Millennium Ecosystem Assessment

Bridging Scales and Epistemologies:
Linking Local Knowledge and Global Science
in Multi-Scale Assessments

Alexandria, Egypt
17th-20th March, 2003

# MULTI-SCALE INTEGRATED ANALYSIS OF SOCIETAL METABOLISM: LEARNING FROM TRAJECTORIES OF DEVELOPMENT AND BUILDING ROBUST SCENARIOS

**Jesus Ramos-Martin**
**Istituto Nazionale di Ricerca**
**per gli Alimenti e la Nutrizione**
**Roma, Italy. E-mail: ramos@inran.it**

## *What MSIASM does ?*

**Representation of the performance of a system in terms of a set of attributes** by using 'parallel non equivalent descriptive domains'. It is, therefore, a 'discussion support tool'. It allows:

- Learning from trajectories of development, and
- Building robust scenarios

## *The rationale of the approach is based on:*

a) **'mosaic effects across levels'**

b) **'impredicative loop analysis'**

c) **'the continuous search and the updating of useful narratives for surfing in complex time'**

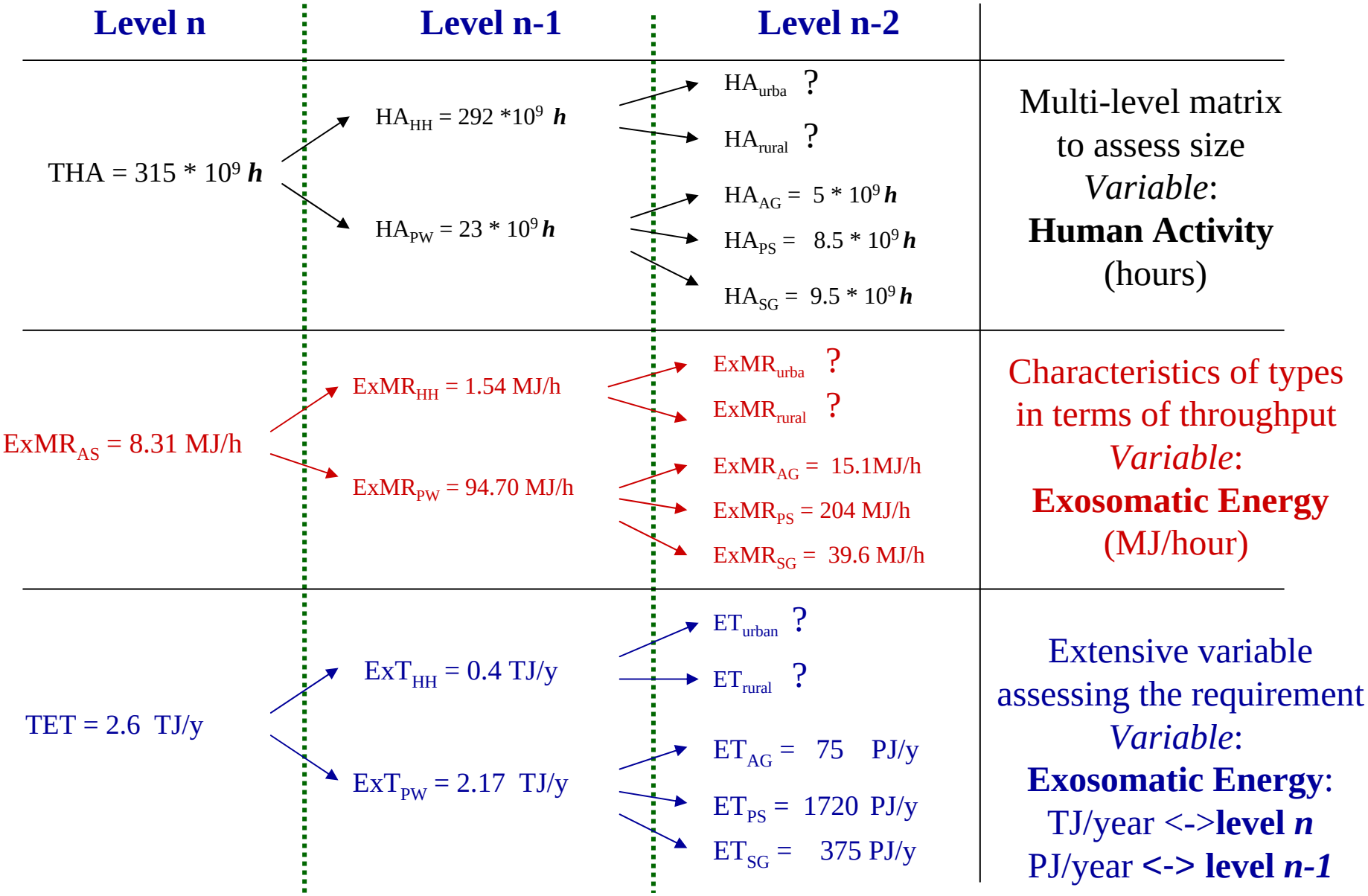
***What MSIASM does ?***

**Representation of the performance of a system in terms of a set of attributes** by using ‘parallel non equivalent descriptive domains’. It is, therefore, a ‘discussion support tool’

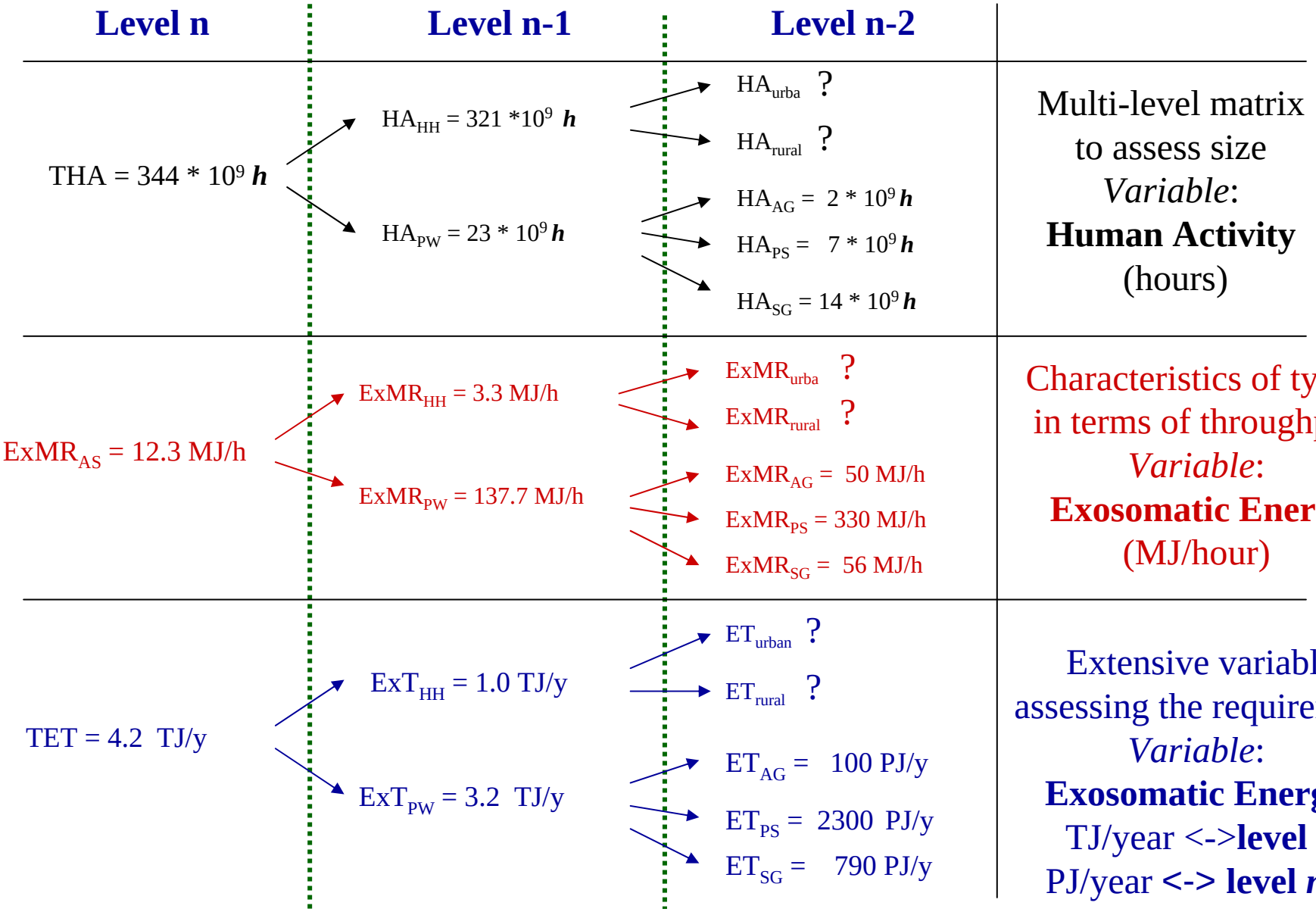
***The rationale of the approach is based on:***

**a) ‘mosaic effects across levels’**

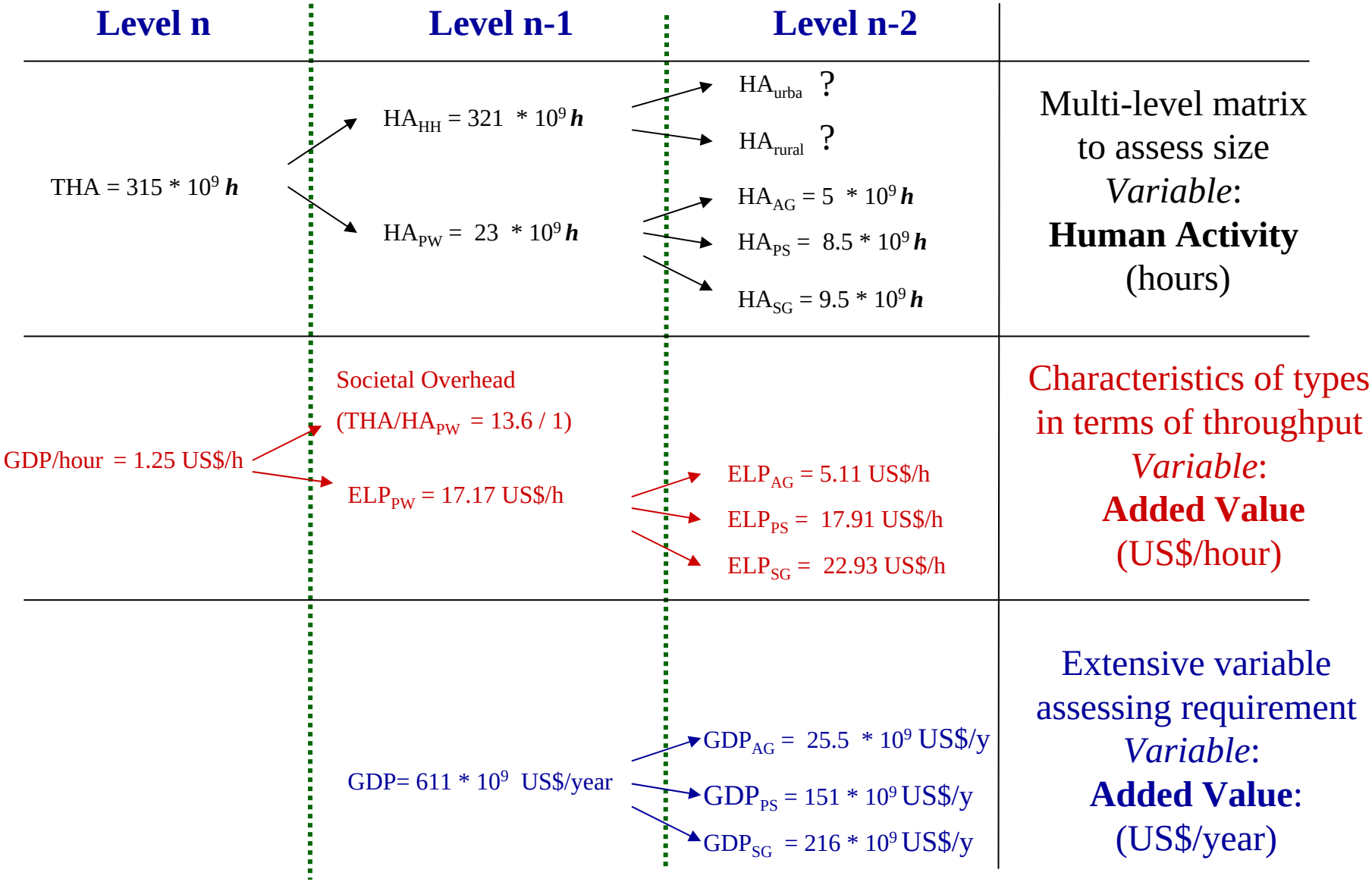
# Dendograms of EMR in Spain in 1976



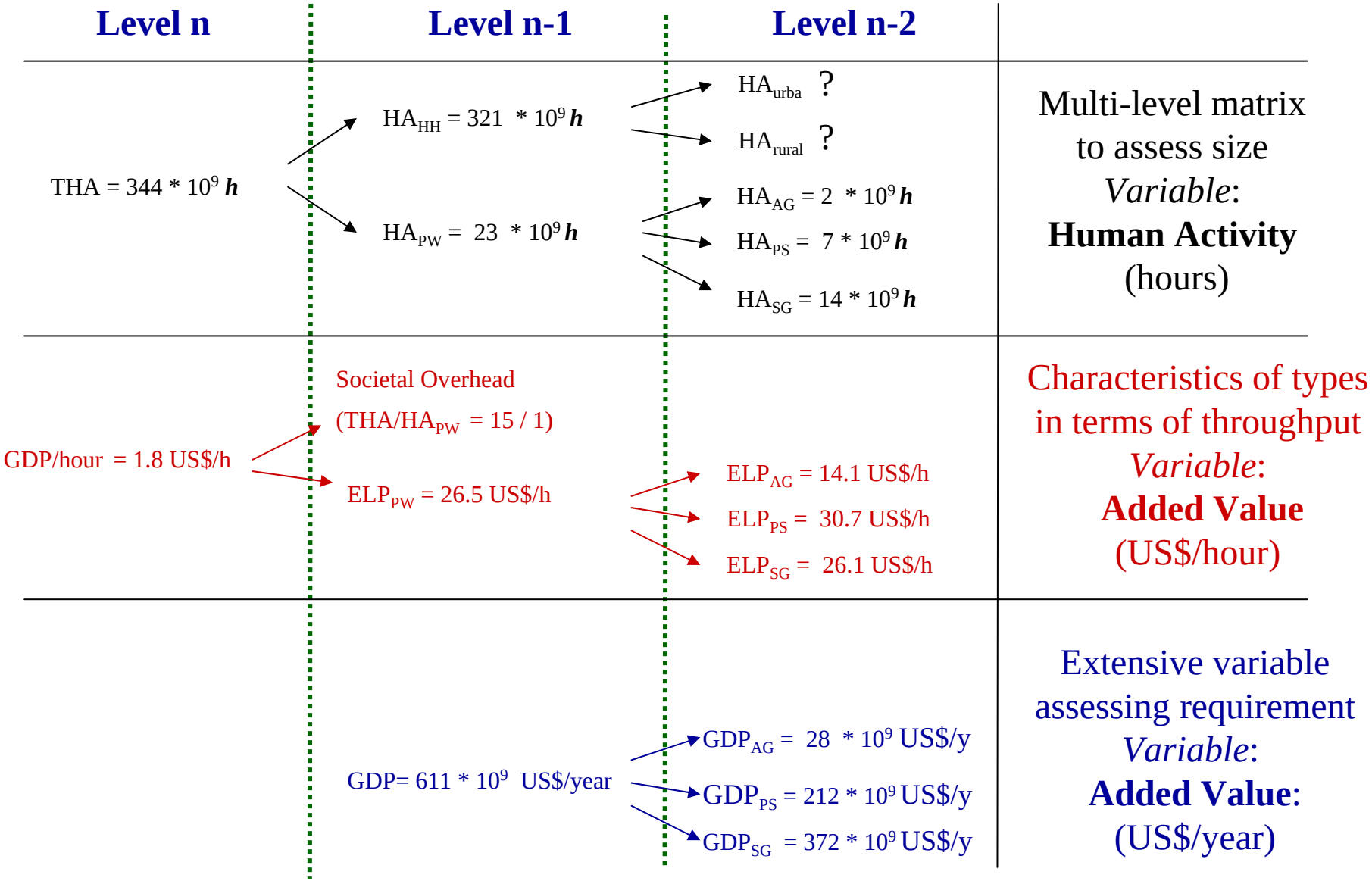
# Dendograms of EMR in Spain in 1996



# Dendogram of ELP in Spain in 1976



# Dendogram of ELP in Spain in 1996



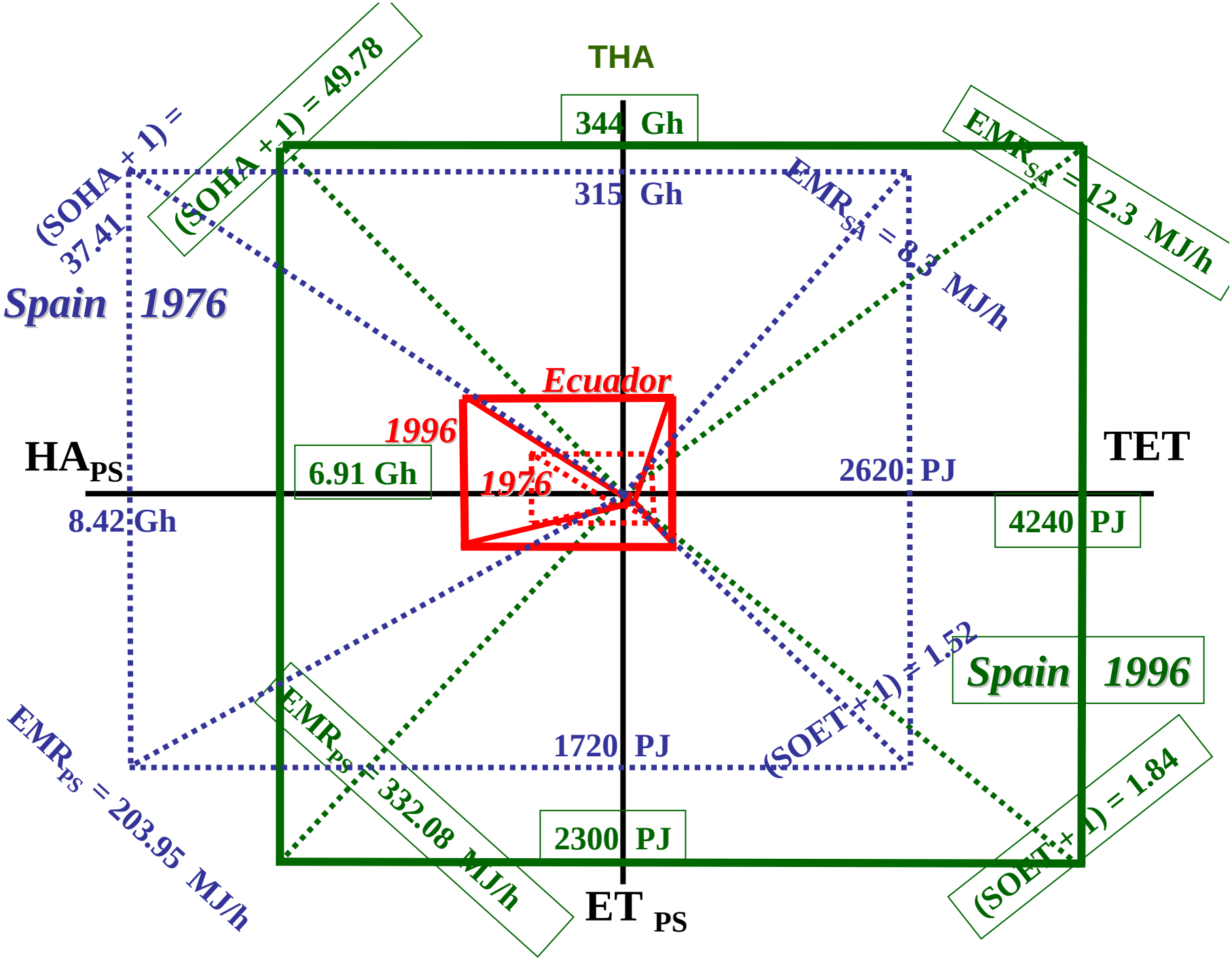
***What MSIASM does ?***

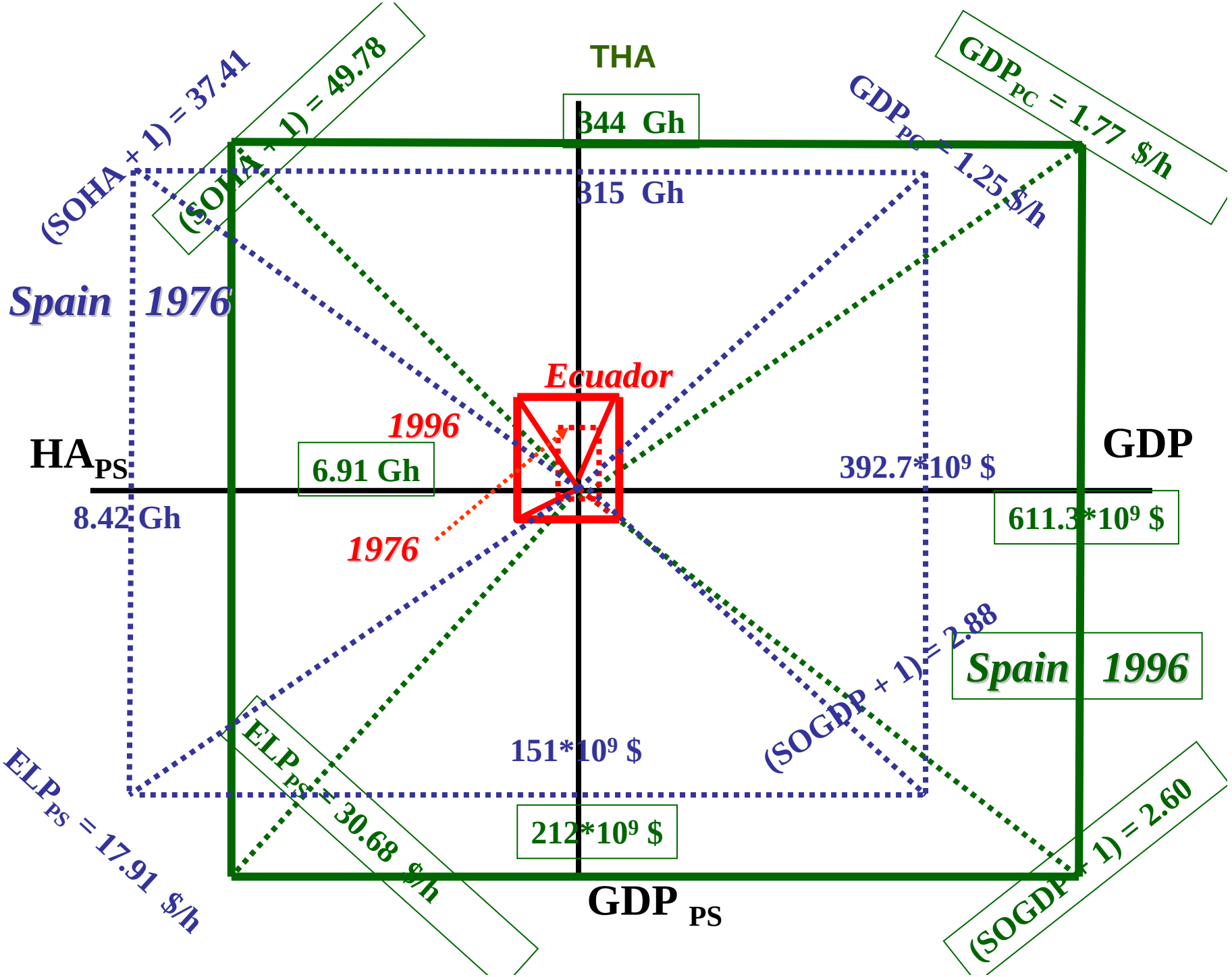
**Representation of the performance of a system in terms of a set of attributes** by using ‘parallel non equivalent descriptive domains’. It is, therefore, a ‘discussion support tool’

***The rationale of the approach is based on:***

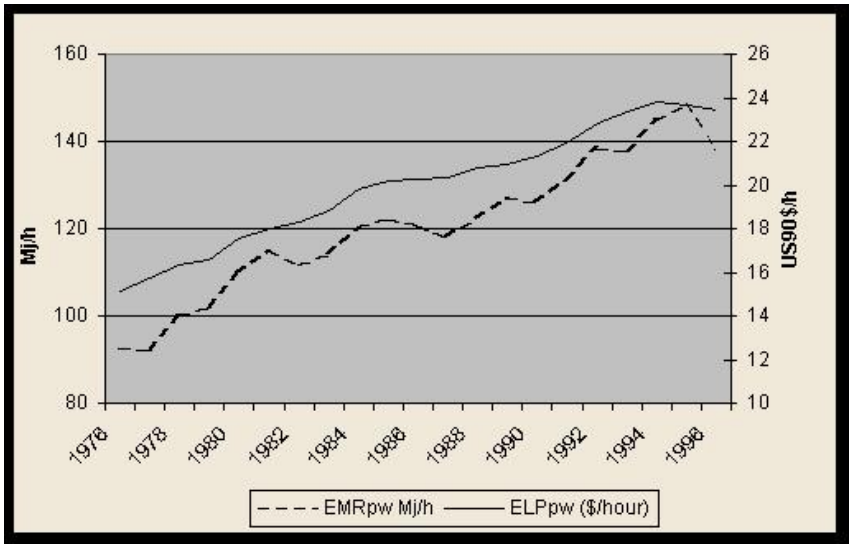
a) ‘mosaic effects across levels’

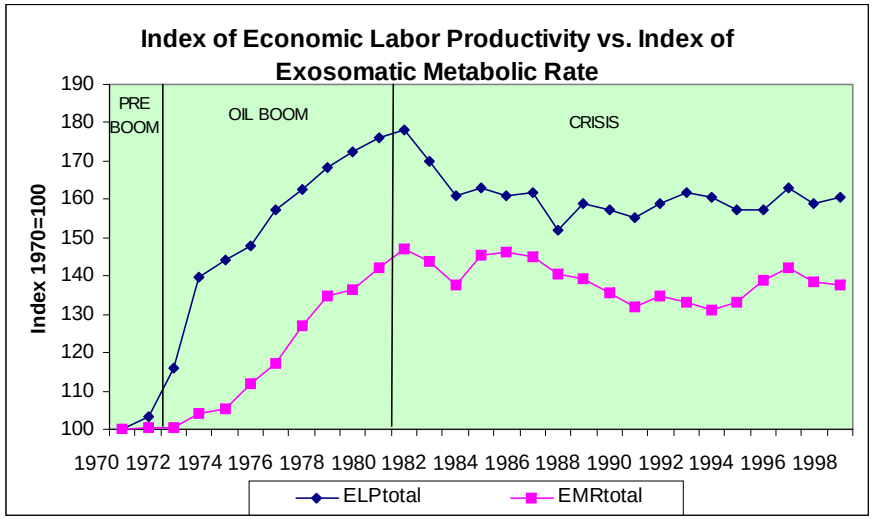
**b) ‘impredicative loop analysis’**


THA
344 Gh
315 Gh
(SOHA + 1) = 49.78
(SOHA + 1) = 37.41
EMR SA = 12.3 MJ/h
EMR SA = 8.3 MJ/h
Spain 1976
Ecuador
1996
1976
HA PS
6.91 Gh
8.42 Gh
2620 PJ
4240 PJ
TET
Spain 1996
(SOET + 1) = 1.52
EMR PS = 332.08 MJ/h
EMR PS = 203.95 MJ/h
1720 PJ
2300 PJ
(SOET + 1) = 1.84
ET PS


THA
344 Gh
315 Gh
(SOHA + 1) = 37.41
(SOHA + 1) = 49.78
GDP PC = 1.77 $/h
GDP PC = 1.25 $/h
Spain 1976
Ecuador
1996
1976
HA PS
8.42 Gh
6.91 Gh
GDP
392.7*10⁹ $
611.3*10⁹ $
(SOGDP + 1) = 2.88
Spain 1996
151*10⁹ $
212*10⁹ $
ELP PS = 17.91 $/h
ELP PS = 30.68 $/h
GDP PS
(SOGDP + 1) = 2.60

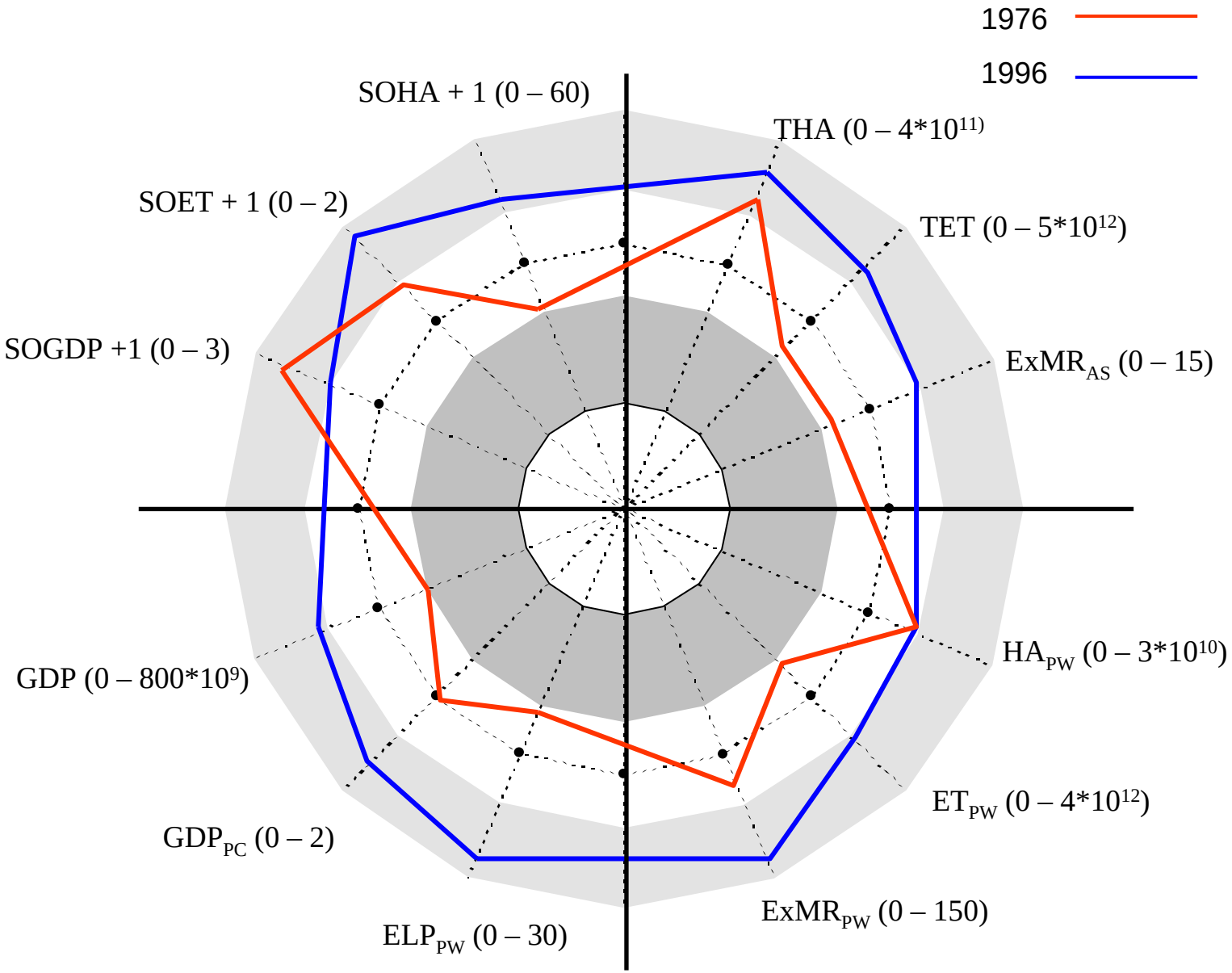
# Establishing a bridge between EMR and ELP in paid work sectors (Spain and Ecuador)




**Source:** Ramos-Martin (2001), Falconi (2001)

# Multi-Objective Integrated Representation of performance SPAIN



## IN SHORT

### *Steps of a MSIASM:*

(A) **Choosing variables able to map the size of the system as perceived from within the black-box** (variable # 1). Typical examples are: “hours of human activity” and “hectares of land area”

(B) **Choosing variables able to map the size of the system as perceived by its context in terms of exchanged flows** (variable # 2). They describe the interaction of the system with its context. Examples are: “exosomatic energy”, “added value”, “other flows of key material inputs”

(C) **Mapping the nested hierarchical structure associated to the nested metabolic system with variables # 1, # 2, and the ratio of the two** (variable # 3). The resulting family of intensive variables # 3 can reflect a *biophysical* accounting (e.g. exosomatic energy flows per unit of human activity) as well as an *economic* accounting (flows of added value per unit of human activity)

***What do we get ?***

**Coherence in the resulting information space** (e.g. economic and biophysical readings referring to different levels of the nested hierarchy)

***How do we get it ?***

**By establishing relations of congruence** over the integrated set of definitions of:

(A) **Extensive variables # 1** such as investments of human activity, land area

(B) **Extensive variables # 2** such as throughputs of matter, energy, and added value in the various compartments

(C) The typical expected values of **intensive variables # 3** associated to the various typologies making up socioeconomic systems at different hierarchical levels

## *Conclusions for the historical analysis*

- **close relationship between ELP and EMR**

- **Spain: Surplus →increase EMRPW (dETPW > dHAPW) →increase in ELPPW → when a threshold was reached all increase went to EMRHH**

- **Ecuador: Population and Debt constraint →surplus is not directed to capitalisation**