MULTI-CRITERIA ANALYSIS IN THE MANAGEMENT OF TEMPORARY REUSE OF SPACES

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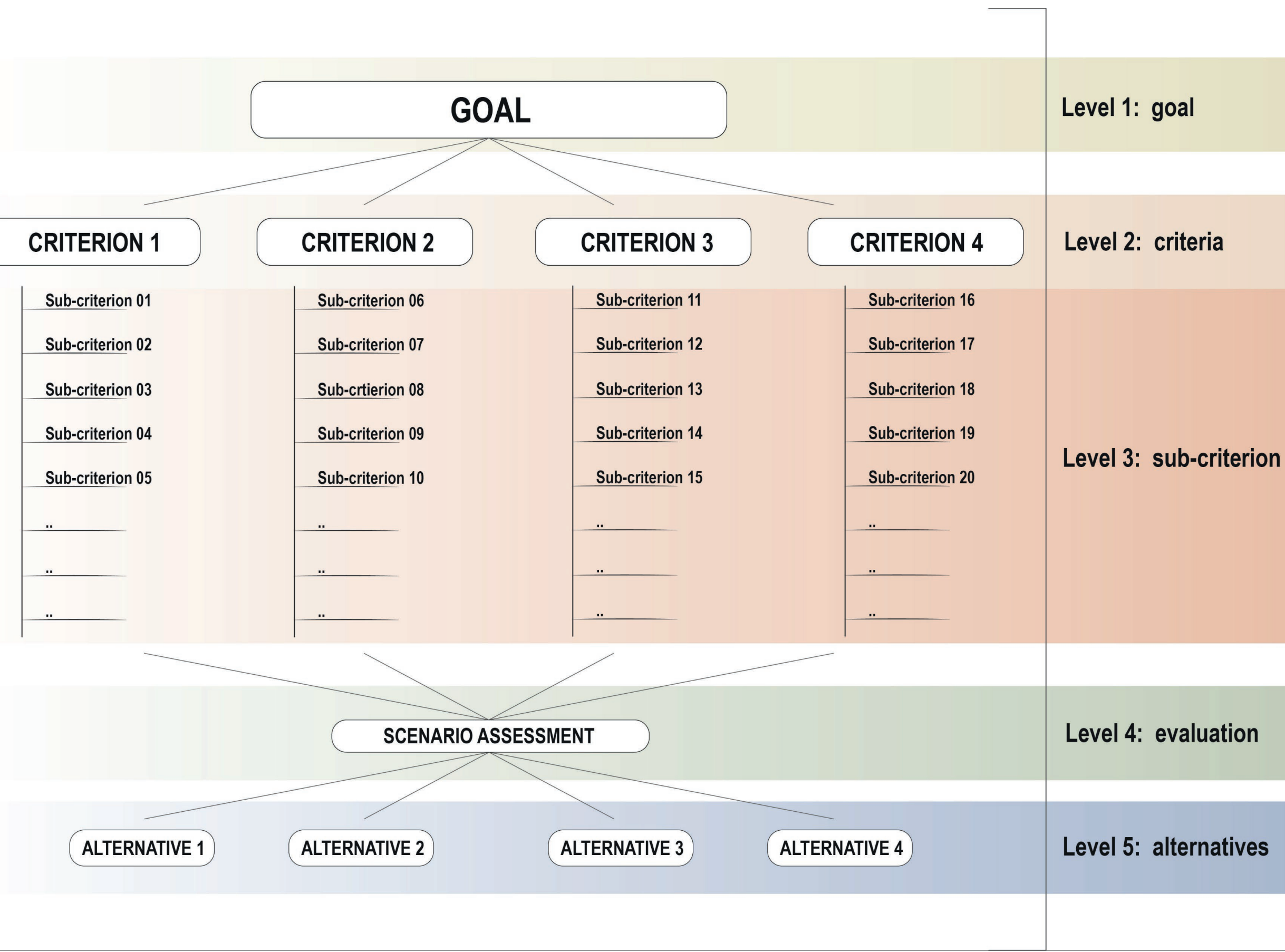*Master's Degree Course in Geourban Planning*

OBJECTIVES

Urban change, both in form and function, has always marked the way of rethinking cities, stimulating continuous studies aimed at the renewal of urban planning aspects.

Especially in contemporary times, this change of perspective requires the increasing involvement of the disciplines of Geography, Urban Planning, Geomatics and Economics, in order to generate new impulses for the urban transformation of spaces that have fallen into disuse.

The aim is therefore to illustrate a methodology that can be used to repurpose disused buildings and to promote the enormous potential of temporary reuse of space, in order to guide the choices of managers/administrators and decision-makers towards new development horizons.

HIERARCHICAL MULTI-CRITERIA METHOD

The proposed multi-criteria model uses a hierarchical analytic process that selects the "best compromise" alternative among a discrete set of proposals previously formulated by different social actors.

	GOAL		Level 1: goal
CRITERION 1	CRITERION 2	CRITERION 3	CRITERION 4	Level 2: criteria
Sub-criterion 01	Sub-criterion 06	Sub-criterion 11	Sub-criterion 16	
Sub-criterion 02	Sub-criterion 07	Sub-criterion 12	Sub-criterion 17	
Sub-criterion 03	Sub-criterion 08	Sub-criterion 13	Sub-criterion 18	
Sub-criterion 04	Sub-criterion 09	Sub-criterion 14	Sub-criterion 19	Level 3: sub-criterion
Sub-criterion 05	Sub-criterion 10	Sub-criterion 15	Sub-criterion 20	
	SCENARIO ASSESSMENT		Level 4: evaluation
ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	Level 5: alternatives

The Saaty's semantic scale has a role essential to the coding, expressing through a quantitative and qualitative relationship the intensity of dominance of a factor with respect to all factors of the analyzed set.

INTENSITY OF DOMINANCE	WEIGHT	EXPLANATION
1; 1; 1	EQUAL IMPORTANCE	Activities contribute equally to the resolution of the objective.
2; 3; 4	WEAK PREVALENCE	The judgement for activity a is slightly favourable compared to function b. The reciprocal of this dominance intensity is used (1/4; 1/3; 1/2) if experience and judgement slightly favour activity b over activity a.
4; 5; 6	STRONG PREVALENCE	The judgment made for activity a is favourable to activity b as evaluated. The reciprocal of this dominance intensity is used (1/6; 1/5; 1/4) if the experience and judgment clearly favour activity b over activity a.
6; 7; 8	DEMONSTRATED PREVALENCE	The dominance of factor a is demonstrated with respect to the comparison function b, i.e. its relevance is found with respect to the comparison set and its sub-criteria. The reciprocal of this dominance intensity is used (1/8; 1/7; 1/6) if the dominance of activity b with respect to activity a is demonstrated in practice.
9; 9; 9	ABSOLUTE PREVALENCE	Activity a is shown to be essential with respect to the function b evaluated. The reciprocal of this dominance intensity (1/9; 1/9; 1/9) is used if the dominance of activity b over activity a is demonstrated with the highest possible level of certainty.
1; 2; 3 3; 4; 5 5; 6; 7 7; 8; 9	COMPROMISE VALUES	To be used when high degrees of uncertainty are encountered, i.e. when the expressed ratings fall within the intermediate class values. Apply when greater precision is required. In the case where activity b predominates over activity a, their reciprocal values can be used (1/3; 1/2; 1) (1/5; 1/4; 1/3) (

If K decision-makers are involved, the individual preferences $\tilde{a}^k_{ij}$ are averaged: $\tilde{a}_{ij} = \frac{\sum_{k=1}^{K} \tilde{a}^k_{ij}}{K}$ and are assembled in the matrix of pairwise comparisons

$$\tilde{A} = \begin{vmatrix} \tilde{a}_{11} & \tilde{a}_{12} & \dots & \tilde{a}_{1n} \\ \tilde{a}_{21} & \tilde{a}_{22} & \dots & \tilde{a}_{2n} \\ \dots & \dots & \dots & \dots \\ \tilde{a}_{n1} & \tilde{a}_{n2} & \dots & \tilde{a}_{nn} \end{vmatrix}$$

It is computed as the geometric average of the values obtained from the fuzzy comparisons of each criterion $\tilde{u}_i$:

$$\tilde{u}_i = \left(\prod_{j=1}^{n} \tilde{a}_{ij}\right)^{\frac{1}{n}} \quad i = 1, \dots, n$$

Then the vector sum (symbol $\oplus$) of each fuzzy element $\tilde{u}i$ is computed and it is elevated to the exponential value (-1):

$$\tilde{u} = (\tilde{u}_1 \oplus \tilde{u}_2 \oplus \tilde{u}_3 \oplus \dots \oplus \tilde{u}_n)^{-1}$$

The subsequent step amounts to computing the fuzzy weight relative to the i-th criterion, where the symbol $\oplus$ denotes the fuzzy product and the vector containing fuzzy weight in ascending order:

$$\tilde{o}_i = \tilde{u}_i \otimes (\tilde{u}_1 \oplus \tilde{u}_2 \oplus \tilde{u}_3 \oplus \dots \oplus \tilde{u}_n)^{-1} = (lw_i; mw_i; uw_i)$$

Since the term $\tilde{o}_i$ is a triangular number as well, it needs to be "de-fuzzified", by using the "center of gravity" method:

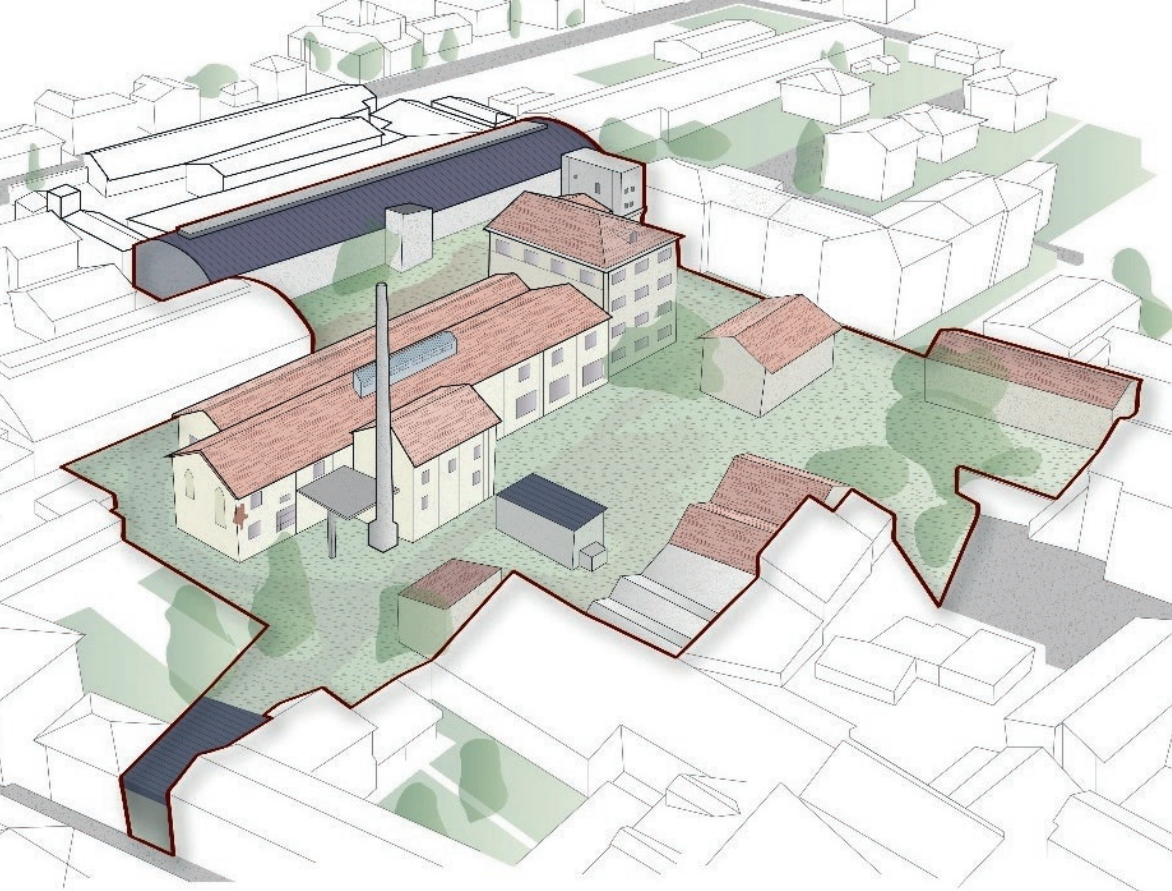$$M_i = \frac{(lw_i + mw_i + uw_i)}{3}$$

and, then normalized: $N_i = \frac{M_i}{\sum_{i=1}^{n} M_i}$

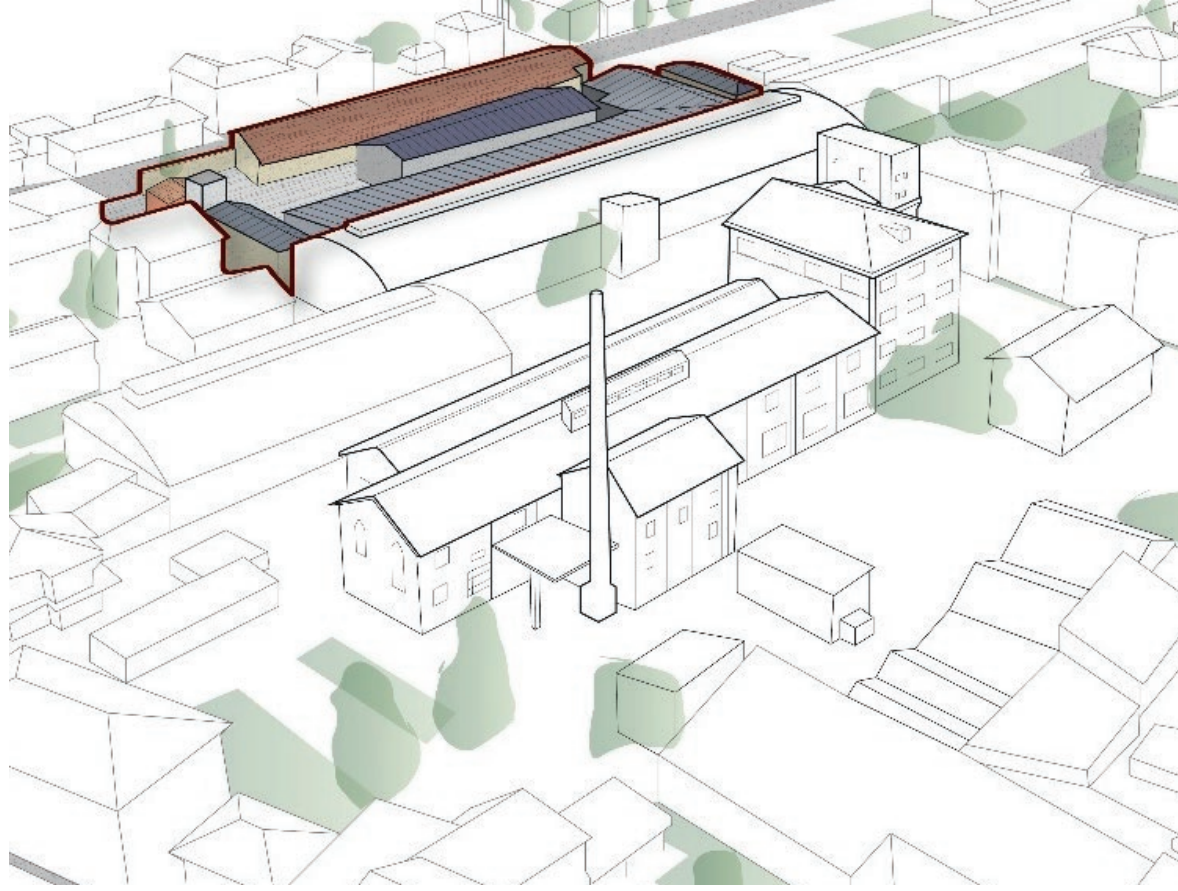## STUDY CASE: COGNITIVE PHASES OF THE TERRITORY

The case study focuses on Bareggio, a municipality in the province of Milan, one of those urban dimensions having a multifunctional character, articulated and composed of numerous economic and social dynamics.
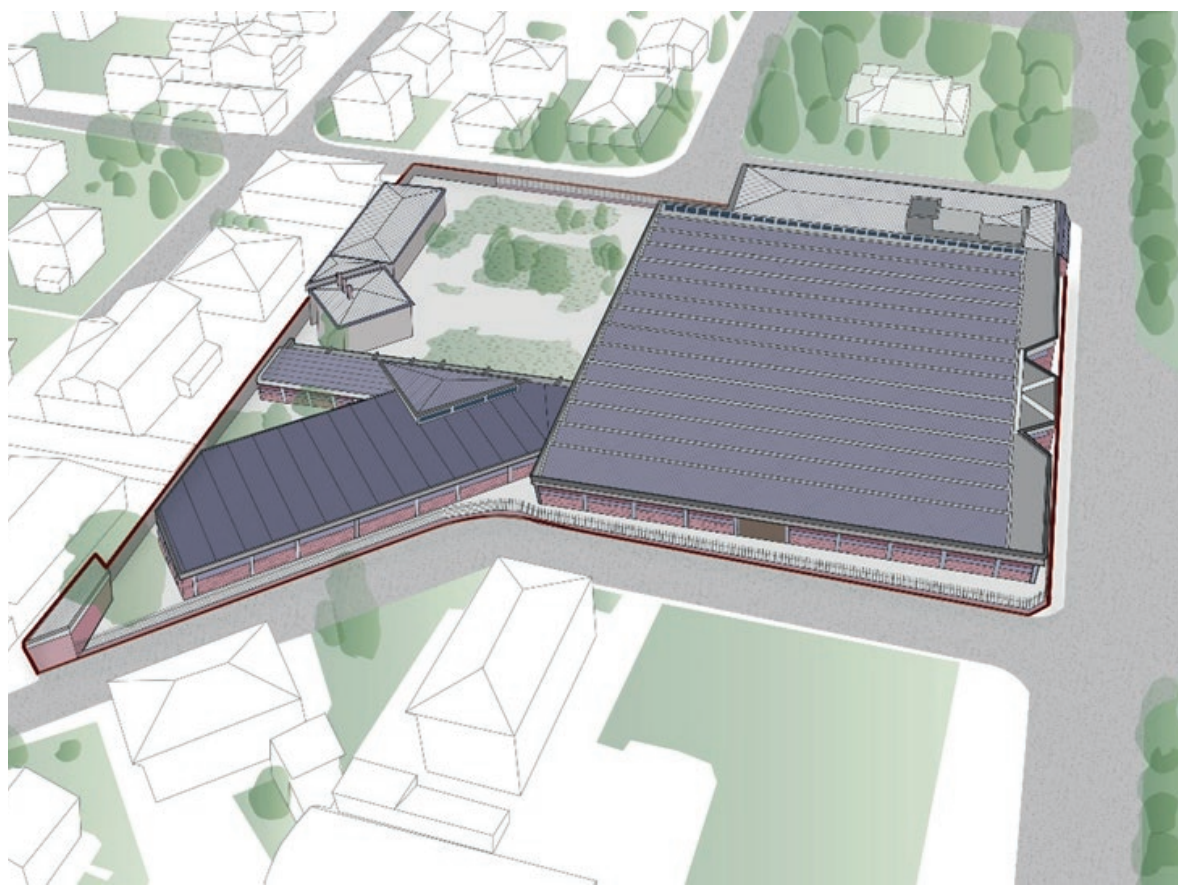

EX CARTIERA AREA
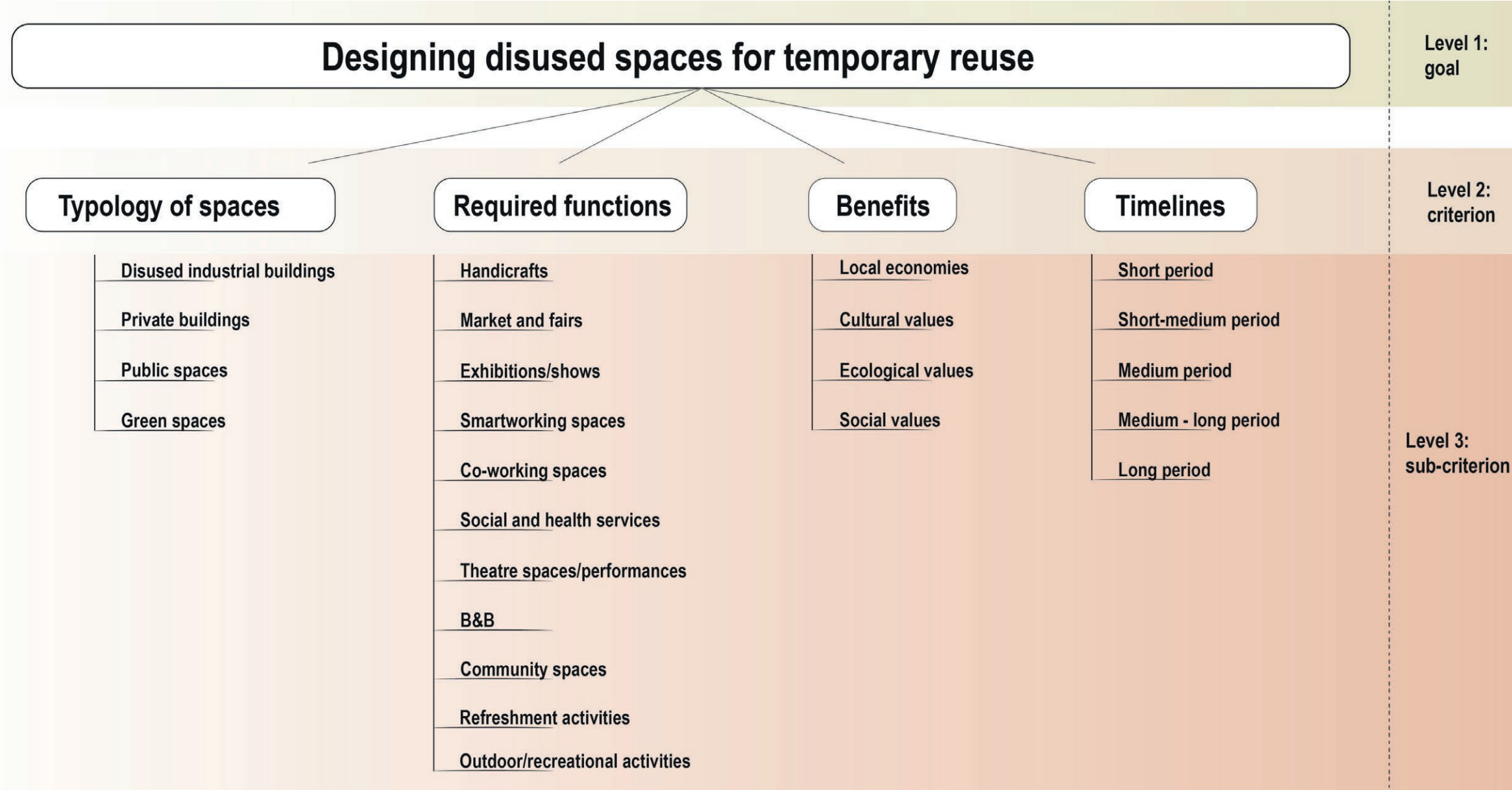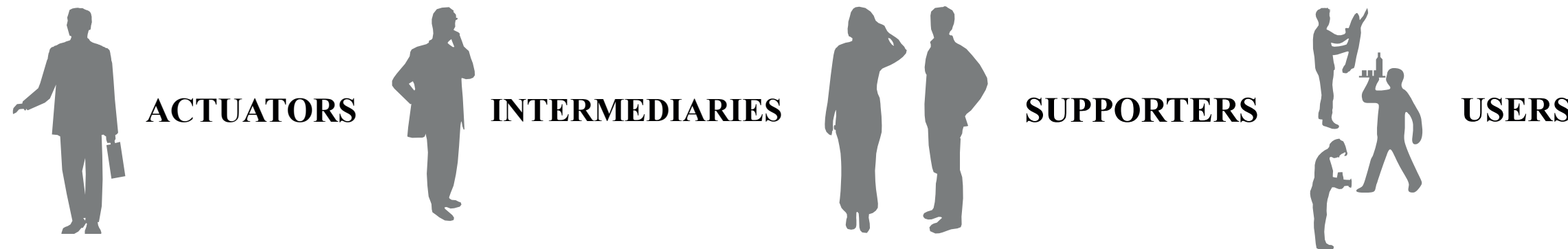*Existing area*

EX SAPLA AREA
Existing area

EX ALMA AREA
Existing area

METHODOLOGICAL APPROACH: FUZZY MODEL

The participatory process of the social component (private individuals, public authorities, associations, citizens) made it possible to identify the main criteria and sub-criteria of the multi-criteria model, providing a structure capable of responding to local needs

ACTUATORS   INTERMEDIARIES   SUPPORTERS   USERS

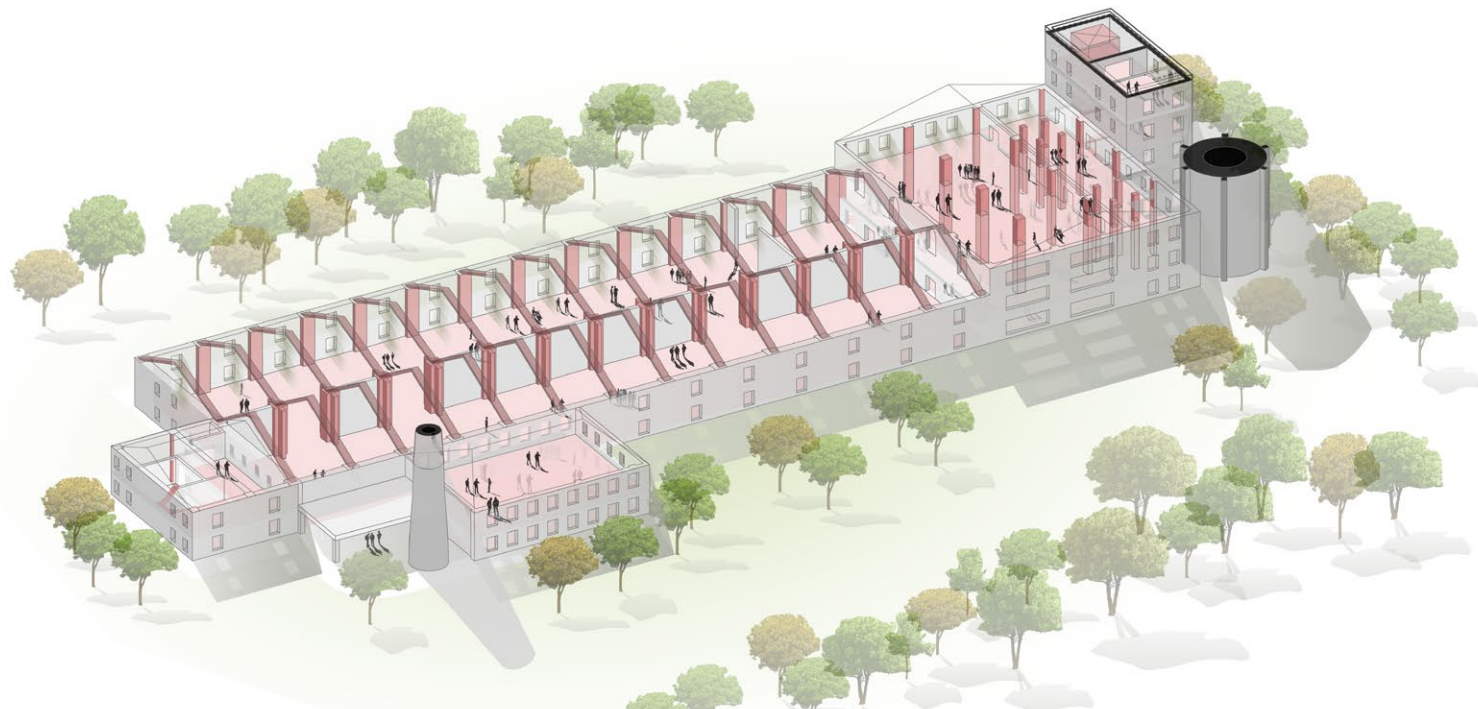|			
Designing disused spaces for temporary reuse			Level 1: goal
Typology of spaces	Required functions	Benefits	Timelines	Level 2: criterion
Disused industrial buildings	Handicrafts	Local economies	Short period	
Private buildings	Market and fairs	Cultural values	Short-medium period	
Public spaces	Exhibitions/shows	Ecological values	Medium period	
Green spaces	Smartworking spaces	Social values	Medium - long period	
	Co-working spaces		Long period	Level 3: sub-criterion
	Social and health services			
	Theatre spaces/performances			
	B&B			
	Community spaces			
	Refreshment activities			
	Outdoor/recreational activities			

STUDY CASE: APPLICATION OF THE MULTI-CRITERIA FUZZY MODEL

The three areas, the Ex Cartiera, the Ex Sapla and the Ex Alma, have been specifically studied in order to be able to hypothesize alternative project scenarios, evaluating as well all the positive and negative factors of each area. For each area, the aspects that were introduced and at the same time assessed were:
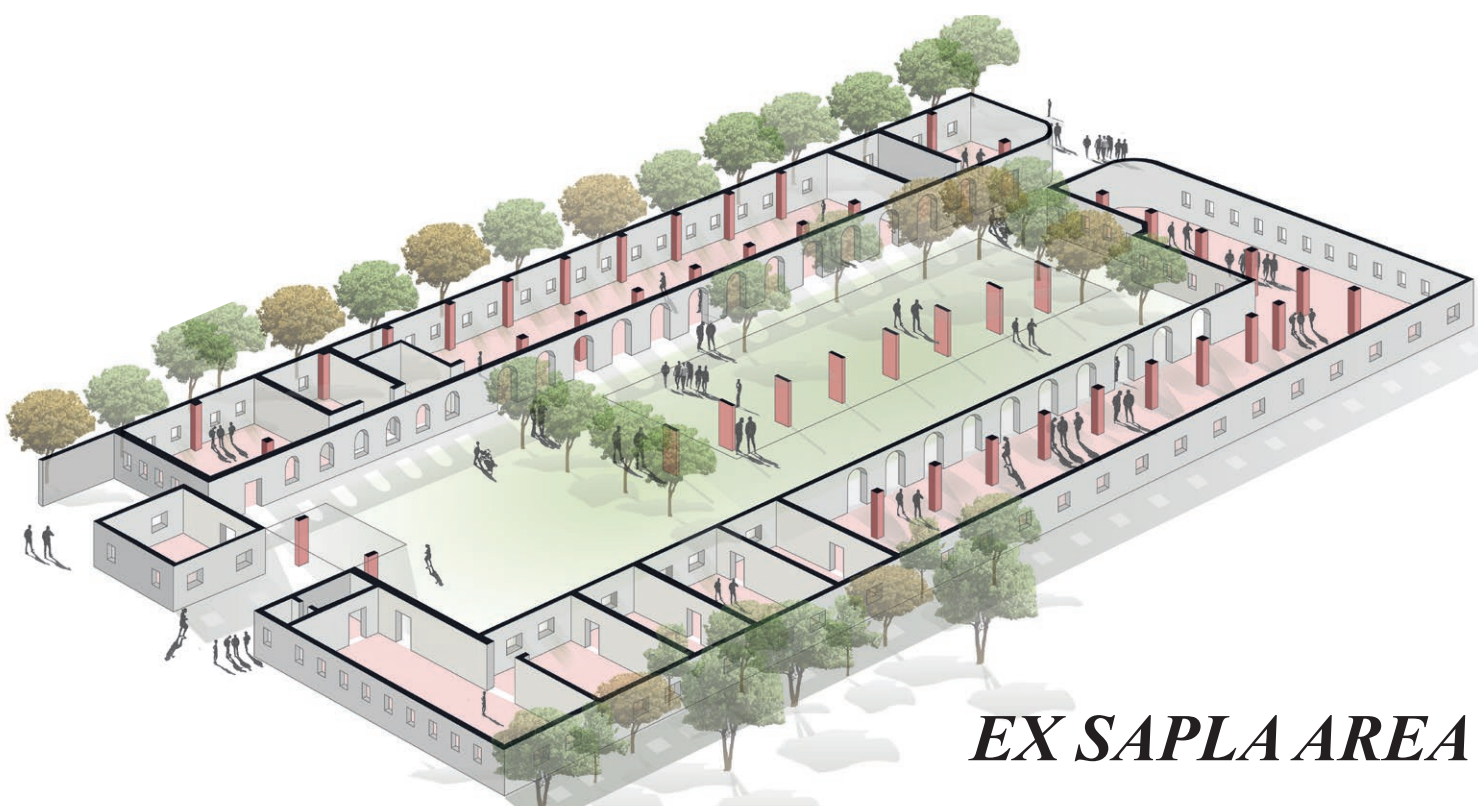
- Economic feasibility: the feasibility of the economic impact on each individual project area becomes fundamental if such an intervention is to be envisaged.

- Legislative conditions: for an overall assessment of the general characteristics of the intervention it is fundamental to observe, for each area, the feasibility of the project actions according to the legislative provisions made available by the competent bodies.
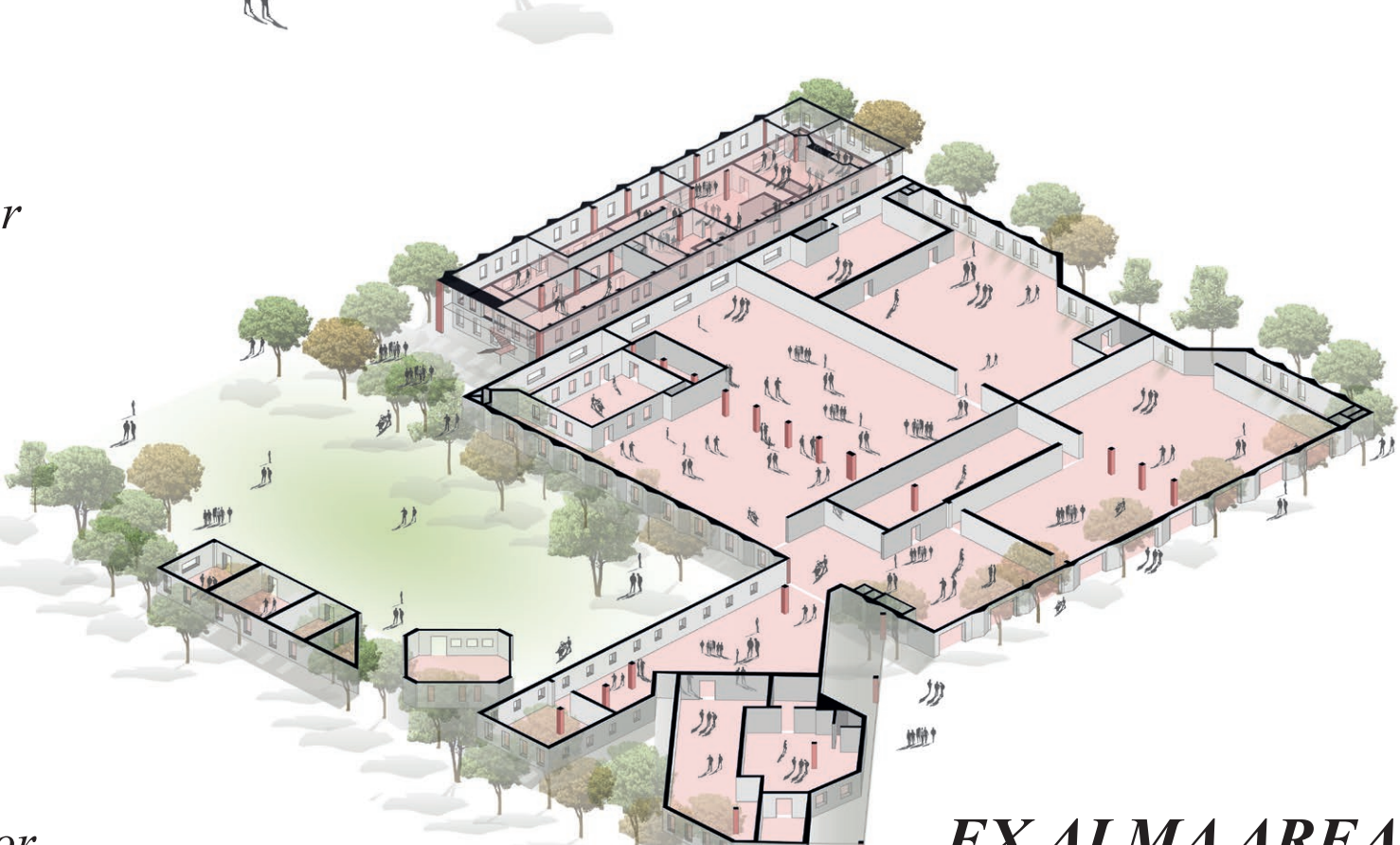
- Contextual variables: in order to allow for a complete and diversified reading of the areas, some specifications are inserted for each area, trying to assign a 'weight' according to the different impacts that these could have on the other evaluation characteristics.
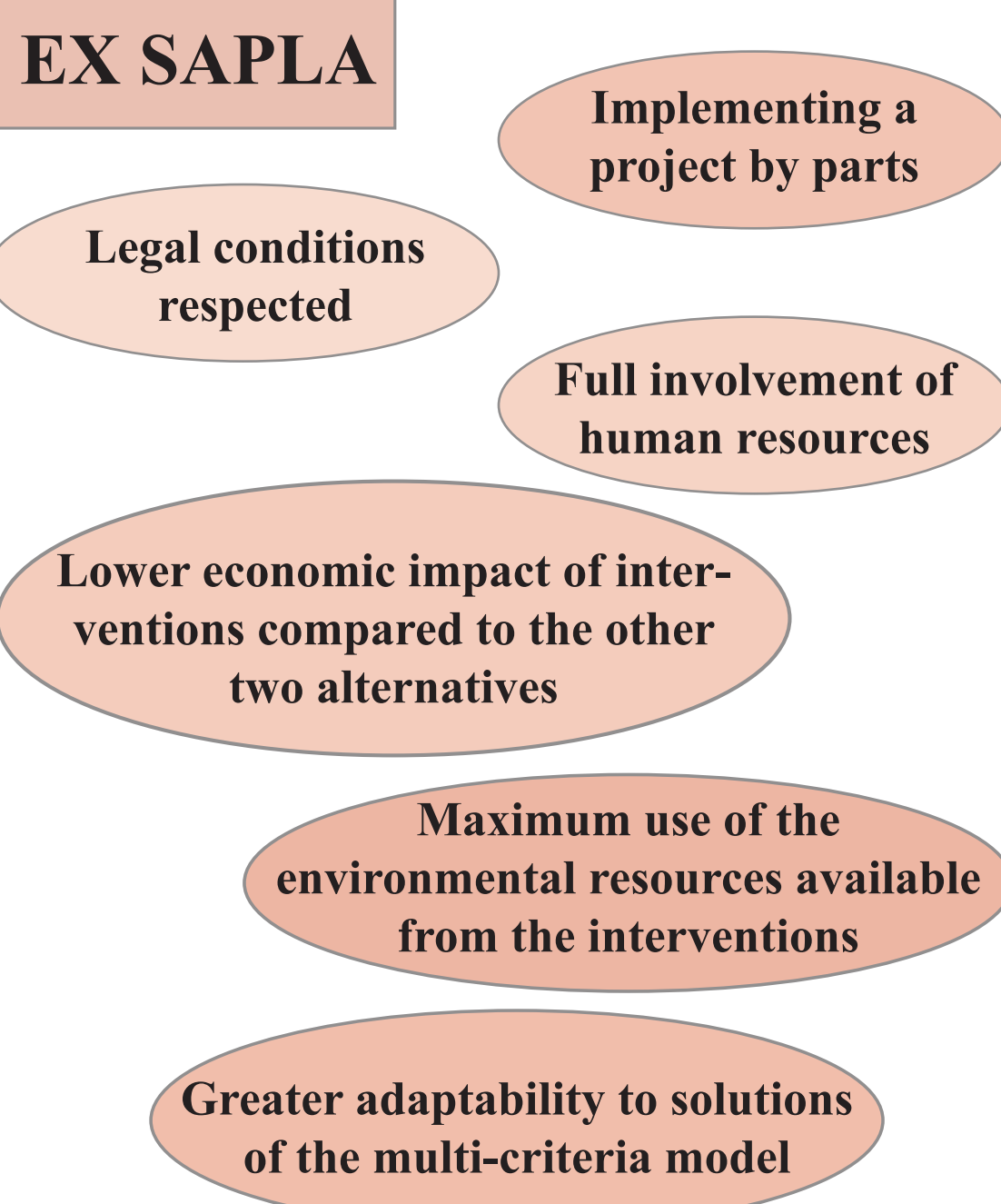

EX CARTIERA AREA

EX SAPLA AREA

EX ALMA AREA

Ex Cartiera - ground floor

Ex Cartiera - first floor

Ex Cartiera - second floor

Ex Cartiera - third floor

DATA PROCESSING AND RESULTS

Each area allowed to highlight positive and negative factors of the temporary re-use process, which were evaluated in order to obtain a useful and effective result for the activation of the process.

EX SAPLA

- Implementing a project by parts
- Legal conditions respected
- Full involvement of human resources
- Lower economic impact of interventions compared to the other two alternatives
- Maximum use of the environmental resources available from the interventions
- Greater adaptability to solutions of the multi-criteria model

In conclusion, on the basis of what emerges from the project alternatives, constructed on the basis of the multi-criteria model applied to the different contexts and the economic estimate of the interventions, it is possible to state that the area with the greatest feasibility of interventions is the **EX SAPLA area.**

SUMMARY SHEET

APPLICATIONS OF THE MULTI-CRITERIA MODEL:

Although the available surfaces within the intervention area are limited, the spaces and functions that can be introduced are in accordance with those foreseen by the multi-criteria model. The adaptability of the volumes to the different activities remains medium to high, with several different volumes available.

ECONOMIC FEASIBILITY:

With the aim of quantifying the economic impact of the measures required to complete the areas, the following estimate is given:

GROUND FLOOR			
Type of spaces	Total surface area (mq)	Expected costs (€)	Estimation of interventions (€/mq)
Production + Offices	1.237	500	618.500
Storage	441	500	220.500
Private building	50,70	500	25.350

EXTERNAL WORKS			
Type of spaces	Total surface area (mq)	Expected costs (€)	Estimation of interventions (€/mq)
Green areas	1.248	4,31	3.578,88

EXTERNAL WORKS - MAINTENANCE			
Type of spaces	Total surface area (mq)	Expected costs (€)	Estimation of interventions (€/mq)
Green areas	1.248	25,12	51.349,76

TOTAL ESTIMATE			
Type of spaces	Total surface area (mq)	Expected costs (€)	Estimation of interventions (€/mq)
Production + Offices	1.237	500	618.500
Storage	441	500	220.500
Private building	50,70	500	25.350
Green areas	1.248	4,31	3.578,88
Green areas maintenance	1.248	25,12	51.349,76
TOTALE			901.078,64

Finally, the need to re-think both the functions and the evolution of an area, respecting its vocations and the needs of the community, must necessarily be placed at the centre of the 'best practices' of an urban study, favouring, in this way, the socio-economic, cultural and tourist development of the territory and its inhabitants.