strategy and to generate the procedure by assessing the practice quality of young professionals.

e. Regarding ancillary areas:

- to augment and extend present informational infrastructure for a safe information flow,
- to ensure continual maintenance and modernization of IT resources,
- to develop partnership projects concerning IT aspects and their application to medical activities,
- to make IT system more flexible, to train, certify and maintain personnel involved in the process.

The activity planning is structured by semesters (S) based on Gantt chart (Table 3).

Expected results:

- assessment report for the situation existent at the moment of the takeover drawn up and presented,
- economic and financial analysis prepared, communicated and discussed,
- management and action plan drawn up and communicated,
- additional incomes achieved,
- new contracts signed,
- real costs by type of patient determined,
- new functional building,
- local partnerships concluded,
- motivation of highly professionalized, creative and loyal administrative personnel,
- planning and monitoring service for department management implemented and working
- qualitative evaluation procedures and criteria defined and applied,
- personnel trained and certified,
- purchase of IT and informational components,
- informational system developed according to needs,
- research projects prepared and financed,
- scientific papers published in specialized magazines, at national and international scientific events.

Target indicators:

- to lower debts to suppliers,
- to reduce the number of invalidated cases to a minimum,
- to increase level of demand with 5% after negotiating a realistic and remunerated contract,
- to maintain surgery rate in surgery departments,
- to improve patient and accompanying person satisfaction,

- to continually increase MCI level up to the real value expressed by the cases in each department,
- to maintain DMS,
- to maintain a low mortality rate in all departments, to lower it in CICU,
- number of scientific articles published in established science journals,
- number of participations of teaching / research personnel in scientific events,
- number of research projects prepared, applied and financed – as partners and coordinators.

5. CONCLUSIONS

1. Modern management engineering involves abilities for program planning and statistical processing, use of information technology, process modeling and simulation, accountancy and mathematics, laying an emphasis on rational approaches to problems and logical reasoning.
2. This work is oriented towards managerial engineering-specific activities carried out in a health unit of great importance for the intercommunity life.
3. Specific indicators are shown and a strategy for using “strengths”, based on opportunities, and to reduce effects of “weaknesses” and threats is proposed.
4. Different objectives corresponding to areas of activity are achieved by activity planning supported by target indicators and activities structured according to timeline charts.

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Table 1. Hospital Unit (HU) activities.

No.	Indicator	Name	UM	Total HU	Card. 1	Card. 2	Sur-gery	CICU	Reco-very
1	A. Service indicators	a. Number of discharged patients	no.	4050	948	1512	606	539	445
		b. Average period of use hospital stay	days	5.72	4.18	3.60	11.67	3.47	10.81
		c. Bed use rate	%	69	37	120	156	69	44
		d. Case-mix index	%	2.14	1.53	1.57	4.83	1.77	-
		e. Surgical interventions in the total number of discharged patients	%	94.00	-	-	94.00	-	-
		f. Patients hospitalized by prior appointment	%	55.90	59.85	59.06	73.06	17.49	80.13
		g. Emergencies in the total number of hospitalized patients	%	32.04	24.76	25.28	27.96	78.28	0.00
		h. Referral patients hospitalized	%	67.96	75.24	74.72	72.04	21.72	100
		i. Hospitalized / presented patients	no.	90.83	50				
		j. Ambulatory examinations	no.	50					
		2	B. Quality indicators	a. In-hospital mortality rate	%	1.70	0.42	0.13	0.17
b. Nosocomial infection rate	%			0.05	0.00	0.00	0.33	0.00	0.00
c. Rate of patients re-hospitalized within 30 days after	%			7.46					

	d. Match between diagnosis when hospitalized / discharged	%	74.40	80.06	86.18	68.81	64.19	69.89
	e. Patients hospitalized and transferred to other hospitals	%	0.10	0.11	0.00	0.17	0.37	0.00

Here are some indicators:

Contracted MCI. 01.01.2008 – 31.12 2008 = 1.5936

Contracted MCI. 01.01.2012 – 31.12 2012 = 1.8489

Achieved MCI. 01.01.2012 – 30.10 2012 = 2.1990

Table 2. Financial results./EURO/

No.	Name*	2008	2009	2010	2011	2012(I-XI)
1	A	6,285569	5,512355	4,970459	4,531051	4,845958
2	B	5,465019	5,205854	4,359015	4,123493	3,819238
3	C	820549	306500	611444	407558	1,026720

* A: Effective DRG and chronic patients, B: Contracted DRG and chronic patients, C: Difference between contracted and effective.

Grand total (2008 -2012) : 3,172,771 EURO.

Table 3. Activity planning according to Gantt chart

Activity	Year 1		Year 2		Year 3	
	S1	S2	S1	S2	S1	S3
To find additional resources and incomes, including European funds, to use them efficiently and to improve management efficiency	X					
To modernize technical and material resources by equipping the new “C” wing in view of maximum use of existent space.	X	X	X			
To make the angio-CT system work as soon as possible in order to provide services that are unique in this part of the country.	X	X				
To purchase at least one angiograph for the interventional cardiology activity.	X	X	X			
To formalize the heart transplant activity	X	X	X	X	X	X
To improve human resource management	X	X	X	X	X	X
To consolidate and develop the management system, including department management, by ensuring informational support	X	X	X	X	X	X
To reorganize functional spaces	X	X	X			