

MULTICRITERIA DECISION-BASED APPROACH FOR RESOURCE ALLOCATION PROBLEMS IN SLUM AREAS

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ABSTRACT

Public resources are limited, and their efficient allocation needs to meet the local community demands and a careful planning by the decision-makers. Two common approaches have emerged from the literature on analyzing resource allocation problems. Methods that compare the total expected cost of investment options with their total expected benefits and optimized methods. These methods focus on choices, and not on a wide range of fundamental objectives of the decision-makers. Moreover, these methods usually fail to consider the residents' preferences in the decisions. This paper proposes a new framework for resource allocation decisions in slum areas considering both stakeholder's preferences - the community and the decision-makers. The framework is applied in a community to define the attribute resources and their periodization, and then, these resources are assessed by the decision-makers according to the available costs and future benefits from this investment.

KEYWORDS. Multi-criteria Decision Analysis (MCDA). Resource Allocation. Preference prioritization. Slums.

ADM – Apoio à Decisão Multicritério

1. Introduction

Slums or informal settlements are areas characterized by (temporary) structures that lack basic infrastructure (for instance, water supply and sewerage) [Bagheri, 2013] and poor physical infrastructure or lack of accessibility (for instance, stairs, sidewalks and pavement) [Vieira et al., 2024]. Hence, these areas face severe limitations in accessing basic living conditions, exacerbated by inequalities, especially in healthcare and education [Killemsetty and Patel, 2022]. They also suffer from cramped living spaces, high population densities, and restricted property rights [Reydon et al., 2015].

The resource allocation for these settlement areas is a strategic and complex problem [Vieira et al., 2024], which involves balancing benefits and costs and an appraisal of the risks of realizing such benefits [Montibeller et al. 2009]. These strategic and complex decisions often involve many decision-makers with diverse views [Phillips & Bana E Costa, 2007]; however, it is rare to consider the residents' preferences for the resources, who may have opposed values for resource allocations, resulting in conflicts of interest [Haag et al., 2022].

Given the diverse perspectives of stakeholders and the far-reaching implications of decisions across space and time, multiple objectives need to be considered in such decisions. Multi-Criteria Decision Analysis (MCDA) is touted as an effective approach for aiding decision-makers in addressing the aforementioned challenges [Montibeller, 2009] and has been extensively employed in practice [Phillips, 2007; Phillips and Bana e Costa, 2007].

The most common resource allocation applied methods are: Cost-Benefit Analysis (CBA) [Vessey, 1994]; portfolio decision analysis [Liesjö et al., 2007, 2020; Salo et al., 2011], MCDA [Bana E Costa, 2001; Lienert et al., 2016; Montibeller et al., 2009], participatory approach via workshops with small groups [Ackermann et al., 2014], decision conferencing [Phillips & Bana E Costa, 2007], which involve stakeholder representatives, or a mix of methods [McKenna et al., 2018; Montibeller et al., 2009; Zheng & Lienert, 2018].

These studies fail to consider the residents' preferences based on which resources are most valuable for them. Value-Focused Thinking (VFT) [Keeney, 1996] enables engagement with slum residents and generates in-depth insights into the lives of slum communities [Killemsetty & Patel, 2022], and also helps decision-makers regarding the decision-making processes [Vieira et al., 2024]; for example, in their decision-making when allocating resources. Moreover, most studies neglect a large group of residents' preferences or are focused on alternatives [Macharis & Milan, 2015]; these studies do not consider the aggregated preferences and relative weights of the resource attributes based on individual preferences.

This paper suggests a new framework for resource allocation decisions for slum areas that considers both stakeholder's preferences - the community and the decision-makers, and also suggests an approach for addressing the aggregated relative weights of the resource attributes. This framework is applied in a community to define the attribute resources and their prioritization, and then, these resources are assessed by the decision-makers according to the available costs and benefits from this investment. The framework encompasses two phases: The first phase is built on stakeholders's preferences. In this phase, the objectives and their prioritization are defined by the community. In the second phase, the same objectives are evaluated by the decision-makers considering costs and benefits analysis.

Differently to some participatory approaches that involve the stakeholders in a decision-making process interactively [Macharis, 2007] and others potentially overlook qualitative aspects of decision-making [Liesjö et al., 2020], this study contributes to the state-of-the-art by providing a generic framework to be applied by the decision-makers in slums/settlement areas based on a set of criteria, including the stakeholders' preferences. While the latest studies have discussed the costs and benefits to be considered in general resource allocation decisions, the present study proposes an innovative methodological approach based on [Goodwin and Wright, 2005] modeling, but focusing on the particular aspects that exist only in poor communities. The proposed approach directly accounts for the preferences of the main stakeholders involved in resource allocation problems, including the residents.

2. Conceptual Framework

This section suggests a new framework for community-based preference elicitation for resource allocation decisions. It is divided into six stages. The first four (in grew) encompass the residents' preferences, and the last two stages are related to the decision-makers. Table 1 shows the six stages, a short description and recommended methods for each stage.

Table 1. Framework for Community-based preference elicitation.

Stage	Description	Recommended methods
1. Understanding the needs of the community	Understanding of the needs and the conditions of the local population in terms of liveability	- Local visits; - Unstructured interviews - Workshops with the community
2. Defining the fundamental objectives	The resource allocation represents the fundamental objectives according to the local population	- Structured interviews - Value-Focused Thinking (VFT) - Decision conferencing; Brainstorming
3. Eliciting the preferences	Elicitation process that reveals the preference of an individual to choose an improvement on one resource instead of another one	- Survey-based protocol for preference elicitation based on pairwise comparison or others that assume rationality
4. Weighting aggregation process	Weighting aggregation rule for ordinal rank preference order based on pairwise comparison	- Preference Learning - Monte Carlo Simulation - Aggregated preference method
5. Determining the regions and sectors by the decision-makers	The decision-makers must define the regions related to the available (spatial) allocation and respective vulnerabilities	- Interviews with a few DM - Delphi method ($10 \leq \text{NDM}^* \leq 50$) or Mathematical aggregation methods if NDM is larger
6. Identifying the costs and benefits of resource allocation	The resource allocation is determined by crossing resources regarding costs and benefits	- SMART, MACBETH approaches and Swing weighting method - Computational simulation model by using the EQUITY software (version 3.4)

Note: N(DM) = Number of (Decision-makers).

2.1. Stage 1 - Understanding the needs of the Community

Understanding community-based preferences starts with local visits, which are essential to better understand the conditions of the area, and people and their liveability [Cavalheiro & Abiko, 2015; Killemssetty et al., 2022a]. In decision analysis, the studies regarding community-based preferences are still far from understanding the most important local needs (Aubert & Friedrich, 2021). Initially, unstructured interviews allow us to explore how the residents construct their world in their own words (Mwiti & Goulding, 2018).

Systematic structuring within individual and formal interviews and workshops can also be organized [Lienert et al., 2015]. Workshops are appropriate to discuss what the fundamental objectives of people are related to the subject, to talk to the leaders of such a community, and to establish initial alternatives and agreement on the objectives – these interactions among stakeholders are recommended [Gregory et al., 2012], and also important in the MCDA processes [Keeney, 1996; Kuller et al., 2022a]. The advantage of workshops is that they produce fast agreement [Lienert et al., 2015].

2.2. Stage 2 - Defining fundamental objectives

After understanding the needs of the community, structured interviews with leaders are welcome. Other approaches are also used for revealing the objectives, such as: the VFT approach [Keeney, 1996] for the inclusion of stakeholder values in setting their fundamental objectives [Killemsetty and Patel, 2022]; brainstorming [Goodwin and Wright, 2005]; decision conferencing [Vennix et al., 1992]. Decision conferencing primarily aims to amalgamate decision analysis techniques with the beneficial aspects and dynamics of small-group decision-making. These approaches will depend on access to the community's members, time, and costs. In this case, the structured interview can be fast and effective if access to the right interviewers is facilitated.

2.3. Stage 3 - Eliciting the preferences

I suggest applying compensatory methods for preference elicitation based on pairwise comparison as they meet consistency and transitivity among alternatives [Keeney & Raiffa, 1976], although some respondents are easily distracted during the rating or scoring of alternatives [Bryson et al., 1995]. The methods must be simple, easy to understand, and based on the fundamental axioms of decision theory.

I also recommend applying the protocol in the community via face-to-face interviews. This method stems from their ability to overcome challenges such as low literacy rates, unreliable population data, and technological limitations [Aubert & Friedrich, 2021]. However, depending on the complexity and length of the survey (with many attributes to be compared), the abilities of applicants and the background of the respondents, face-to-face interviews can sometimes lead to respondent distraction, boredom, or fatigue [Aubert & Friedrich, 2021]. Applying an interactive mode [Vieira, 2024] for preference elicitation is advised in this case.

2.4. Stage 4 - Weighting aggregation process

In this section, the challenge is to solve the judgments established by each respondent's individual ordinal ranking of the resources [Riabache et al., 2012]. The preference learning approach, in which individual preferences are inferred to perform personalized further recommendations [Agarwal & Chen, 2016; Furnkranz & Hullermeier, 2010], can be applied by indicating which of two pairs of attributes the decision-maker prefers.

Other approaches can be used to derive the community attribute weights after conducting the pairwise comparisons: (1) rank-sum (RS) [Barron & Barrett, 1996]; (2) rank reciprocal (RR) [Stillwell & Seaver, 1981], (3) centroid (ROC) [Edwards & Barron, 1994]. These methods aggregate the individual quantitative weights. A major drawback is that this type of aggregation obfuscates individual rankings. These rank-based methods are highly sensitive to the number of attributes and may provide rather arbitrary quantitative weights. To alleviate these issues, I suggest using the Monte Carlo simulation to define the criteria weights in the ordinal scale provided by Butler et al. [1997]. In each iteration, simulated weights are generated for each subject, with these weights fulfilling the ranked order that the subject established in the survey.

2.5. Stage 5 - Determining the regions and vulnerabilities by the decision-makers

After obtaining the value tree composed of the resource attributes and respective weights, alternatives are also suggested that must be given by the decision-makers, who address the problem in terms of spatial location to receive the resource allocation (i.e., health, education, sports, infrastructure, etc.) in the slum areas. In this case, these alternatives are regions with a lack of resources. Later, these alternatives are crossed with the attributes to measure how well an alternative performs over all the attributes.

Then, a group of decision-makers decide where to allocate resources between competing slum regions in a city. However, it becomes more complex if the group has N decision-makers. An aggregating preference judgment between attributes and regions [Goodwin and Wright, 2005], somehow, is needed to be applied.

2.6. Stage 6 - Identifying the costs and benefits of resource allocation

It uses MCDA modeling to address multiple dimensions of benefit within the available budget, including the preferences of residents for resource allocation [Goodwin and Wright, 2005]. Figure 1 depicts the steps used in this stage.

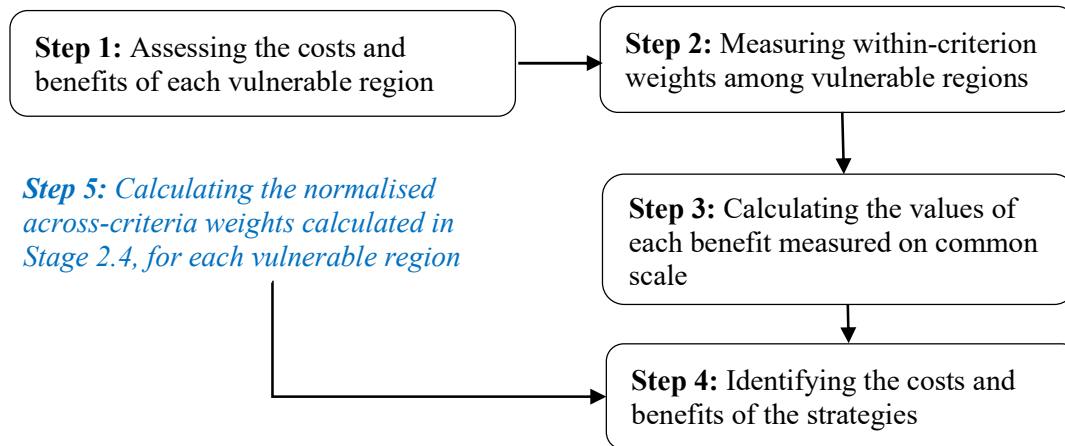


Figure 1. MCDA modeling for resource allocation according to the costs and benefits.

Note: The case study provides a description of the full steps (see section 3.6).

3. Community case study

3.1. General description of the local community

Initially, an empirical study was performed in a disadvantaged community in Votorantim-SP. Three visits were conducted encompassing face-to-face interviews with the population and remote interviews with community leaders and other citizens. I had a close relationship with a resident who later supported this study by interviewing the residents.

3.2. Fundamental objectives

Table 2 shows the attributes (preferences for public resource allocation) and their levels according to the preferences of community members through three interviews with community leaders. For each attribute, there is the status quo (the worst possible predictions) and a future improvement (the best possible predictions). All attributes are preferential independent of one another since they are unique, and there is no influence among them; if one takes place, there is no effect on the others.

Table 2. Fundamental objectives.

Attribute	Attribute level – status quo	Attribute level – improvement
Workforce	Not registered (informal)	Registered (Formal)
Health system	General practitioner	Clinic, Gynecology, pediatrics, psychiatry
Education	Part-time school for children	Full-time school for children
Infrastructure	<i>Basic:</i> Water and electricity come to the community entrance	Water and electricity come to their home; sewerage is provided
	<i>Physical:</i> Poor	Stairs, sidewalks and pavement

3.3. Eliciting preferences and characteristics of the community

The questionnaire design consisted of two sections. For the first section, the explanatory variables such as gender, age, education level, employability levels, income, number of residents

within the family and residence time were selected. The second section includes the central questions for eliciting preferences in resource allocation decisions by applying an elicitation protocol developed by Vieira [2024].

In total, 141 community members were interviewed; 64% denominated themselves as male. The age of the respondents was distributed into three categories: 38% were between 18 and 39 years old, 55% were between 40 and 59 years old, and the 7% remaining were elderly people. 76.6% of the respondents had a low education level (no high school); the remaining graduated from high school and none went to college. Only 17% of the sample had formal employment, and 58% were unemployed. Moreover, 91% of the respondents declared that they earned up to half the minimum salary and 35% had a monthly per capita income of R\$89.00.

3.4. Weighting process

I ran the Monte Carlo simulation to define the criteria aggregated weights using the technique provided by Buttler et al. [1997]. The weights for all subjects were simulated based on the ordinal rank order of the individual preferences in community-based surveys. Figure 2 shows the value tree, including all attributes and respective weights.

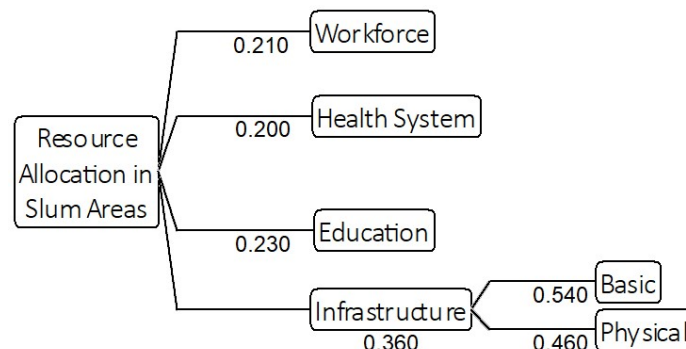


Figure 2. Value Tree based on residents' preferences.

3.5 Slum regions: an illustrative problem

This and the next subsections provide an illustrative example based on a decision-maker interview and secondary data from the municipality. The idea is to show how the MCDA model runs, including costs and benefits for some vulnerable areas in Sorocaba (a neighbourhood city that preserves the same characteristics of the Votorantim city).

Table 3 shows five regions assisted by CRAS (Centro de Referência de Assistência Social). CRAS is located in areas of vulnerability and social risk. In red is a hypothetical situation in which the decision-maker may decide to expand or open a CRAS unit or keep the current unit as the status quo in some city regions during an electoral term (four years). Note that there are 3 types of CRAS according to the number of assisted families. The option for maintaining the status quo (the current CRAS), expanding the CRAS to assist more families, or opening a new CRAS is organized in the order of exclusive options, with option 1 (current situation) representing the lowest level of expenditure. According to the decision-maker, it can be used to identify the possible combinations of options (called packages) for the regions. For example, one package would be (in red): *the decision-makers open a CRAS₃ in the Cajuru region, open two CRAS₁ in the Ipiranga region and maintain the status quo in the other three regions*. The decision-makers can better strategically allocate the CRAS in those areas.

There are $2 \times 3 \times 3 \times 3 \times 3 = 162$ combinations. The problem is that the decision-makers would like to choose a Package that better combines the budget (Costs) and the benefits according to their preferences/objectives.

Table 3. Illustrative options/regions.

<i>CRAS assistance by regions</i>			
Vulnerable region	Option 1 (current)	Option 2	Option 3
Carandá	Status Quo (CRAS ₁)	Expand to CRAS ₂	
Habiteto	Status Quo (CRAS ₁)	Expand to CRAS ₂	Expand to CRAS ₃
Cajuru	Status Quo (CRAS ₂)	Open a CRAS ₁	Open a CRAS ₃
Brigadeiro Tobias	Status Quo (CRAS ₂)	Open a new CRAS ₂	Expand CRAS ₂ to CRAS ₃
Ipiranga	Status Quo (CRAS ₃)	Open a CRAS ₁	Open two CRAS ₁

Note₁: CRAS₁ the reference of assistance is 2,500 families; CRAS₂ 3,500 families, CRAS₃ 5,000 families.

Note₂: All options are exclusive.

3.6. Costs and benefits of resource allocation in a simulation model

In this stage, the model was formulated in EQUITY software. The decision-makers had to give the costs and benefits associated with each vulnerable region. Now, the steps described in section 2.6 can be followed.

In **Step 1**, the decision-makers had to estimate costs and elicit the benefits for each option (Table 4). To do this, a value scale which ranged from 0 to 100 was used, in which 0 represented the least desirable effect and 100 the most desirable. The benefits would be improved if the initiatives were implemented. For example, in the case of 'Education', a value of 100 regarding the Carandá region (expand the current CRAS₁ to CRAS₂) was hypothetically judged to be much more important than maintaining the status quo (CRAS₁).

Table 4. Estimated costs and elicited benefits for each planning

Vulnerable Regions	Benefits					
	* Costs	Workforce	H. System	Education	Basic I.	Physical I.
Carandá						
Status Quo (CRAS ₁)	10	0	0	0	0	0
Expand to CRAS ₂	30	100	100	100	100	100
Habiteto						
Status Quo (CRAS ₁)	12	0	0	0	0	0
Expand to CRAS ₂	28	20	30	25	80	60
Expand to CRAS ₃	40	100	100	100	100	100
Cajuru						
Status Quo (CRAS ₂)	30	0	0	0	0	0
Open a CRAS ₁	35	30	60	50	60	60
Open a CRAS ₃	80	100	100	100	100	100
Brigadeiro Tobias						
Status Quo (CRAS ₂)	30	0	0	0	0	0
Open a new CRAS ₂	40	50	40	60	50	30
Expand to CRAS ₃	60	100	100	100	100	100
Ipiranga						
Status Quo (CRAS ₃)	30	0	0	0	0	0
Open a CRAS ₁	35	40	40	70	20	40
Open two CRAS ₁	70	100	100	100	100	100

Note: R\$M = Investments in Reais/period. *Costs in Thousands of Reais.

In **step 2** – Due to the independent assessment of values in each region, a shift from 0 to 100 regarding a specific benefit could hold varying levels of preference when compared across different regions. To address this, it became essential to standardize these benefit changes on a common scale. Therefore, within-criterion weights gauge the varying lengths of these scales by

directly comparing the 0 to 100 improvements for different regions. In this step, the swing weighting method is used. For example, the decision-makers are asked to imagine an option with the least desirable effect on education. This package would involve maintaining the status quo in all regions. Then, the decision-makers are asked: if they could choose to change just one of the improvements in this package, which change would lead to the most significant improvement in Education? After some debate, the decision-makers agreed that this improvement would be achieved if a switch was made in the Habiteto region from maintaining the status quo (option 1) to expand to CRAS₃ (option 3). This meant that ‘Education’ in the Habiteto region was assigned a weight of 100. Afterward, the decision-makers evaluated the improvements in other regions, comparing them to the first. Subsequent discussion led them to conclude that Cajuru would only yield 80% of the Education improvement compared to the previously identified switch in the Habiteto. Similar assessments were made for the Carandá, which received a score of 40 related to Habiteto, Brigadeiro Tobias (60) and Ipiranga (30); all were evaluated related to Habiteto. Subsequently, these weights were determined for the remaining benefits.

Each benefit was standardized onto a common scale, facilitating the measurement of the impact of selecting a specific option on that particular benefit (**Step 3**). It was determined by crossing the weights in Step 2 with the scores in Table 4. Table 5 displays the values and highlights Education as an example. The Habiteto region was chosen as the most important to be improved; therefore, it is the reference point (score of 100). However, the decision-makers pointed out low benefits for “Education” with lower importance related to Cajuru (score of 80). Then, proportionally, the benefits in option 2 (Open a new CRAS₁) and option 3 (Open a CRAS₃) would be “40” and “80” respectively. A similar calculus determined the remaining benefit scores for all vulnerable regions.

Table 5. Standardized scales for the benefits.

Vulnerable Regions	Benefits				
	Workforce	H. System	Education	Basic I.	Physical I.
Carandá					
Status Quo (CRAS ₁)	0	0	0	0	0
Expand to CRAS ₂	20	100	40	90	50
Habiteto					
Status Quo (CRAS ₁)	0	0	0	0	0
Expand to CRAS ₂	10	24	25	32	18
Expand to CRAS ₃	50	80	100	40	30
Cajuru					
Status Quo (CRAS ₂)	0	0	0	0	0
Open a CRAS ₁	12	36	40	60	24
Open a CRAS ₃	40	60	80	100	40
Brigadeiro Tobias					
Status Quo (CRAS ₂)	0	0	0	0	0
Open a new CRAS ₂	50	20	36	15	9
Expand CRAS ₂ to CRAS ₃	100	50	60	30	30
Ipiranga					
Status Quo (CRAS ₃)	0	0	0	0	0
Open a CRAS ₁	36	16	21	14	40
Open two CRAS ₁	90	40	30	70	100

Step 4 identifies the overall benefits and costs of any of the options. At this point, the decision-makers were asked to propose a package they felt would best use the budget. Up to R\$165,000.00 would be available to support the investments in the regions. The minimum cost for

all regions to maintain the status quo (operational costs) would be R\$112,000, and the maximum cost would be a package of R\$280,000.00.

Suppose the package the decision-makers suggested involved improving the benefits of option 1 (status quo) in Ipiranga and option 2 for the remaining regions: expand to CRAS₂ in Carandá, expand to CRAS₂ in Habiteto, open a CRAS₁ in Cajuru, and open a new CRAS₂ in Brigadeiro Tobias. It means, R\$30,000.00 (Ipiranga) + R\$30,000.00 (Carandá) + R\$28,000.00 (Habiteto) + R\$35,000.00 (Cajuru) + R\$40,000.00 (Brigadeiro Tobias), totalizing a package of R\$163,000.00 (see Table 4). In terms of benefits, considering the same package (see Table 7), for the Workforce, there would be a total value of 92 or (0 + 20 + 10 + 12 + 50), 180 for health System benefits, 141 for Education, 197 for Basic Infrastructure and 101 for Physical infrastructure.

The across-criteria weights (**Step 5**) were calculated according to the community's preferences (Section 3.4). The overall benefits were calculated by taking a weighted average (Note: the weights collected at a community in Votorantim must be considered as the standardized weights for all regions).

The overall value of the benefits is calculated using the final weights multiplied by the respective values:

Overall value of the benefits = Workforce weighting x value for workforce (0.21 x 92) + Health system weighting x value for Health System (0.20 x 180) + Education weighting x value of Education (0.23 x 141) + Basic infrastructure weighting x value of Basic infrastructure (0.19 x 197) + Physical infrastructure weighting x value of Physical infrastructure (0.17 x 101) = 19.32 + 36 + 45.54 + 37.43 + 17.17 = **155.46**.

If similar computations are performed for the least beneficial Package, determined by a computer, the calculated benefit value would be 0 (status quo for everyone) with costs of R\$112,000.00. Conversely, for the most advantageous package, the benefit value reaches 325.5 with costs of R\$280,000.00. Rescaling the benefits between (Figure 3), the proposed package yields 47.77% of the potential benefit improvement achievable by transitioning from the worst to the best package and costs of R\$163,000.00.

Figure 3 shows the packages at efficient frontier (F, in green) and the others (see green area) by using a computer. All packages are represented by both costs and benefits. The efficient frontier connects the packages that present the optimal balance: either the highest value of benefits for a specified cost or the lowest for a given level of benefits.

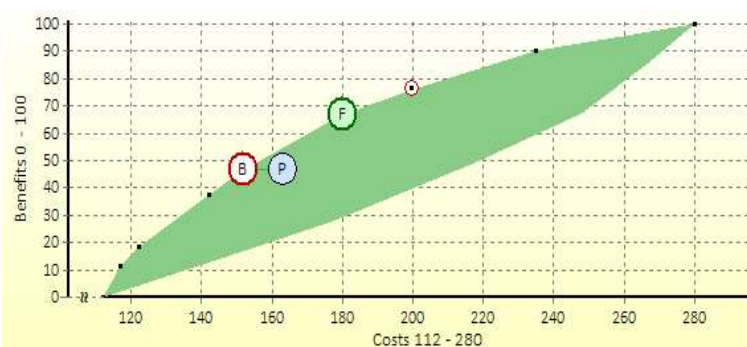


Figure 3. The Efficient frontier for all strategies

The proposed package (P, highlighted in blue) does not fall on the efficient frontier. In such instances, the EQUITY model suggests an alternative package B (in red), which delivers the most favorable benefits (48.2%) at a lower cost (R\$152,000.00) compared to the package in P (i.e., lower cost and slightly better benefits). The package in B would differ from P regarding the Ipiranga region (open a CRAS₁ instead of maintaining the status quo) and Habiteto (maintain the status quo instead of expanding to CRAs₂).

4. Discussion and Framework's limitations

This research proposes a six-stage framework for resource allocation in slum areas from the viewpoints of the main stakeholders - the residents and decision-makers. The first four stages (phase I) are dedicated to the residents and the last two (phase II) to the decision-makers (Note: each stage encompasses a huge amount of work, often structured in some steps). These two stages were built based on the framework for resource allocation provided by Goodwin and Wright [2004]. However, the sixth stage was modified by considering the within-criterion weights from the perspective of residents (see step 5 of stage 6) instead of decision-makers. It is a challenge as the preferences of different residents of several communities must be considered.

This “new step 5” can be innovative since, to the best of our knowledge, it is the first time the perspective of the users is considered in this structure. Therefore, overall, it primarily considered what the stakeholders value on resource attributes [Killemssetty and Patel, 2022] instead of strengthening investments in some regions for convenience or because it would be at lower costs. However, the weights calculated according to the preference of each community member, using the same procedure, can differ across community, as well as the attributes for both stakeholders.

This proposed framework may bring insights into resource allocation in disadvantaged communities. Somehow, it can contribute to public policies in decision-making by the decision-makers. This framework may hold the promise of being crafted into an urban planning advisory service tailored for practitioners. It aims to facilitate the creation of development projects geared toward marginalized communities, fostering transformative changes in their lives through a participatory approach [Killemssetty et al., 2022b].

This proposed framework also has some limitations. It does not incorporate the packages' interdependency on the analysis or sensitivity analysis. A compelling avenue for future research involves showcasing the integration of these interdependencies and elucidating their influence on sensitivity analysis concerning the risk/return ratio. Because of generating the attributes' ordinal rank, the individual preference's judgment aggregation is still an issue [Furnkranz and Hullermeier, 2010]. Moreover, the second phase of the framework was based on a hypothetical situation.

5. Final Considerations

This framework contributes to the literature in three ways.

First, based on Goodwin and Wright [2005], it encompasses six stages; the four stages concern the residents' perspective, who must use the resource and should give their preferences. The residents chose the resource attributes and also gave them relative priority. This participatory approach provides an engagement regarding the resources and may facilitate their implementation by the decision-makers.

Second, this structure provides a simulation approach [Butler et al., 1997] to alleviate the preference aggregation problem. Instead of ignoring the individual rank as provided by some approaches (ROC and Rank Sum), the simulated weights are generated for each subject, fulfilling the ranked order that the subject established in the survey.

Third, the aggregated weights based on the communities are incorporated in the second part of the framework to establish the prioritization of the benefits; usually, this step is made by the decision-makers. Therefore, the community and decision-makers can be conjointly analyzed for the same attribute resources (benefits). The proposed framework does more than merely support the decision-makers in resource allocation problems; it offers an objective way for adjusting costs and benefits according to the community's preference.

This proposal raises managerial implications. The last two-stage framework can be repeated until decision-makers have the best fit for their defined costs and benefits. Simplifying the multicriteria decision-making process into a single objective analysis guided by the efficiency frontier makes implementation much more straightforward.

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