



Carlos A. Bana e Costa



Fostering participation and knowledge construction processes in real settings through decision analysis and collaborative value modeling

XV

WWW.MULTICRITERIO.ES

REUNIÓN

DEL GRUPO ESPAÑOL DE
DECISIÓN MULTICRITERIO

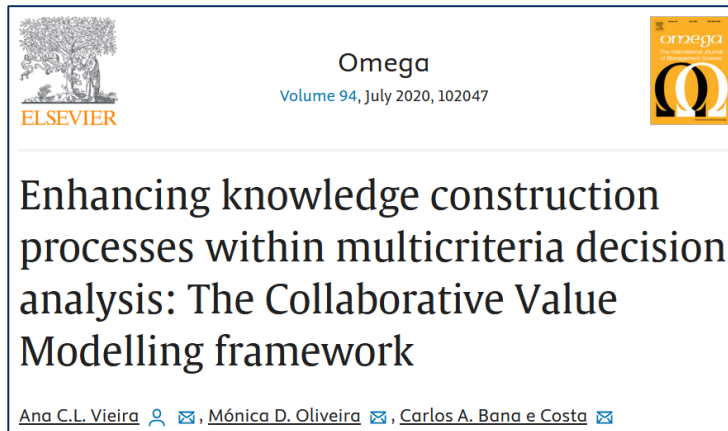
Reunión del Grupo de Trabajo SEIO en Decisión Multicriterio

○ **4-6** ABRIL 2024
OVIEDO ○

This talk is about...

The Collaborative Value Modelling (CVM) Framework.

A new socio-technical framework that combines non-face-to-face and face-to-face group processes to effectively engage many stakeholders and experts in real-world knowledge construction processes to build widely informed (multi-criteria) evaluation models.



The CVM framework combines...



... large-scale participatory Web-Delphi processes with smaller-scale Decision Conferencing processes to promote agreement in the different stages of a multicriteria value modeling.

Sound multicriteria decision aiding methods.

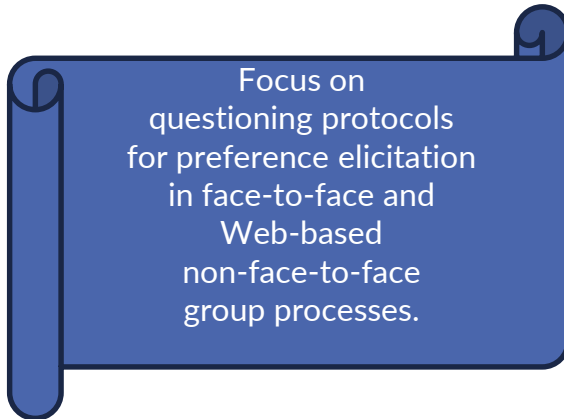


“...extracting problem-solving expertise from a team of experts collaboratively.” (Liou, 1992)

Decision Conferences for interactive and face-to-face modelling.

Delphi for engaging experts and other stakeholders in an interactive, non-face-to-face setting.

Topics of this talk...



Focus of this talk... why?



Focus on questioning protocols for preference elicitation in face-to-face and Web-based non-face-to-face group processes.

- **Pay attention to the Question Wording Effect:**

Advances in the Science of Asking Questions (Schaeffer NC, Dykema J 2020):

Given the increased use of web, mobile, and mixed-mode surveys, research about issues related to the optimal implementation of questions—especially for batteries, grids, discrete-value questions, and other complicated question forms—is needed.

Constructing Delphi statements for technology foresight (Andersen PD 2023):
The study conducted in this paper confirms that the construction of Delphi statements and respondents' understanding of those statements is underresearched.

- **Avoid the Frame effect:**

The Framing of Decisions and the Psychology of Choice (Tversky A and Kahneman D 1981):

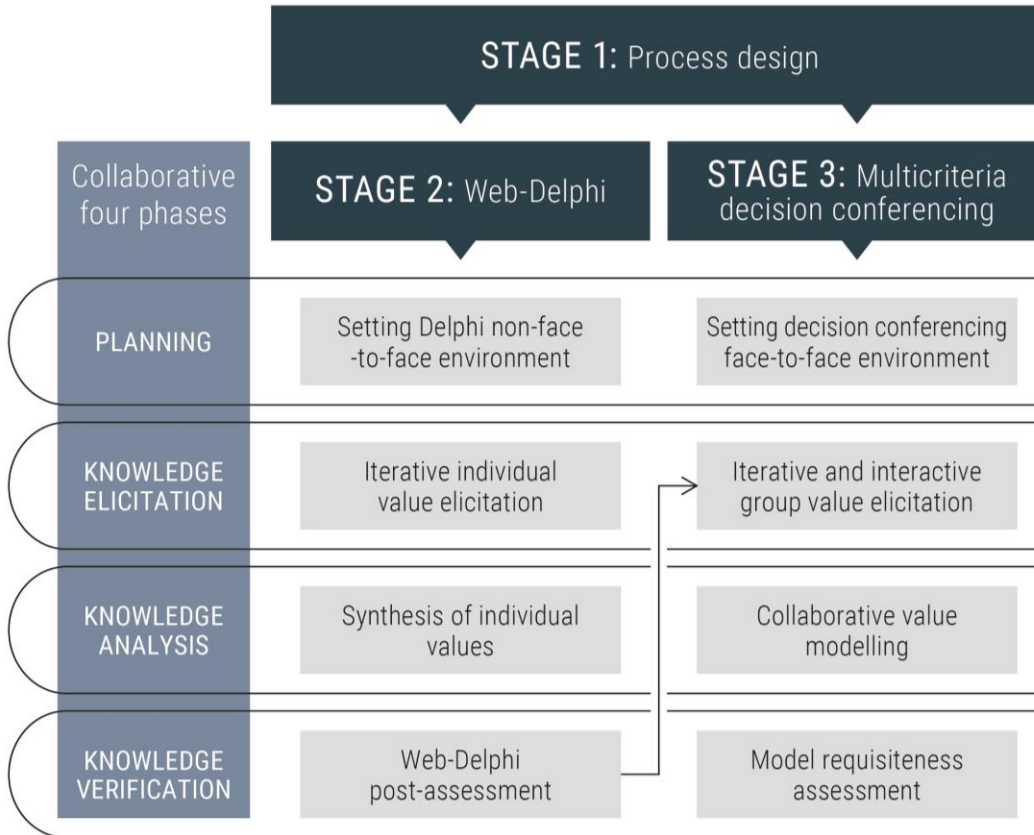
The effects of frames on preferences are compared to the effects of perspectives on perceptual appearance. The dependence of preferences on the formulation of decision problems is a significant concern for the theory of rational choice.

The development of the CVM Framework adopts the principles of ...



- *Value Creation: Value-Focused Thinking and Decision Quality*
- *Divide and Conquer: Multicriteria Value Measurement with MACBETH*
- *Process Consultation*
- *Socio-technical modelling*
- *Requisite modelling*

CVM stages, phases and tasks



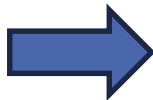
Source: Vieira et al.(2020)



Characteristics of CVM social processes



Web-based Delphi *participatory* processes



Decision conferencing *collaborative* processes

Large groups / or geographical dispersed /
or without time to meet

- General Delphi key features: anonymity and iteration → avoid social pressure; controlled feedback and summary statistics → engage in discussion in a **non face-to-face** format.
(Linstone HA and Turoff M 2002)
- Specific Web-Delphi key features: rapid execution process; low costs; each participant can respond in its own pace; high and geographically dispersed number of participants; friendly and attractive interface → reduced drop-out.

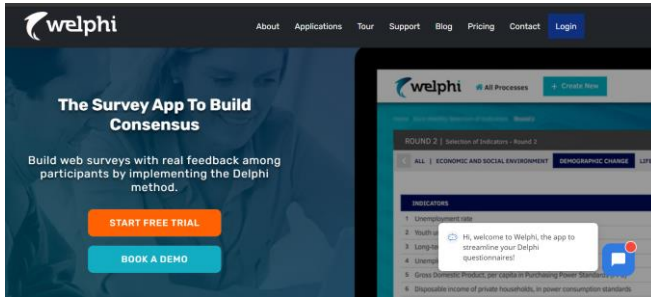
Small evaluation groups

- One or more **face-to-face** workshops.
- Attended by key players representing the diversity of perspectives.
- Facilitated by an impartial specialist in group processes & decision analysis.
- Using a requisite (necessary and sufficient) model created on-the-spot to help provide structure to thinking.

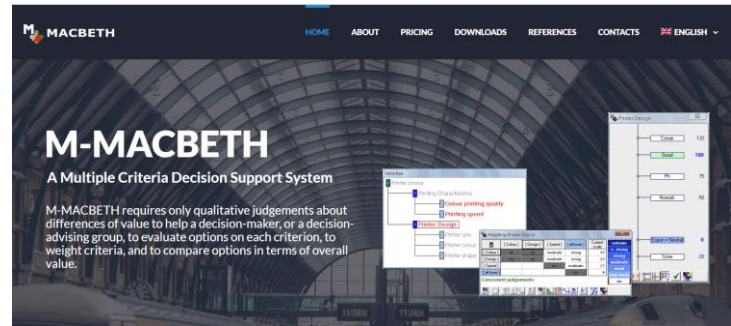
(Phillips LD and Bana e Costa CA 2007)



Welphi and M-MACBETH Decision Support Systems



<https://www.welphi.com/en/>



<https://m-macbeth.com/>

The six real applications of CVM

Challenges

- 1 > Building a sound model to assess population health across European regions and help designing policies (2015-2018)
- 2 > Helping the Brazilian Forum for Climate Change in prioritizing measures to mitigate carbon emissions (2017-2018)
- 3 > Helping GALP, a key energy operator in Portugal, to select an enterprise management system (2018-2019)
- 4 > Promoting agreement about policy recommendations to improve Sustainability and Resilience in the Portuguese health system (2022)
- 5 > Helping Portuguese hospitals and the national regulatory agency reflect on the added value of distinct types of medical devices (2018-2023)
- 6 > Producing a national consensus in the field of immunology (confidential condition) with health professionals from different specialties (2022-2023)

Clients



Overview of impacts



1

- First successful full application of the Collaborative Value Modelling framework
- Engagement of 200 participants from different EU countries



4

- 43 policy recommendations to improve Sustainability and Resilience in national health system were publicly discussed
- Engagement of 40 top-level participants



2

- Prioritization of measures to mitigate carbon emissions was achieved
- Engagement of 226 participants from different sectors



5

- Portuguese hospitals and national regulatory agency reflect together on the added value of distinct types of medical devices
- Engagement of 180 participants



3

- The type and key features for the new enterprise management system were agreed upon
- Engagement of 60 participants from different departments

6

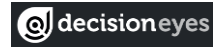
- A national consensus in the field of immunology was reached
- Engagement of 13 professionals from different medical specialties



Detailed presentation of the six applications is available at [Full version](#)



Together with team members
Mónica Oliveira and Ana Vieira
and the collaboration of João Bana e Costa



The presentation given by Monica Oliveira in the competition of the Award Session is available at

[Full version](#)

The first complete application of CVM



Shaping EUROpean policies to promote HEALTH equitY



Building a sound model to assess population health across European regions and help designing policies (2015-2018)



Horizon 2020
Research & Innovation programme
Grant agreement No 643398

- First successful full application of the Collaborative Value Modelling framework
- Engagement of 200 participants from different EU countries

Objective:

- To construct a **Population Health Index (PHI)** able to measure population health on the European regions, **avoiding common critical mistakes**, and combining available data and scientific evidence with the views of experts and stakeholders.
- The PHI will then be used **to inform the design of policies** to improve PH and reduce health inequalities across European regions.

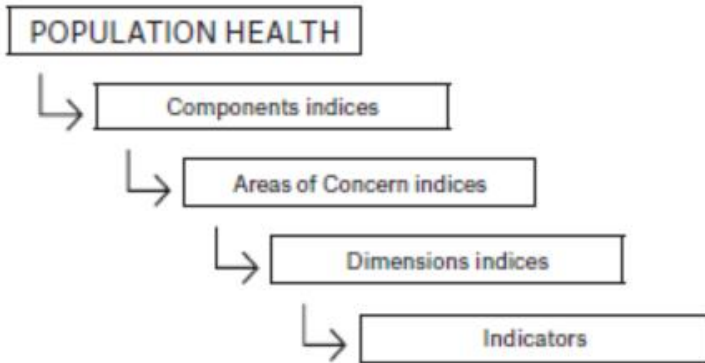
January 2015 - December 2017

Budget: €3 Million

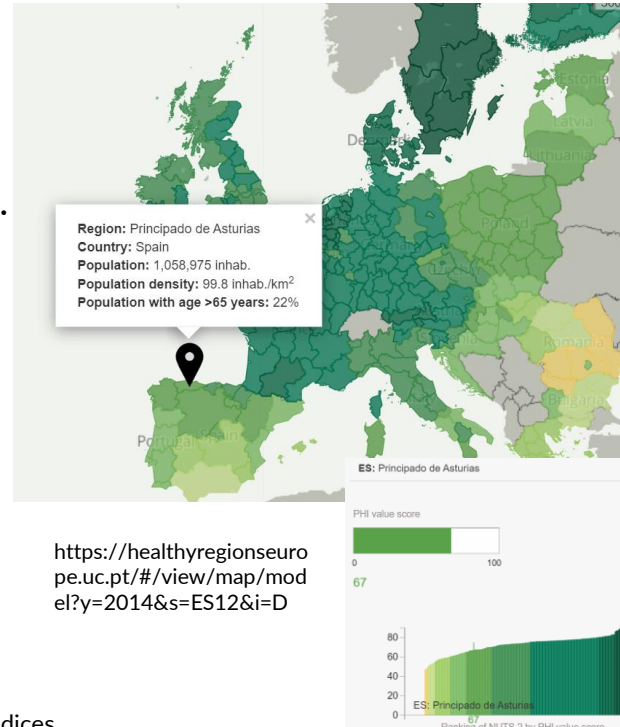
15 beneficiaries, across 12 European countries

Our sociotechnical intervention

Under a CVM framework, the MACBETH method was used in Web-Delphi and multicriteria decision conferencing processes to construct a chain of group additive value function models, resulting in a Population Health Index (PHI) with a multi-level structure.



The healthy regions Europe Web GIS

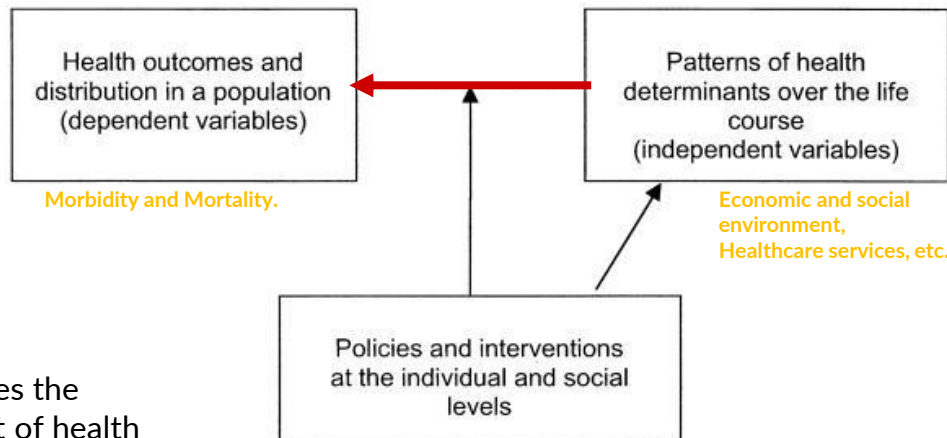


<https://healthyregioneurope.uc.pt/#/view/map/model?y=2014&s=ES12&i=D>

Bana e Costa, CA *et al.* (2023) Collaborative development of composite indices from qualitative value judgements: The EURO-HEALTHY Population Health Index model, *European Journal of Operational Research*, 305, 1, 16, 475-492.

Kick-off meeting (engaging EURO-HEALTHY Consortium partners)

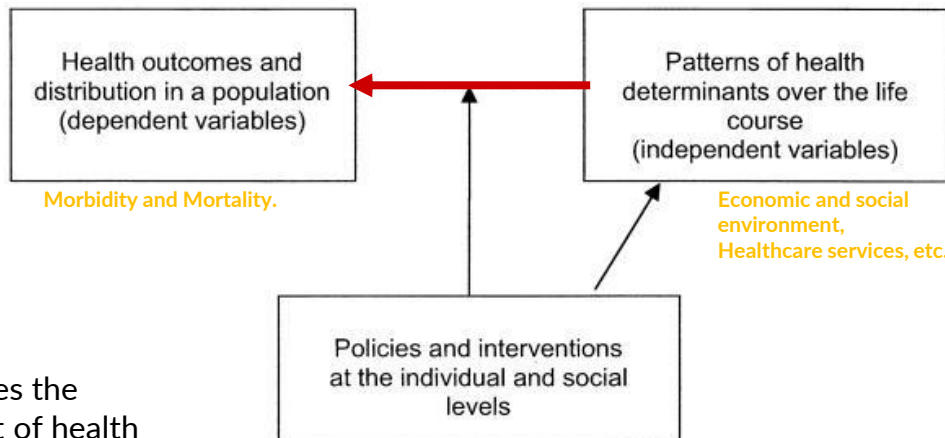
Kindig and Stoddard (2003) conceptualization of “population health” was adopted.



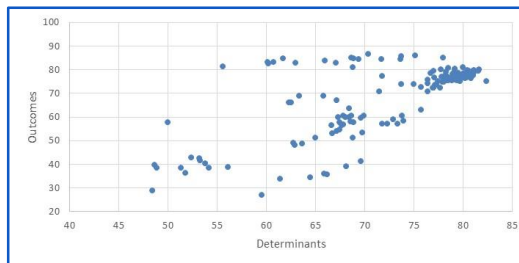
“Population health” combines the definition and measurement of health outcomes and their distribution, the patterns of **determinants that influence such outcomes**, and the policies that influence the optimal balance of determinants.

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The social component

Large and/or geographical dispersed stakeholders' panels

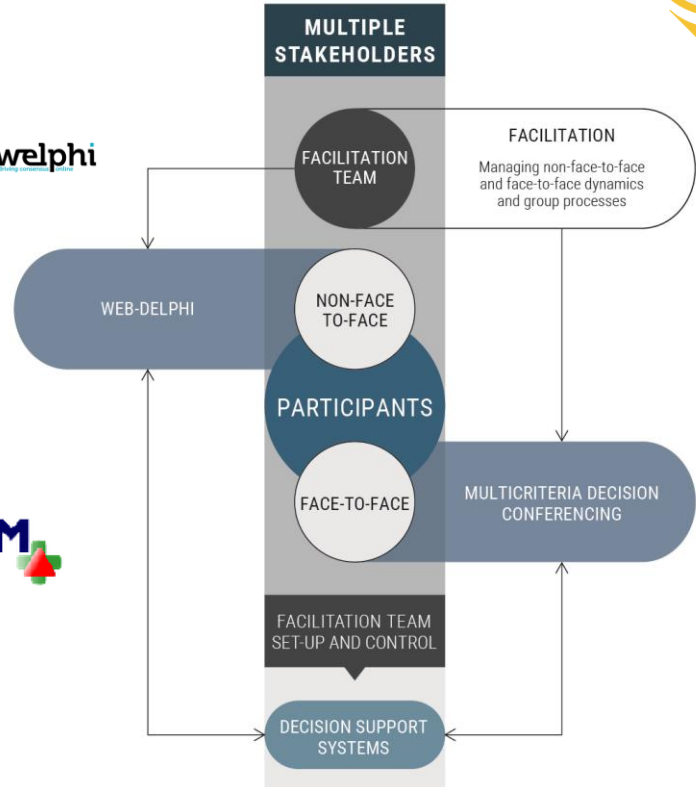
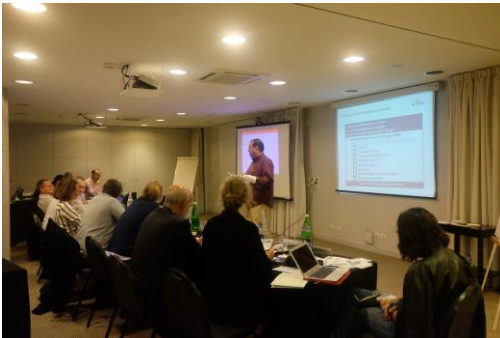
Questionnaire Page - Socio-economic determinants (SEC) - Round 1

Economic and Social Environment | Health Indicators

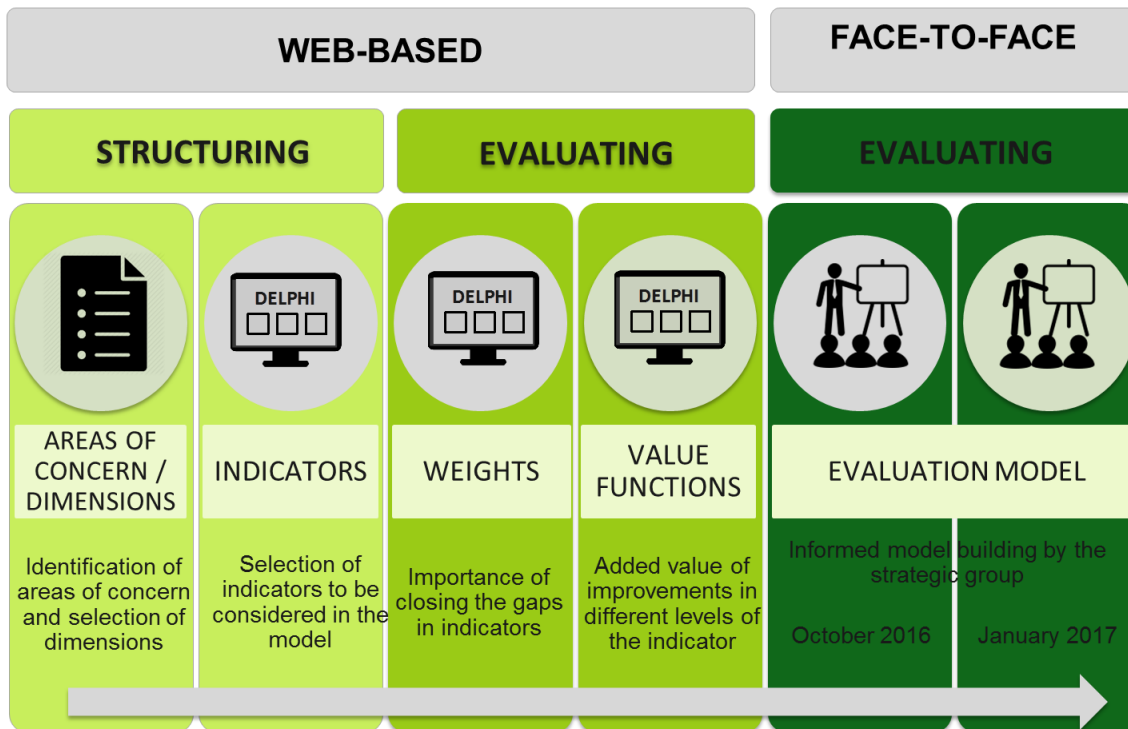
To reduce inequalities in Europe, how important is to close this Gap?

INDICATOR	Gap	Not important	Very little important	Medium important	Very important	Extremely important	Very important	Extremely important	Very important
Unemployment rate (%)	16.3 vs 10	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Long term unemployment rate - 12 months and more (%)	8.1 vs 5.6	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Disposable income of private households per capita (Euro per household)	1000 vs 1000	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
People at risk of poverty or social exclusion (%)	16.8 vs 6.2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Disposable income ratio - 80/20 split index	1.3 vs 1.2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Expenditure on care for elderly (% of GDP)	5.1 vs 3.2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Population aged 25-64 with upper secondary		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Small strategic group

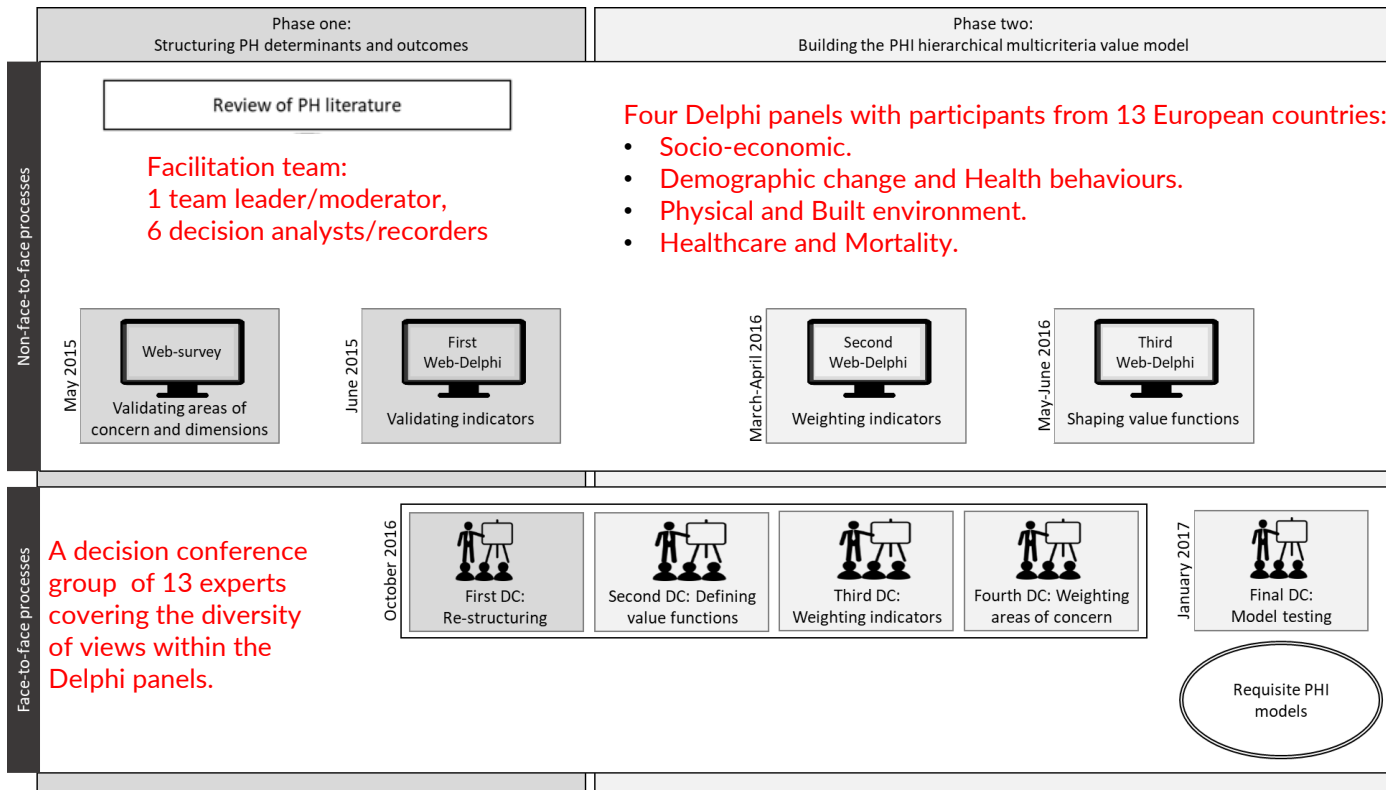


Source: Vieira et al. (2020)

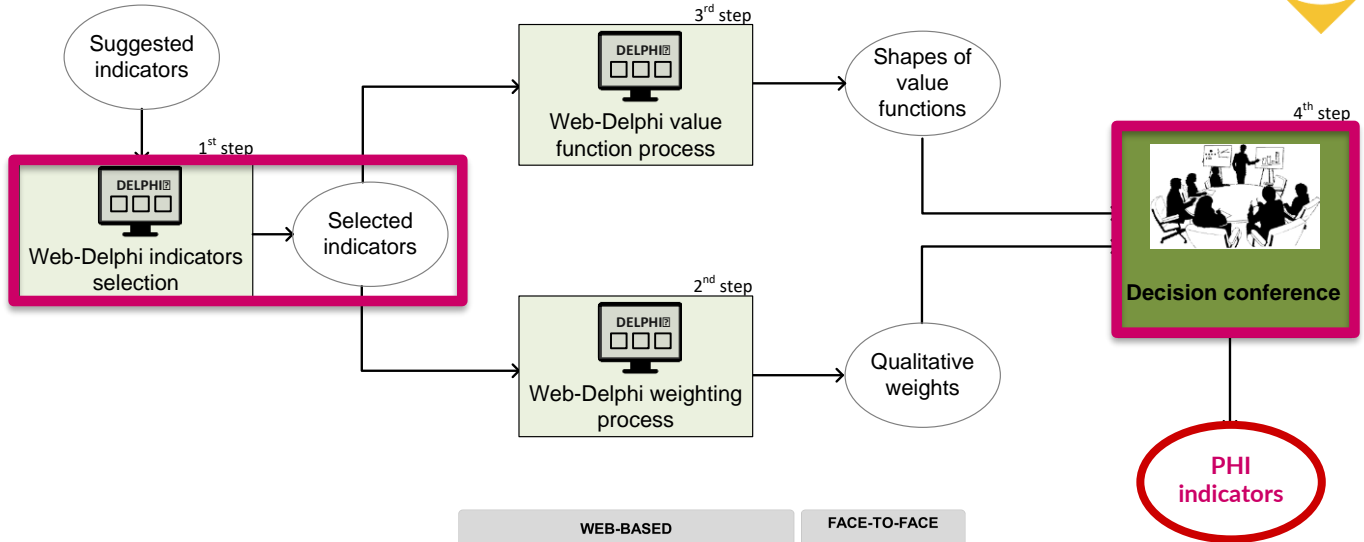


The Web-Delphi Process Design was implemented simultaneously with four panels

Facilitation team, Delphi panels, and decision conference group set up at the kick-off meeting



Activities for the selection of indicators

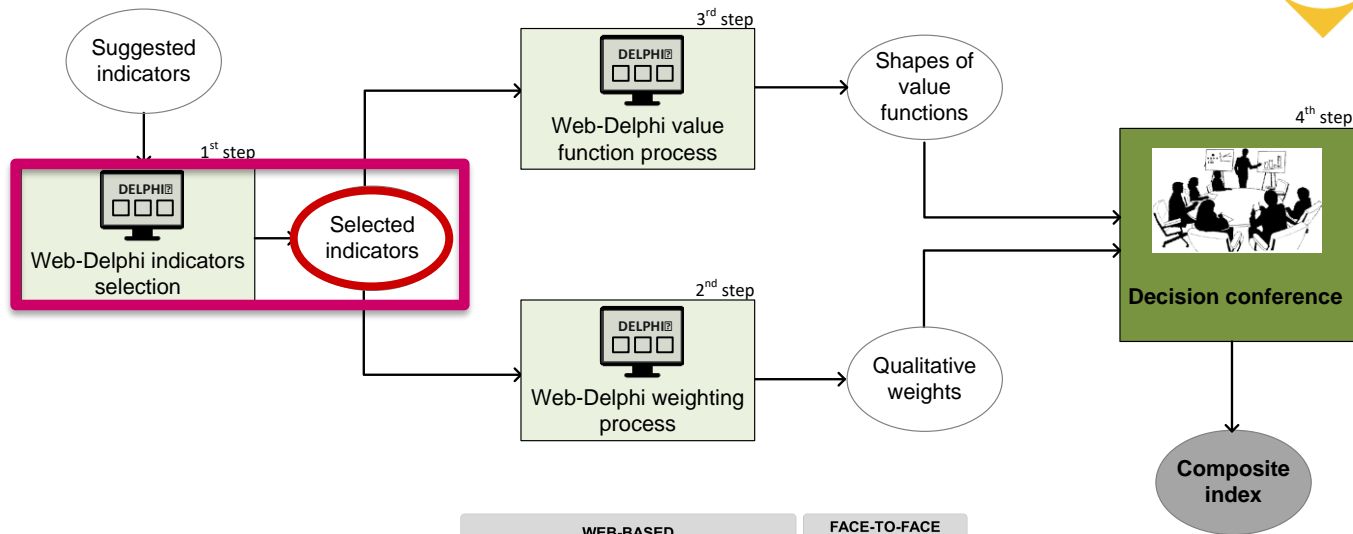


WEB-BASED		FACE-TO-FACE	
STRUCTURING	EVALUATING	EVALUATING	
<p>AREAS OF CONCERN / DIMENSIONS</p> <p>Identification of areas of concern and selection of dimensions</p>	<p>INDICATORS</p> <p>Selection of indicators to be considered in the model</p>	<p>WEIGHTS</p> <p>Importance of closing the gaps in indicators</p>	<p>VALUE FUNCTIONS</p> <p>Added value or improvements at different levels of the indicator</p>
		<p>EVALUATION MODEL</p> <p>Informed model building by the strategic group</p> <p>October 2016 January 2017</p>	

PHI indicators

Atlas of Population Health in European Union Regions

1st activity for the selection of indicators: Web-Delphi process (two rounds)



WEB-BASED		FACE-TO-FACE	
STRUCTURING	EVALUATING	EVALUATING	
AREAS OF CONCERN / DIMENSIONS	INDICATORS	WEIGHTS	VALUE FUNCTIONS
Identification of areas of concern and selection of dimensions	Selection of indicators to be considered in the model	Importance of closing the gaps in indicators	Added value of improvements in different levels of the indicator
			Informed model building by the strategic group
			October 2016 January 2017


Atlas of
Population
Health
in European
Union
Regions













1st Web-Delphi process (two rounds): Round 1 of indicators selection (from 120 identified in a systematic review of literature)

A five-point Likert scale of concordance/discordance was used to elicit individual options from the participants.

Example of individual selection:










THIS INDICATOR IS RELEVANT TO THE EVALUATION OF THE EUROPE'S POPULATION HEALTH



INDICATOR		STRONGLY DISAGREE	DISAGREE	NEITHER AGREE NOR DISAGREE	AGREE	STRONGLY AGREE
Unemployment rate		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Youth unemployment rate		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Long-term unemployment rate (12 months and more)		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Unemployment gender ratio		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Gross Domestic Product, per capita in Purchasing Power Standards (PPS)		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Disposable income of private households, in power consumption standards (PPCS)		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
People at risk of poverty or social exclusion		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
People living in households with very low work intensity (aged 0 to 59 years)		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Severe material deprivation rate		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Gini Coefficient		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Disposable income ratio (S80/S20)		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Beneficiaries of disability pension		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

1st Web-Delphi process (two rounds): Round 2 only for the indicators not yet consensually selected

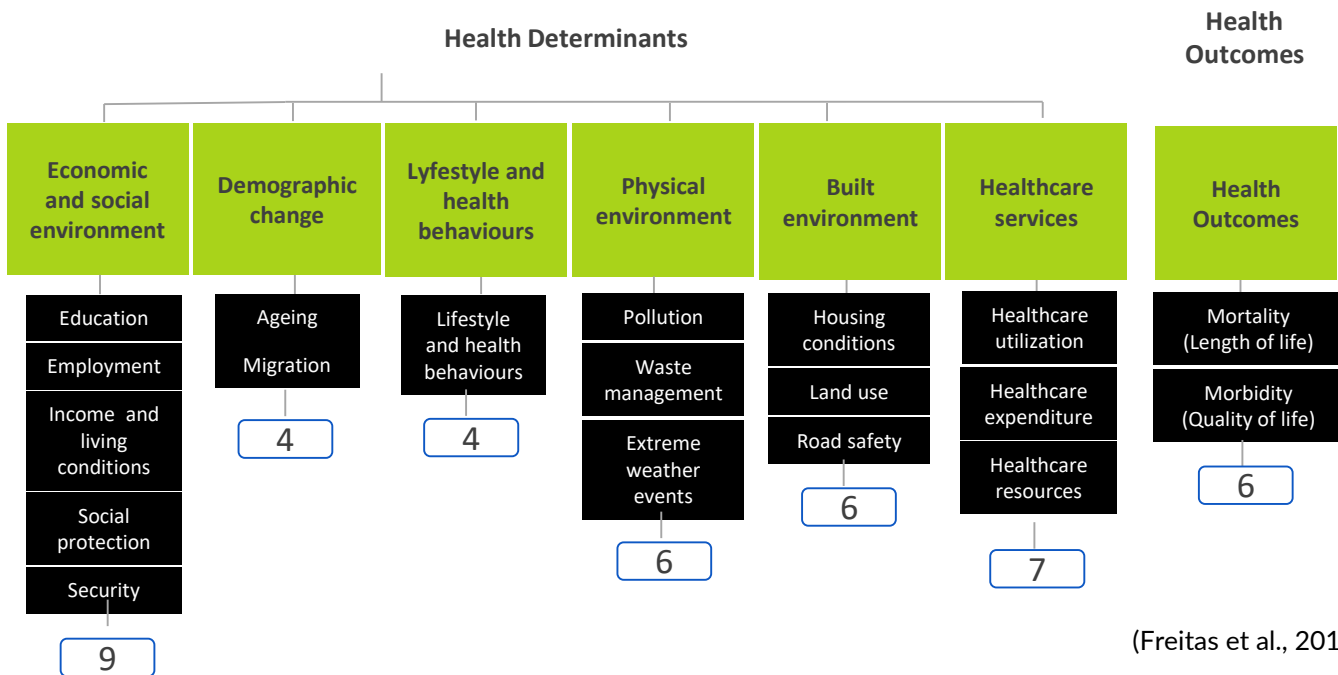
At the beginning of the 2nd Round, the participants were presented individually with their answers and the statistics of the panel answers in the 1st Round and were invited to keep or change them.

INDICATOR		STRONGLY DISAGREE	DISAGREE	NEITHER AGREE NOR DISAGREE	AGREE	STRONGLY AGREE
1 - Unemployment gender ratio		<input type="radio"/> 3%	<input checked="" type="radio"/> 16%	<input type="radio"/> 27%	<input type="radio"/> 36%	<input type="radio"/> 18%
2 - Gross Domestic Product, per capita in Purchasing Power Standards (PPS)		<input type="radio"/>	<input checked="" type="radio"/> 19%	<input type="radio"/> 16%	<input type="radio"/> 43%	<input type="radio"/> 21%
3 - People living in households with very low work intensity (aged 0 to 59 years)		<input type="radio"/>	<input checked="" type="radio"/> 13%	<input type="radio"/> 16%	<input type="radio"/> 43%	<input type="radio"/> 27%
4 - Gini Coefficient		<input type="radio"/>	<input checked="" type="radio"/> 10%	<input type="radio"/> 18%	<input type="radio"/> 39%	<input type="radio"/> 33%
5 - Beneficiaries of disability pension		<input type="radio"/> 1%	<input checked="" type="radio"/> 21%	<input type="radio"/> 22%	<input type="radio"/> 40%	<input type="radio"/> 15%
6 - Social protection benefits - social exclusion (% of total benefits)		<input type="radio"/>	<input type="radio"/> 6%	<input type="radio"/> 19%	<input type="radio"/> 46%	<input checked="" type="radio"/> 28%
7 - Expenditure on social protection benefits (% of GDP)		<input type="radio"/> 1%	<input checked="" type="radio"/> 18%	<input type="radio"/> 21%	<input type="radio"/> 40%	<input type="radio"/> 19%
8 - Households with access to the internet at home		<input type="radio"/> 4%	<input checked="" type="radio"/> 31%	<input type="radio"/> 39%	<input type="radio"/> 21%	<input type="radio"/> 4%
9 - Voter turnout in national elections		<input type="radio"/> 13%	<input type="radio"/> 25%	<input type="radio"/> 33%	<input type="radio"/> 15%	<input checked="" type="radio"/> 13%

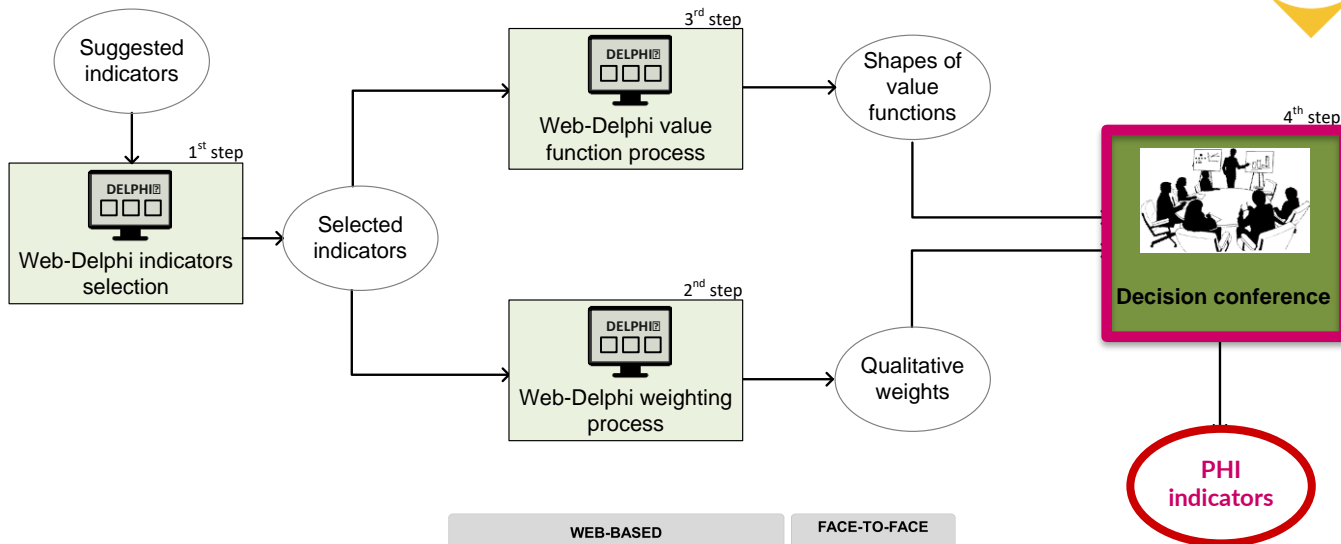
1st Web-Delphi results: selected indicators

The indicators will be the evaluation criteria in the multicriteria value model, within the respective area of concern.

42 PHI Indicators 19 Key dimensions (19) 7 Areas of concern (7)



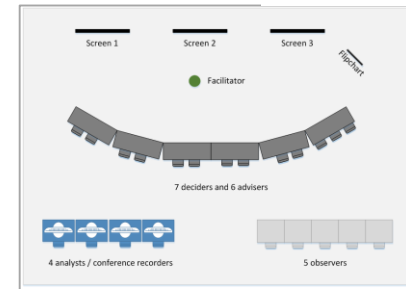
2nd Activity for indicators selection: Decision conference



WEB-BASED		FACE-TO-FACE	
STRUCTURING	EVALUATING	EVALUATING	EVALUATING
AREAS OF CONCERN / DIMENSIONS	INDICATORS	WEIGHTS	VALUE FUNCTIONS
Identification of areas of concern and selection of dimensions	Selection of indicators to be considered in the model	Importance of closing the gaps in indicators	Added value of improvements in different levels of the indicator
			EVALUATION MODEL
			Informed model building by the stakeholder group
			October 2016 - January 2017

2nd Activity for indicators selection: Decision conference

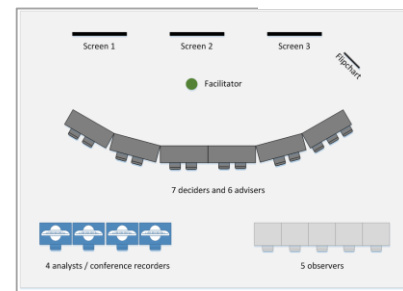
- Objective: engage the strategic group towards a shared understanding about measuring PH through the PHI model.
- Strategic group: 7 deciders and 6 advisers.
- Facilitation team: 1 team leader/moderator, 6 decision analysts/recorders.
 - Analysis of the 42 indicators selected in 1st Web-Delphi.
 - Final selection of the PHI indicators and model structure.



Layout of the conference room.

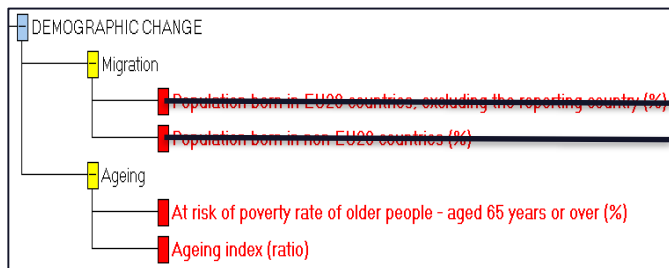
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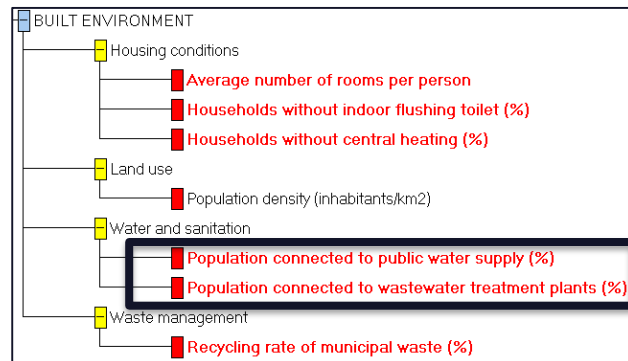


Layout of the conference room.

Two indicators were removed (due to double-counting)

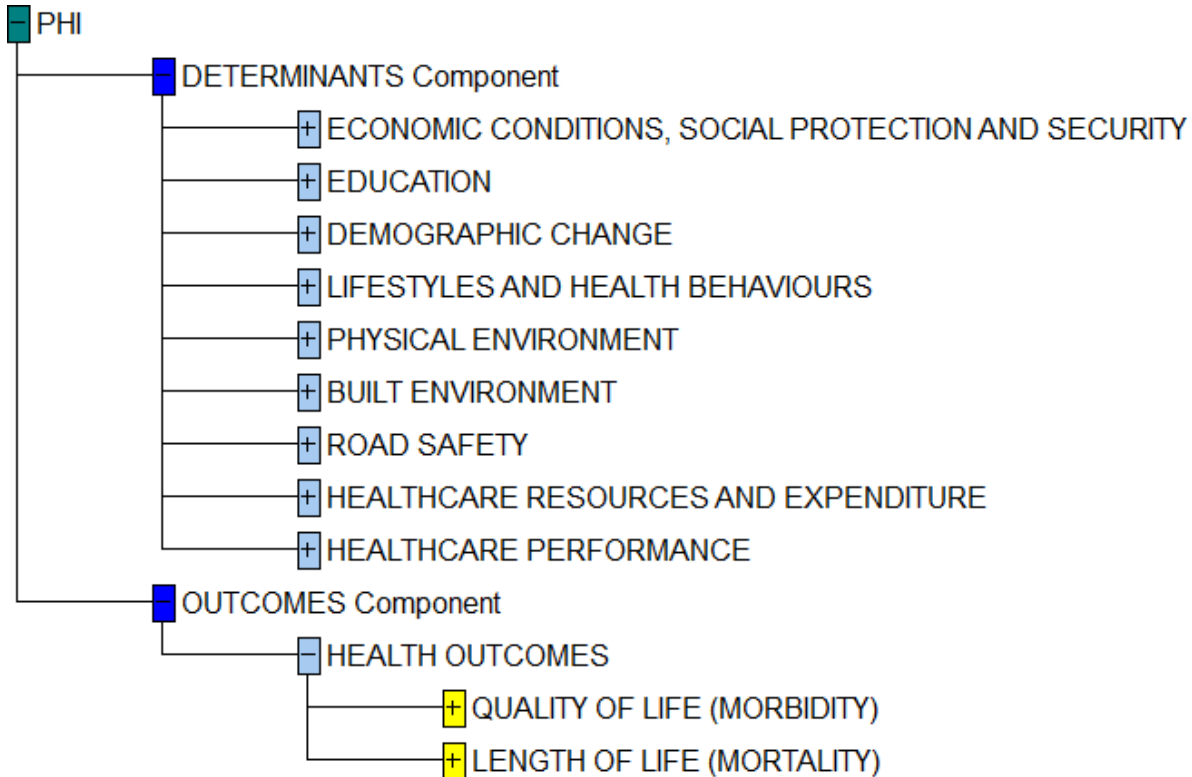


Two other indicators were added (due to incompleteness)



Final structure of the PHI model (two Components)

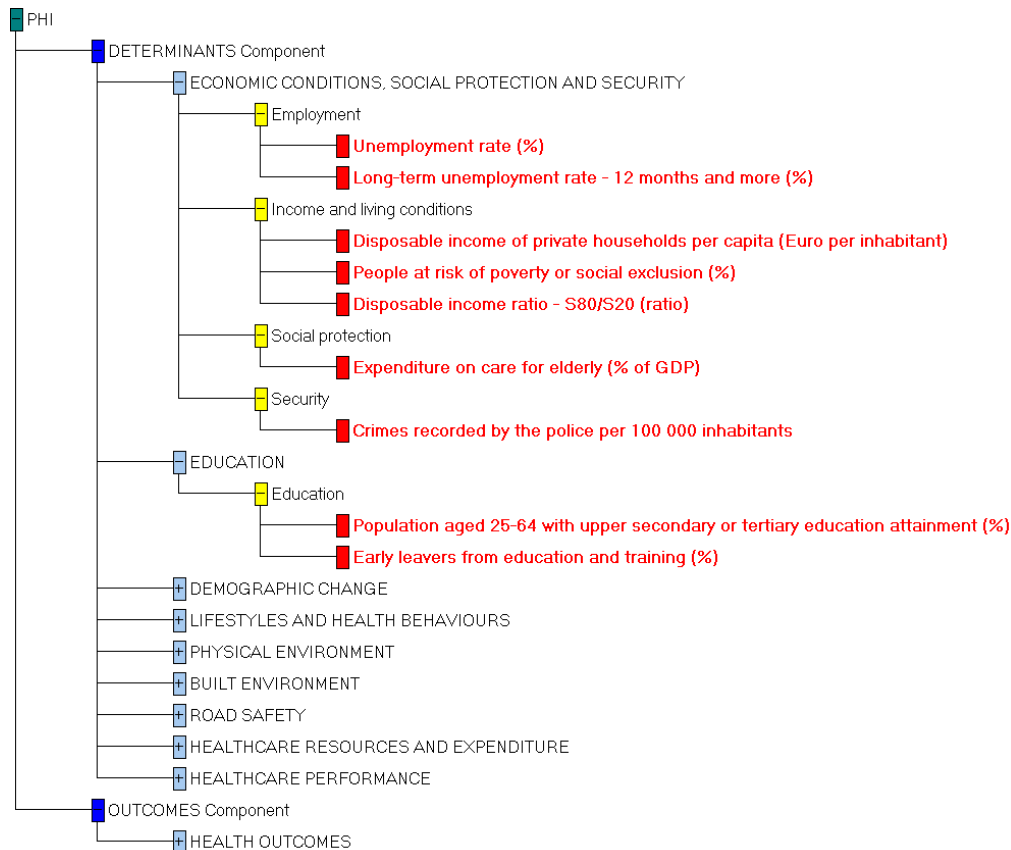
AREAS OF CONCERN



Final structure of the PHI model (two Components)

HEALTH DETERMINANTS COMPONENT

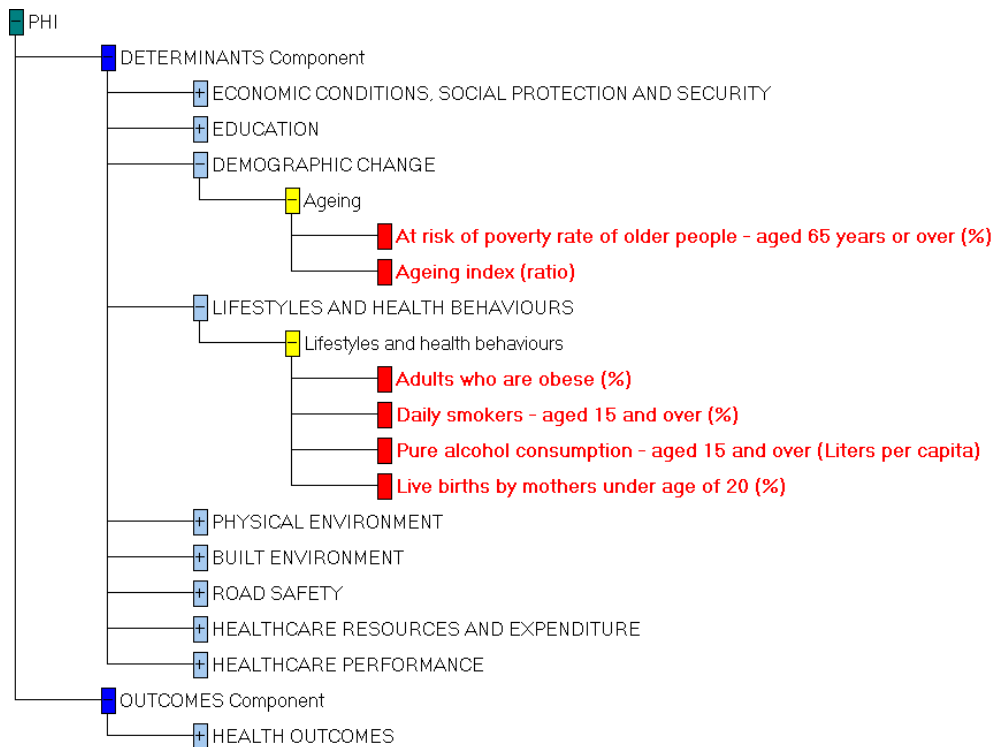
Areas of concern, Dimensions and Indicators



Final structure of the PHI model:

HEALTH DETERMINANTS COMPONENT

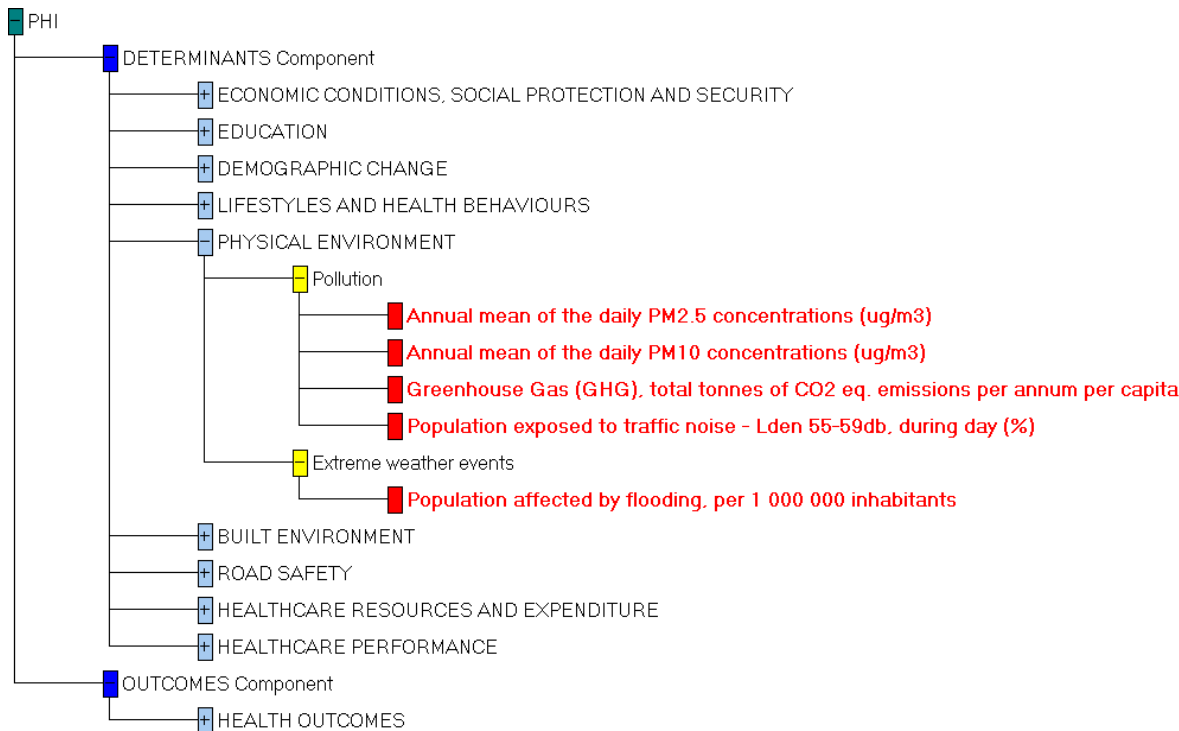
Areas of concern, Dimensions and Indicators (cont.)



Final structure of the PHI model:

HEALTH DETERMINANTS COMPONENT

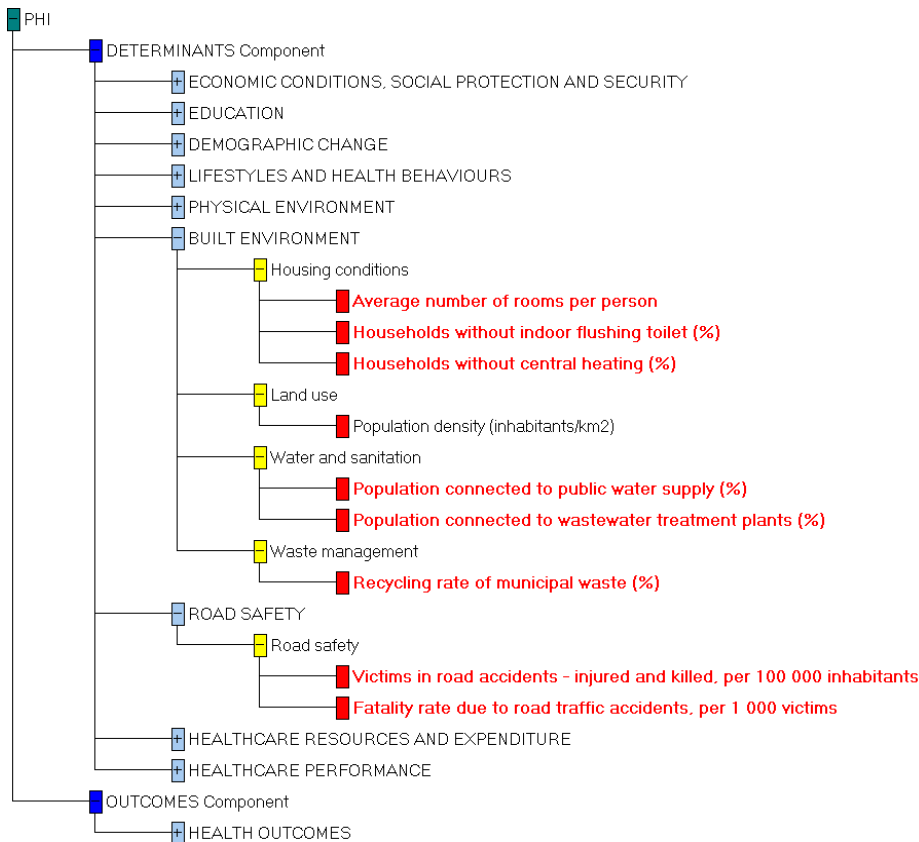
Areas of concern, Dimensions and Indicators (cont.)



Final structure of the PHI model:

HEALTH DETERMINANTS COMPONENT

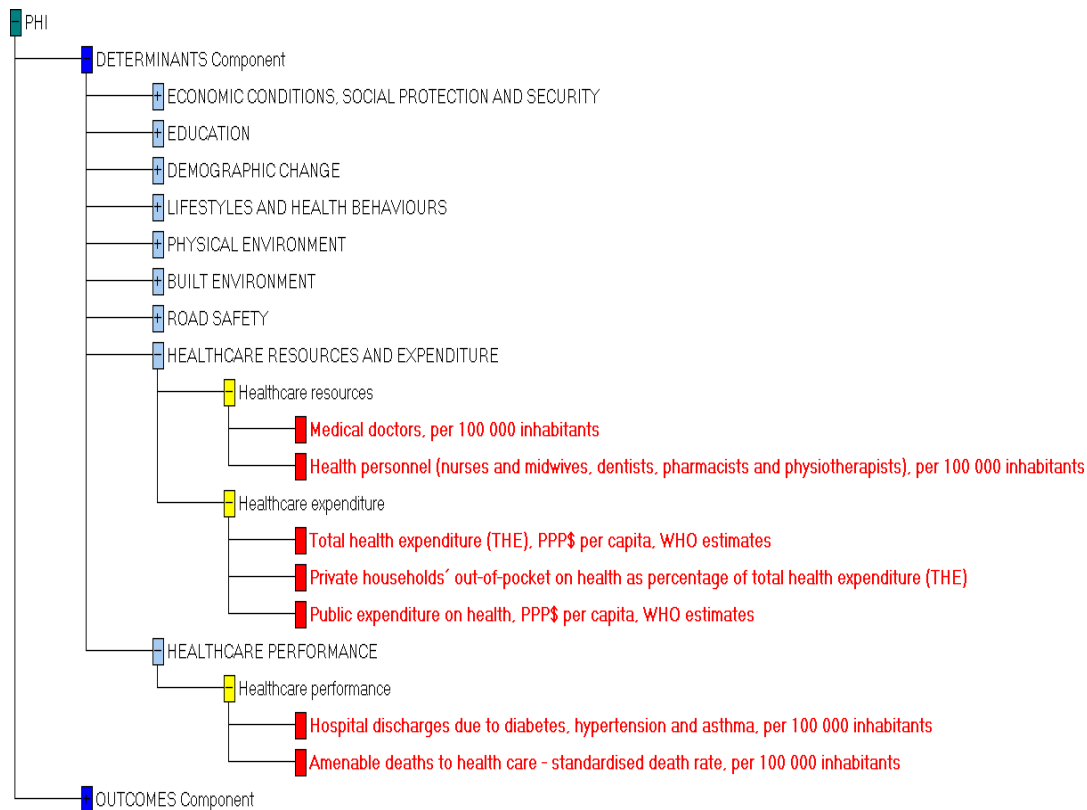
Areas of concern, Dimensions and Indicators (cont.)



Final structure of the PHI model:

HEALTH DETERMINANTS COMPONENT

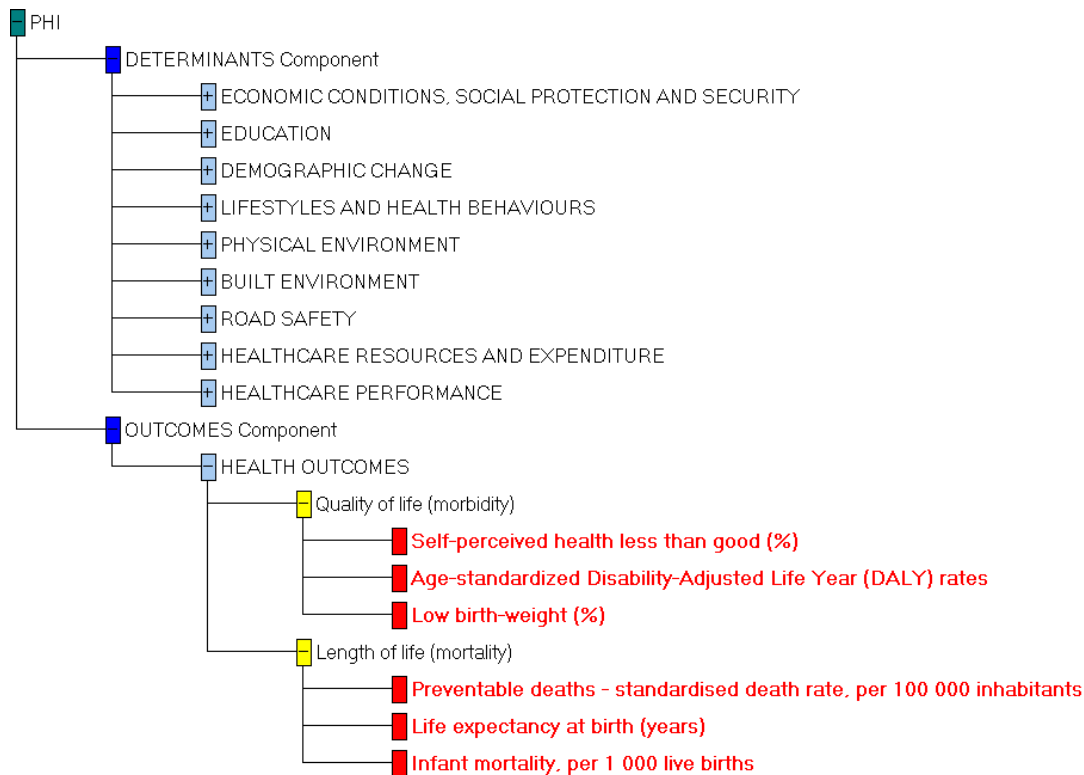
Areas of concern, Dimensions and Indicators (cont.)



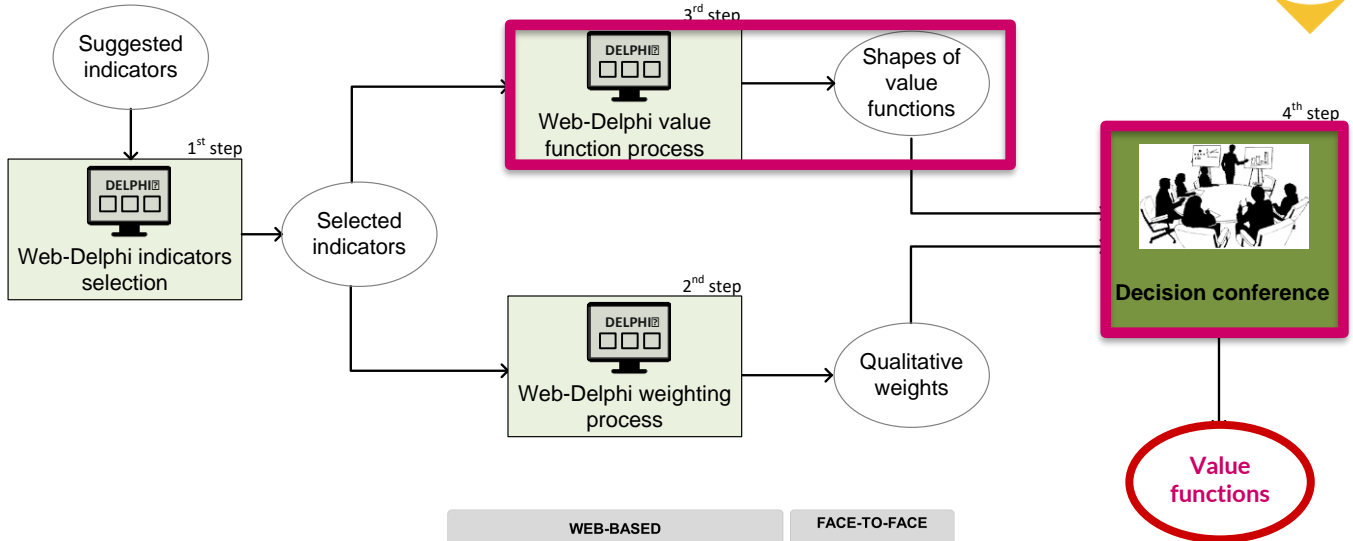
Final structure of the PHI model:

HEALTH OUTCOMES COMPONENT

Areas of concern, Dimensions and Indicators



Activities for construction of the value functions



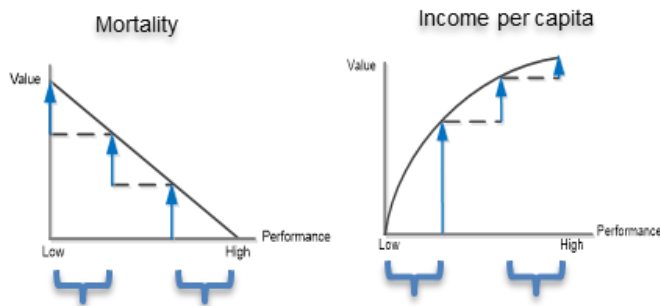
WEB-BASED		FACE-TO-FACE	
STRUCTURING	EVALUATING	EVALUATING	EVALUATING
AREAS OF CONCERN / DIMENSIONS	INDICATORS	WEIGHTS	VALUE FUNCTIONS
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			Informed model building by the strategic group October 2016 - January 2017

The role of a ('measurable') value function

... in the PHI additive value model

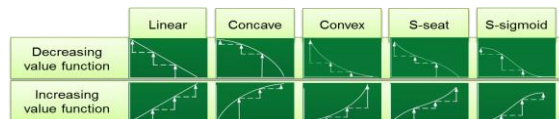
$$\sum_{indicator=1}^n Weight_{indicator} \times V_{indicator}(performance)$$

Does improving performance by one unit always add the same value?



What is the added value of an improvement in performance to population health in Europe?

A value function converts improvements in performance into added value for health.



Measuring value with MACBETH



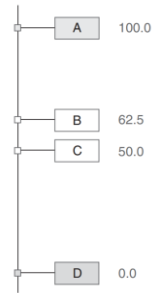
... by constructing a quantitative value function through the elicitation of qualitative value judgments.

MACBETH asks for qualitative judgements about differences in attractiveness (added value).
For A preferred to B, how much more attractive (preferred) is A compared to B:

MEASURING
ATTRACTIVENESS BY A
CATEGORY
BASED
EVALUATION
TECHNIQUE
M



	A	B	C	D
A	No	Weak	Moderate	Extreme
B		No	Vweak-weak	Moderate
C			No	Moderate
D				No



Matrix of elicited qualitative judgments

MACBETH value scale

1st article

Bana e Costa CA, Vansnick JC (1994): MACBETH - An interactive path towards the construction of cardinal value functions. *Int T Oper Res* (1:489-500)

Theory

Bana e Costa CA *et al.* (2005): The mathematical foundations of MACBETH, in *Multiple Criteria Decision Analysis: State of the Art Surveys* (409-437)

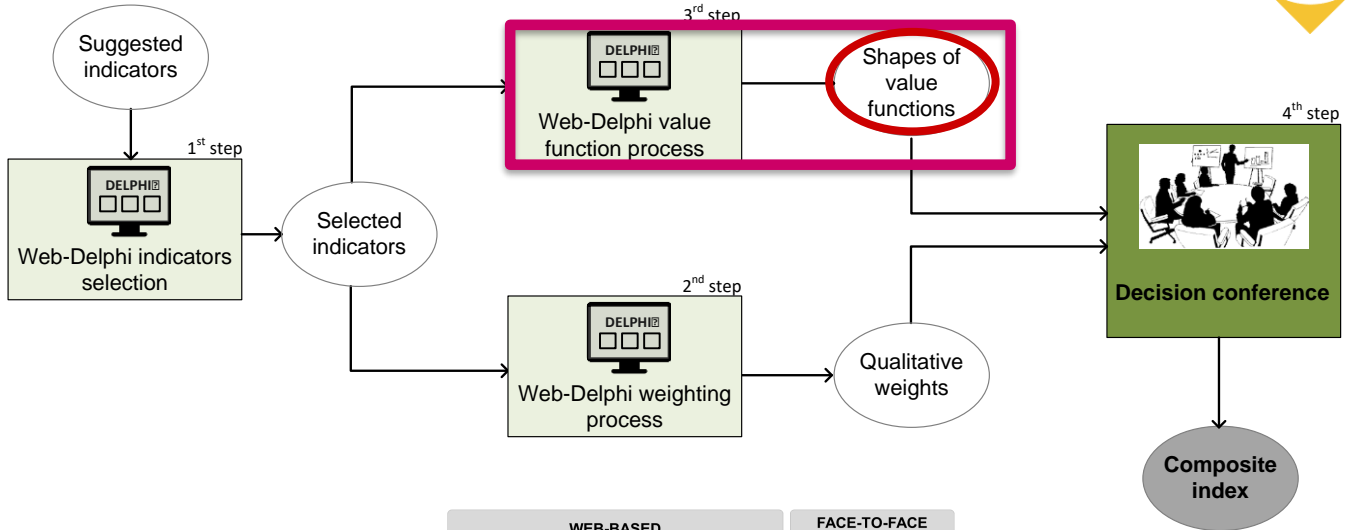
Update

Bana e Costa CA *et al.* (2012): MACBETH. *Int J Inf Tech Decis* (11:359-387)

In Spanish

Bana e Costa CA *et al.* . (2011), "Introducción a MACBETH", J.C. Leyva López (ed.), *Análisis Multicriterio para la Toma de Decisiones: Métodos y Aplicaciones* (233-241).

1st Web-Delphi Activity for value functions construction



WEB-BASED		FACE-TO-FACE	
STRUCTURING	EVALUATING	EVALUATING	
AREAS OF CONCERN / DIMENSIONS	INDICATORS	WEIGHTS	VALUE FUNCTIONS
Identification of areas of concern and selection of dimensions	Selection of indicators to be considered in the model	Importance of closing the gaps in indicators	Added value of improvements at different levels of the indicator
		EVALUATION MODEL	
		Informed model building by the strategic group	
		October 2016	January 2017

1st VF Activity - Agreeing on a shape for the value function for each indicator, using MACBETH questioning protocol in Web-Delphi processes (simultaneously with the four panels)

Example:

To improve population health in Europe, what is the contribution of this change in Unemployment rate (%)?

Select one:

- extreme
- v. strong
- strong
- moderate
- weak
- very weak

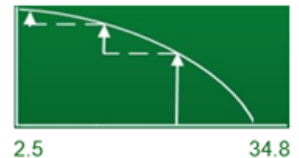
A MACBETH judgments was elicited for each of three intervals of improvement in performance



Example of judgements given by one participant



The implicit MACBETH value function is decreasing concave



1st VF Activity - Agreeing on a shape for the value function for each indicator, using MACBETH questioning protocol in Web-Delphi processes (simultaneously with the four panels)



- Processes developed in three sequential rounds over an 8-week period (from May 3 to June 30, 2016).
- An 'identity card' for each indicator was available online, including the range of performance across European regions.
- The MACBETH qualitative categories were used to elicit individual judgements from the participants.



Round 1 1st question

To improve population health in Europe, what is the contribution of this change in Unemployment rate (%)?

from

34,8
%

to

24,0
%

13,3

%

2,9

%

Very weak contribution

Weak contribution

Moderate contribution

Strong contribution

Very strong contribution

Extreme contribution

Don't know/ Don't want to answer

Previous

Add/Edit comment

Next

1st VF Activity - Agreeing on a shape for the value function for each indicator, using MACBETH questioning protocol in Web-Delphi processes (simultaneously with the four panels)

Round 1
2nd question

To improve population health in Europe, what is the contribution of this change in Unemployment rate (%)?

from 34.8% to 24.0%

to 13.3% to 2.5%

Very weak contribution | Weak contribution | **Moderate contribution** | Strong contribution | Very strong contribution | Extreme contribution | Don't know/ Don't want to answer

Previous | Add/Edit comment | Next

Round 1
3rd question

To improve population health in Europe, what is the contribution of this change in Unemployment rate (%)?

from 34.8% to 24.0%











to 13.3% to 2.5%

Very weak contribution | **Weak contribution** | Moderate contribution | Strong contribution | Very strong contribution | Extreme contribution | Don't know/ Don't want to answer

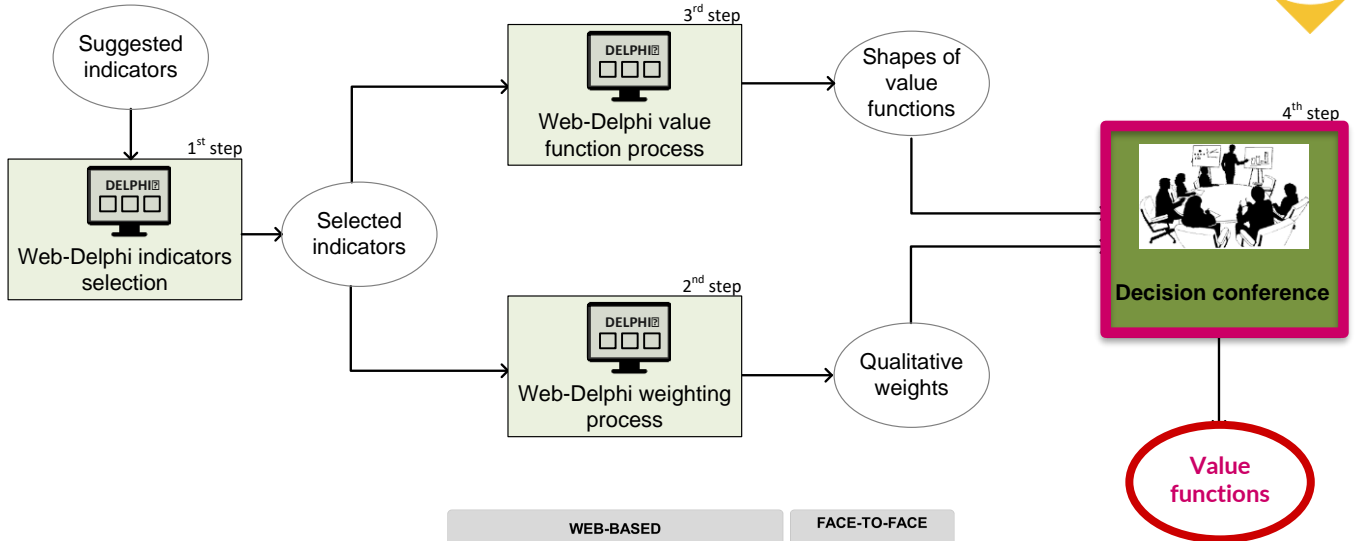
Previous | Add/Edit comment | Next

Indicator	1 st change	2 nd change	3 rd change	Implicit value function type and shape
Unemployment rate (%)	34.8 → 24.0	24.0 → 13.3	13.3 → 2.5	[2.5; 34.8]
Your judgements:	Very strong	Strong	Moderate	Concave

1st VF activity - Web-Delphi value function shaping: Results for the indicators of the socio-economic panel

Dimension	Indicator	Performance range		Group majority value function shape	Linear	Convex	Concave	S-seat	S-sigmoid	Don't know/Don't want to answer
		Min	Max							
Employment	Unemployment rate (%)	2.5	34.8		2 (14%)	1 (7%)	11 (79%)			
	Long-term unemployment rate - 12 months and more (%)	0.8	22.1		2 (14%)		12 (86%)			
Income & living conditions	Disposable income of private households per capita (Euro per inhabitant)	4300	23800				14 (100%)			
	People at risk of poverty or social exclusion (%)	8.6	55.8		3 (21%)	1 (7%)	10 (71%)			
	Disposable income ratio - S80/S20 (ratio)	3.5	7.2		6 (43%)		8 (57%)			
Social protection	Expenditure on care for elderly (% of GDP)	0.0	2.3		3 (21%)		11 (79%)			
Education	Population aged 25-64 with upper secondary or tertiary education attainment (%)	26.7	97.3		1 (7%)		13 (93%)			
	Early leavers from education and training (%)	2.2	32.8		1 (7%)		12 (86%)	1 (7%)		
Security	Crimes recorded by the police per 100.000 inhabitants	60.5	1741.4		3 (21%)		11 (79%)			
Quality of Life (Morbidity)	Self-perceived health less than good (%)	17.7	54.7		11 (79%)	2 (14%)	1 (7%)			

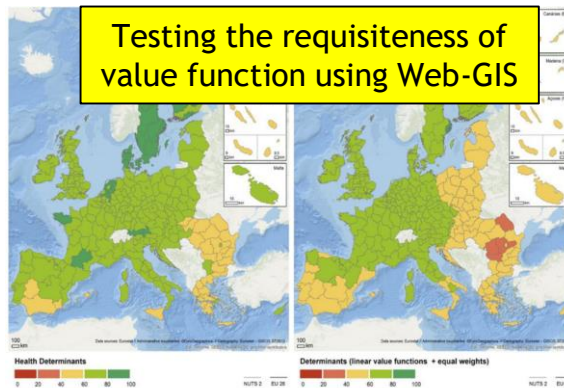
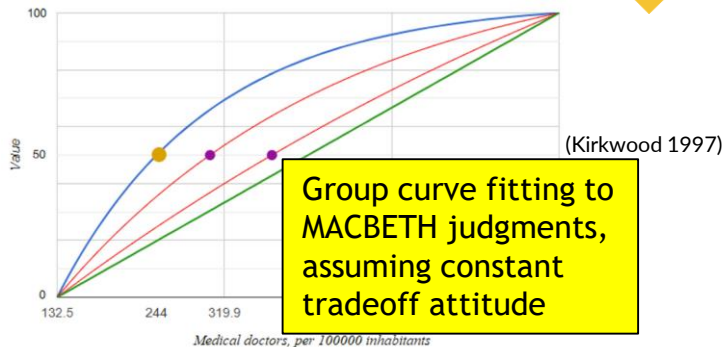
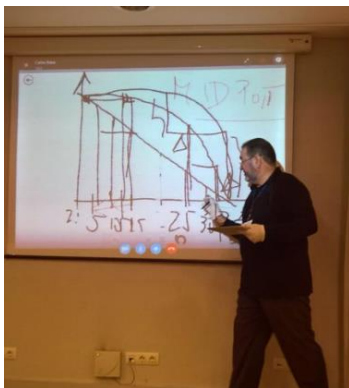
2nd Activity for the construction of value functions



WEB-BASED		FACE-TO-FACE	
STRUCTURING	EVALUATING	EVALUATING	EVALUATING
AREAS OF CONCERN / DIMENSIONS	INDICATORS	WEIGHTS	VALUE FUNCTIONS
Identification of areas of concern and selection of dimensions	Selection of indicators to be considered in the model	Importance of closing the gaps in indicators	Added value of improvements in different levels of the indicator
			EVALUATION MODEL
			Informed model building by the strategic group
			October 2016 - January 2017

2nd VF Activity: Decision conference for value functions definition

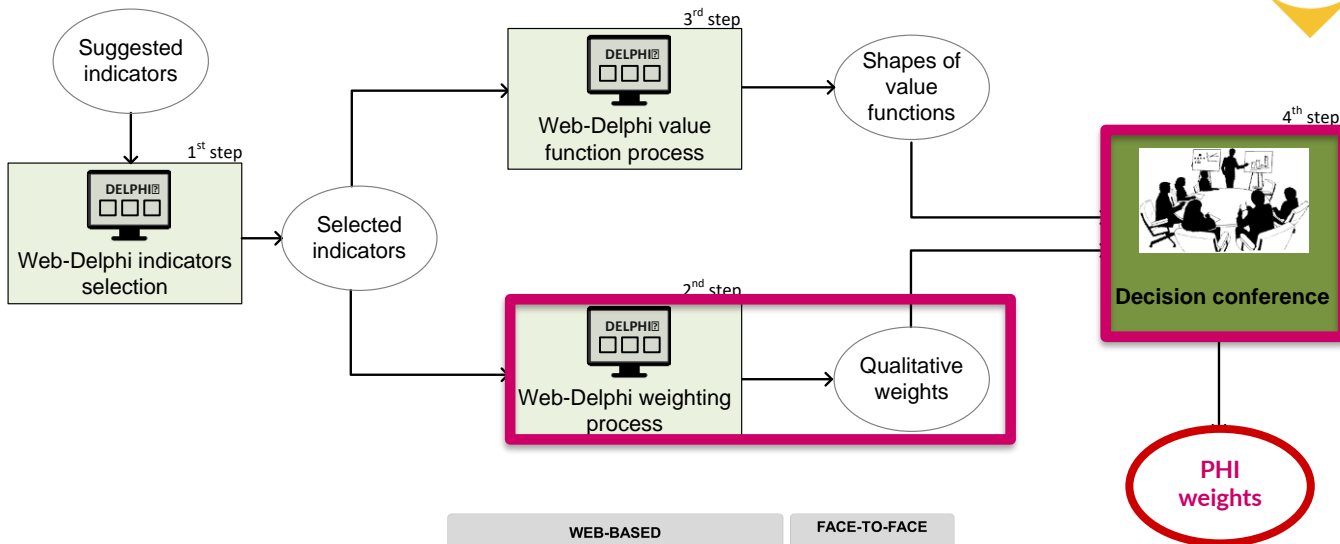
- Analysis of the results of the Web-Delphi value function shaping process
- Definition of missing value function shapes.
- Validation (and/or adjustment) of the proposed value function for each indicator.



Carme Borrell @carme1848 · 25 de out de 2016
 Prof Carlos Bana is doing much effort to help us to understand the importance of value functions of indicators of @euro_healthy project

Agència de Salut Pública de Barcelona

The Weighting Activities



WEB-BASED		FACE-TO-FACE	
STRUCTURING	EVALUATING	EVALUATING	EVALUATING
AREAS OF CONCERN / DIMENSIONS	INDICATORS	WEIGHTS	VALUE FUNCTIONS
Identification of areas of concern and selection of dimensions	Selection of indicators to be considered in the model	Importance of closing the gaps in indicators	Added value of improvements in different levels of the indicator
			Informal meeting with the stakeholder group October 2016 - January 2017

Weighting Activities (for each component separately):

1st Within areas of concern (Delphi and DC) and

2nd across areas of concern (Only DC)

Weighing of all the indicators within each area of concern.

Example:

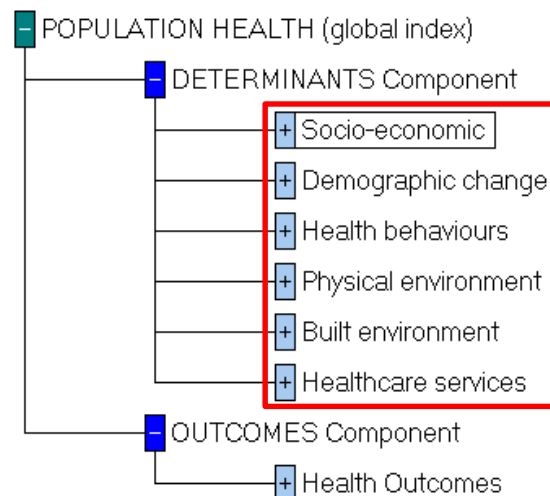
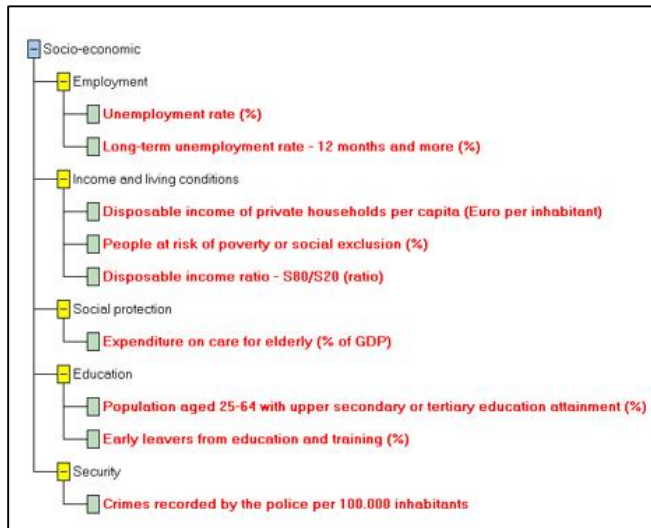
the nine Socio-economic indicators



Weighing of all the areas of concern of a component.

Example:

The six determinants areas



Avoid direct weighting, the “most common critical mistake” (Keeney, 1992)



A major error in multi-criteria modelling is the attempt to assign weights that reflect the ‘importance’ of the criteria without reference to any considerations of ranges on the value scales and how much each one of those ranges matters to the decision maker.

(Phillips LD, Bana e Costa CA 2007 p.57)

Weights reflect the range of the attribute being weighted as well as its importance.

(Edwards W, Barron FH 1994, p.315)

The European Commission’s first state-of-the-art report on CI development (Saisana & Tarantola, 2002) highlights that CI “are based on sub-indicators that have no common meaningful unit of measurement and there is no obvious way of weighting these sub-indicators”(p. 5). Hierarchical or non- hierarchical aggregation by weighted-sum is the most common model adopted (OECD, 2008), with a critical issue being **how to ensure commensurability in a theoretically meaningful way.**

(Bana e Costa CA et al. 2023, p.476)

Two reference performance levels should be defined on each indicator, allowing the additive value model to be theoretically and substantively meaningful. Depending on the context, they can be:

Two fixed references	References of relative value	References of intrinsic value	Strategic references
Upper level	Best plausible	Good	Target
Lower lever	Worst plausible	Neutral	Status quo

... in the PHI additive value model

$$\sum_{indicator=1}^n \boxed{\text{Weight}_{indicator}} \times V_{indicator}(\text{performance})$$

A weight converts partial added value on the indicator into added value on the area.

Fixed reference levels:

$$V_{indicator}(\text{best 2014}) = 100$$

$$V_{indicator}(\text{worst 2014}) = 0$$

MACBETH Questioning protocol with an unambiguous meaning for the weighting

Example:

Indicator

People at risk of poverty or social exclusion (%)

To reduce health inequalities in Europe, how important is to close the gap in this indicator?

Select one:

- extreme
- v. strong
- strong
- moderate
- weak
- very weak
- no



55.8%
people at risk of poverty
(Worst in 2014)

8.6%
people at risk of poverty
(Best in 2014)

1st Weighting activity - Agreeing on indicators qualitative weighs, using MACBETH questioning protocol in Web-Delphi processes (simultaneously with the four panels)



- Processes developed in three sequential rounds over a 5-week period (February 29 - April 4, 2016).
- Participants of each panel were presented with a list of the respective indicators and their gaps. An 'identity card' for each indicator was available online, including the range of performance across European regions.
- The MACBETH qualitative categories were used to elicit individual weighting judgements from the participants:

“To reduce inequalities in Europe, how important is to close this Gap?”

“Socio-economic” panel

Round 1

Economic and Social Environment | Health Outcomes

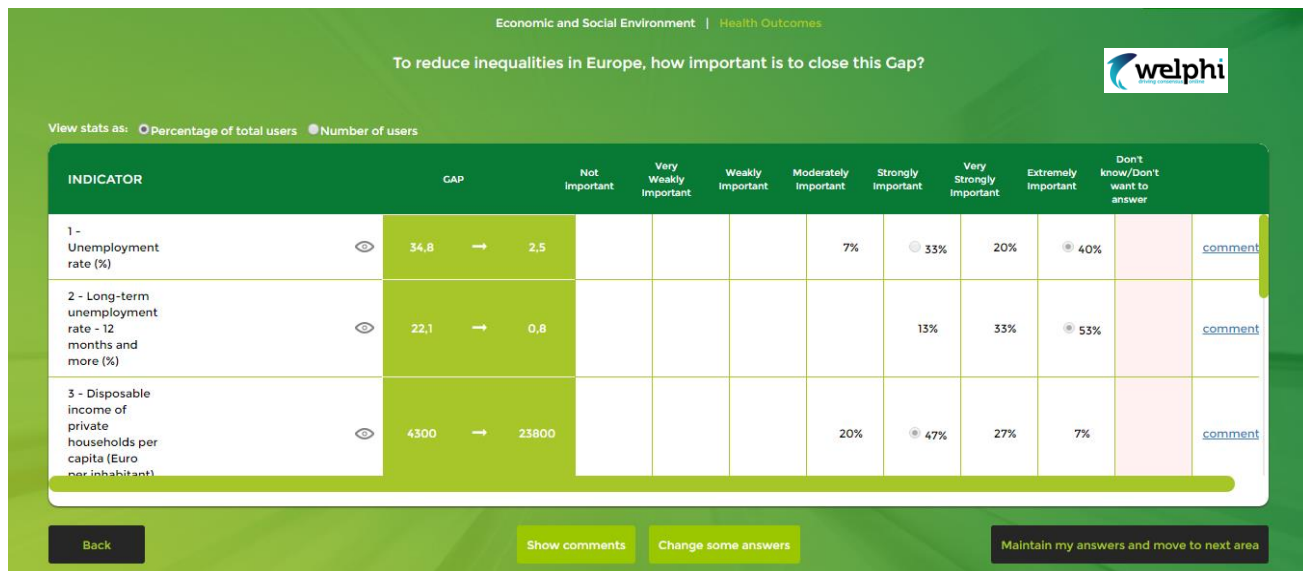
To reduce inequalities in Europe, how important is to close this Gap?

INDICATOR	GAP	Not Important	Very Weakly Important	Weakly Important	Moderately Important	Strongly Important	Very Strongly Important	Extremely Important	Don't know/Don't want to answer	comments
Unemployment rate (%)	34.8 → 2.5	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> comments
Long-term unemployment rate - 12 months and more (%)	22.1 → 0.8	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/> comments
Disposable income of private households per capita (Euro per inhabitant)	4300 → 23800	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> comments
People at risk of poverty or social exclusion (%)	55.8 → 8.6	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/> comments
Disposable income ratio - S80/S20 (ratio)	7.2 → 3.5	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/> comments
Expenditure on care for elderly (% of GDP)	0.0 → 2.3	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> comments
Population aged 25-64 with upper secondary	79.8 → 99.7	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/> comments

Back Save & Next

1st Weighting activity - In Rounds 2 and 3 the participants were presented with their weighting judgements, and a statistics for all participants, and were invited to keep or change them

Example of feedback after Round 1: “Socio-economic” panel



1st Weighting activity: Comments provided by participants on round 1 and 2

“Socio-economic” panel

Unemployment rate (%)

Round 2

**Very strongly
important**

Although employment rate is strongly important for health inequalities, its direct impact on health access is reduced by accessible and universal health systems - so this characteristic is key. Also, some unemployment is to be expected in dynamic and competitive economies. That is the reason that I feel that to state as extremely important will bring too much emphasis when compared to other important indicators.

Population aged 25-64 with upper secondary or tertiary education attainment (%)

Round 2

**Extremely
important**

Although a minority of participants chose the alternative 'extremely important', based on the literature (particularly, empirical literature) I still believe that education is a major determinant of health inequalities; it acts above and beyond other factors like income.

Early leavers from education and training (%)

Round 2

**Extremely
important**

Although a minority of participants chose the alternative 'extremely important', based on the literature (particularly, empirical literature) I still believe that education is a major determinant of health inequalities; it acts above and beyond other factors like income.

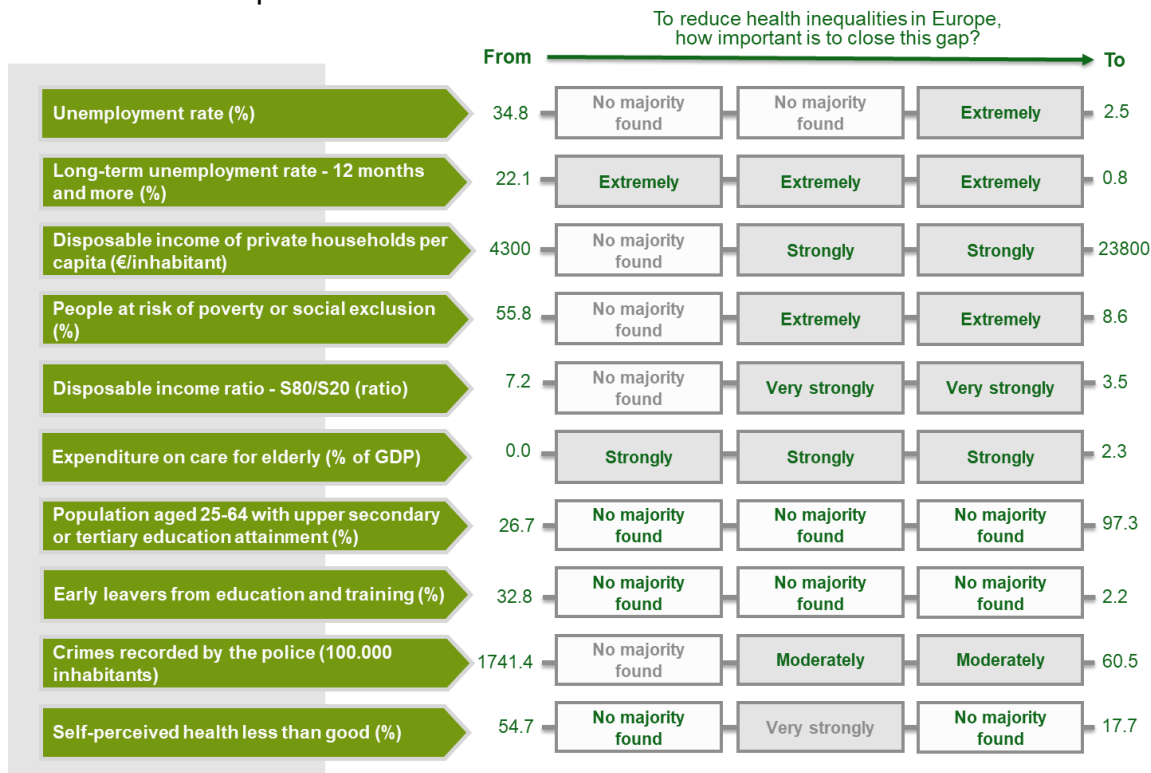
1st Weighting activity – Qualitative swing weights: Results for the indicators of the socio-economic panel

“Socio-economic” panel

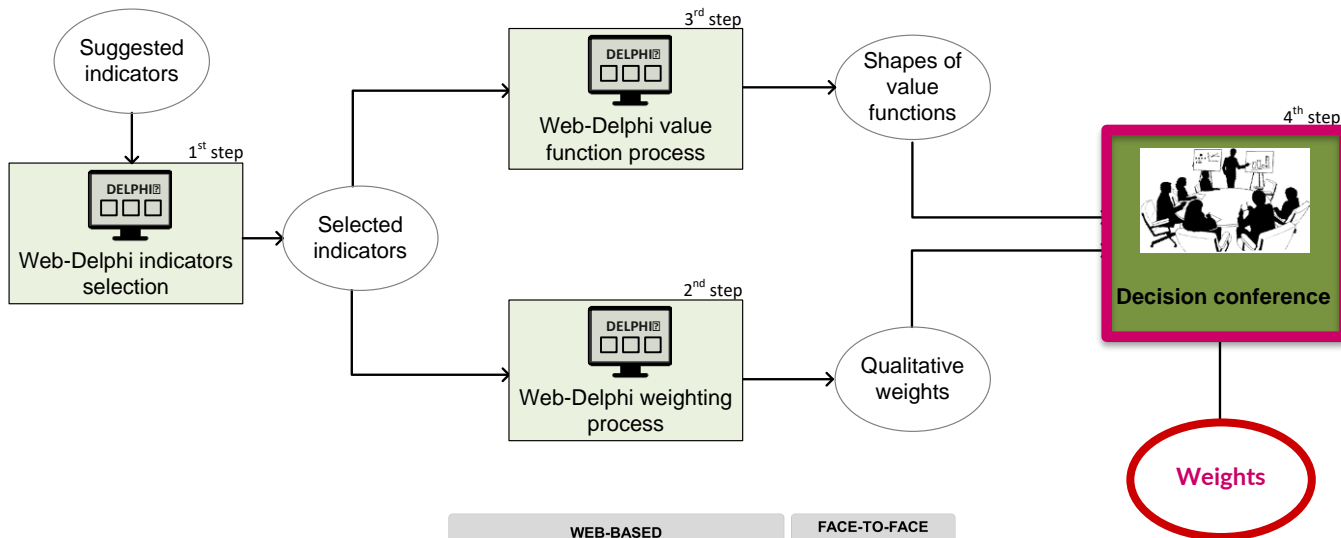
Dimension	Indicator	GAP		Group majority judgment about closing the gap	Importance levels						Don't know/Don't want to answer
		From	To		Not important	Very weakly important	Weakly important	Moderately important	Strongly important	Very strongly important	
Employment	Unemployment rate (%)	34.8	2.5	Extremely important			1 (7%)	3 (20%)	2 (13%)	9 (60%)	
	Long-term unemployment rate - 12 months and more (%)	22.1	0.8	Extremely important				2 (13%)	2 (13%)	11 (73%)	
Income & living conditions	Disposable income of private households per capita (Euro per inhabitant)	4300	23800	Strongly important			1 (7%)	10 (67%)	3 (20%)	1 (7%)	
	People at risk of poverty or social exclusion (%)	55.8	8.6	Extremely important				1 (7%)	1 (7%)	13 (87%)	
	Disposable income ratio - S80/S20 (ratio)	7.2	3.5	Very strongly important				3 (20%)	10 (67%)	2 (13%)	
Social protection	Expenditure on care for elderly (% of GDP)	0.0	2.3	Strongly important		1 (7%)	4 (27%)	9 (60%)	1 (7%)		
Education	Population aged 25-64 with upper secondary or tertiary education attainment (%)	26.7	97.3	No majority found		1 (7%)	2 (13%)	4 (27%)	7 (47%)	1 (7%)	
	Early leavers from education and training (%)	32.8	2.2	No majority found			1 (7%)	6 (40%)	6 (40%)	2 (13%)	
Security	Crimes recorded by the police per 100.000 inhabitants	1741.4	60.5	Moderately important		4 (27%)	8 (53%)	3 (20%)			
Quality of Life (Morbidity)	Self-perceived health less than good (%)	54.7	17.7	No majority found		2 (13%)	1 (7%)	4 (27%)	6 (40%)	2 (13%)	

1st Weighting activity – Overview of the intermediate (round 1 and round 2) and final (round 3) results

“Socio-economic” panel



2nd Weighting activity – Decision conference



WEB-BASED		FACE-TO-FACE	
STRUCTURING	EVALUATING	EVALUATING	EVALUATING
AREAS OF CONCERN / DIMENSIONS	INDICATORS	WEIGHTS	VALUE FUNCTIONS
Identification of areas of concern and selection of dimensions	Selection of indicators to be considered in the model	Importance of closing the gaps in indicators	Added value of improvements in different levels of the indicator
			EVALUATION MODEL
			Informed model building by the strategic group
			October 2016
			January 2017

1st Weighting DC (1 half-day):

Weighting the indicators within each area of concern

Analysis of the results of the Web-Delphi weighting process
for the indicators within each area:

Elicitation of missing group majority judgments

Validation (and/or adjustment) of the proposed weights

2nd Weighting DC (1 half-day)

Weighting the areas of concern

Analysis of the structure of the Population Health Index
for each area of concern:

Elicitation of MACBETH weighting judgment across areas

Validation (and/or adjustment) of the proposed area weights



Weighting the indicators within each area of concern

Elicitation of missing group majority judgments

Validation (and/or adjustment) of the proposed weights

HEALTHCARE RESOURCES AND EXPENDITURE

Healthcare resources

Medical doctors, per 100 000 inhabitants

Health personnel (nurses and midwives, dentists, pharmacists and physiotherapists), per 100 000 inhabitants

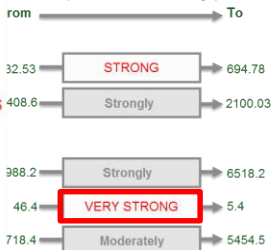
Healthcare expenditure

Total health expenditure (THE), PPP\$ per capita, WHO estimates

Private households' out-of-pocket on health as percentage of total health expenditure (THE)

Public expenditure on health, PPP\$ per capita, WHO estimates

To reduce health inequalities in Europe, how important is to close this gap?



Imagine a hypothetical region with the worst performances in all the five indicators of this area. If a policy could improve its performance from the worst to the best performance on one (and only one) of the indicators, which indicator would you prefer to improve, and how important would that improvement be (to population health in the region)?

Filling in the MACBETH matrix of weighting judgements

	[Out-of-pocket health]	[Health personnel]	[Total health expend]	[Medical doctors]	[Public expend health]	Worst all over
[Out-of-pocket health]	I	P	P	P	P	v. strong
[Health personnel]		I	I	I	P	strong
[Total health expend]			I	I	P	strong
[Medical doctors]				I	P	strong
[Public expend health]					I	moderate
Worst all over						I

Consistent judgements

Test question:
Could different gaps lead you to change your judgements?

Weighting the indicators within each area of concern

Elicitation of missing group majority judgments

Validation (and/or adjustment) of the proposed weights

HEALTHCARE RESOURCES AND EXPENDITURE

Healthcare resources

Medical doctors, per 100 000 inhabitants

Health personnel (nurses and midwives, dentists, pharmacists and physiotherapists), per 100 000 inhabitants

Healthcare expenditure

Total health expenditure (THE), PPP\$ per capita, WHO estimates

Private households' out-of-pocket on health as percentage of total health expenditure (THE)

Public expenditure on health, PPP\$ per capita, WHO estimates

To reduce health inequalities in Europe, how important is to close this gap?



Imagine a hypothetical region with the worst performances in all the five indicators of this area. If a policy could improve its performance from the worst to the best performance on one (and only one) of the indicators, which indicator would you prefer to improve, and how important would that improvement be (to population health in the region)?

Matrix of MACBETH weighting judgements

	[Out-of-pocket health]	[Health personnel]	[Total health expend]	[Medical doctors]	[Public expend health]	Worst all over	Current scale
[Out-of-pocket health]	I	very weak	P	P	P	v. strong	25
[Health personnel]		I	I	I	P	strong	20
[Total health expend]			I	I	P	strong	20
[Medical doctors]				I	very weak	strong	20
[Public expend health]					I	moderate	15
Worst all over						I	0

Consistent judgements

MACBETH qualitative trade-off question:

Imagine a hypothetical region with the worst performance on all the five indicators in this area. How much would you prefer a policy that improves its performance from worst to the best on "Private householders...", or another policy that improves its performance from worst to best on "Health personnel...", leaving all other performances unchanged?



It is not always necessary to complete the entire matrix.

Test question:
Could different gaps lead you to change your judgements?

Weighting the areas of concern

Elicitation of MACBETH weighting judgment across areas
Validation (and/or adjustment) of the proposed area weights

1st elicitation step: The difference of implementation priority between the policy package on the left and the no-intervention policy should be:

Policy package to close all of the gaps within Economic conditions, social protection and security

Dimension	Indicator	GAP	
		From	To
Employment	Unemployment rate (%)	34.8	2.5
	Long-term unemployment rate - 12 months and more (%)	22.1	0.8
Income & living conditions	Disposable income of private households per capita (Euro per inhabitant)	4300	23800
	People at risk of poverty or social exclusion (%)	55.8	8.6
	Disposable income ratio - S80/S20 (ratio)	7.2	3.5
Social protection	Expenditure on care for elderly (% of GDP)	0.0	2.3
Security	Crimes recorded by the police per 100.000 inhabitants	1741.4	60.5



Qualitative questioning protocol based on the comparison of subsets of indicators (adapting the conditional weighting procedure suggested by Keeney and Raiffa 1976, sections 3.7.3 and 3.7.4).

Select one of the six categories below:

Very weak	Weak	Moderate	Strong	Very strong	Extreme
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Weighting the areas of concern

Elicitation of MACBETH weighting judgment across areas

Validation (and/or adjustment) of the proposed area weights

2nd elicitation step: To reduce health inequalities in Europe, which of the two following policy packages should receive higher implementation priority?

Policy package to close all of the gaps within Economic conditions, social protection and security

Dimension	Indicator	GAP	
		From	To
Employment	Unemployment rate (%)	34.8	2.5
	Long-term unemployment rate - 12 months and more (%)	22.1	0.8
Income & living conditions	Disposable income of private households per capita (Euro per inhabitant)	4300	23800
	People at risk of poverty or social exclusion (%)	55.8	8.6
	Disposable income ratio - S80/S20 (ratio)	7.2	3.5
Social protection	Expenditure on care for elderly (% of GDP)	0.0	2.3
Security	Crimes recorded by the police per 100.000 inhabitants	1741.4	60.5

Policy package to close all of the gaps within Education

Dimension	Indicator	GAP	
		From	To
Education	Population aged 25-64 with upper secondary or tertiary education attainment (%)	26.7	97.3
	Early leavers from education and training (%)	32.8	2.2

Select one of the three hypotheses below:

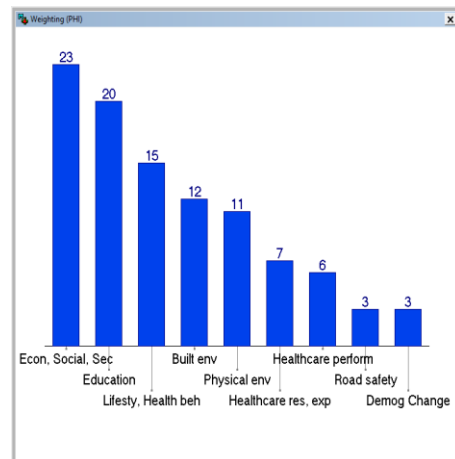
- A policy package to close all gaps within the area on the **left**.
- A policy package to close all gaps within the area on the **right**.
- These two policy packages should receive **equal** implementation priority.

Weighting the areas of concern

Elicitation of MACBETH weighting judgment across areas
Validation (and/or adjustment) of the proposed area weights

Results of the MACBETH voting procedure (avoids judgemental inconsistency)

Policy package that closes all gaps in the area	Package priority (difference to SQ)						DC package priority (difference to SQ)	Priority difference to next
	Very weak	Weak	Moderate	Strong	Very strong	Extreme		
Economic conditions, social protection and security						7	Extreme	Moderate
Education					1	6	Extreme	Strong
Lifestyles and Health Behaviours				2	3	2	Very strong	Moderate
Built Environment				3	4		Very strong	Weak
Physical Environment			1	3	2	1	Very strong	Moderate
Healthcare resources and expenditure			3	3	1		Strong	Weak
Healthcare performance		1	2	3	1		Strong	Moderate
Demographic Change	1	2	2	1	1		Moderate	No difference
Road safety		3	1	2	1		Moderate	



Weights validated by the seven deciders

Test question:
Could different gaps lead you to change your judgements?

MACBETH conditions of order preservation (COP)



1. If the difference of attractiveness was judged...

- extreme*: assign to it a numerical value of 6, or, if not possible, greater than 6
- very strong*: assign to it a numerical value of 5, or, if not possible, greater than 5
- strong*: assign to it a numerical value of 4, or, if not possible, greater than 4
- moderate*: assign to it a numerical value of 3, or, if not possible, greater than 3
- weak*: assign to it a numerical value of 2, or, if not possible, greater than 2
- very weak*: assign to it a numerical value of 1, or, if not possible, greater than 1
- null (indifference)*: assign to it a numerical value of 0,

such that

conditions of order preservation (COP)

2. if one difference of attractiveness was judged more intense than another, then the numerical value assigned to the former judgment must be greater than the numerical value assigned to the latter (a condition of order preservation).

These conditions can be mathematically formulated in a linear programming problem, which solution involves associating a numerical score with each qualitative judgment elicited. Conceptually,

	A	B	C	D
A	no	weak	moderate	extreme
B		no	very weak	moderate
C			no	moderate
D				no

Consistent judgements

	A	B	C	D	MACBETH basic
A	no 0	weak 3	moderate 4	extreme 8	8
B		no 0	very weak 1	moderate 5	5
C			no 0	moderate 4	4
D				no 0	0

MACBETH basic differences

MACBETH basics

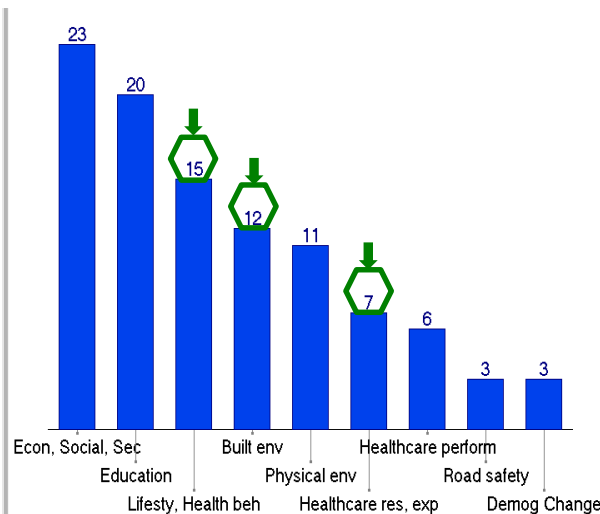
MACBETH group judgements

DC package priority (difference to SQ)	Priority difference to next
Extreme	Moderate
Extreme	Strong
Very strong	Moderate
Very strong	Weak
Very strong	Moderate
Strong	Weak
Strong	Moderate
Moderate	No difference
Moderate	

MACBETH scaling procedure

DC package priority (difference to SQ)	Priority difference to next
Extreme 23	Moderate 3
Extreme 20	Strong 4
Very strong 16	Moderate 3
Very strong 13	Weak 2
Very strong 11	Moderate 3
Strong 8	Weak 2
Strong 6	Moderate 3
Moderate 3	No difference
Moderate 3	

Final area weights adjusted, validated and agreed by the deciders' group.



MACBETH linear programming formulation (LP-MACBETH)

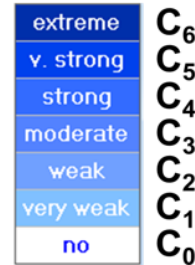


- Let X be a finite set of $n > 2$ (actual or hypothetical) options, among which x^+ and x^- are such that:

x^+ is at least as attractive as any other option of X
and

x^- is at most equally attractive to any other option of X .

- Assume that a set of pairwise comparison judgments has been expressed by an evaluator in terms of the seven MACBETH categories (C_k , $k = 0, \dots, 6$) of difference in attractiveness:



- A judgment between two options x and y of X such that x is at least as attractive as y will be denoted :

- $(x, y) \in C_k$ ($k = 0, \dots, 6$)
when the difference in attractiveness between x and y is expressed by the single category C_k

- When uncertainty or hesitation judgments are present, that is, when differences of attractiveness between options are assigned to several consecutive categories, for example from C_i to C_s , the comparison of any two x and y of X , such that x is more attractive than y , will be denoted :

- $(x, y) \in C_i \cup \dots \cup C_s$ ($i, s = 1, \dots, 6$ con $i < s$).

From the basic MACBETH scale to an interval value scale



Each time a qualitative judgement is elicited, the consistency of all the judgements made by the respondent is checked. Suggestions can be made for resolving inconsistencies if they arise.

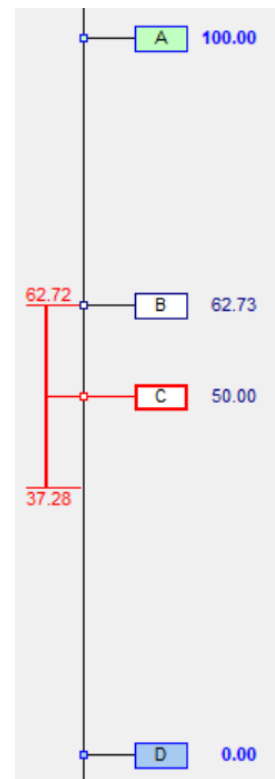
	A	B	C	D	MACBETH basic
A	no 0	weak 3	moderate 4	extreme 8	8
B		no 0	very weak 1	moderate 5	5
C			no 0	moderate 4	4
D				no 0	0

MACBETH basic differences

The numerical scale suggested by MACBETH to reconcile the judgements in the matrix is a higher-ordered metric scale (Siegel S, 1956)

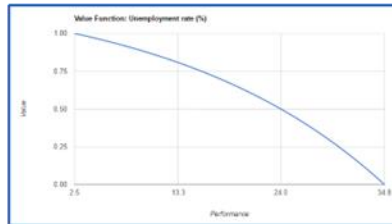
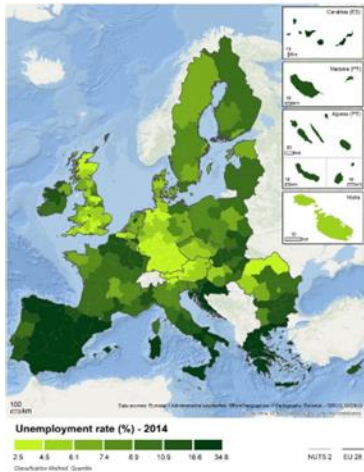
	Current scale	MACBETH anchored	MACBETH basic
A	100	100.00	8.00
B	63	62.50	5.00
C	50	50.00	4.00
D	0	0.00	0.00

Observe the scale axis and compare value intervals.



Applying the PHI model

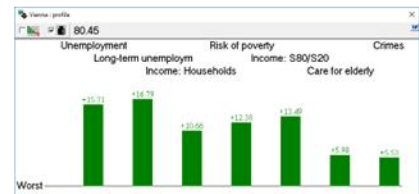
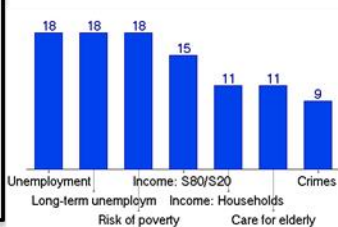
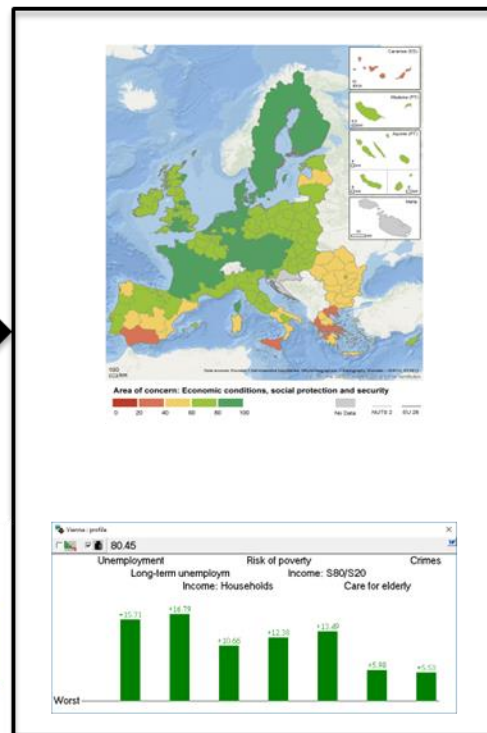
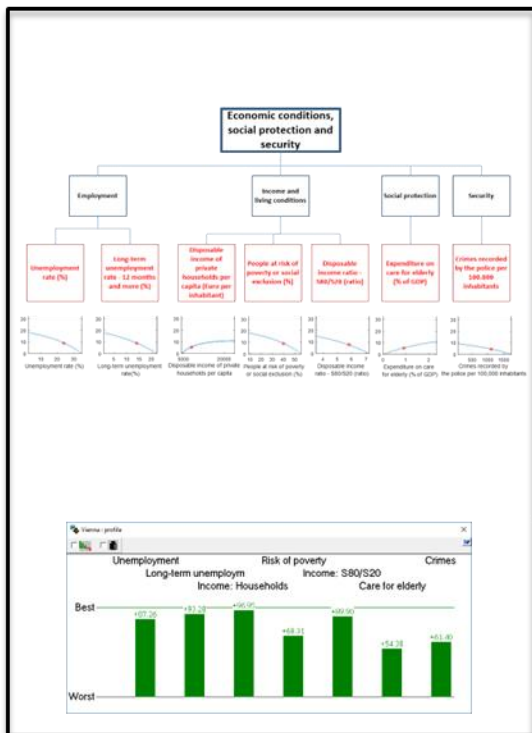
Transforming performance into value on the indicator Unemployment Rate



Weights validated by the seven deciders

Region score on the area of concern

Economic conditions, social protection and security



In the final Decision Conference

Extensive sensitivity and robustness analyses of PHI model results in face of different types of uncertainty:

- On the regions performances on the indicators
- On value functions
- On indicators and areas weights

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Interfaces with Other Disciplines

Collaborative development of composite indices from qualitative value judgements: The EURO-HEALTHY Population Health Index model



Carlos A. Bana e Costa^a, Mónica D. Oliveira^{a,b}, Ana C. L. Vieira^{a,*}, Liliana Freitas^a, Teresa C. Rodrigues^{a,c}, João Bana e Costa^c, Ângela Freitas^d, Paula Santana^{d,e}

In the final Decision Conference

Extensive sensitivity and robustness analyses of PHI model results in face of different types of uncertainty:

- On the regions performances on the indicators
- On value functions
- On indicators and areas weights



In Case-studies, namely the evaluation of health policies in Lisbon

WILEY

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Desirability–doability group judgment framework for the collaborative multicriteria evaluation of public policies

Carlos A. Bana e Costa^{a,b}, Mónica D. Oliveira^{a,c} , Teresa C. Rodrigues^a
and Ana C.L. Vieira^{a,*} 

Summing up on the added value of applying the collaborative value modelling framework



Effective to collect **knowledge** and the views from a **large number of stakeholders**

Helps promoting **dialogue and consensus** in decision modelling

Can be **tailor-made** for diverse and complex decision contexts, such as for scenario building

Is enhanced in **combination** with **distinct decision analysis techniques and tools**

Can be adapted to **risk, optimization and other decision modelling contexts**

Can be helped by **decision tools to easy its implementation**

CVM has shown to be effective in designing multicriteria decision analysis models that incorporate experts' and stakeholders' values and knowledge, promoting engagement and contributing to model acceptance.

The CVM stages and main tasks within each stage



Stage 1 Process design

Defining the evaluation problem by identifying both its domain and scope

Selecting the multicriteria activities in which the Web-Delphi stage is going to be implemented

Identifying and selecting the enlarged number of experts and other stakeholders and the key-players that will be involved respectively at the Web-Delphi and multicriteria decision conferencing stages

Establishing a facilitator and facilitation team

Preparing scientific evidence and data to be used by participants

Selecting the methods and decision support systems (DSS) to be used during both the Web-Delphi and multicriteria decision conferencing stages



Stage 2 Web-Delphi

Designing the Web-Delphi process or processes (type of first round, number of rounds, stopping criteria, individual value elicitation protocols, type of feedback)

Preparing specific invitation letters (calling notes), instructions

Implementing the Web-Delphi process or processes as previously designed

Synthesizing the individual answers (values) between rounds

Preparing summary reports and/or Web-Delphi post-assessment



Stage 3 Multicriteria Decision conferencing

Designing decision conferencing' technical activities, group value elicitation protocols, MACBETH voting materials

Preparing invitation letters (calling notes)

Preparing the visual presentation of the results of the Web-Delphi processes (and additional scientific evidence and data when needed)

Preparing the multicriteria decision conferencing room layout

Implementing the multicriteria technical activities, group value elicitation protocols

Implementing MACBETH voting procedures

Preparing reports that document the results of the multicriteria decision conferencing process

Source: Vieira et al. (2020)

The development of the CVM Framework adopts the principles of ...



- *Value Creation:
Value-Focused Thinking
and
Decision Quality*

Value-Focused Thinking: A Path to Creative Decisionmaking (Ralph L. Keeney 1992),
Many decision methodologies not only do not promote creativity, they inhibit it..

Decision Quality: Value Creation from Better Business Decisions (Spetzler C et al. 2016)

- *Divide and Conquer:
Multicriteria Value
Measurement with
MACBETH*

The spirit of decision analysis is divide and conquer: Decompose a complex problem into simpler problems, get one's thinking straight in these simpler problems, paste these analyses together with a logical glue, and come out with a program for action for the complex problem. (Raiffa H 1968)

Value judgments expressed in words are not psychologically equivalent to value judgments expressed in numbers. (Fasolo B and Bana e Costa CA 2014)

The development of the CVM Framework adopts the principles of ...



- *Process Consultation* *One can only help a human system to help itself.*
(Schein E 1999)
- *Socio-technical modelling* *Bridging the socio-technical gap between the support that a social decision-making process requires and what analytic techniques usually offer.*
(Bana e Costa CA et al. 2023)
- *Requisite modelling* *The model can be considered requisite only when no new intuitions emerge about the problem.*
(Phillips LD 1984)

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