A Decision Support Tool for Hospital Project Sustainability Evaluation

ABSTRACT

This study aims to develop a Decision Support Tool (DST) able to evaluate the sustainability of strategic projects which could be implemented in a hospital context. The applied methodology was based on a double Multi-Criteria Decision Analysis realized by the traditional Analytic Hierarchy Process and the more recent Value-Analytic Hierarchy Process. A case study developed in a middle-size Italian hospital from 2016 to 2019 was proposed in order to implement a sustainability index, named normalized *Sustainability Group Global Rating*, which represents a first effort to define a standard index for hospital project sustainability.

Keywords: Public Health Analytics; Digital Health; Sustainability; Healthcare Management; AHP.

1. Introduction

Healthcare management has always been considered a great challenge and a strong effort to implement strategies and new tools are required. A big issue for the healthcare system is the processing of clinical data into insights, knowledge, and informed decisions. Strategies are usually declined into different projects but carrying out several simultaneous plans is not always sustainable. During the last period a great attention has been paid on sustainability and value generation in the healthcare sector. A preliminary proposal for the sustainability measurement, through the AHP, was reported in 2017 with promising results. However, to the best of our knowledge, there are no consolidated methodologies allowing the objective quantification of the healthcare's project sustainability. The present research was born from the need to translate the sustainability of all strategic projects to the hospital's board of directors composed by people with different professional extractions. For this reason, the authors have tried to answer the question of translating the sustainability of a strategic health project into a single indicator.

2. Literature Review

Several authors have used Knowledge Management (KM) in the healthcare sector to sustainably manage the rapid changes in this sector and make correct decisions. Other authors have used Business Analytics (BA) to combine all the necessary information and make effective decisions. Another methodology is the Multi-Criteria Decision Analysis (MCDA) that supports the decision-makers to organize and synthesize the heterogeneous information, with analysis and evaluation of different alternatives and monitor of their impact. Analytic Hierarchy Process (AHP) is part of the MCDA and has become widely used for medical decision making: from clinical guidelines development to biomedical innovations, technology development and performance evaluation.

3. Hypotheses/Objectives

This study aims to develop a Decision Support Tool (DST) for the sustainability evaluation of strategic projects proposed in the hospital context. A double Multi-Criteria Decision Analysis was realized by the traditional Analytic Hierarchy Process and the more recent

Value-Analytic Hierarchy Process, in order to implement a sustainability index named Sustainability Group Global Rating.

4. Research Design/Methodology

This study was based on a double MCDA realized by the traditional AHP and the recent Value-Analytic Hierarchy Process (V-AHP). Both methods are able to realize a quick and easy multi-criteria decision process. The AHP was developed in late Seventies allowing a pairwise comparisons of criteria and/or items. It realizes an overall ranking of the items leading towards a "rational decision". Compagno et al. simplifies the traditional AHP methodology introducing the Value-Analytic Hierarchy Process (V-AHP) formulated combining the traditional AHP rating on qualitative criteria with the "lean" rating on quantitative criteria, this latter where the "lean" rating is obtained by the ratio between the value of performance related to the i-th item and the sum of performance values related to all the items under investigation. The hierarchy for this investigation, depicted in Figure 1, was developed according to the holistic vision of the sustainable healthcare system defined by Fineberg.

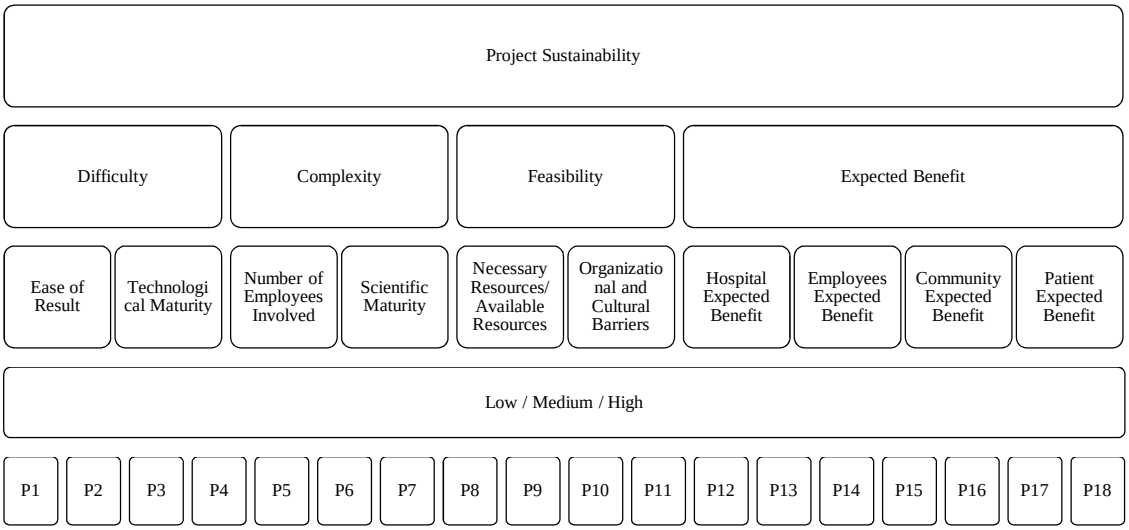

Figure 1. Project Sustainability Hierarchy

Project Sustainability, first level of hierarchy, is the general objective of the evaluation. The second level of the hierarchy define the four evaluation criteria related to the Project Sustainability:

- Difficulty;
- Complexity;
- Feasibility;
- Expected Benefit.

Third level of the hierarchy consists of evaluation sub-criteria:

- Ease of Result and Technological Maturity are two sub-criteria related to the Difficulty criterion;
- Number of Employees Involved and Scientific Maturity are two sub-criteria related to the Complexity criterion;

• Necessary Resources/Available Resources and Organizational and Cultural Barriers are two sub-criteria related to the Feasibility criterion;

• Hospital Expected Benefit, Employees Expected Benefit, Community Expected Benefit and Patient Expected Benefit are four sub-criteria related to the Expected Benefit criterion.

The fourth level of the hierarchy shown the three level of intensity – Low, Medium and High – used to evaluate the performance of each item referring to each sub-criterion.

Fifth level of the hierarchy consists of 18 project items under investigation better described in Table 2.

PROJECT ID	PROJECT DESCRIPTION
P 1	Process engineering and computerization
P 2	Master plan for the new hospital: technical activities, lows and paths
P 3	Open hospital
P 4	The new professions: the pharmacologist, clinical interpreter
P 5	Intensity of care and tutoring
P 6	Business: the standardization of best practices lean
P 7	DMT development
P 8	Individual performance evaluation
P 9	Adherence to ethical values: the ethical charter
P 10	Training
P 11	Appropriateness and efficiency
P 12	Morphic imaging – functional
P 13	Mini-invasiveness
P 14	Robotic technologies
P 15	Genomics
P 16	Technologies for the elderly
P 17	Research
P 18	IRCCS “aging” and research activities

Table 2. Project ID and description

5. Data/Model Analysis

For the purpose of the paper, the *Sustainability Global Rating (SGR)* of the 18 projects, was obtained applying the V-AHP method previously described. Seven evaluations by the same number of *Decision Makers* belonging to the organization were carried out; the results of these evaluations were therefore subject to a Group Decision Making Process in order to obtain a single *18×1* array with the *Sustainability Group Global Rating (SGGR)* of the 18 project items. Subsequently, the normalized *Sustainability Group Global Rating (NSGGR)* of the 18 project items was compared with the normalized *Annual Implementation Rating (NAIR)* of the of the same 18 project items in order to carried out, for each project item, the gap between *NAIR* and *NSGGR* representing a normalized KPI named *Annual Sustainability Critical Project (SCP).*

PROJECT ID	NSGGR	RANKING NSGGR	2017 NAIR	2018 NAIR
P8	1	1	0,5	Not available
P2	0,9638	2	1	0,75

P11	0,9448	3	0,8276	Not available
P1	0,8931	4	1	1
P7	0,8773	5	0,95	0,99
P5	0,8716	6	0,75	1
P10	0,845	7	1	1
P9	0,8319	8	1	0,5
P17	0,8284	9	1	1
P16	0,8282	10	0,75	1
P3	0,8035	11	1	1
P6	0,7874	12	0,645	0,875
P18	0,7225	13	1	1
P13	0,7139	14	0,75	0,75
P12	0,7129	15	1	1
P4	0,7045	16	1	1
P15	0,6787	17	1	0,566
P14	0,6368	18	0,75	0,75

Table 2 Projects Ranking

Second and third columns of table 2 shown, for each project, the normalized *Sustainability Group Global Rating (NSGGR)* and the related ranking. Fourth and fifth columns of the same table shown, respectively for 2017 and 2018 years, the *Normalized Annual Implementation Rating (NAIR)* also depicted in Figure 5. A NAIR value of 1 is representative of an objective achieved to 100%. On the contrary, for example, a NAIR value of 0.5 means that 50% of the target has been reached for this parameter. This data was provided by a hospital office responsible. In addition, a body outside the hospital certified these scores.

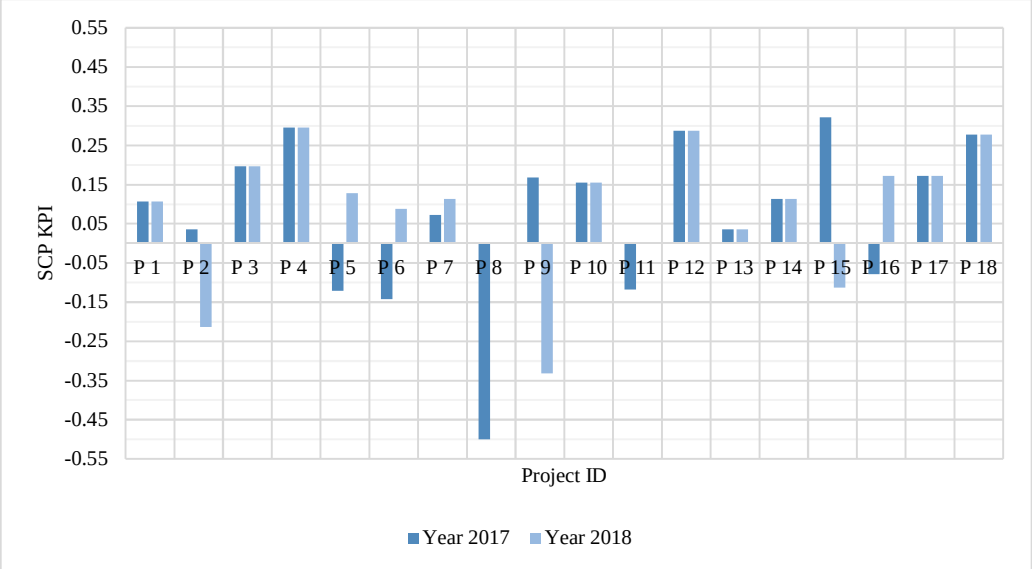

Figure 2. Sustainability Critical Project KPI for 2017 and 2018

6. Limitations

This research has several limitations: the normalized *Sustainability Group Global Rating (NSGGR)* was carried out by interviews realized in 2016 on a set of 18 three-year projects starting from 2017. It should be appropriate, as shown by the heterogeneity of the results over the years, an annual refresh of the Decision-Making process in order to have an updated index including new information and level of knowledge available. Secondly, NAIR should be refined. In fact, it has been demonstrated that management has often given projects time schedule depending on no-controllable external factors. However, this last criticality does not depend so much on the method as on the performance cycle implemented.

7. Conclusions

The normalized *Sustainability Group Global Rating (NSGGR)* depicted in this study is a quali-quantitative index useful to Decision-Makers in order to realize forecast on the sustainability evaluation of strategic projects implementable in the hospital context. On the contrary, the *Normalized Annual Implementation Rating (NAIR)* represents a progress index of implemented projects. The gap between *NAIR* and *NSGGR*, here defined *Annual Sustainability Critical Project (SCP)*, measures the distance between the strategic plan of the Board of Directors and the operations realized by the Line Directions. Ideally these values should be zero but it never happens. A positive value means that the result achieved is higher than the sustainability index and therefore less ambitious targets have been given. On the contrary, if it is a negative value, the project has been underestimated or too ambitious targets have been given. This Decision Support Tool, developed for the hospital context, can be applied to any organization with easy customization, even if further researches are necessary to narrow listed limitations.

8. Key References

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