ADAPTIVE REUSE:
HOW SUCCESSFUL CAN A RECOVERY BE WITHIN THE CONTEMPORARY *SUSTAINABLE* ERA?

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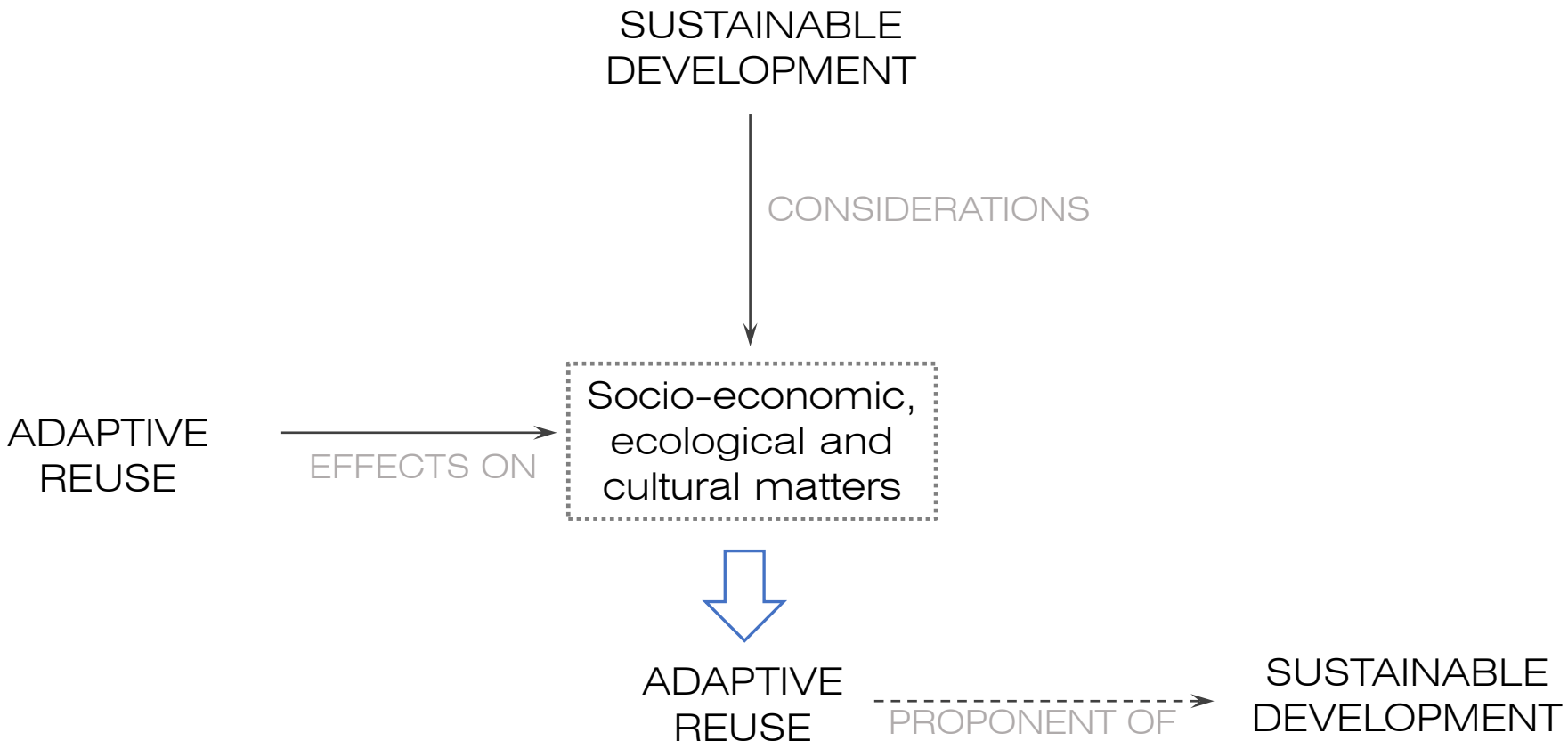

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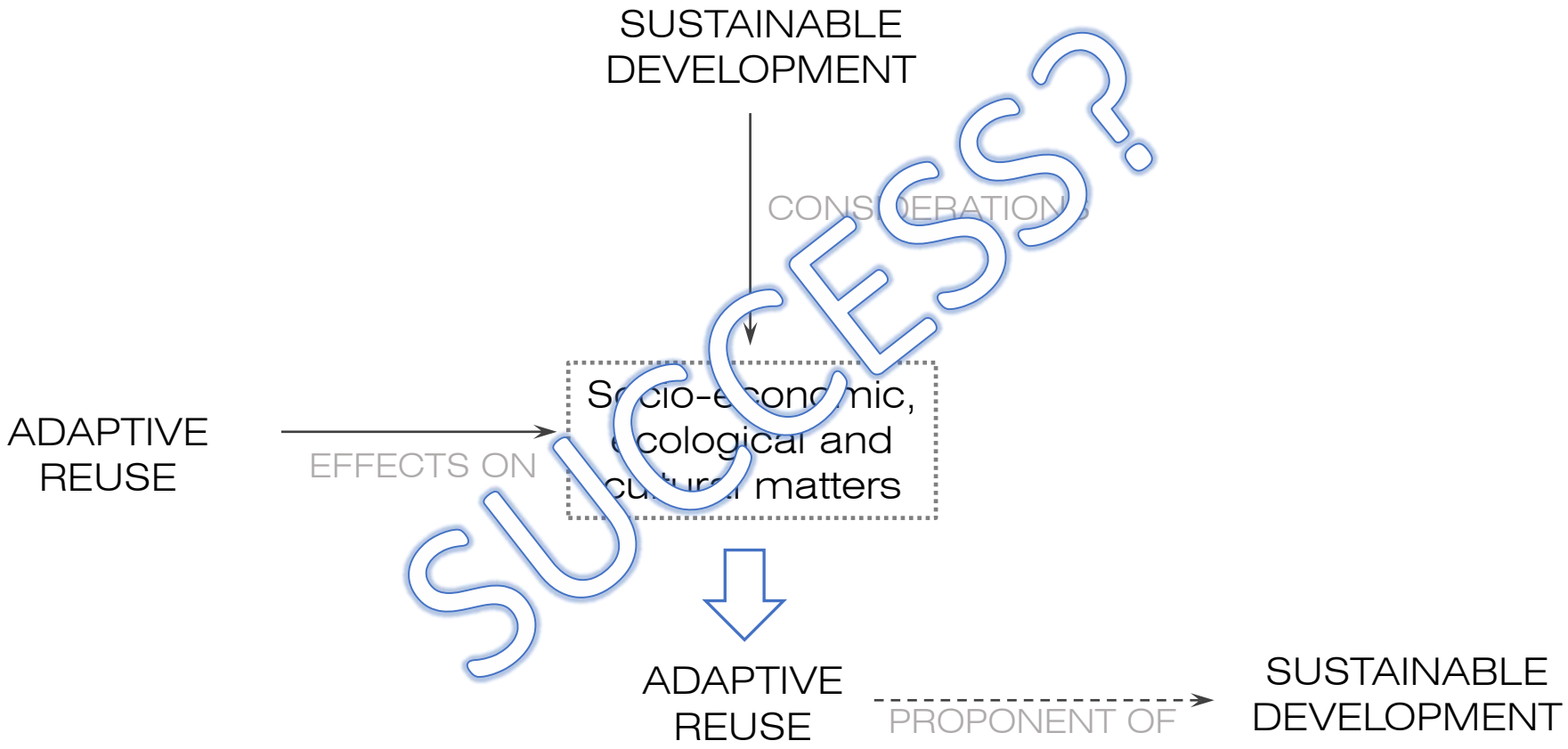


OVERVIEW

Adaptive Reuse

Adaptive Reuse and Sustainability-driven Developments

Successful (?) Recoveries within the Build Environment

Empirical Research: **Model** establishing the most Important **Criteria**

Findings and Reflection on Current Situation

ADAPTIVE REUSE

- "to re-use a building or structure for the purpose of giving it new life through a new function" (ODASA, 2014)

- "adaptive reuse is described as developing the potential of additional use and wear for functionally obsolete buildings – it is essentially the recycling of a building" (Ijla & Broström,2015)

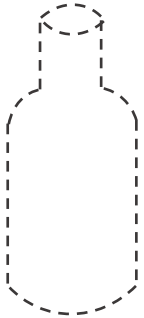
- Not just restoration and renovation

- **Not necessarily implying a change of use** but generally as works including "rehabilitation, renovation or restoration" (Bullen,2007)

- from Latin 'ad'+'aptar' which means to+fit

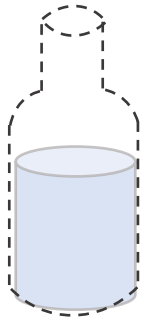
…TO FIT WHAT?

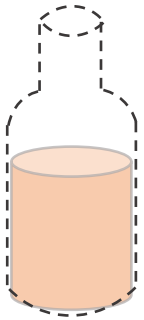
ADAPTIVE REUSE

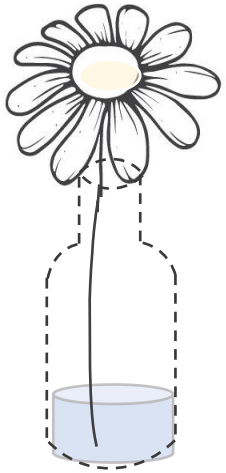


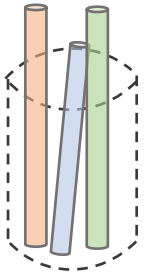
‘ad’+‘aptar’ which means to+fit

Purpose: **extension of useful life**

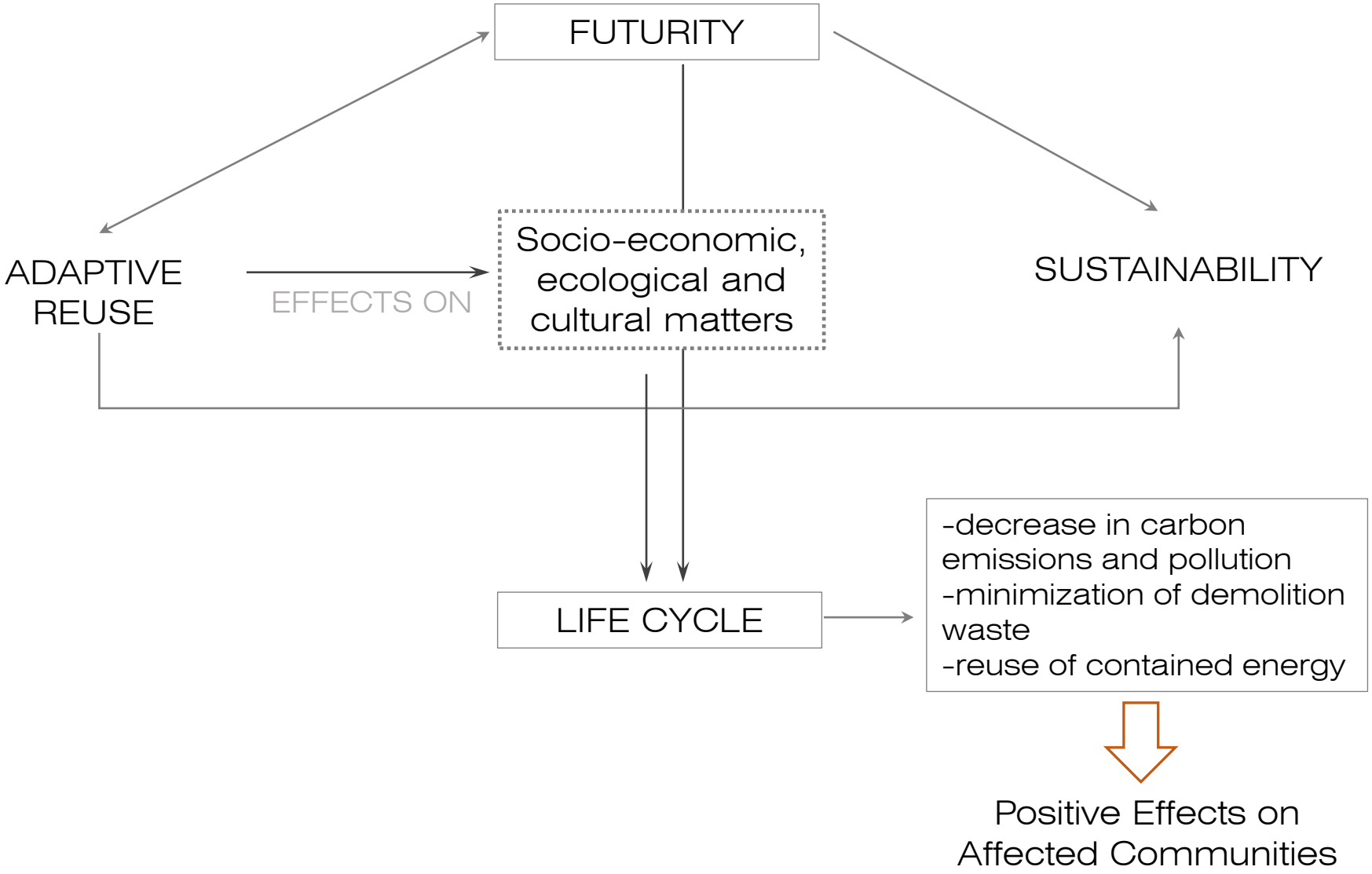








ADAPTIVE REUSE AND SUSTAINABILITY-DRIVEN DEVELOPMENTS



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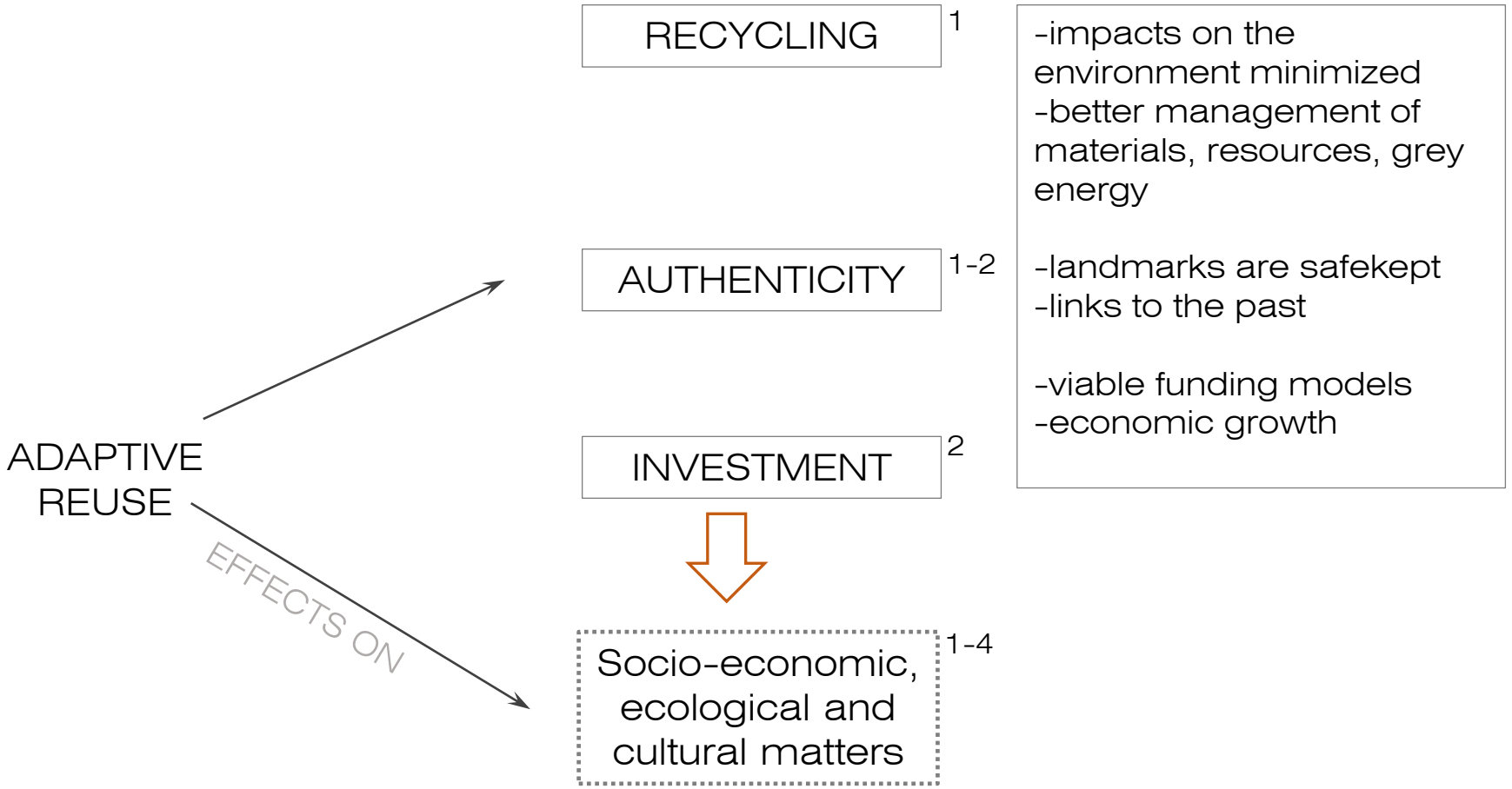

FINDINGS AND REFLECTION ON CURRENT SITUATION

SUSTAINABILITY

Multi-dimensional Character[1]

Not a fixed definition[1-3]

A Process

Not a Score to Achieve

Not a Balance Sheet[2]

Change in Mentality and Habits

CONSIDERATIONS

Socio-economic, ecological and cultural matters[4-8]

1: Worster, 1993, 2: Djalali & Vollard, 2008, 3: Pyla, 2008, 4: Cooper, 1999, 5: Kohler, 1999, 6: Ding, 2008, 7: Rypkema, 2005, 8: Merlino &Steinbrueck, 2008

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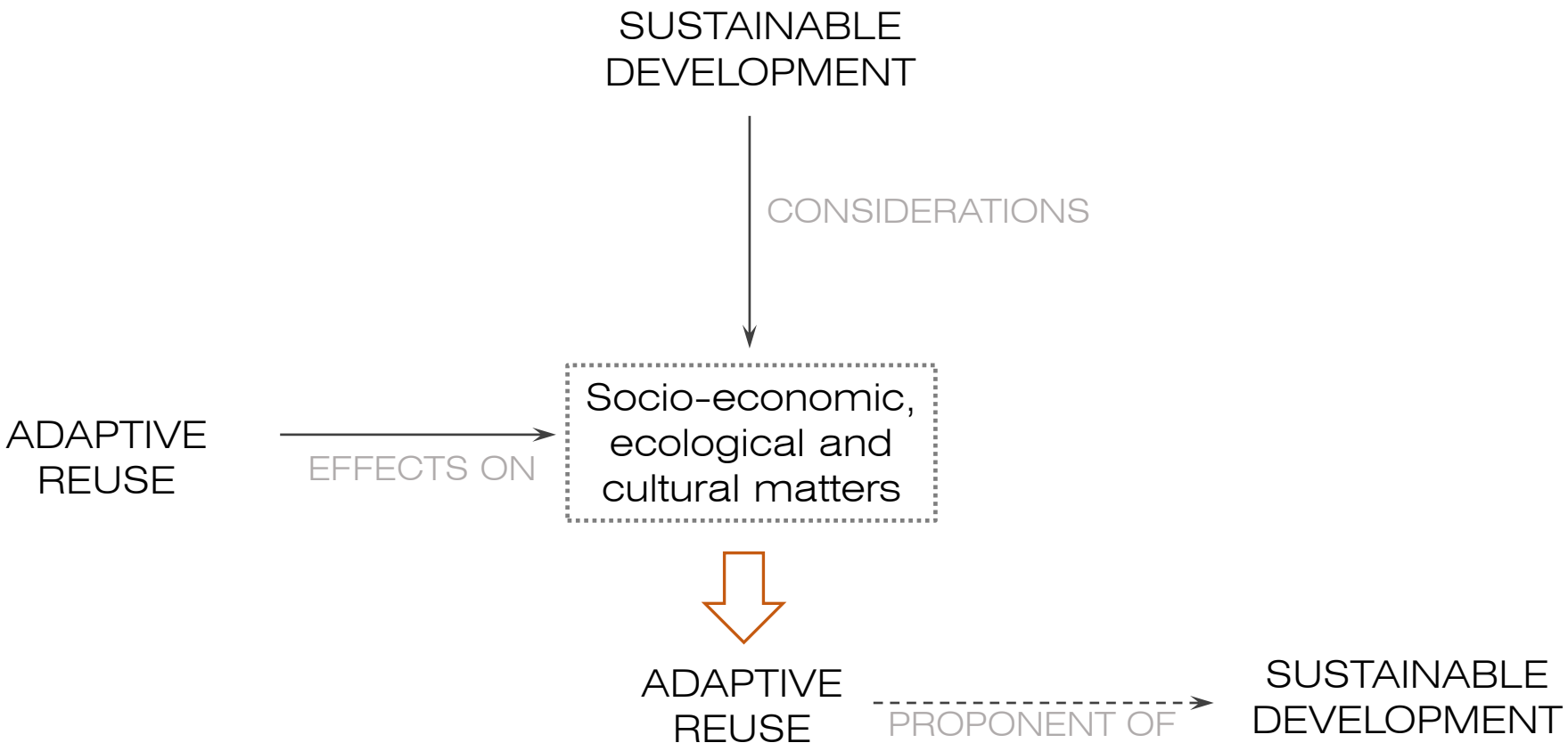

SUCCESSFUL (?) RECOVERIES WITHIN THE BUILD ENVIRONMENT

ADAPTIVE REUSE?

A method of extending the useful life of buildings by a combination of improvement and conversion

Success??

On which grounds?

-quality

-general public perception

-popularity

SUCCESSFUL (?) RECOVERIES WITHIN THE BUILD ENVIRONMENT

ADAPTIVE REUSE?

Success??

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SUCCESSFUL (?) RECOVERIES WITHIN THE BUILD ENVIRONMENT

ADAPTIVE REUSE?

Success??

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SUCCESSFUL (?) RECOVERIES WITHIN THE BUILD ENVIRONMENT

ADAPTIVE REUSE?

Success

Measuring Success/ Degree of Success:

Expressing the intangible quantity in tangible terms

-A formula was created using a measurable quantity (time/ active years), to investigate the extent to which the adaptation benefited the unit itself, by continuing its life

-In cases where the strategy implemented led to more active years, then the reuse was considered more successful.

SUCCESSFUL (?) RECOVERIES WITHIN THE BUILD ENVIRONMENT

EMPIRICAL RESEARCH: ESTABLISHING THE MOST IMPORTANT CRITERIA

MULTIPLE LINEAR REGRESSION ANALYSIS

- **OBJECTIVE:** Correlation between the selected variables with the Degree of Success of Adaptive Reuse (DoSAR)

/ **to establish the criteria that mostly affect a successful adaptive reuse**

- Assessment of a large number of built examples

→better and more precise results within the framework of this research

- The data collected is cross-sectional; the data concerns different built examples through a given timeframe

- A Multi-attribute framework embraces the uniqueness of the case studies

EMPIRICAL RESEARCH: ESTABLISHING THE MOST IMPORTANT CRITERIA

General Form:

$$y_i = \beta_0 + \beta_1 x_{1i} + \cdots + \beta_k x_{ki} + u_i$$

- *'y'*: **the dependent variable**
- *'x'* s: the independent variables
- *'k'*: the number of the regressors/independent variables
- *'i'*: the number of observations
- $'\beta_k'$: the **relationship between 'y' and 'x'**. Estimated from the data collected
- $'u_i'$: Error of the model. Omitted variables

- The data collected for this project is **cross- sectional**; the data comes from observations on different built examples.

EMPIRICAL RESEARCH: ESTABLISHING THE MOST IMPORTANT CRITERIA

EMPIRICAL RESEARCH: ESTABLISHING THE MOST IMPORTANT CRITERIA

CASE no: 8 | Date of visit: 23.11.16

1. PROFILE

1.1 ADDRESS: Agia Omologites
1.2.1 YEAR OF CONSTRUCTION: 1951 | 1.2.2 FIRST USE: storage
1.3.1 YEAR OF CONVERSION: 2012 | 1.3.2 SECOND USE: workshop
1.4 NUMBER OF USUAL USERS: 10
1.5 COVERED AREA (M²): 78.3
1.6 AREA: URBAN / RURAL
1.7 VERNACULAR: YES / NO
1.8 BIOCLIMATIC FUNCTION: YES / NO
1.9 LISTED BUILDING: YES / NO
1.10 VIABILITY SCORE 20/30

1.11 FACADE

2. INFO ON THE YEAR OF CONVERSION

2.1 REAL COST OF CONVERSION (100 000 €): 200 000
2.2 PRICE INDEX OF CONSTRUCTION MATERIALS: 104,96
2.3 GROWTH RATE (%) 1,879 inf.
~3,158

3. INFO ON MATERIALS

3.1 PRIMARY CONSTRUCTION MATERIAL: adobe

4. NOTES

22262470

CASE no: 10 | Date of visit: 23.11.16

1. PROFILE

1.1 ADDRESS: Agia Omologites
1.2.1 YEAR OF CONSTRUCTION: 1930 | 1.2.2 FIRST USE: house
1.3.1 YEAR OF CONVERSION: 2006 | 1.3.2 SECOND USE: tourism
1.4 NUMBER OF USUAL USERS: 12
1.5 COVERED AREA (M²): 286
1.6 AREA: URBAN / RURAL

1.11 FACADE

CASE no: 4 | Date of visit: 21.11.16

1. PROFILE

1.1 ADDRESS: Stavrodis historic centre
1.2.1 YEAR OF CONSTRUCTION: 1915 | 1.2.2 FIRST USE: olive mill
1.3.1 YEAR OF CONVERSION: 2011 | 1.3.2 SECOND USE: art school
1.4 NUMBER OF USUAL USERS: 16
1.5 COVERED AREA (M²): 144
1.6 AREA: URBAN / RURAL
1.7 VERNACULAR: YES / NO
1.8 BIOCLIMATIC FUNCTION: YES / NO
1.9 LISTED BUILDING: YES / NO
1.10 VIABILITY SCORE 19/30

1.11 FACADE

2. INFO ON THE YEAR OF CONVERSION

2.1 REAL COST OF CONVERSION (100 000 €): 90000
2.2 PRICE INDEX OF CONSTRUCTION MATERIALS: 103,64
2.3 GROWTH RATE (%) 1909 inf.
0,321

3. INFO ON MATERIALS

3.1 PRIMARY CONSTRUCTION MATERIAL: adobe wall

4. NOTES

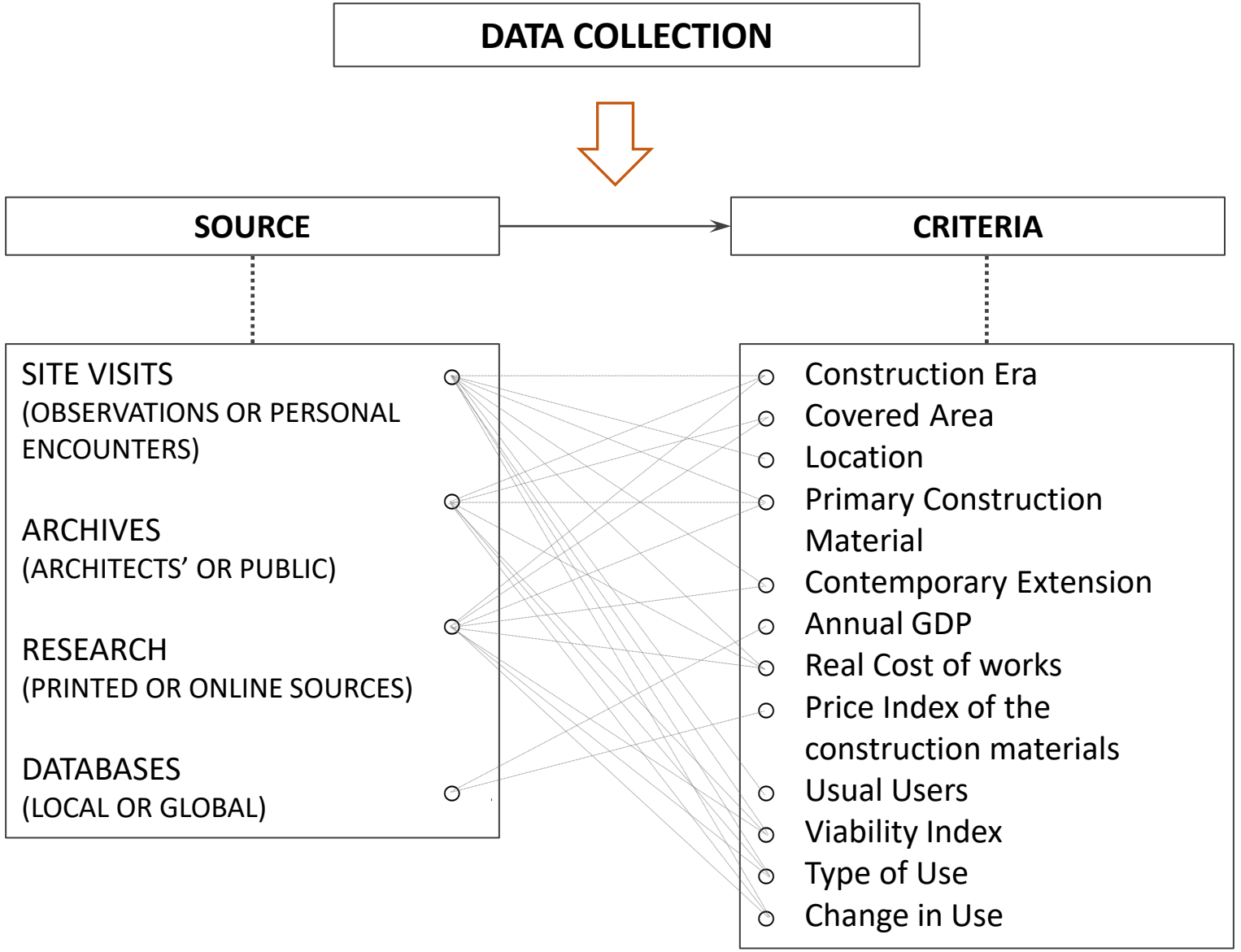
Thermal insulation	N
Use of renewable sources of energy (at least one)	N
Installation of water meter, cooling tower, domestic hot water	Y
Use of recycling policies	Y
Energy efficient equipment	Y
SCORE	6 /10
Maintenance plan for the land/environment surrounding the built elements	N
SCORE	2 /3
Physical and conceptual connection to the cultural/historical context	Y
Option for documentation of the history lying on site	Y
Respect of the existing fabric by new technologies installed	Y
SCORE	6 /7
Possibility for new job-openings	N
Windows for daylight and outer views in all regularly occupied rooms	Y
Noise insulation	N
Provision of shaded spaces (trees and heat-absorbing materials)	Y
Proximity to public transport (5 minutes on foot)	Y
SCORE	6 /10
TOTAL SCORE	20 /30

Connection to communal/inclusive public spaces	Y		
Provision of parking spaces (cars, bicycles and motorcycles)	N		
Provision of ventilation options: mechanical systems or natural system through design or plans for airflow	Y		

Provision of parking spaces (cars, bicycles and motorcycles)	N
Provision of ventilation options: mechanical systems or natural system through design or plans for airflow	Y
Provision of shaded spaces (trees and heat-absorbing materials)	Y
Proximity to public transport (5 minutes on foot)	Y
SCORE	7 /10
TOTAL SCORE	19 /30

Provision of parking spaces (cars, bicycles and motorcycles)	N
Provision of ventilation options: mechanical systems or natural system through design or plans for airflow	Y
Provision of shaded spaces (trees and heat-absorbing materials)	Y
Proximity to public transport (5 minutes on foot)	Y
SCORE	5 /10
TOTAL SCORE	19 /30

EMPIRICAL RESEARCH: ESTABLISHING THE MOST IMPORTANT CRITERIA



EMPIRICAL RESEARCH: ESTABLISHING THE MOST IMPORTANT CRITERIA

THE DEPENDENT VARIABLE

Need for an index establishing the degree of how successful a rehabilitation is:

$$y = \frac{\text{second use in years}}{\text{total operating years}} \times \text{year the conversion was realised}$$

The ratio ('y') expressing the **relationship between the active years** of two different phases of a building

EMPIRICAL RESEARCH: ESTABLISHING THE MOST IMPORTANT CRITERIA

THE DEPENDENT VARIABLE

Need for an index establishing the degree of how successful a rehabilitation is:

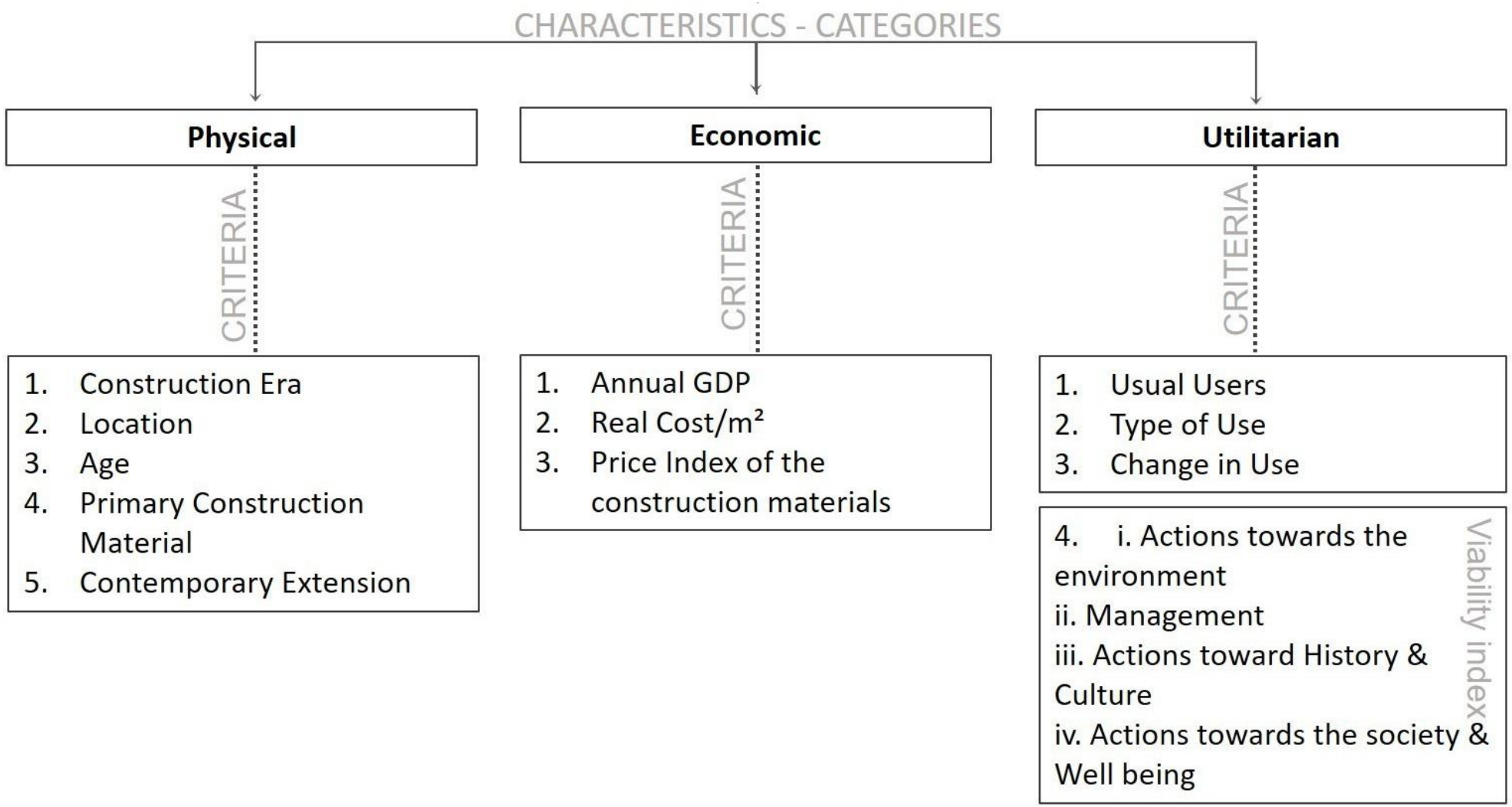
$$y = \frac{\text{second use in years}}{\text{total operating years}} \times \text{year the conversion was realised}$$

Penalization term

The ratio (‘y’) expressing the **relationship between the active years** of two different phases of a building

EMPIRICAL RESEARCH: ESTABLISHING THE MOST IMPORTANT CRITERIA

THE INDEPENDENT VARIABLES



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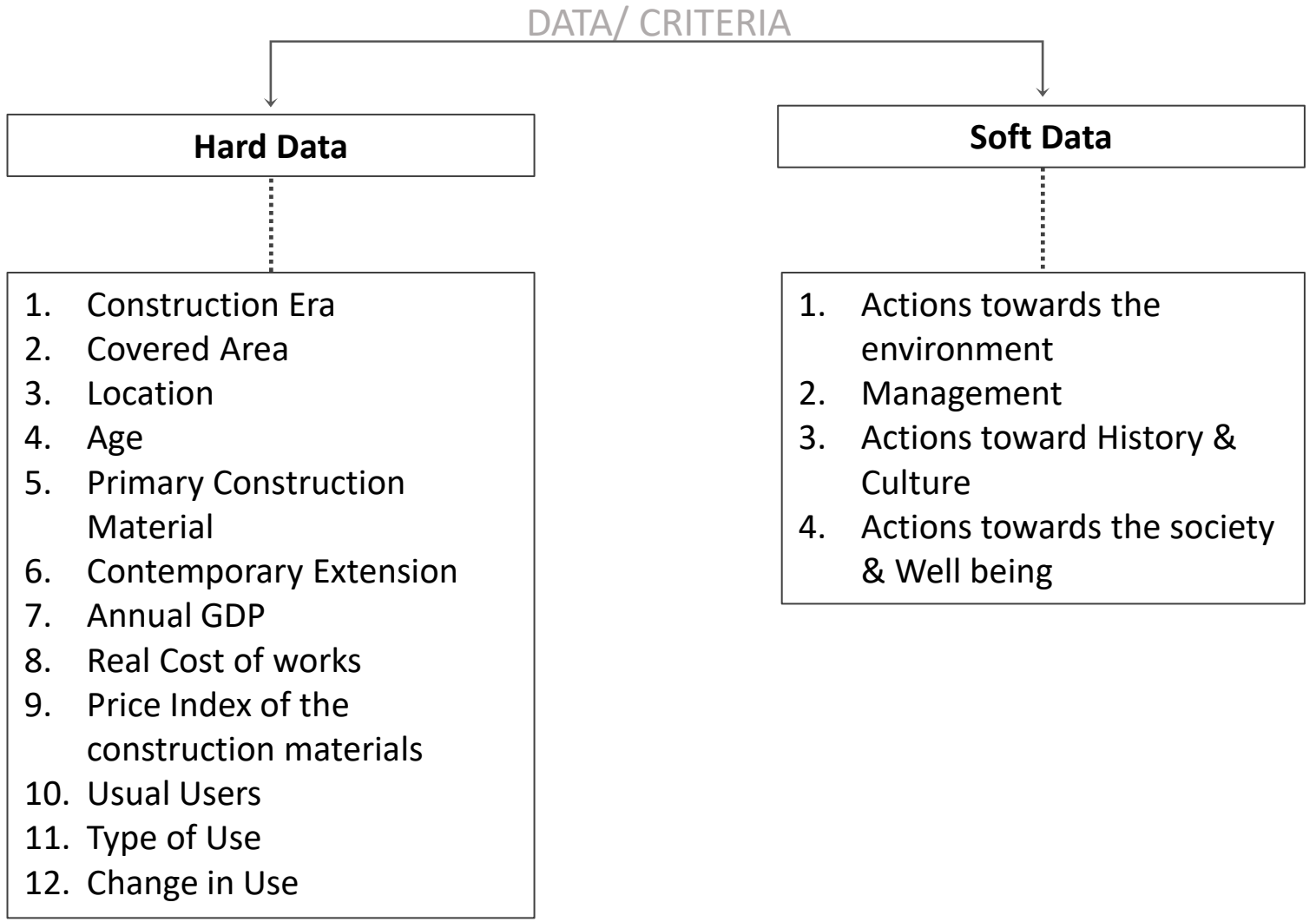


EMPIRICAL RESEARCH: ESTABLISHING THE MOST IMPORTANT CRITERIA

Variable Name	Storage Type	Variable Label
DoSAR	Real Number	**DoSAR**
ConEra	Dummy	**Construction Era**
NuU	Integer Number	**Number of Usual Users**
Lc	Dummy	**Location**
GdpG	Real Number	**GDP Growth Rate**
CostM2	Real Number	**Real Cost per M2**
PiCm	Real Number	**Price Index of Construction Materials**
Pcm	Dummy	**Primary Construction Material**
Tu	Dummy	**Type of Introduced Use**
VScr	Real Number	**Viability Score Index**
Ext	Dummy	**Extension**
Cu	Dummy	**Change in Use**

$$DoSAR_{i=}\beta_0 + \beta_1 ConEra_1 + \beta_2 NuU_i + \beta_3 Lc_i + \beta_4 GdpG_i + \beta_5 CostM2_i + \beta_6 PiCm_i + \beta_7 Pcm_i + \beta_8 Tu_i + \beta_9 VScr_i + \beta_{10} Ext_i + \beta_{11} Cu_i + u_i$$

EMPIRICAL RESEARCH: ESTABLISHING THE MOST IMPORTANT CRITERIA

Regression Run in Stata®

```
. reg  DoSAR ConEra  NuU Lc GdpG CostM2 PiCm Pcm Tu VScr Ext Cu
```

Source	SS	df	MS
Model	1450012.44	11	131819.312
Residual	263565.633	77	3422.93029
Total	1713578.07	88	19472.4781

Number of obs	= 89
F(11, 77)	= 38.51
Prob > F	= 0.0000
R-squared	= 0.8462
Adj R-squared	= 0.8242
Root MSE	= 58.506

DoSAR	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ConEra	56.59666	15.9111	3.56	0.001	24.91361	88.27971
NuU	.0761036	.1573901	0.48	0.630	-.2373001	.3895074
Lc	14.32749	14.97082	0.96	0.342	-15.48322	44.13821
GdpG	2.740354	2.362138	1.16	0.250	-1.963264	7.443971
CostM2	-.0064307	.0056194	-1.14	0.256	-.0176203	.004759
PiCm	-6.82166	.5334761	-12.79	0.000	-7.883947	-5.759374
Pcm	3.507657	15.7497	0.22	0.824	-27.854	34.86931
Tu	11.16138	19.06204	0.59	0.560	-26.796	49.11875
VScr	-118.1395	92.64651	-1.28	0.206	-302.6223	66.3433
Ext	-10.10934	13.79437	-0.73	0.466	-37.57744	17.35875
Cu	6.895591	16.84083	0.41	0.683	-26.63878	40.42996
_cons	863.5094	69.55531	12.41	0.000	725.0071	1002.012

EMPIRICAL RESEARCH: ESTABLISHING THE MOST IMPORTANT CRITERIA

Independent Variable	Expected Correlation with DoSAR	True Correlation with DoSAR
Construction Era	+/-	+
Number of Usual Users	+/-	+
Location	+	+
GDPG Rate	+	+
Real Cost per m²	+	-
Price Index of the Construction Materials	-	-
Primary Construction Material	+/-	+
Type of Use	+/-	+
Viability Score	+	-
Extension	+	-
Change in Use	+/-	+

FINDINGS AND REFLECTION ON CURRENT SITUATION

On the Variables' Statistical Significance

The **Price Index of the Construction Materials** is the **best regressor**

(not the capital or economic growth)

The **Construction Era** (legislative background/construction technologies) is **statistically significant**

The prediction that the number of **Usual Users**, or the **Location** would be statistically significant **was overturned**

The **Original Materiality** of a unit holds minor significance

→should not be a barrier in future adaptations

FINDINGS AND REFLECTION ON CURRENT SITUATION

On the Variables' Statistical Significance

The **Viability Index** has **small explanatory power** over the DoSAR

→however, the manufactured **system exists in the best version** of the model

When the Index is examined (not as accumulative score but) in its four categories separately:

the **management** of the property and the actions towards the **socioeconomic** fabric and **wellbeing:** higher explanatory power

FINDINGS AND REFLECTION ON CURRENT SITUATION

On the Variables' Statistical Significance

The **Use** itself holds **minor significance**:

- A **public use** is more probable to **extend a unit's useful life**
- Change of use, or a built extension have **small contribution**
- The 'change in use' and the 'type of use' can be omitted from the model, but the 'extension' should not

FINDINGS AND REFLECTION ON CURRENT SITUATION

On the Project

Stakeholders' Stance:

Acknowledgement of all aspects of potential rehabilitation plans

- Single units
- Complexes
- Neighbourhoods

Contribution to decision Making?

Resource Management, Involved Costs (tangible and intangible,

Effective processes and Assessments

FINDINGS AND REFLECTION ON CURRENT SITUATION

On the Project

Assessment Methodology:

- evaluation of multiple examples at the same time

→robust results

→indication of current behaviours and trends

→possibility to quantify different types of data

Data from Cyprus:

Sample should be expanded, more research in other regions

The Dependent Variable:

Manufactured to reflect success

→ Not the same with popular rating systems

FINDINGS AND REFLECTION ON CURRENT SITUATION

On the Project

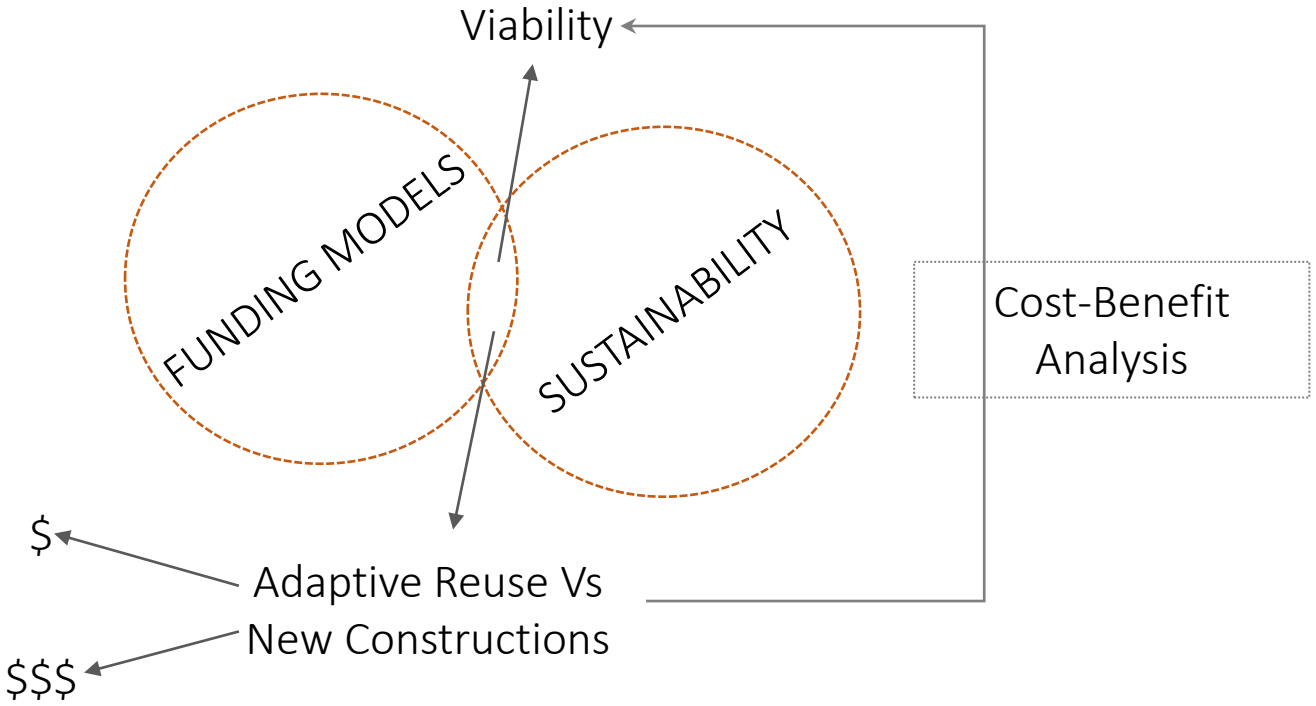
Future Development:

- Further exploration of the practice of Adaptive Reuse
- Investigation of other regions
- Combined research and comparisons with the case of Cyprus (now a limitation)
- Methodology could be applied in other aspects of the field of architecture

FINDINGS AND REFLECTION ON CURRENT SITUATION

There can be economic, physical, legislative and utilitarian variables affecting an adaptation positively→ their contributions not equal

New trends, the growing needs, and the changing context into which the policies are developed reflect the need for constant evaluation and research.



Thank you.

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