
Università degli Studi di Firenze
Dipartimento di Studi Sociali
Conceptual process and methodology aimed at developing complex social indicators used in demographic policy
ЦЕНТЪР ЗА ИЗСЛЕДВАНЕ НА НАСЕЛЕНИЕТО
Българска академия на науките
София
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Introduction

Measuring processes by:

- *a **fundamental** process* $\Rightarrow$ lenght, volume
- *a **deriving** process* $\Rightarrow$ density, velocity
- *a **defining** process* $\Rightarrow$ socio-economic status

Introduction

In social sciences,
the measurement process requires a design
allowing indicators to be defined:

1. Defining the conceptual framework	⇨	Comprehensive approach
↓		
2. Developing the indicators	⇨	Logical modeling (hierarchical design)
↓		
3. Managing the complexity	⇨	Analytical process (multi-stages and multi-techniques)
↓		
4. Framing the complexity	⇨	Developing a system of indicators

Introduction

Defining the conceptual framework

Developing the indicators

Managing the complexity

Framing the complexity

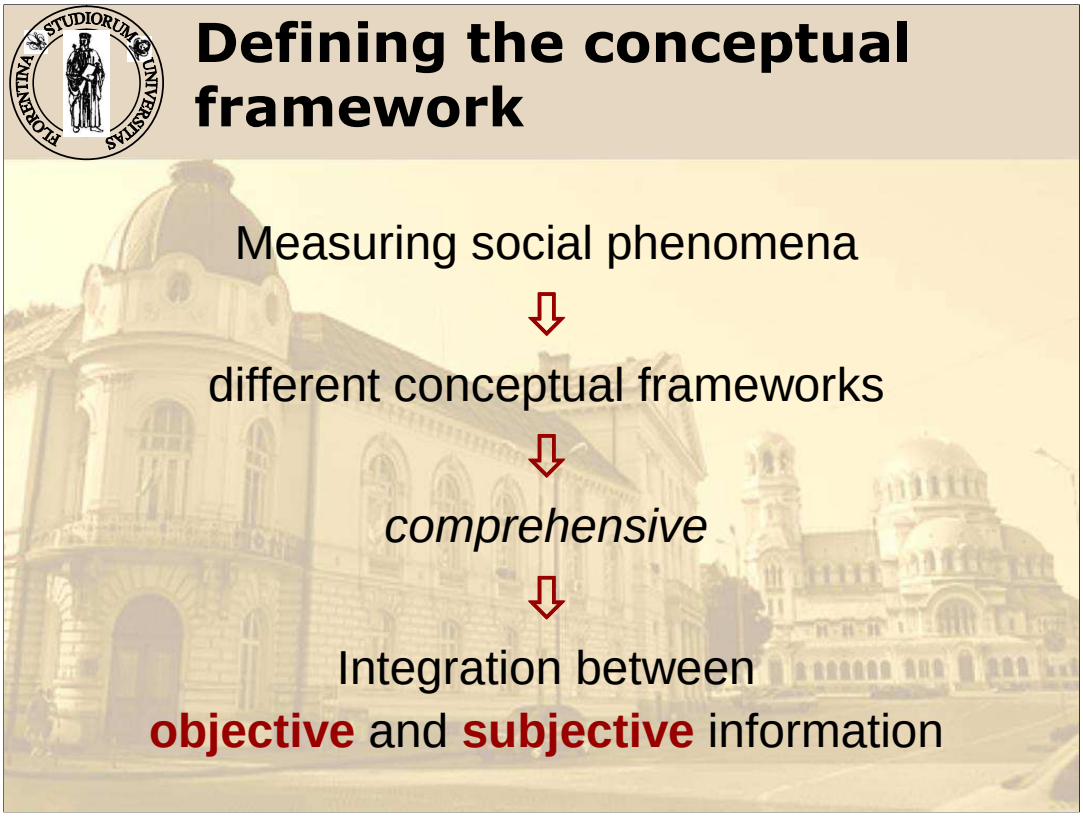
1.

Defining the conceptual framework

Developing the indicators

Managing the complexity

Framing the complexity



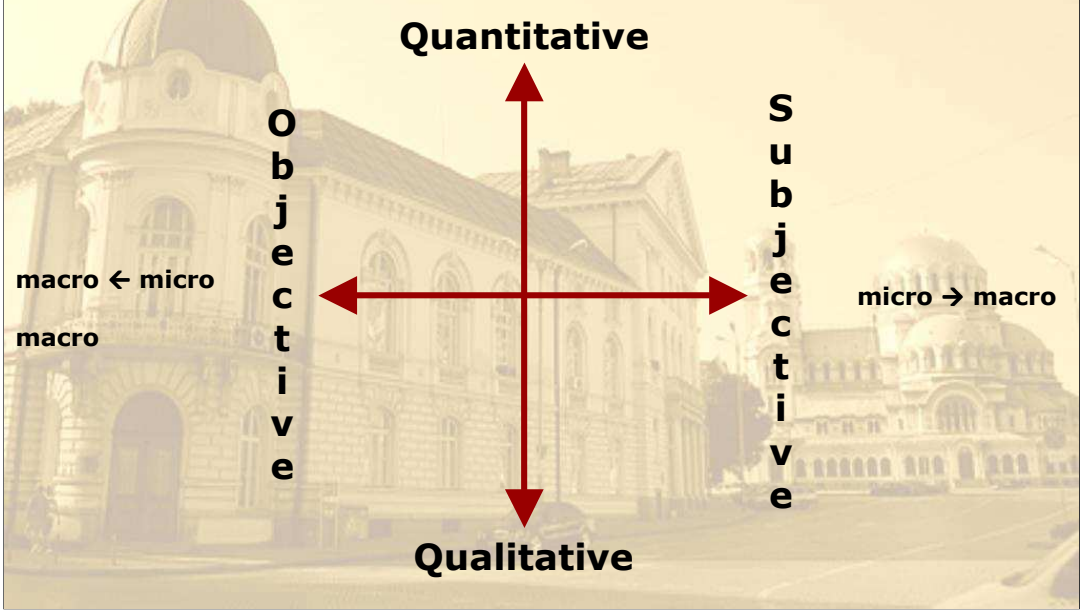
Defining the conceptual framework. Different conceptual frameworks can be identified in order to measure social phenomena.

Generally, a **comprehensive approach** is needed allowing objective information – with reference to micro-individual level and macro-societal level – and subjective information to be integrated.

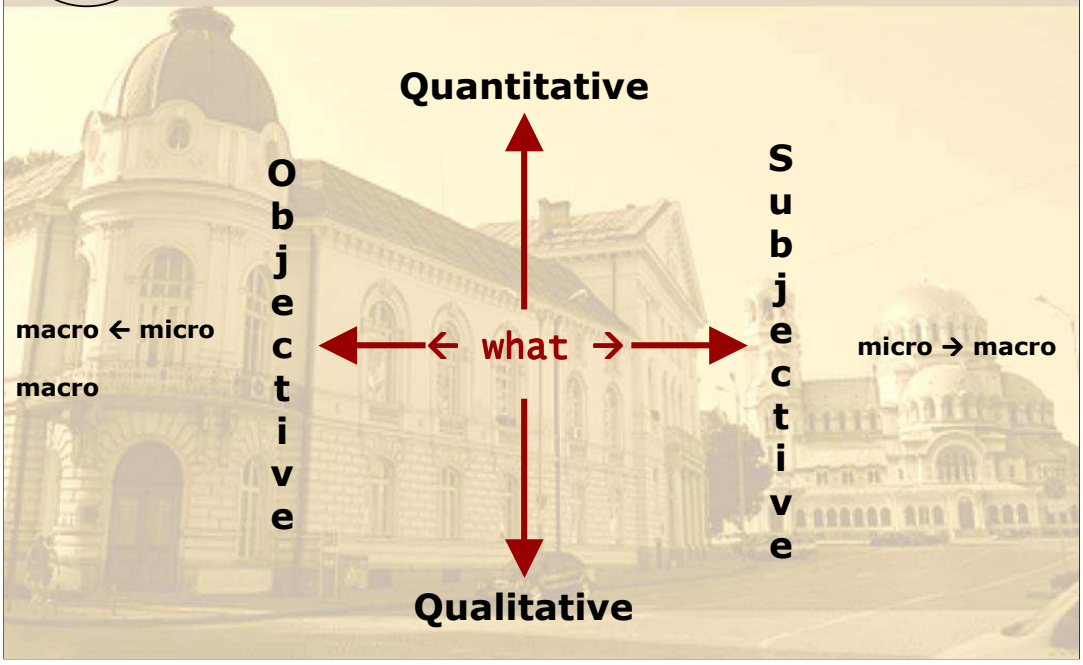
The possibility to integrate objective and subjective information requires a solid methodological structure as a consequence of a clear theoretical construction assuming the correct perspective of integration. This means that the methodological structure for integration is based upon a clear conceptual framework able to depict

- a shared definition of the two perspectives and of their relationships
- a conceptual perspective of integration that takes into account the complexity of the observed reality.

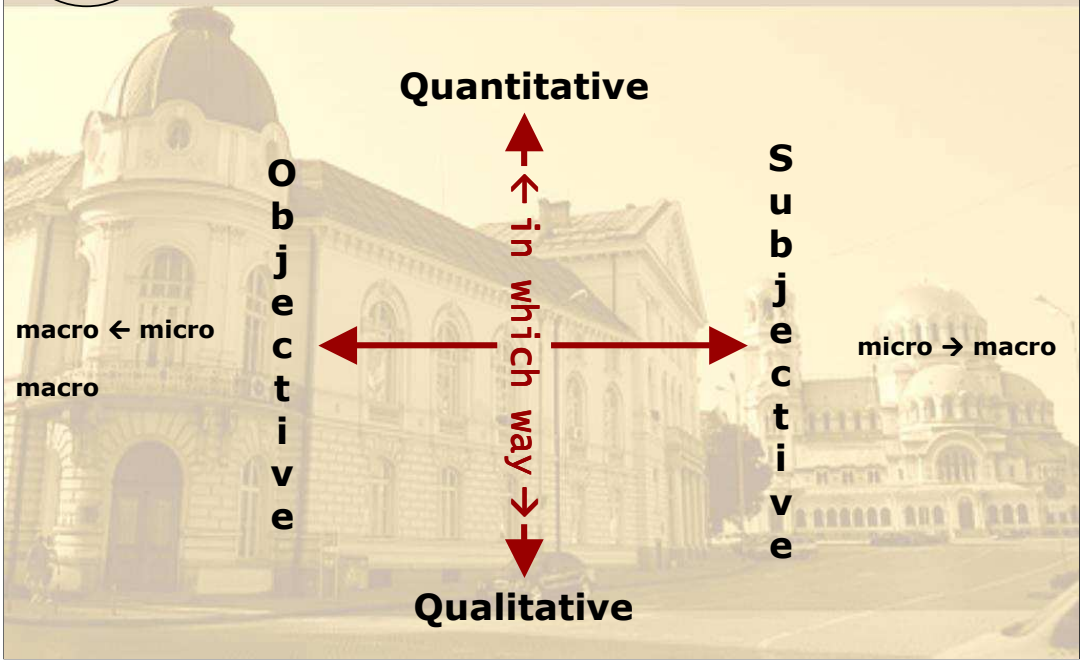
Defining the conceptual framework



Defining the conceptual framework



Defining the conceptual framework



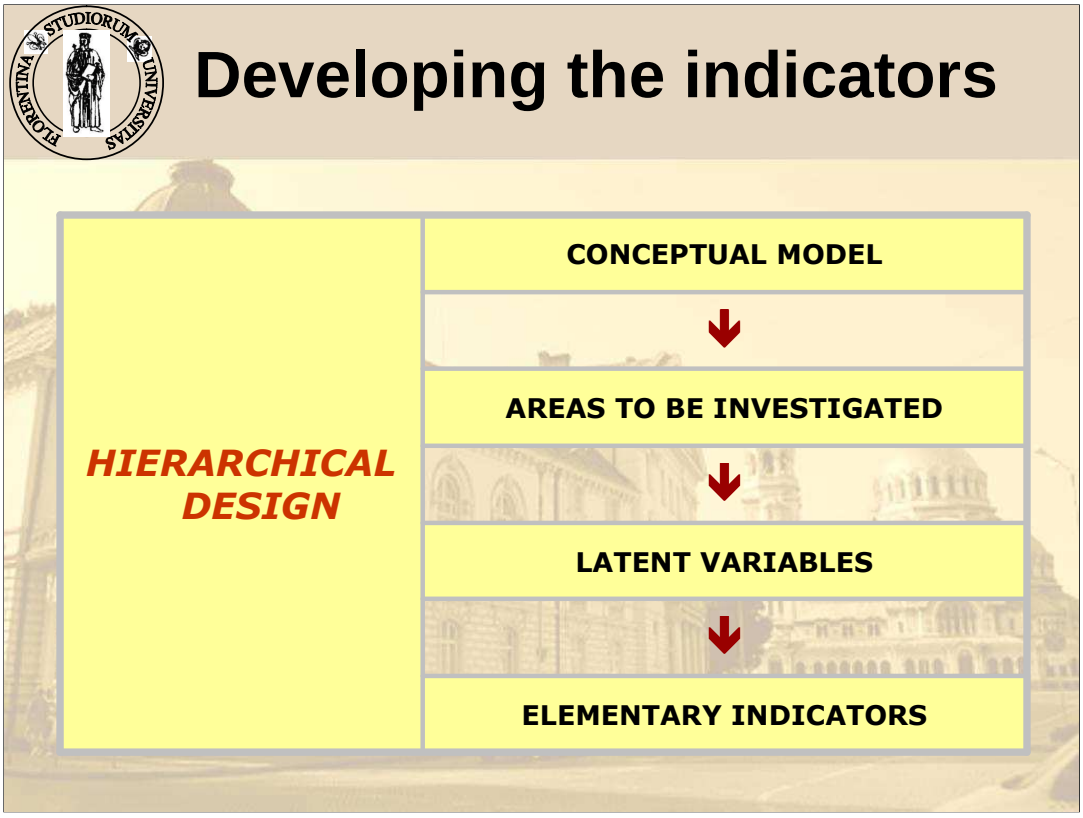
2.

Defining the conceptual framework

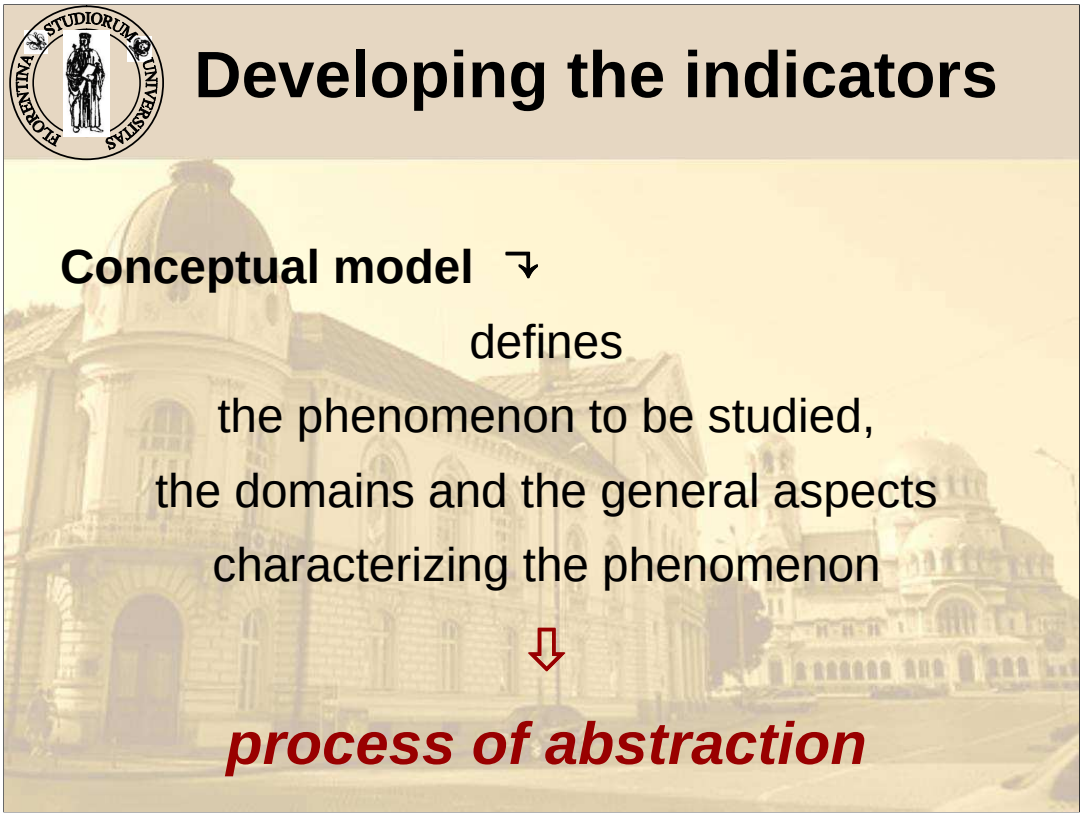
Developing the indicators

Managing the complexity

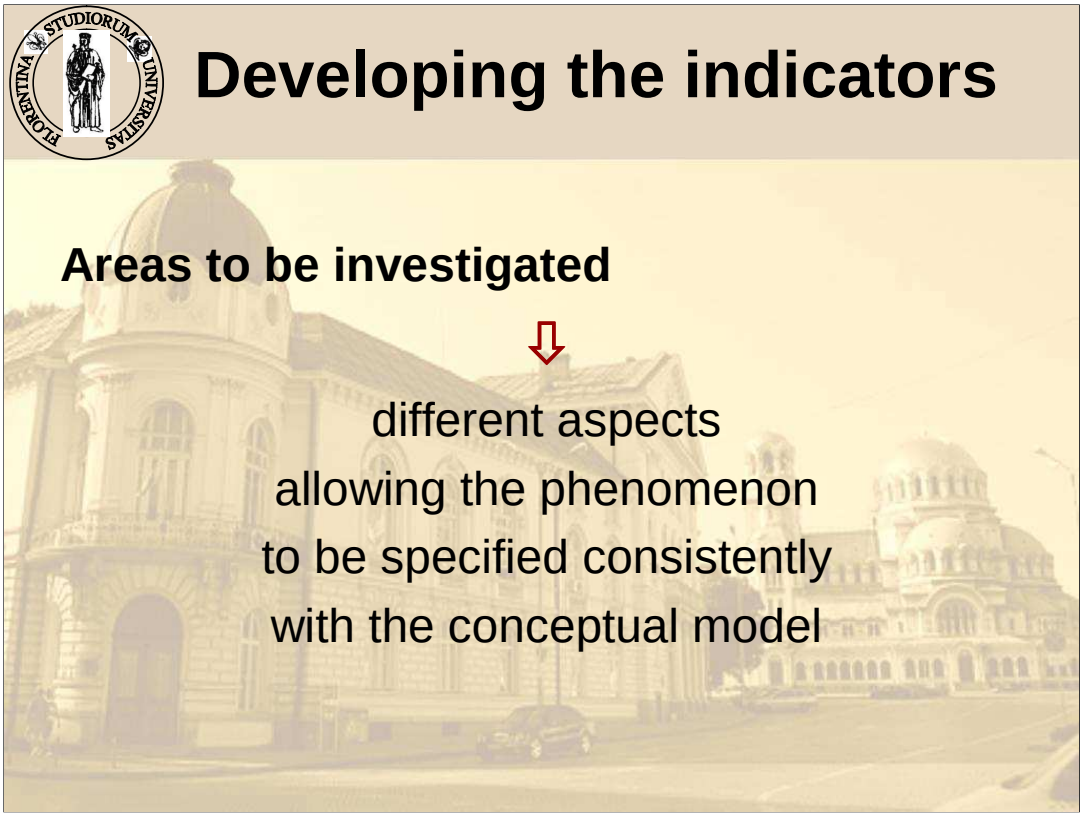
Framing the complexity



Developing the indicators. Indicators should be developed through a **logical modeling process** conducting from concept to measurement. The process leads in adequately defining the perspectives allowing the complexity of the observation to be managed.



The definition of the conceptual model represents a process of abstraction, a complex stage that requires the identification and definition of theoretical constructs that have to be given concrete references of applicability. In social sciences, the description of concepts varies according to (i) the researcher's point of view, (ii) the objectives of the study, (iii) the applicability of the concepts, (iv) the socio-cultural, geographical, historical context. Concerning this, we can refer to concepts like health, education, well-being, income, production, trade, etc.



The areas (in some cases named “pillars”) define in general terms the different aspects that allow the phenomenon to be clarified and specified consistently with the conceptual model. The process of defining areas can be long and exacting, especially with complex constructs, and requires an analysis of literacy review.

Developing the indicators

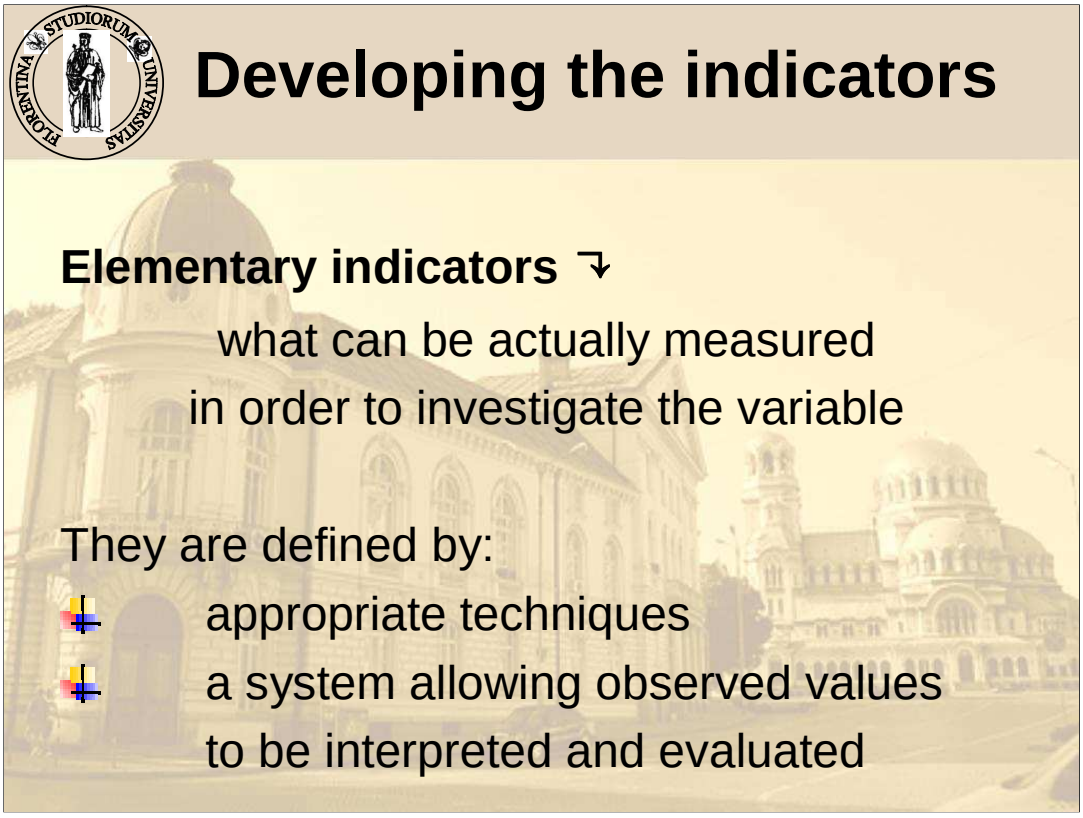
Latent variables ↴

elements to be observed
in order to define
the corresponding area

Their definition requires:

- theoretical assumptions (dimensionality)
- empirical statements

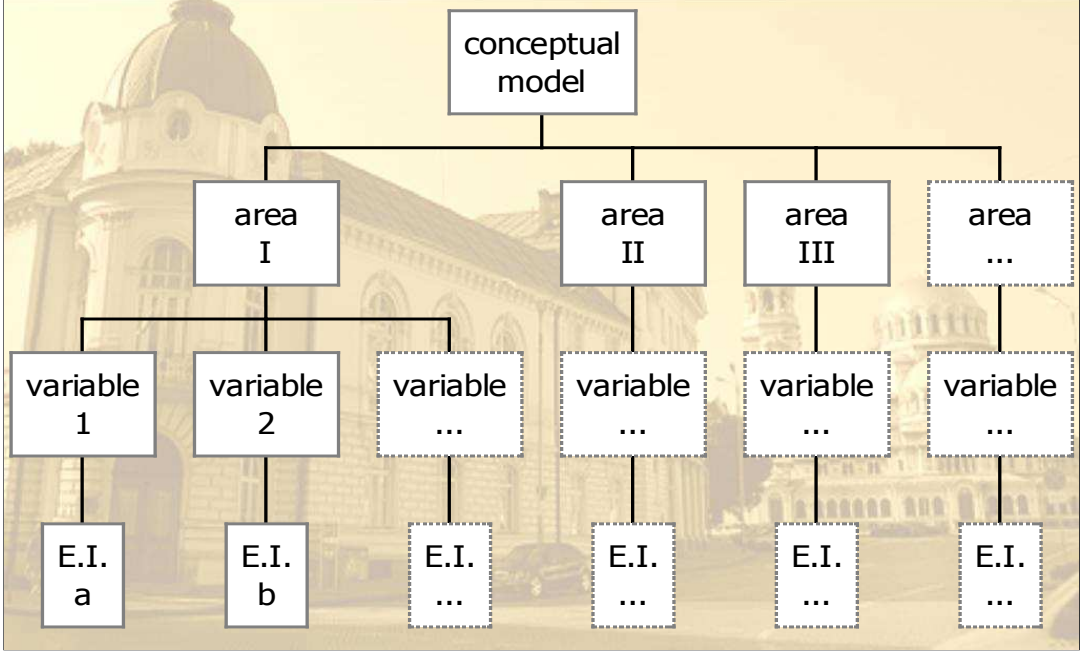
Each variable represents one of the aspects to be observed and confers an explanatory relevance onto the corresponding defined area. The identification of the latent variable is founded on theoretical assumptions (e.g. homogeneity, dimensionality) and empirical statements so that the defined variable can reflect the nature of the considered phenomenon consistently with the conceptual model.



Each elementary indicator (item, in subjective measurement) represents what can be actually measured in order to investigate the corresponding variable. This means that each observed element represents not a direct measure of the variable but an **indicator**[1] of the reference variable (DeVellis, 1991). The hierarchical process allows a meaningful and precise position to be attributed to the indicator inside the model. In other words, each indicator takes on and gains its own meaning, and consequently can be properly interpreted because of its position inside the hierarchical structure: each indicator represents a distinct component of the phenomenon within the hierarchical design. The possibility to define and to consider alternative forms for each indicator, has to be evaluated.

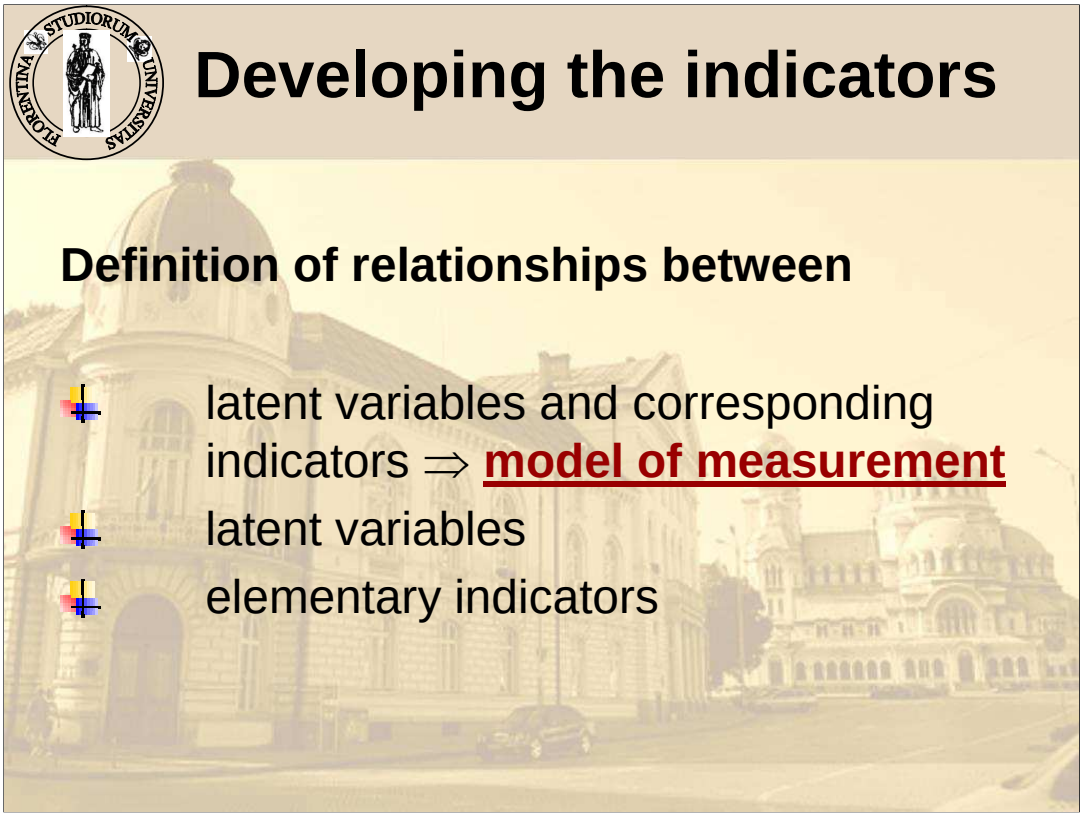
[1] In data analysis, indicators/items are technically defined “variables”; consequently, these are conceptually different from “latent variables”.

Developing the indicators



Developing the indicators

COMPONENT	THE QUESTION TO WHICH THE COMPONENT GIVES AN ANSWER	DEFINITION OF THE COMPONENT
CONCEPTUAL MODEL	Phenomena to be studied	The conceptual model defines the **phenomena** to be studied and the domains and the general aspects that characterize the phenomena
AREAS/PILLARS TO BE INVESTIGATED	Aspects defining the phenomenon	Each area represents each **aspect** that characterizes and defines the theoretical model
LATENT VARIABLES	Elements to be observed	Each variable represents each **element** that has to be observed in order to define the corresponding area. The variable is named **latent** since is not observable directly
ELEMENTARY INDICATORS (E.I.)	In which way each element has to be measured	Each indicator (item, in subjective measurement) represents **what is actually measured** for each variable and is defined by appropriate techniques and by a system that allows observed value to be evaluated and interpreted.



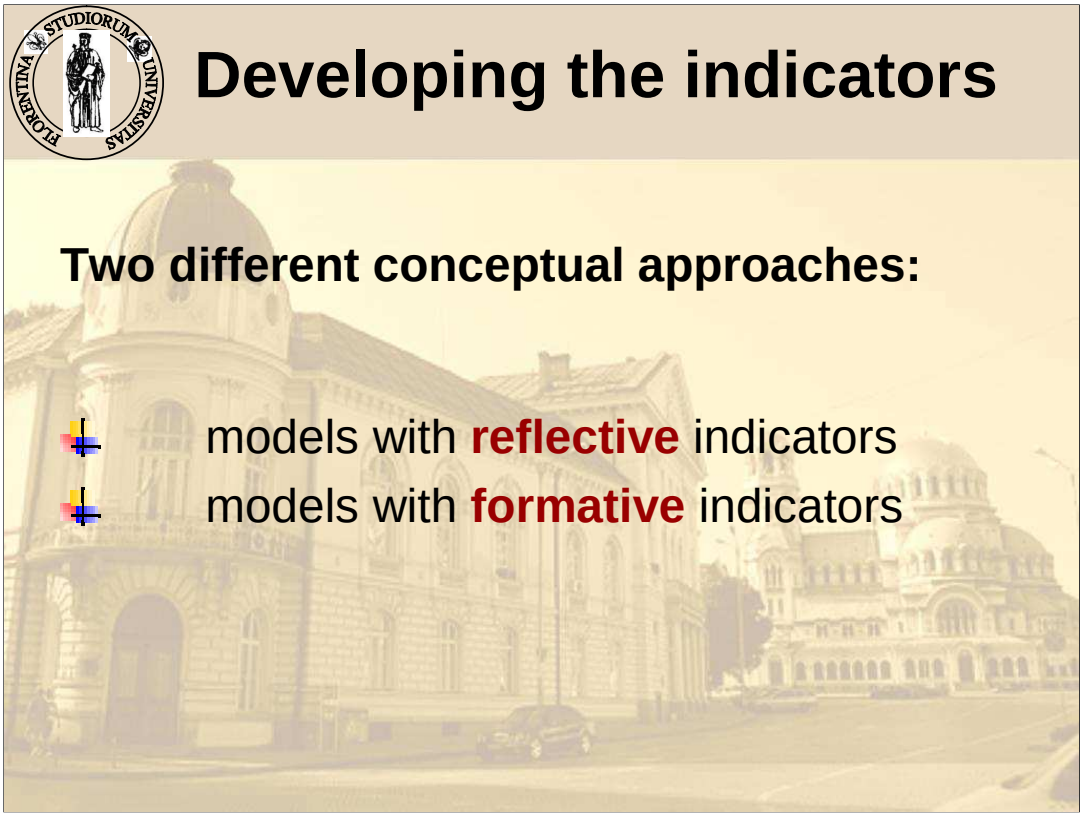
A further component of the hierarchical design definition is represented by the relationships between:

• *Latent variables and the corresponding indicators*: these relations define the **measurement model**, which will be discussed below. Consistently with the measurement model, also the relationship between the *elementary indicators* should be defined In this perspective, two different states can be identified:

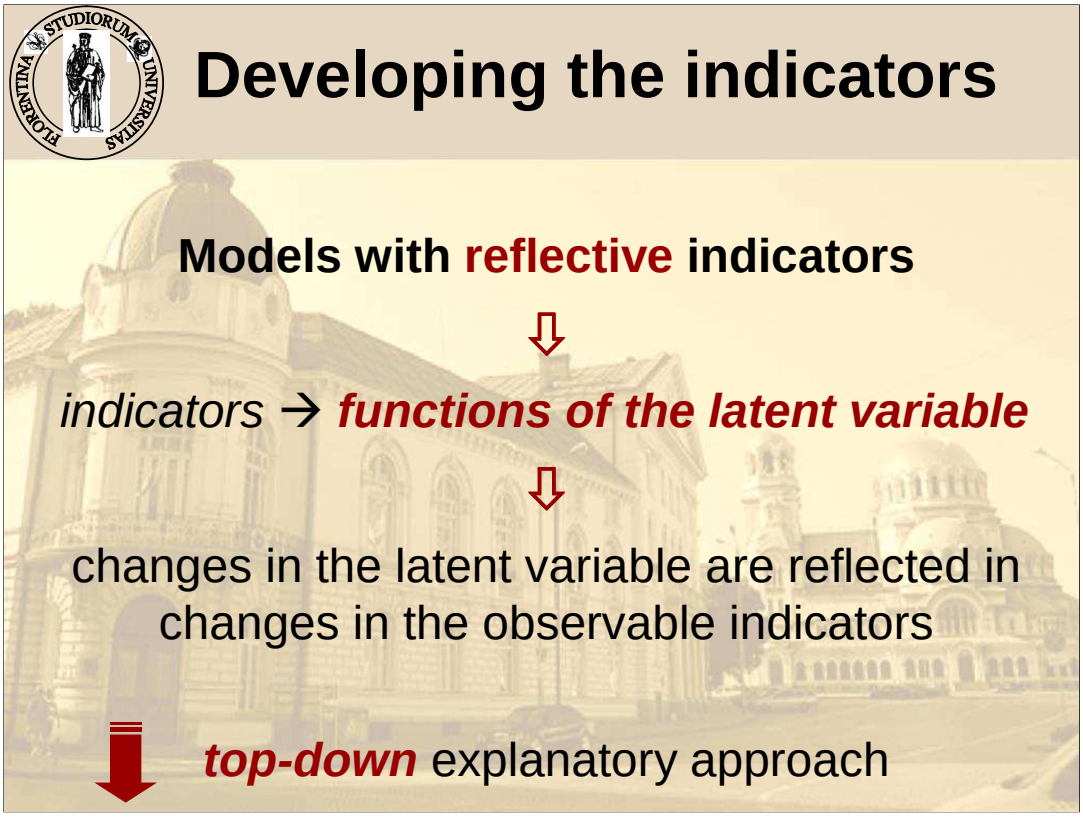
  o indicators are related to each other and relate to the same latent variable (in other words, they contribute to the definition of same variable); in these cases, the indicators are called *constitutive*;

  o indicators are not related to each other and relate to different latent variables; in this case, the indicators are called *concomitant*.

• *Latent variables* for a given area: these relations are defined in the ambit of the conceptual model and identify the structural pattern (**relating model**). Defining these relationships is crucial, for example, in the perspective of integrating objective and subjective information.



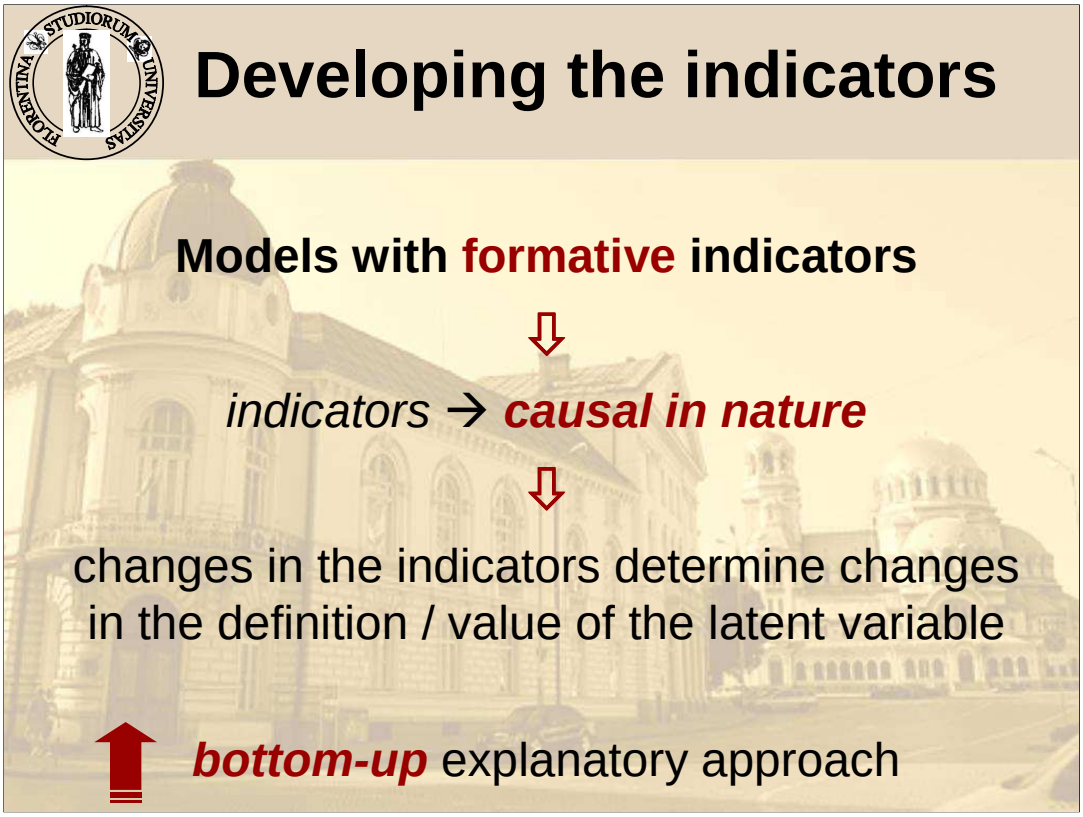
The measurement model can be conceived through two different conceptual approaches



Models with reflective indicators (referring to the *top-down* explanatory approach). In this case, latent constructs are measured by indicators assumed to be *reflective* in nature. In other words, the indicators are seen as functions of the latent variable, whereby changes in the latent variable are reflected (i.e. manifested) in changes in the observable indicators.[1]

Structural relationships are identified among latent constructs by statistically relating covariation between the latent constructs and the observed variables or indicators, measuring these latent, unobserved constructs. If variation in an indicator X is associated with variation in a latent construct Y, then exogenous interventions that change Y can be detected in the indicator X. Most commonly this relationship between construct and indicator is assumed to be *reflective.* That is, the change in X is a reflection of (determined by) the change in the latent construct Y. With reflective (or *effect*) measurement models causality flows from the latent construct to the indicators.

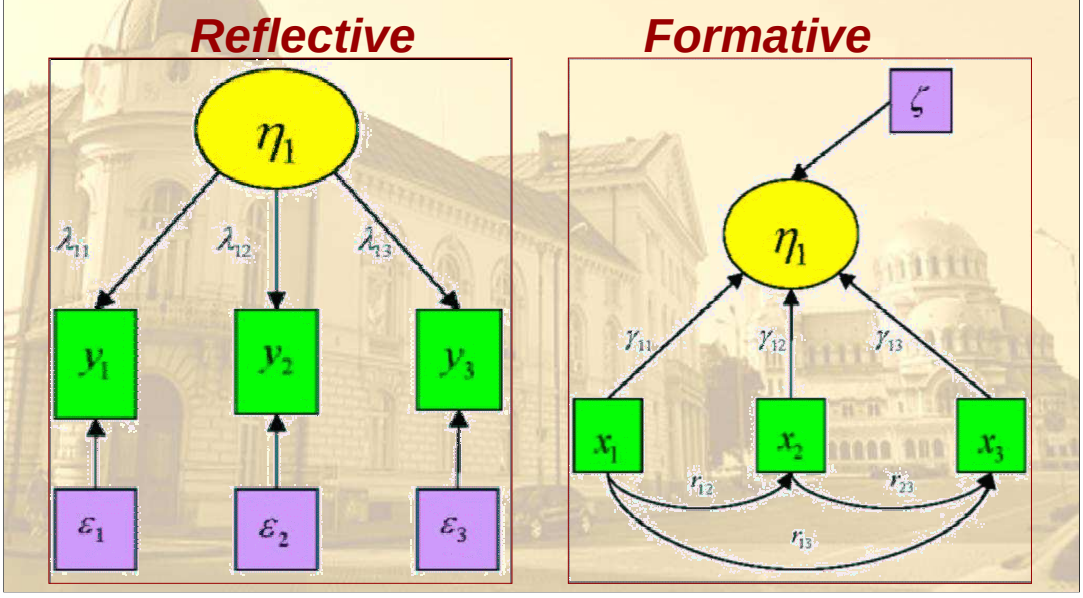
[1] As pointed out, the proposed model is conceptually related to latent structural models that find analytical solutions through the application of the structural equations method (Asher, 1983; Bartholomew, 1999; Blalock, 1964, 1974; Bohrnstedt and Knocke, 1994; Lazarsfeld & Henry, 1968; Long, 1993a, 1993b; Maggino, 2005; Netemeyer et al., 2003; Saris, 1990; Sullivan, 1981; Werts, 1974).



Models with formative indicators (referring to the *bottom-up* explanatory approach). In this case, indicators are viewed as causing – rather than being caused by – the latent variable. The indicators are assumed to be *formative* (or causal) in nature. Changes in formative indicators, as firstly introduced by Blalock (1964), determine changes in the value of the latent variable. In other words, a construct can be defined as being determined by (or *formed* from) a number of indicators. In this case, causality flows from the indicator to the construct.

An example is socio-economic status (SES), where indicators such as education, income, and occupational prestige are items that cause or form the latent variable SES. If an individual loses his or her job, the SES would be negatively affected. But to say that a negative change has occurred in an individual's SES does not imply that there was a job loss. Furthermore, a change in an indicator (say income) does not necessarily imply a similar directional change for the other indicators (say education or occupational prestige).

Developing the indicators



Traditionally, the reflective view is seen related to the development of scaling models applied especially (as we will see) in subjective measurement (*scale construction*), whereas the formative view is commonly seen in the development of *composite indicators* based on both objective and subjective measurements.

The distinction between formative and reflective measures is important because proper specification of a measurement model is necessary before meaning can be assigned to the relationships implied in the structural model.

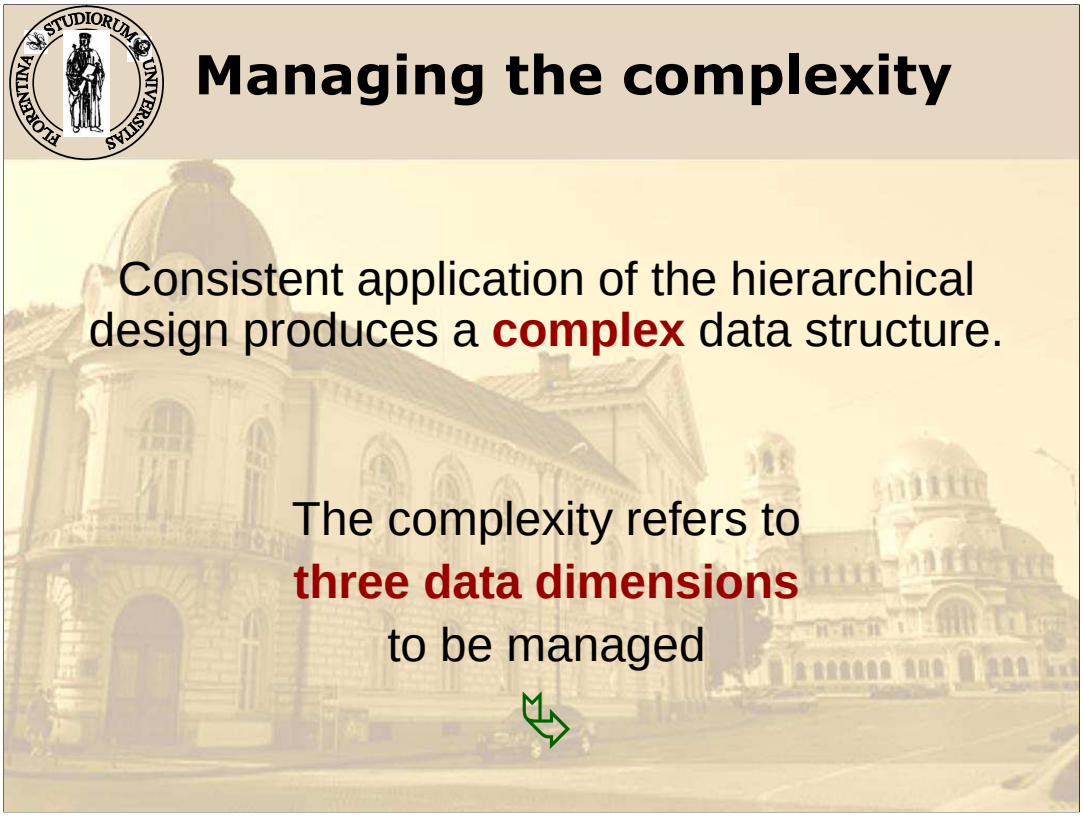
3.

Defining the conceptual framework

Developing the indicators

Managing the complexity

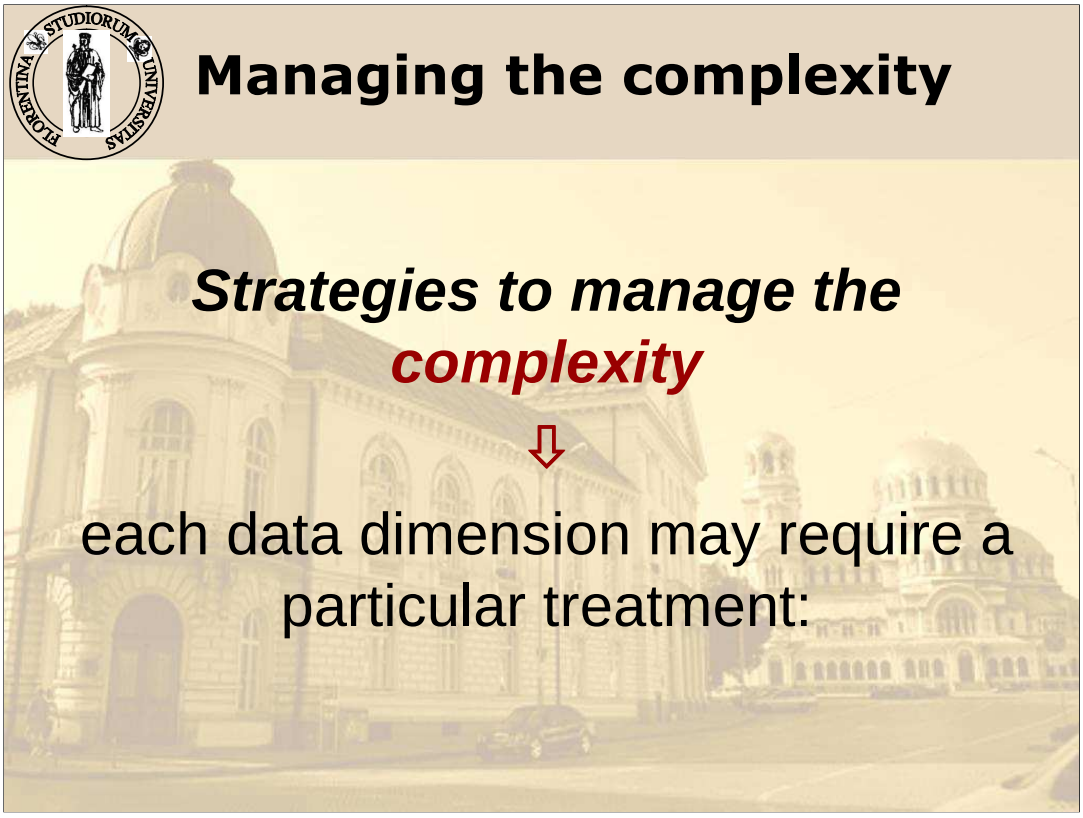
Framing the complexity



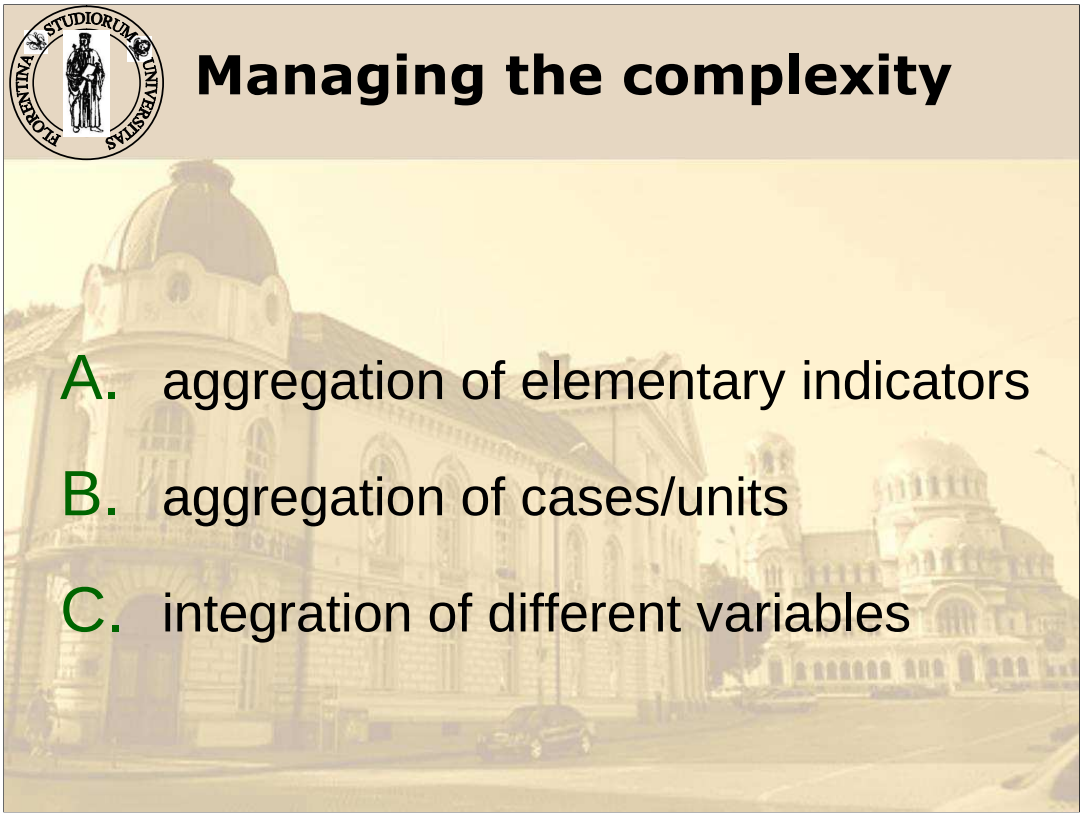
Managing the complexity. In order to manage the complexity of the obtained data structure aimed at integrating different elements (e.g. objective and subjective) a "composite" **analytical process**, defined by subsequent steps (MULTI-STAGES) and by different analytical approaches (MULTI-TECHNIQUES) is needed.

Managing the complexity

- ***Elementary Indicators***
  (several indicators for each variables)
- observed ***Cases/Units***
  (several units for each observation)
- ***Variables***
  (several variables are defined)



Consequently, the logical structure of data requires a complex organization and management, in which three corresponding data dimensions can be observed. In order to manage the complexity, each dimension may require a particular treatment, consistently with the conceptual model. In particular:



- elementary indicators may require to be aggregated in order to construct complex indicators (aggregation of elementary indicators)
- observed units may require to be aggregated in macro-units
- defined variables may require to be analysed through particular analytical approaches aimed at relating them in a comprehensive model.

Managing the complexity

Stage	Perspectives		Level of analysis	Analytical issues
i	**Aggregating elementary indicators**	Creation of complex indicators by aggregating elementary indicators	From elementary indicators to complex indicators	• Reflective approach → synthetic indicators • Formative approach → composite indicators
⇩				
ii	**Relating variables**	Understanding relationships between characteristics in order to integrate / merge information (e.g. objective and subjective)	Micro level	Different solutions (consistently with conceptual framework)
⇩				
iii	**Aggregating observed units**	Creation of macro-units by aggregating elementary units	From micro units to macro units	Following - homogeneity criterion - functionality criterion
⇩				
iv	**Relating variables**	Understanding relationships between characteristics in order to integrate / merge information (e.g. objective and subjective)	Macro level	Different solutions (consistently with conceptual framework)

In particular, four stages can be identified in order to define the procedure:

1. aggregating elementary indicators, according to the reflective or formative approaches (*construction of complex indicators)* at micro level

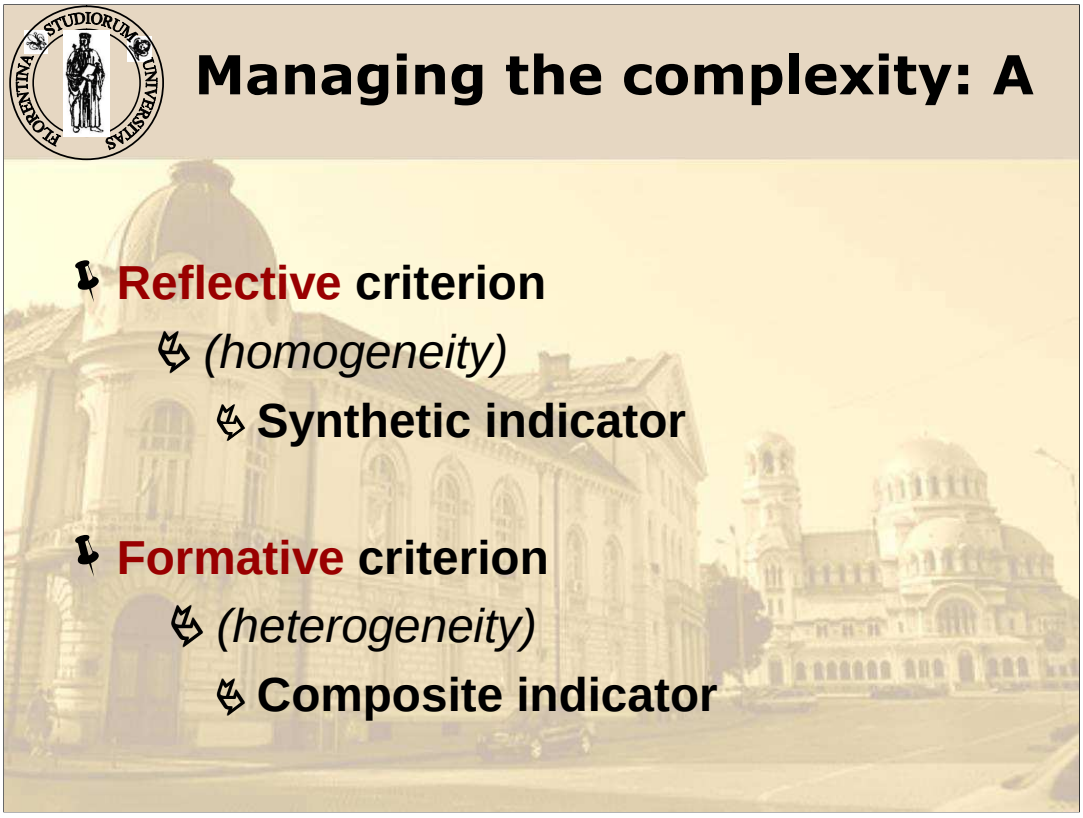
2. adequately relating variables by identifying the proper analytical approaches (e.g. integrating / merging objective and subjective indicators), consistently with the level of analysis (micro)

3. aggregating observed units (*definition of macro-units*) in order to lead the information observed at micro-level to the proper macro-level results; identifying the proper aggregation criterion should take into account the nature of measured characteristics (e.g. compositional, contextual, and so on) requiring different analytical approaches

4. adequately relating variables by identifying the proper analytical approaches (e.g. integrating / merging objective and subjective indicators), consistently with the level of analysis (macro)

In order to better manage the complexity of the measured data, analytical models are required providing for significant data aggregations at different levels in order to ensure correct and different comparisons, transversal (between groups, regions) and longitudinal at both micro and macro levels.

In other words, the complexity of this structure can be reduced by defining and applying additional models. The purpose of these models is – through the definition and adoption of particular assumptions – to condense and synthesize the dimension by referring to the *multiple measures*.



The construction of complex indicators should be consistent with the adopted measurement model. In this context, the traditional distinction between formative and reflective is particular important since aggregation of indicators has to be consistently accomplished. In other words, indicators can be aggregated into complex structure through a consistent methodology according to two different criteria:

- *Reflective criterion* (homogeneity), which can be adopted when the elementary indicators to be aggregated refer to the same latent variable; in this case, the condensed value is obtained by applying an appropriate scaling model that can produce a synthetic indicator.
- *Formative criterion* (heterogeneity), which can be adopted when the aggregation is obtained by indicators (elementary and/or synthetic) that are not necessarily related to each other (in a statistic sense); in this case the aggregated indicator is obtained by applying the appropriate index construction procedure. The aggregated indicator is named composite indicator; in particular cases, the composite indicator is called comprehensive/summary indicator when constructed with the intention of being exhaustive with reference to a certain construct or reality.

In both cases, the condensation of elementary indicators, considered multiple measures, produces new synthetic values. Each synthetic indicator tries to re-establish the unity of the described concept described by the corresponding latent variable.

Managing the complexity: A

Reflective approach

Properties of reflective indicators (Diamantopoulos & Winklhofer, 2001):

- indicator are interchangeable (the removal of an indicator does not change the essential nature of the underlying construct),
- correlations between indicators are explained by the measurement model,
- two uncorrelated indicators cannot measure the same construct (internal consistency),
- each indicator has error term,
- the measurement model can be estimated in the ambit of a larger model that incorporates effects of the latent variable.

Managing the complexity: A

- **Reflective approach**

assessment of reliability and validity

⇩

statistical approach

⇩

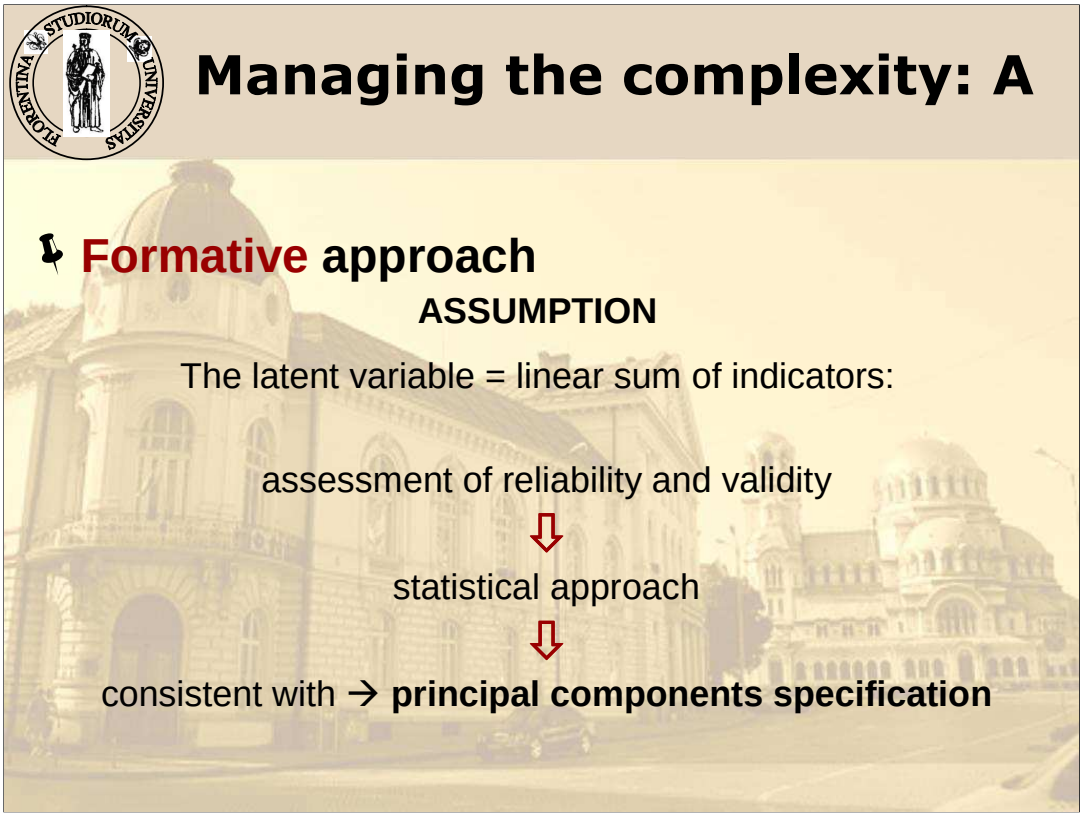
consistent with → **factor models**

Managing the complexity: A

Formative approach

Properties of formative indicators (Diamantopoulos & Winklhofer, 2001):

- indicator are not interchangeable (omitting an indicator is omitting part of the construct),
- correlations between indicators are not explained by the measurement model,
- two uncorrelated indicators can both serve as meaningful indicators of the same construct (internal consistency in not important),
- indicators do not have error terms



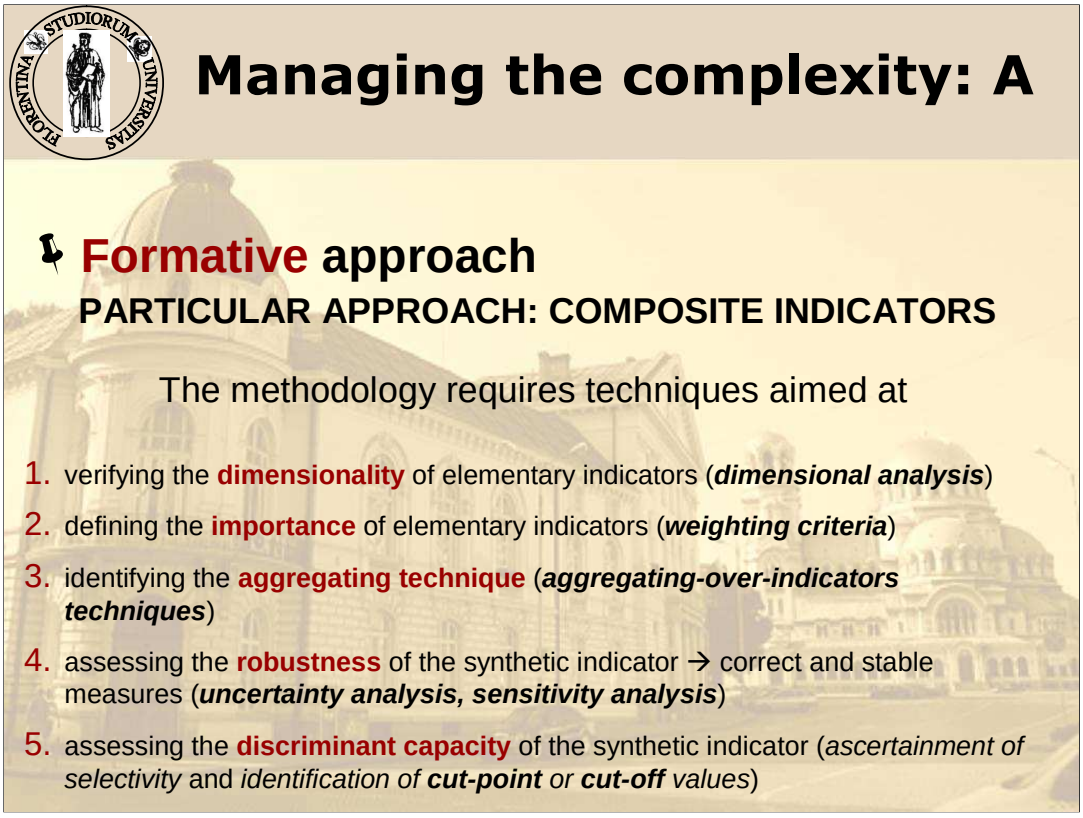
In defining the procedure, four critical issues must be considered (Diamantopoulos & Winklhofer, 2001):

- **Content specification**. It refers to the scope of the latent variable, the domain of content the composite indicator is intended to capture. In the ambit of formative model, content specification is inextricably linked with indicator specification.

- **Indicator specification**. Ideally, the indicators must cover the entire scope of the latent variable, previously described in terms of content. The exclusion of an indicator is possible but causes the risk of changing latent variable specification. However an excessive number of indicators is undesirable for difficulties in both data collection and data analysis (number of parameters to be estimated). This issue is particular important especially in aggregative perspective. The risk is that the defined elementary indicators would be implicitly substitutable. This risk leads to one of the one of the problems that could be faced in constructing composite indicators that is ***compensability***.

- **Indicator collinearity**. Excessive collinearity among indicators makes it difficult to separate the distinct influence of the individual indicator on the latent variable. Multicollinear indicators turn out to be redundant and may cause the exclusion of one of them.

- **External validity**. Since exploring the suitability of indicators can not be performed through the internal consistency perspective (which is typical of reflective approach), in order to assess the wellness measurement, the composite indicator can be related to other measures. The basic idea is, in other words, to explore the quality of individual indicators by relating each of them with another variable (external to the composite indicator): only the indicators significantly related to the variable of interest would be retained. This process should be supported by a solid theoretical background. Another approach is to include some reflective indicators and estimate a multiple indicators and multiple causes (MIMIC) model (Diamantopoulos & Winklhofer, 2001).



Elementary indicators defined through a formative approach can be summarized through a process aimed at constructing **composite indicators**. The obtained composite indicator synthesizes a number of values expressed by the indicators that compound it (Nardo et al., 2005; Sharpe & Salzman, 2004) and re-establishing the unity of the concept described in the hierarchical design. The aggregating process allows to obtain not a faithful description of the reality, but an "indication" that will be more or less accurate, meaningful, and interpretable depending on the defined hierarchical design and the applied methodology. In other words, the composite indicators are aimed at describing synthetically a reality, which is and remains complex.

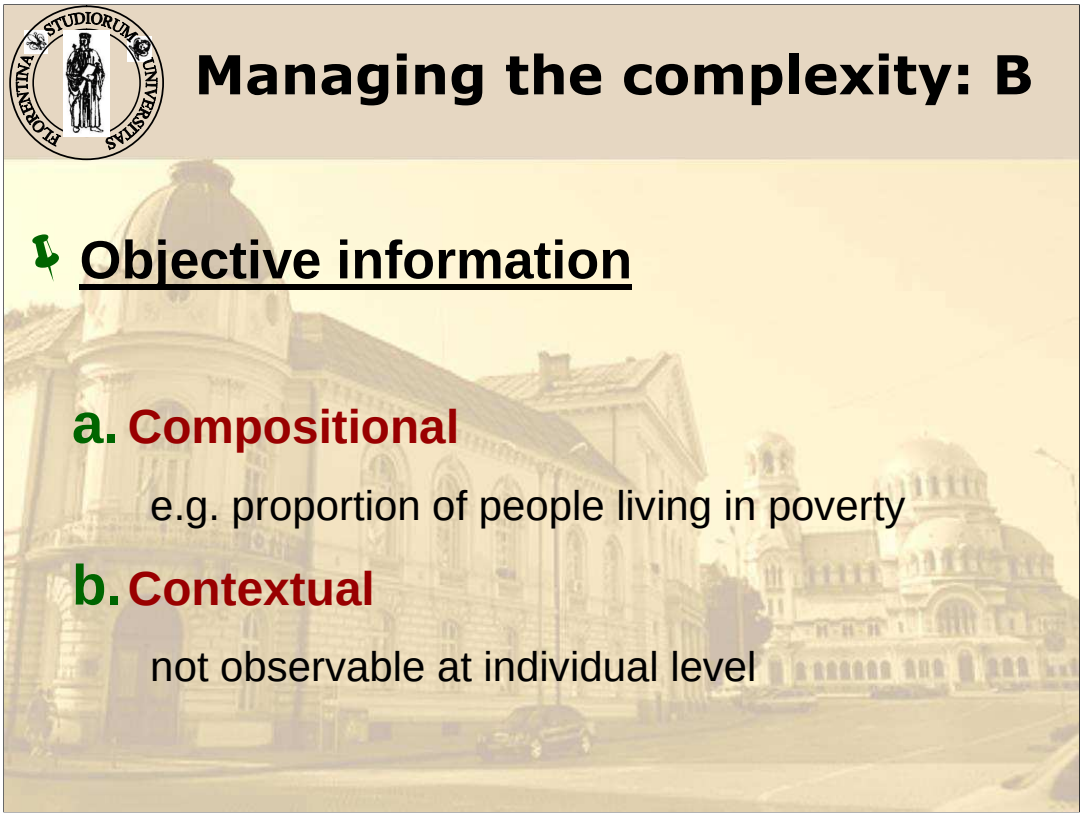
In order to pursue the goal of integration, we need to lead information to be analysed at the same level. This means that if the interest is to obtain a composite picture (e.g. national), the information collected at micro level needs to be in someway aggregated to the proper scales (spatial or temporal) in order to accomplish a correct analysis integrating objective and subjective data.

Managing the complexity: B

Aggregation of cases/units is required in order to lead information to be analysed at the same level

		LEVEL of observation	
		Micro	Macro
INFORMATION	objective	individual living conditions	population or territory information
	subjective	subjective well-being	*not observable*

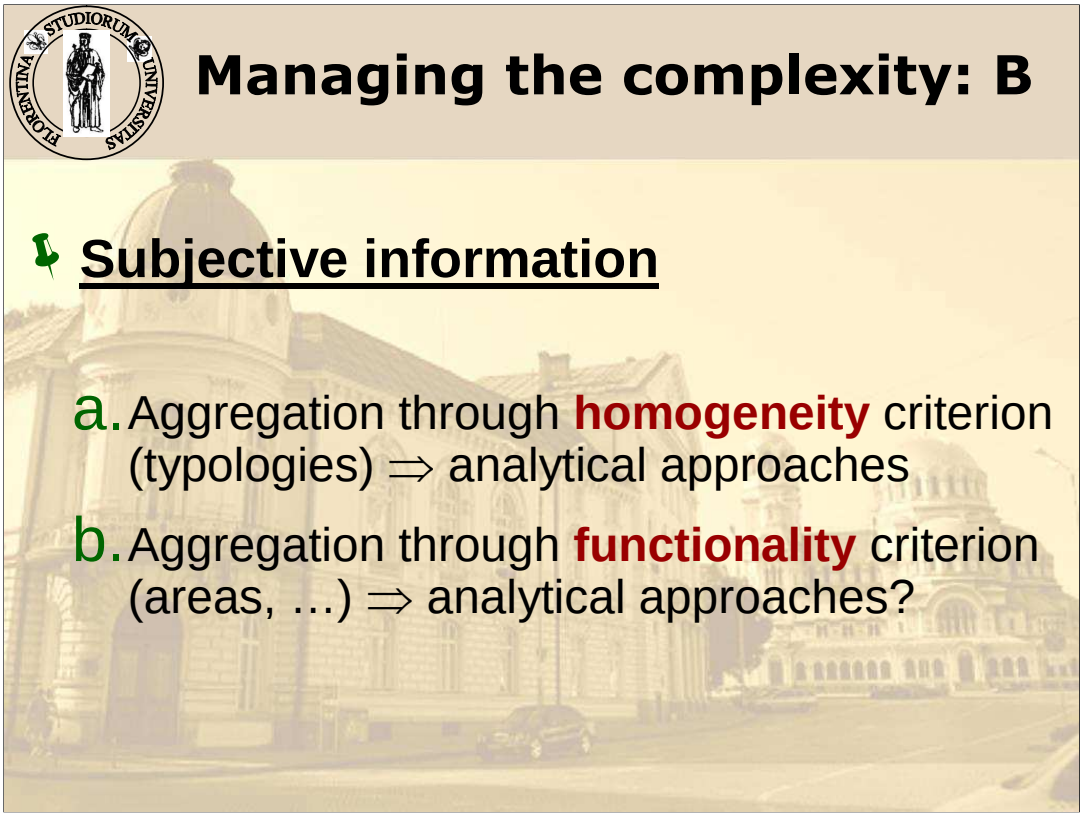
Actually, the problem of aggregation concerns the reduction/condensation of values observed at lower levels (usually, individuals) to higher levels (e.g. geographical areas) among which comparisons will be carried out. This problem involves both objective and subjective indicators, with different solutions.



The aggregation of objective information (observed at micro or macro level) to the proper scale can be obtained through different **criteria**

(i) “compositional”, when information refers to population (e.g. proportion of people living in poverty),

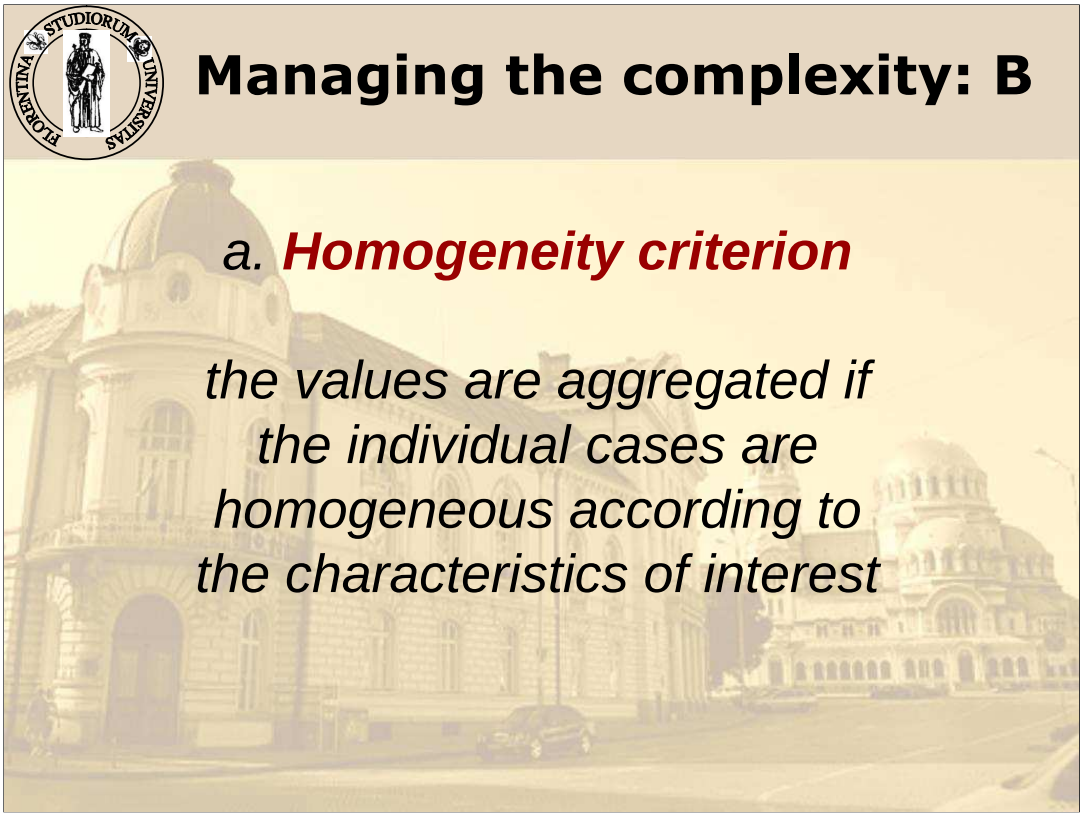
(ii) “contextual”, when information refers to area/territory (irreducible to the individual level), for example, income distribution, population density, or absence of facilities, such as supermarkets, libraries, or health centres.



The aggregation of subjective information requires individuals' values to be aggregated in order to produce new synthetic values to be assigned to new meaningful units identified according to different kind of scales (typologies, geographical areas, administrative territories, etc.). This task is not an easy one and requires different approaches and particular attention and concern.

This aggregation perspective is particularly delicate when the scores to be aggregated refer to characteristics that are non-cumulative (like those related to subjective well-being); consequently, ad-hoc aggregating approaches need to be identified, especially when individual values can not be aggregated by simply summing up individuals' values.

From the technical point of view, the condensing procedure requires to define significant aggregation units and to adopt techniques allowing the aggregation of individual scores (*aggregating criteria*). Two aggregating criteria can be defined.



A. Homogeneity: the values are aggregated if the individual cases are homogeneous according to the characteristics of interest. The aggregated units produced by this criterion are **typologies** which can be then compared with reference to contextual and background (objective) information; identification of typologies requires analytical approaches allowing homogeneous groups among individual cases to be identified (Aldenderfer, 1984; Bailey, 1994; Corter, 1996; Lis, 1977; Hair, 1998):

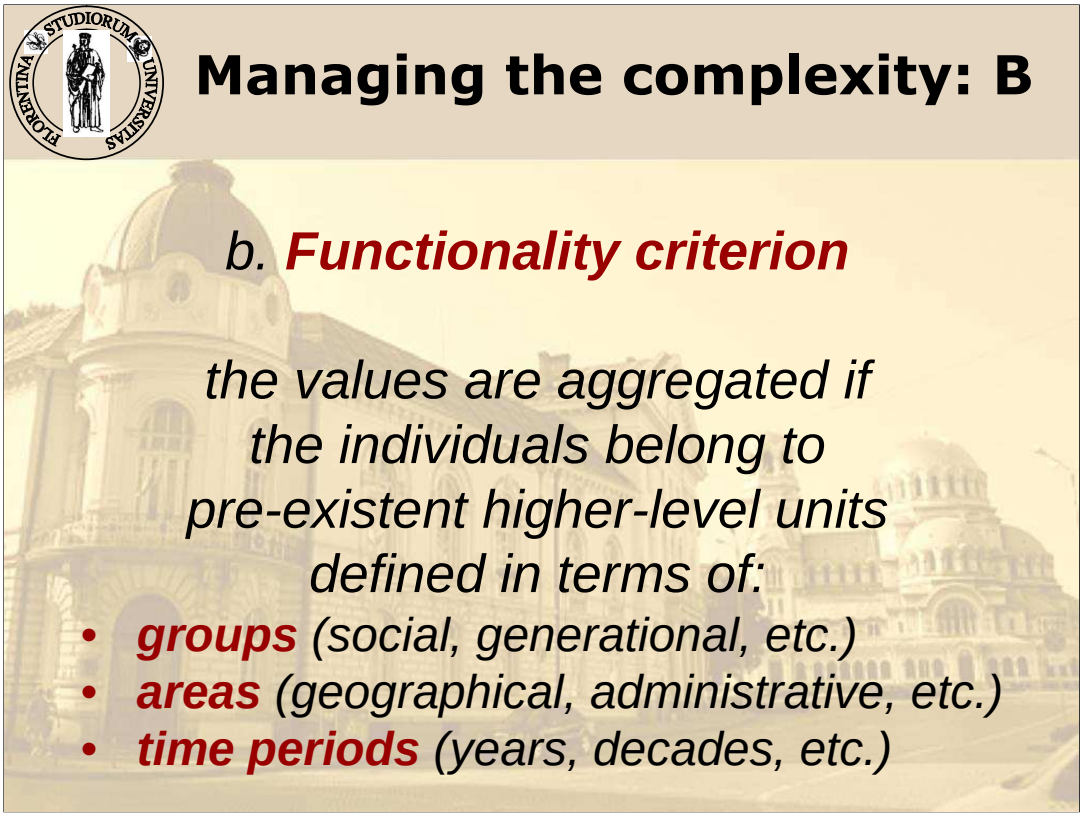
– ***segmentation analysis***, which can be conducted through different approaches (*Hierarchical Cluster Analysis, Q Analysis*);

- ***partitioning analysis***, which can be conducted through other approaches like *K Means Methods*, *Iterative Reclassification Methods*, *"Sift and Shift" Methods*, *Convergent Methods*;

– ***tandem analysis***, which is realized by combining Principal Components Analysis and a clustering algorithm; the latter is applied to the scores obtained by the application of the former.

The difficulty in applying this approach lies in the identification of synthetic scores that reveal themselves to be useless in identifying a cluster structure among observed units. In this perspective *Cluster Analysis* can also be combined with *MultiDimensional Scaling* (MDS) (Nardo et al., 2005a, 2005b).

– ***Factorial k-means Analysis***, which is realized by combining Principal Components Analysis and one of the *partitioning method* (*K Means method*, that is, *not-hierarchical Cluster Analysis*). A discrete clustering model and a continuous factorial one are simultaneously fitted to two-way data in order to identify the best partition of the objects. The partition is described by the best orthogonal linear combinations of the variables (factors) according to the least-squares criterion. This approach has great potentiality since it simultaneously allows two objectives to be reached: data reduction and synthesis, simultaneously in direction of both objects and variables. The factorial k-means



B. Functionality: the values are aggregated if the individuals belong to pre-existent higher-level units defined in terms of **groups** (social, generational, etc.), **areas** (geographical, administrative, etc.), **time periods** (years, decades, etc.).

If the subjective information is collected from a probabilistic sample, it is possible to take into account the weight that each sampled individual has with reference to the correspondent population by assigning a differential weight. The matter is dealt with statistical approaches related to inference methods and sampling techniques.

This kind of aggregation requires particular attention since the application of the traditional statistical averaging techniques does not allow us to highlight the distributional characteristics of each aggregated units, which consequently could not be correctly compared in order to avoid the well-known *ecological fallacy*.[1]

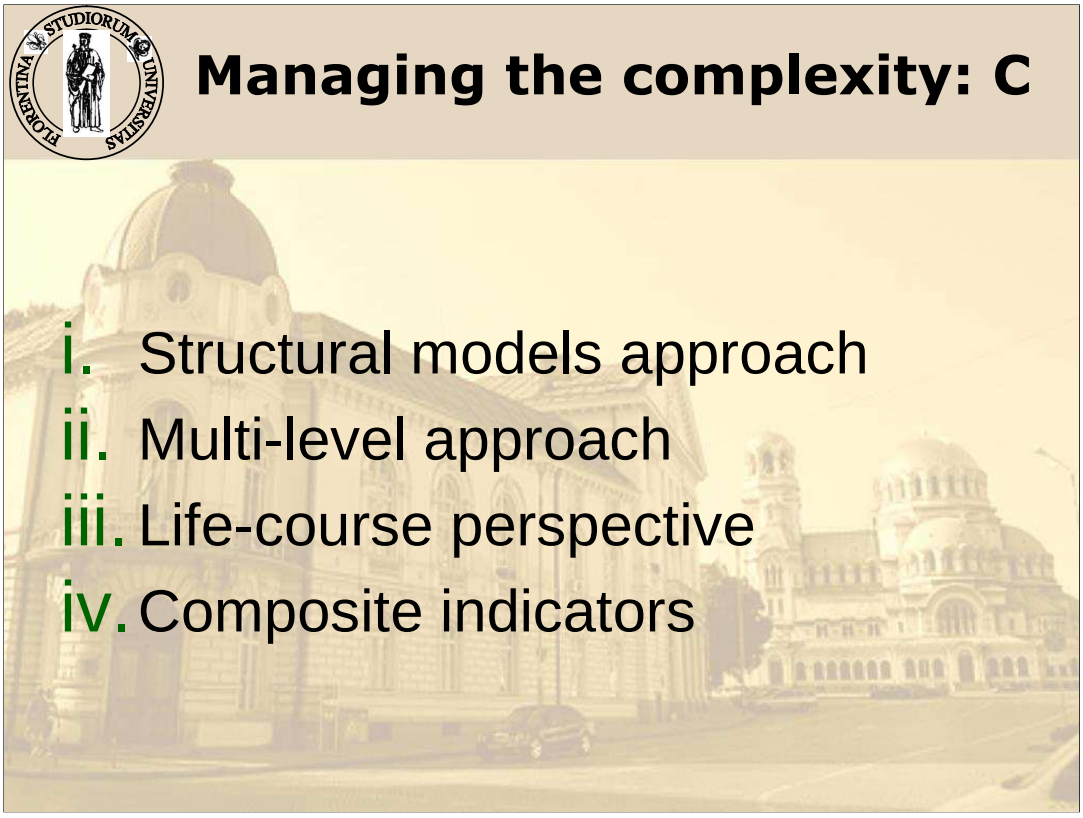
Regarding this issue, there are attempts aimed to weight average values by different criteria (Kalmijn & Veenhoven, 2005; Veenhoven, 2005).

[1] Aggregation of scores collected at micro levels is a well-known issue in many scientific fields, like economics and informatics, where particular analytic approaches are applied (like the probabilistic aggregation analysis). In econometric fields, particular empirical methodologies have been developed, allowing the explanation of systematic individual differences (*compositional heterogeneity*) that can have important consequences in interpreting aggregated values (Stoker, 1993).

Managing the complexity: C

Relating variables:

(at micro and macro level)



After having

- re-constructed the variables by aggregating elementary indicators according to the different and consistent approaches

- built macro-units by aggregating the micro-units (cases) in order to address information to the identified level of analysis,

the object is to assess the **relating model**, concerning the relationships, conceptually modelled and hierarchically designed, between variables.

In this perspective, a proper analytical approach should be identified according to the defined conceptual framework. The feasibility of the different statistical approaches needs to be considered by taking into account their specific assumptions. The goal is to identify a procedure able to yield results, not only statistically valid and consistent with reference to the defined conceptual framework, but also easy to be read and interpreted at policy level.

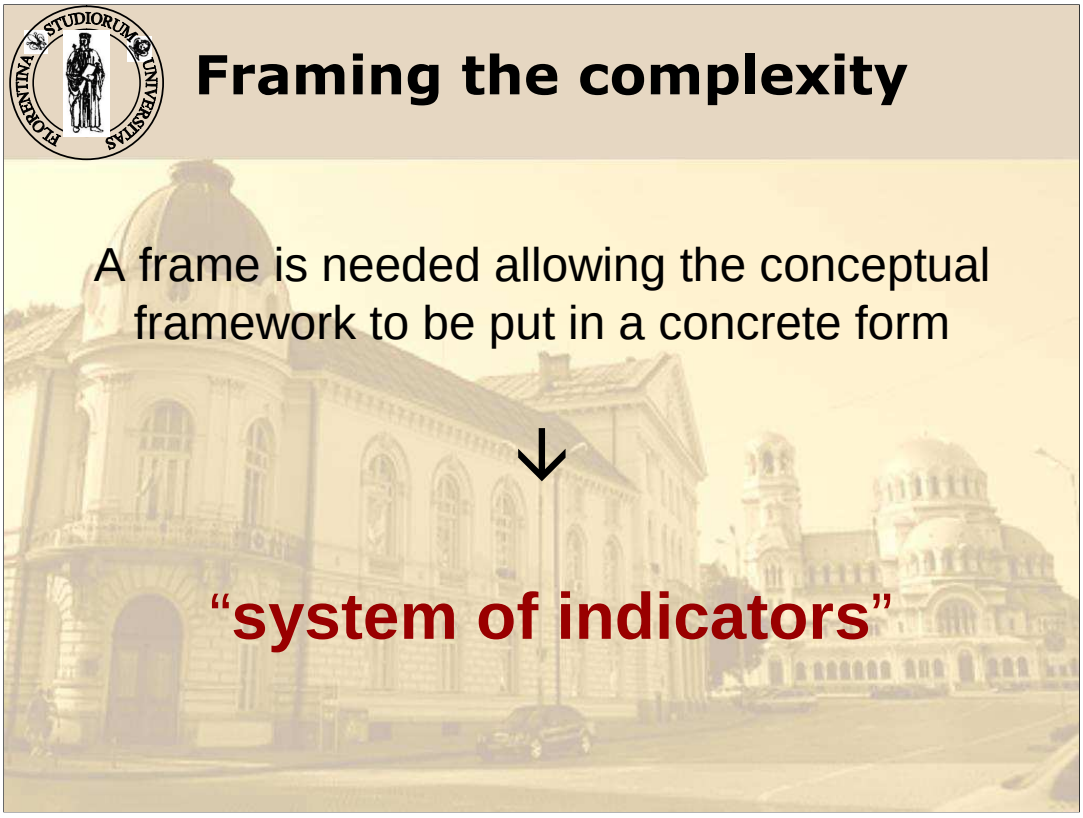
4.

Defining the conceptual framework

Developing the indicators

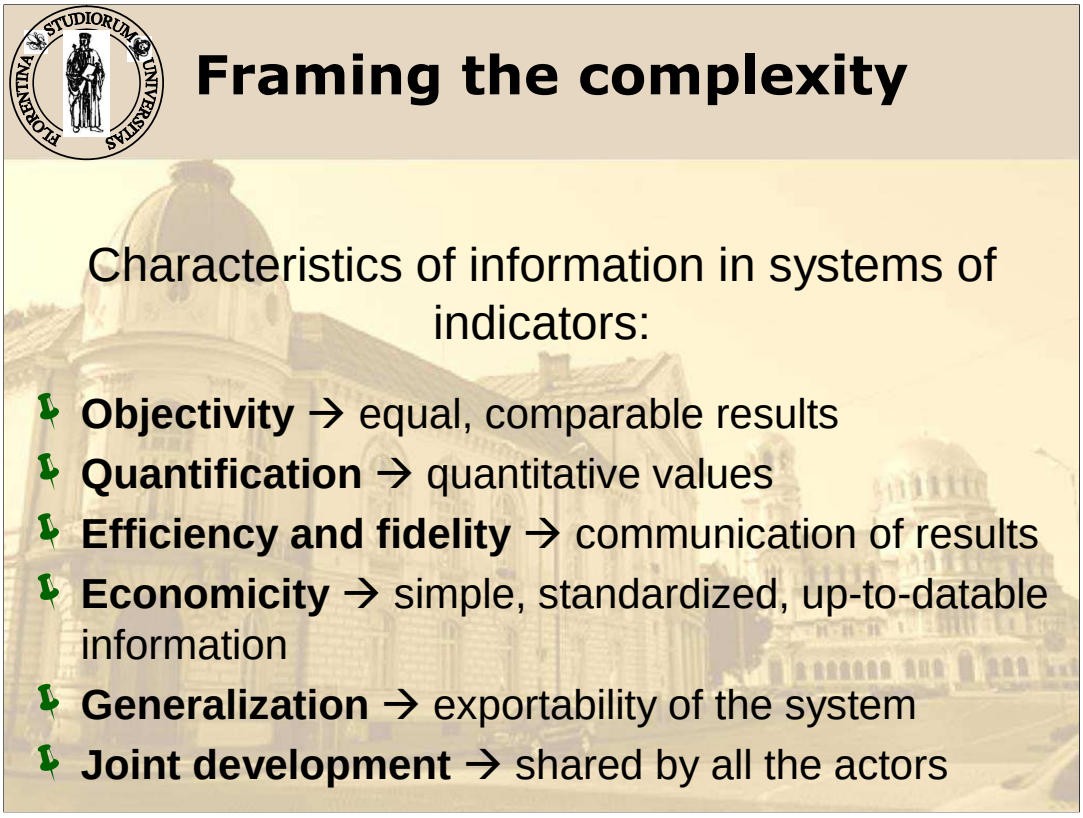
Managing the complexity

Framing the complexity



Framing the complexity. The previous analytical process helps in reducing the complexity. However, the obtained structure needs a frame allowing the conceptual framework to be put in a concrete form. This frame can be found in the “**system of indicators**” approach. This requires an effective organizational context relying on technological supports and allowing data to be managed. This requires structured and systematic data, observed in long-term longitudinal perspective[1]. This is particularly demanding with reference to subjective data, which require a great use of resources (apart from a solid survey research methodology).

[1] In fact, if the purpose were to study the phenomenon in predictive perspective, any observed data would need to be collected over sufficiently long periods to successfully capture or model the quality of life and develop an effective knowledge base.



A system of indicators can produce meaningful information if it presents the following characteristics of:

✉ **objectivity**: the results have to turned out to be equal or comparable, independently from who are the users;

✉ **quantification**: the system has to produce quantitative values – obtained through standardized procedures and measures. This allows results to be reported with more precision and detail, and data to be analysed through complex methods;

✉ **efficiency and fidelity**: methods, techniques and instruments that allowed data and results to be obtained have to be communicated and publicized,

✉ **economicity**: the system has to produce simple, standardized, available and up-to-datable information;

✉ **generalization**: the system has to allow its generalization to other similar context (exportability);

✉ **joint development**: the system has to be developed in a shared way by all the "actors".

Framing the complexity

A Functions of systems of indicators

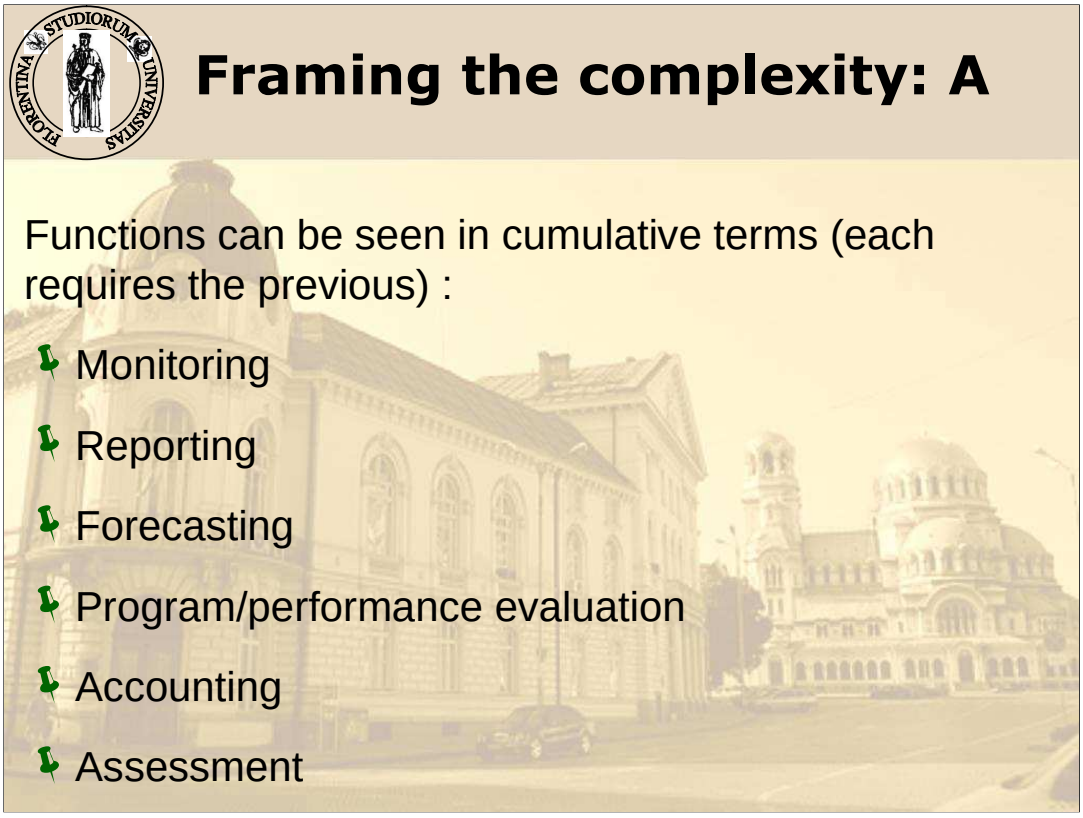
B Elements defining a system of indicators

C Characteristics of indicators within a system

Framing the complexity: A

A.

Functions of systems of indicators



Systems of indicators can be differentiated with reference to the function (Land, 2000; Noll, 1996; Berger-Schmitt & Noll, 2000) for which they have been created. The different functions can be seen in cumulative terms since each of them requires the previous one/s.

Framing the complexity: B

B.

Elements defining a system of indicators

Framing the complexity: B

Main elements

i. Aims
ii. Structure
iii. Analytical approaches
iv. Interpretative and evaluating models

Framing the complexity: C

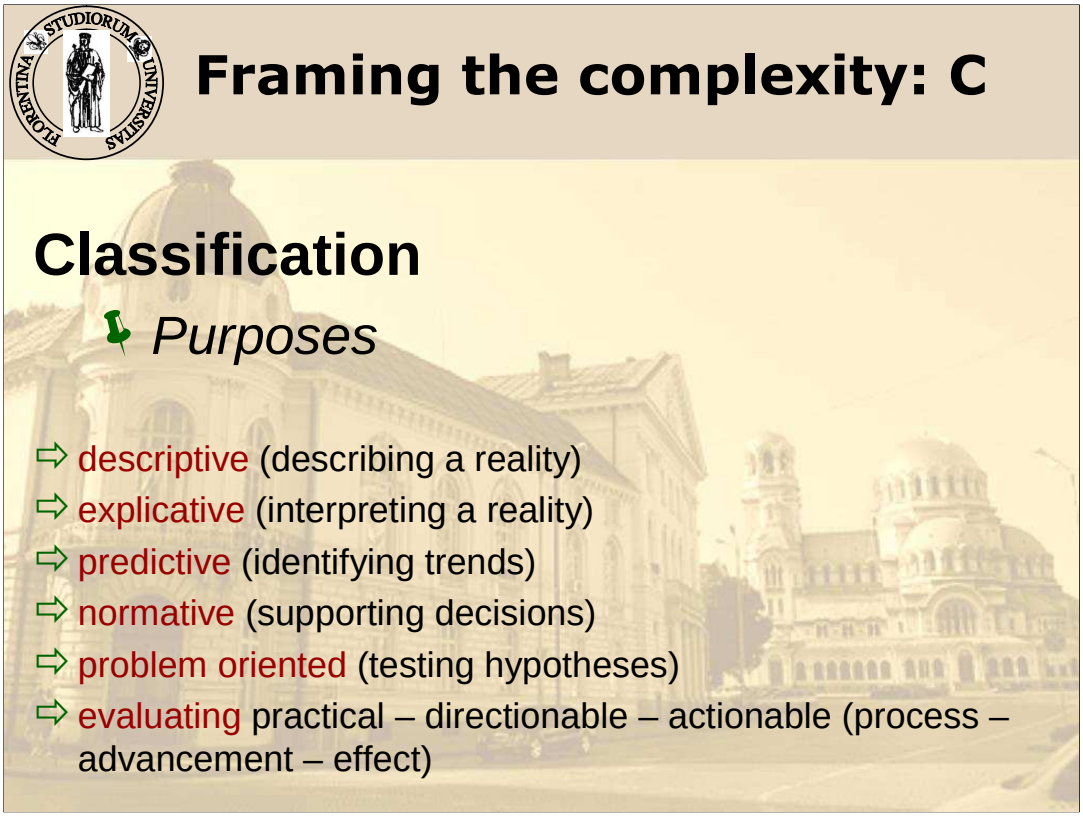
C.

Characteristics of indicators within a system

Framing the complexity: C

Classification

- *Purposes*
- *Governance contexts*
- *Perspectives of observation*
- *Forms of observation*
- *Levels of communication*

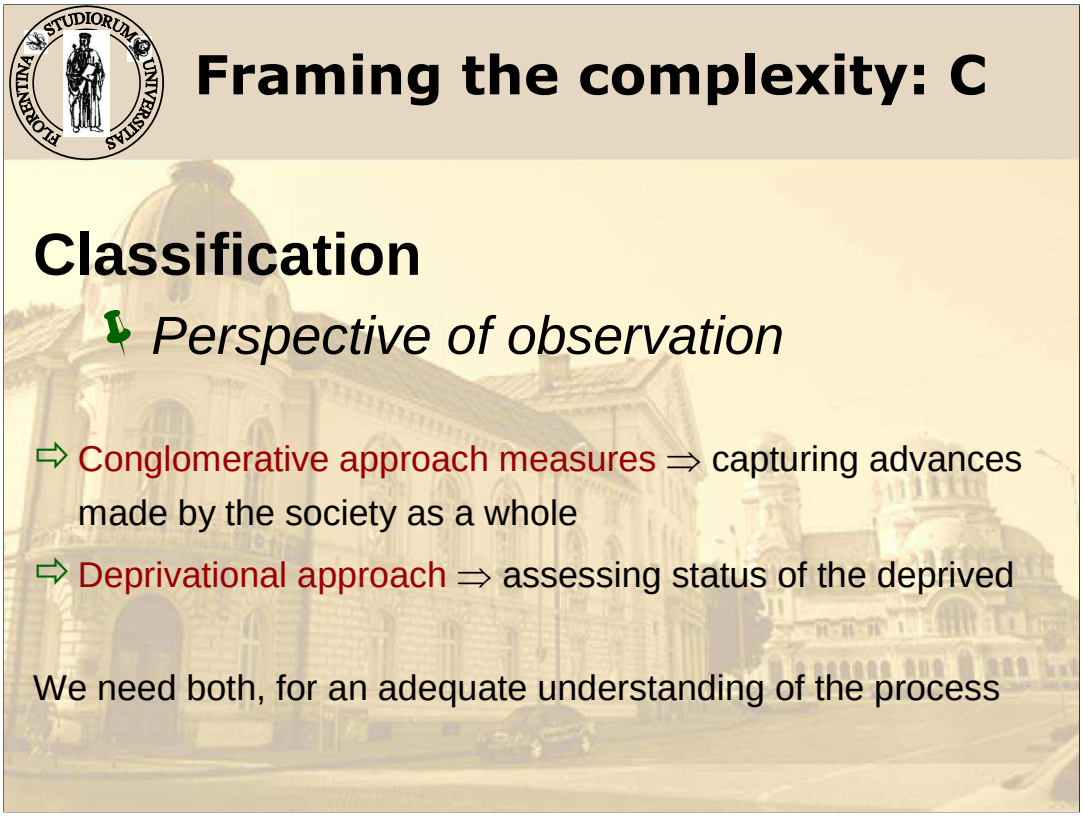


The indicators can be distinguished according to their **purpose** that can be:

- *descriptive*, when the indicators are aimed at describing and knowing a particular reality (for example, quality of life). These indicators are said to be informative and baseline-oriented; in other terms, they allow changes along time, differences between geographical areas, and connections between social processes to pointed out;
- *explicative*, when the indicators are aimed at interpreting reality;
- *predictive*, when the indicators help to delineate plausible evolutional trends that is possible to describe in terms of development or decrement; these indicators require strong prediction models and continuous observations along time;
- *normative*, when the indicators are aimed at supporting, guiding, and directing decisions and possible interventions (policies) concerning problems to be solved. The normative function needs the definition of particular referenced standards defined in terms of time, territory, etc.; the reference values allow to evaluate the attainment of defined goals;
- *problem-oriented*, when the indicators are defined as a function of a specific hypothesis of research and analysis aimed at identifying contexts, kinds, severities of specific problems (for example the lack of quality of life conditions among immigrants);
- *evaluating*, that can be distinguished in
  - *practical*: indicators interfacing with observed process (e.g. in an organization),
  - *directional*: indicators testing if the observed condition is getting better or not,
  - *actionable*: indicators allowing change effects to be controlled.

The indicators can be distinguished according to the **context** in which they are created, used, and interpreted. In this perspective, we can identify different contexts. For example:

- *public debates*: in this case the indicator/s have the function of informing, stimulating, forming and developing particular sensitiveness;
- *policy guidance*: in this case the indicators/s can support particular policy decisions;
- *administrative guidance*: in this case the indicator/s can support the evaluation of the different impacts of different alternatives.

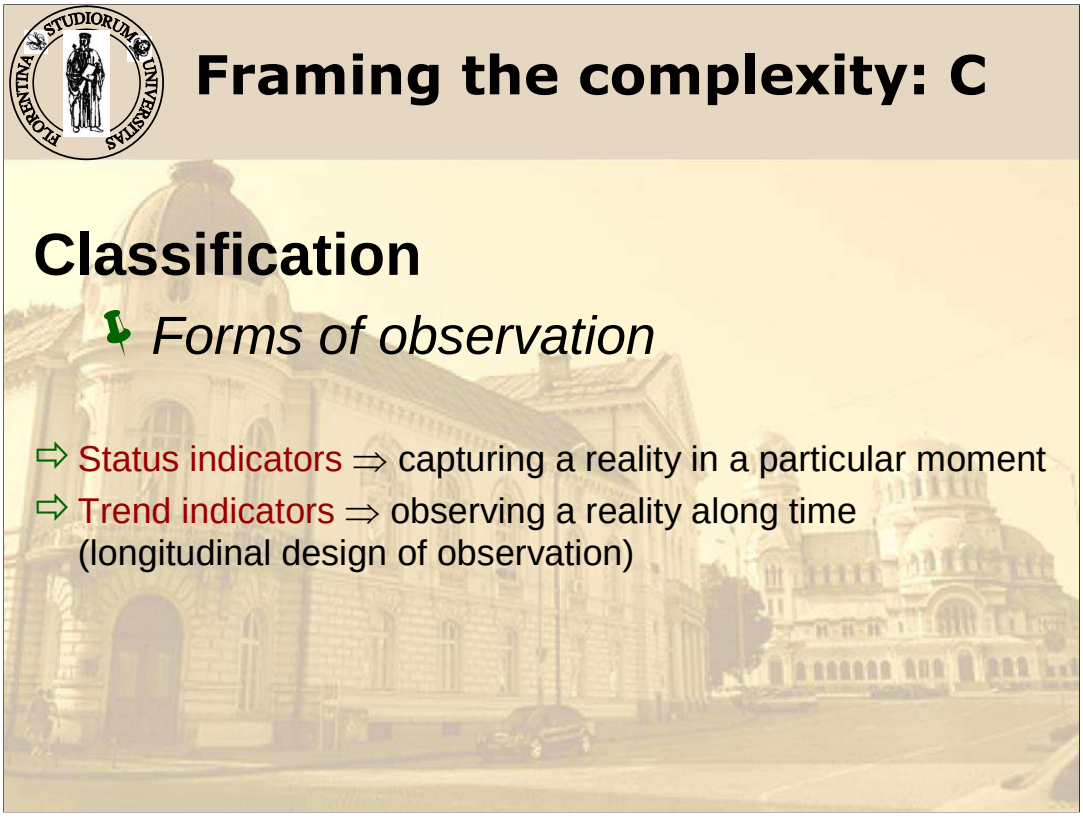


The indicators can be distinguished according to the different **perspectives of observation.** For instance, in the ambit of quality of life, a complex indicator that measures through :

- a *conglomerative* approach measures overall well-being, where increases in well-being of the best-off can offset decreases in well-being of the worst-off;

- a *deprivational* approach measures only the welfare of the worst-off (Anand & Sen, 1997).

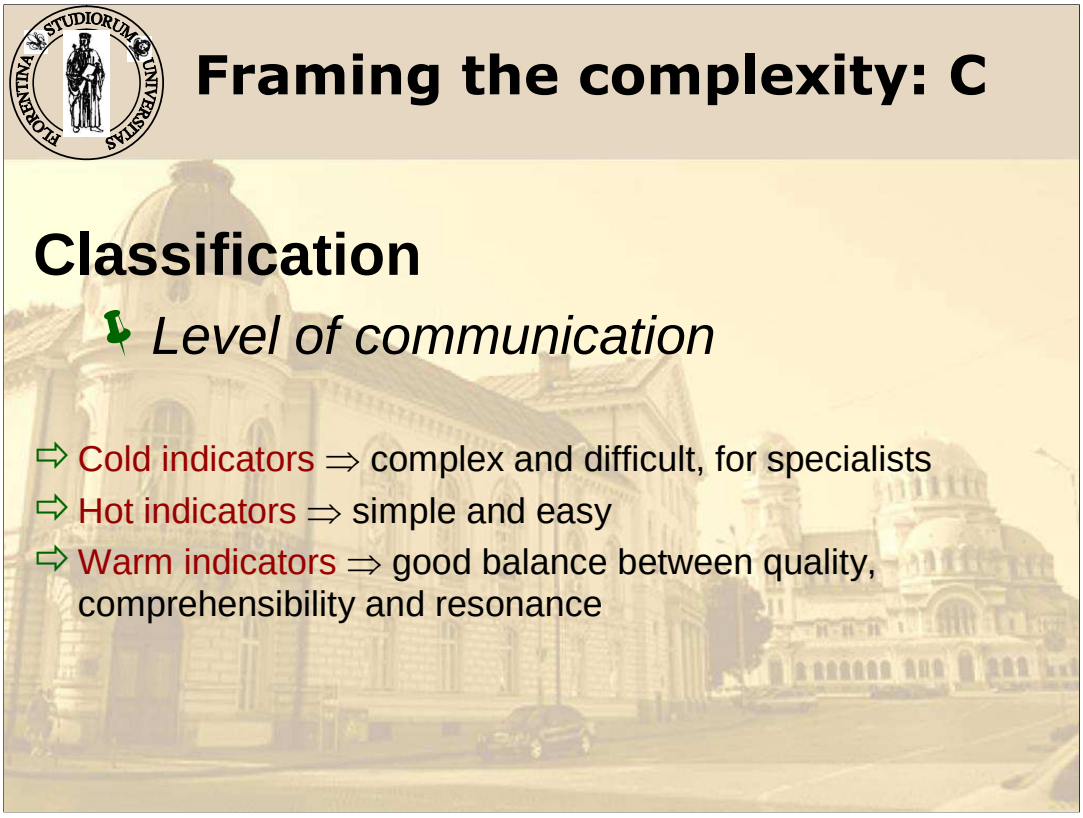
Anand and Sen (1997) arguing that the conglomerative and deprivational perspectives are not substitutes for each other, proposed a *complementary* approach. “We need both, for an adequate understanding of the process of development. The plurality of our concerns and commitment forces us take an interest in each”. The adoption of complementary approach allows us to construct indices of social and economic well-being that should reflect the aggregated and disaggregated approaches. According to this methodology, conglomerative and deprivational indices should be constructed separately side-by-side along the lines of the United Nations Development Programme indicators (Sharpe & Salzman, 2004).



The indicators can be distinguished according to the different **forms of observation.** In this perspective we can distinguish between:

- *status indicators*, which measure the reality in a particular moment; they allow for cross-comparisons between different realities. These indicators can produce cross data that need to be carefully managed since not the different realities can not always be directly compared; this is particularly true in the case of subjective characteristics observed in different geographical, social, cultural, political, environmental, and administrative conditions;

- *trend indicators*, which measure reality along time; they require a defined longitudinal observational design (for example, repeated surveys on particular populations). These indicators can produce *time series* that need to be carefully managed since the observed moments could reveal themselves to be incomparable and/or the defined indicators could reveal themselves as non applicable after some time.



The indicators can be distinguished according to the different **levels of communication.** It regards the target group to which the final indicator will be communicated. In this perspective, indicators can be classified in:

- *cold indicators*: in this case, the indicators have a high level of scientific quality and show a high level of complexity and difficulty;
- *hot indicators*: in this case, the indicators are constructed at a low level of difficult and show a high level of understanding. It is unusual for these indicators to be used in a policy context;
- *warm indicators*: in this case, the indicators show a good balance between quality, comprehensibility, and resonance.

(I) Methodological soundness

This characteristic refers to the idea that the methodological basis for the production of indicators should be attained by following internationally accepted standards, guidelines, or good practices. This dimension is necessarily dataset-specific, reflecting different methodologies for different datasets. The elements referring to this characteristic are (i) concepts and definitions, (ii) scope, (iii) classification / sectorization, and (iv) basis for recording. Particularly important is the characteristic of **accuracy and reliability**, referring to the idea that indicators should be based upon data sources and statistical techniques that are regularly assessed and validated, inclusive of revision studies. This allows accuracy of estimates to be assessed. In this case accuracy is defined as the closeness between the estimated value and the unknown true population value but also between the observed individual value and the "true" individual value. This means that assessing the accuracy of an estimate involves analyzing the total error associated with the estimate: sampling error and measurement error.

(II) Integrity

Integrity refers to the notion that indicator systems should be based on adherence to the principle of objectivity in the collection, compilation, and dissemination of data, statistics, and results. The characteristic includes institutional arrangements that ensure

(i) professionalism in statistical policies and practices,

(ii) transparency, and

(iii) ethical standards.

(III) Serviceability

Framing the complexity: C

An indicator should be able to:	• Define and describe • Observe unequivocally and stably • Record by a degree of distortion as low as possibile	**(I) METHODOLOGICAL SOUNDNESS**
	• Adhere to the principle of objectivity	**(II) INTEGRITY**
	• Reflect adequately the conceptual model • Meet current ad potential users' needs • Be observed through realistic efforts and costs • Reflect the leght of time between its availability and the event of phenomenon it describes • Be analyzed in order to record differences and disparities	**(III) SERVICEABILITY**
	•Be spread	**(IV) ACCESSIBILITY**

Although it does not represent a dimension of quality in itself, prerequisites of quality refers to institutional preconditions and background conditions for quality of statistics. These prerequisites cover the following elements:

(i) legal and institutional environment (including coordination power within and across different institutions)

(ii) resources available for statistical work, and

(iii) quality awareness informing statistical work.

Framing the complexity: C

Problems in selecting indicators

Different issues need to be addressed

in order to

selecting and managing indicators,

especially when this is carried out into

a complex system

allowing the accomplishment of functions like

monitoring, reporting and accounting

Framing the complexity: C

Problems in selecting indicators

Michalos (2006) identified **15** different issues related to the combination of social, economic and environmental indicators.

The issues collectively yield over **200,000** possible combinations representing at least that many different kinds of systems:

Framing the complexity: C

Problems in selecting indicators

- Settlement/aggregation area sizes
- Time frames
- Population composition
- Domains of life composition
- Objective versus subjective indicators
- Positive versus negative indicators
- Input versus output indicators
- Benefits and costs
- Measurement scales
- Report writers
- Report readers
- Quality-of-life model
- Distributions
- Distance impacts
- Causal relations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