Selection of MCDA Techniques to Assess Lean Management Implementations

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Abstract: The process of implementing Lean Management in organizations should be done as effectively as possible, using the adequate resources, and taking into account critical success factors. Additionally, the prior assessment of these factors by using some techniques could lead not only to better Lean Management (LM) implementations but also to soundly prioritize LM alternatives that the organization might have. Then, this research presents a methodology that will help decision-makers to choose the most adequate Multi Criteria Decision Aid (MCDA) technique to weight important critical success factors and ranking the possible LM implementation alternatives such as LM toolsets, LM thinking or LM transformations.

Keywords: Lean Management; implementation; MCDA techniques.

1. Introduction

In current highly competitive business ecosystems, Lean Management (LM) is accepted as an approach to improve organizational operations and, extensively, firm efficiency (Alkhoraif et al., 2019). Then, LM implementations can add value to organizations, as long as such implementations are properly conducted (Coney, 2022). Since organizations differ from each other in many ways (size, strategy, available resources, etc.), decision-makers should assure that the LM implementation process is carried out as efficiently as possible, being able to identify the main critical success factors of the implementation and stating finally which the best approach for carrying out such an implementation is. In this sense, the application of the well-known Multi-Criteria Decision Aid techniques, could be helpful when weighting these critical success factors and ranking the LM implementation alternatives.

Then, the main aim of this paper is to present a methodology that will, among others, help decision-makers to choose the more appropriate MCDA technique for LM implementations. Such a methodology is next presented.

2. MCDA techniques selection

When selecting the most appropriate MCDA techniques, it is previously necessary to clearly state the problem to be solved. In this particular research, the problem is about to prioritize some LM implementation alternatives such as LM toolsets, LM transformations, etc., by assessing some specific criteria. Figure 1 presents a methodology of three stages that specifies the different steps to follow.
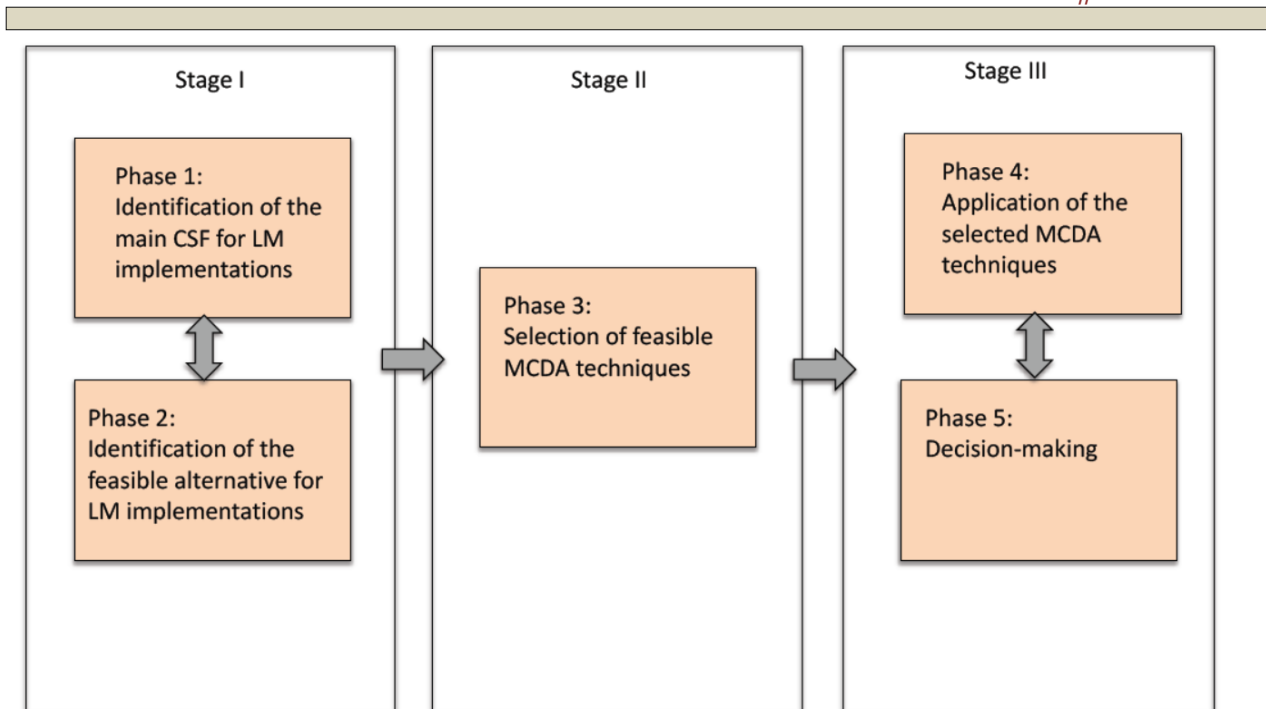
Figure 1 Methodology

Stage I

The Stage I is constituted by two phases, which are next described:

- **Phase 1.** Identification of the main Critical Success Factors for LM implementations. It is compulsory to identify the main LM implementation Critical Success Factors (CSF) from both the scientific literature and managers' experience. Usually, these CSF will be different depending on the sort of organization undertaking the study, as intrinsic characteristics such as firm size, number of employees, market position, financial situation or technological capabilities will surely vary.

- **Phase 2.** Identification of feasible alternatives for LM implementations. Once the CSFs have been established for the specific organization, it is time to clearly identify the alternatives, in other words, the possibilities that the study aims to prioritize. In this particular area, LM toolsets, LM thinking or LM transformations could be the alternatives. In any case, the defined alternatives should come, again, from a consensus in the working group that, for this end, will assess both scientific postulates and organizational experience.

Once both the criteria and the alternatives have been defined, it is time to think of the MCDA techniques that could be used in this particular problem.

Stage II

The Stage II is constituted by one phase, which is next described:

- **Phase 3.** Selection of feasible MCDA techniques. As known, there are many MCDA techniques that could, initially, be applied to this sort of study. Then, the main aim of this phase is to identify which ones could be of more value to address the problem state in Stage I and propose a ranking of them. In this sense, scientific works (Watrobski et al., 2019; Yalcin et al., 2022; Taherdoost & Madanchian, 2023) help to carry out this task and provides guidance to practitioners. In any case, important needed characteristics of the MCDA techniques, such as uncertainty level or type of data, should be stated before to carry out the assessment of the techniques.

Then, for this particular research problem, the main characteristics of the MCDA techniques to be applied should:
- Have a medium-high level of knowledge of the data.
- Implement uncertainty
- Consider possible future business scenarios.

By taking these characteristics into account, it was possible to build the Table I, which presents the assessment of the main feasible MCDA techniques that address these characteristics.

Method	Level of Knowledge of data used	Uncertainty	Inclusion of future events	Ranking
ANP	High	No	No	7
FUZZY AHP	Low	Yes	No	5
COMET	High	No	No	9
FUZZY TOPSIS	Low	Yes	No	4
IDRA	High	No	No	8
Fuzzy VIKOR	Low	Yes	No	3
BWM	High	No	No	6
SBWM	High	No	Yes	1
Fuzzy ANP	Low	Yes	No	2

Then, from Table 1, it is necessary to state which combination of the three desired characteristics will provide the best outcome and, therefore, it will be possible to establish the ranking of these MCDA techniques. In this particular case, it is stated that the fact of including feasible future events (business scenarios) is very relevant for the LM implementations. From Table 1, only the Stratified Best and Worst Method (Torkayesh et al., 2021) includes such feasible future events within the technique, where decision makers identify a set of these events (business scenarios) and allocate them with a realistic probability of occurrence, which is later used to identify the weight of the different CSF and, extensively, to rank the feasible LM implementation alternatives. Therefore, for this particular research problem the most desired characteristic of the MCDA technique is the inclusion of feasible future events, which justifies the ranking shown in the last column of Table 1.

Stage III
The Stage III is constituted by two phases, which are next described:
- **Phase 4.** Application of the selected MCDA techniques. Once the MCDA have been selected, it is time to apply them to solve the stated problem and prioritize the chosen alternatives by taking into account the identified criteria. In order to properly do so, the decision-making team should reach a consensus when weighting the different criteria and carry out subjective comparisons between the variables.
- **Phase 5.** Decision-making. Once the MCDA have been applied, decision-makers will have ranked the different alternatives, such as LM toolsets, LM thinking or LM transformations, which allow them to make important decisions regarding LM implementations and associated actions plans and resource allocation.

3. Conclusions and Future Research Work
This study has presented a methodology that, among others, will help decision-makers to choose the most adequate MCDA technique to weight important critical success factors and ranking the possible LM implementation alternatives such as LM toolsets, LM thinking or LM transformations. Then, it has carried out a ranking of nine MCDA techniques, concluding that the most adequate one is the Stratified Best and Worst Method, as it includes feasible future events (business scenarios), which is very relevant for the LM implementations. Future research work should include the application of all the three stages of the methodology.

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