DEVELOPMENT OF THE DEXICACAO MULTI-CRITERIA DECISION SUPPORT TOOL ADAPTED TO THE VIETNAMESE COCOA PRODUCTION CONTEXT

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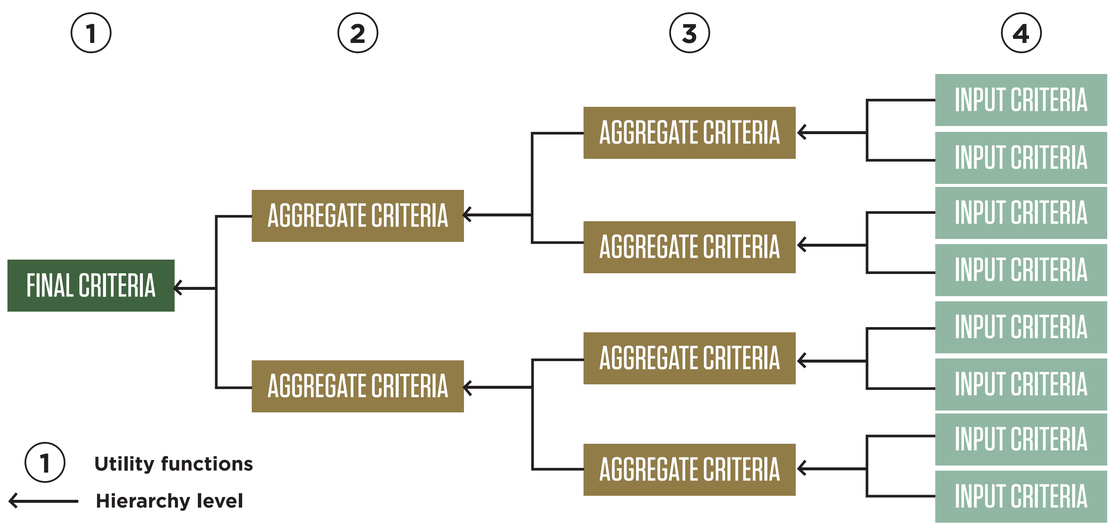
The Vietnamese regions surrounding Ho-Chi-Minh City have a climate e adapted to cocoa production. However, the lack of bibliography and references does not allow the design of specific cropping systems adapted to the agronomic and environmental conditions of the area. Used ex-ante, a Decision Support Tool (DST) allows to build and evaluate theoretical Cultural System (CS) and to improve them before their implementation in the field. DEXiFruit is a multicriteria DST initially defined for apple and peach tree crops in the context of metropolitan France. The adjustment of DEXiFruits to cocoa production and to the Vietnamese tropical context allowed the development of a DEXiCocoa capable of characterizing and evaluating the cocoa-based CS of the area.

Material and Method

DEXiFruits is based on the DEX method, which consists of modeling a situation including several criteria by assigning them a qualitative or quantitative value (Bohanec et al., 2013). The input criterias correspond to the variables of the situation and are gathered in aggregated criterias. A weighting is associated to each of the criteria defining their respective impact on the aggregated criteria they compose.

Figure 1: The DEX method



Results

The first result is the creation of DEXiCacao. To make it operational, seven simple modifications (concerning the name of a criteria, its classes, or its weighting) and seven structural modifications (addition of criteria) were made to DEXiFruits.

Figure 2: Number of criteria changes by branch

Branches	Types of modifications	Number of criterias concerned
ECONOMIC	SIMPLE STRUCTURAL	2* 0
ENVIRONMENTAL	SIMPLE STRUCTURAL	3 7
SOCIAL	SIMPLE STRUCTURAL	3* 0

For example, DEXiFruit has a generic input criteria Yield with an inaccurate qualitative class scale (from Very Low to High). In DEXiCacao, this input criteria becomes Pod Yield, and its class scale becomes a precise quantitative scale (from <240t to 330t<) specific to the yields of the region.

Figure 3: Simple modification of the criteria Yield from qualitative scale to quantitative

Branche	Criteria	DEXiFruit criteria class	New DEXiCacao criteria class
ECONOMIC	POD YIELD	VERY LOW/LOW/MEDIUM/ FAIRLY HIGH/HIGH	240T> / 240T< >270T / 270T< >300T / 300T< >330T / 330T<<

Also, the aggregate criteria Leaching risk composed in DEXiFruits of the input criteria Sensitivity of the land to leaching and Land use area is completed by the addition of the criteria Pluviometry related to the annual volume of rainfall having a strong impact in the tropical context.

Figure 4: Structural modifications of the criterias Sensitivity of the land to leaching and Risk of rain off

(DEXiFruits on the left and DEXiCacao on the right)

Conclusion and Discussions

The DEXiCacao tool remains a generic tool that is not specific to different types of cocoa production. It will require progressive improvements as well as a new sensitivity analysis. In order to be more adapted, the Cacao4Future project developed by CIRAD should focus on taking into account the pedoclimatic conditions of cocoa growing areas, the level of knowledge of future users, include agroforestry aspects and integrate the notion of seasonal periodicity and the life cycle of cocoa cultural systems.

Bibliography

Bohanec M., Žnidaršič M., Rajkovic V., Bratko I., Zupan B. 2013. DEX Methodology: Three Decades of Qualitative Multi-Attribute Modeling. Informatica, 37 : 49-54.

Example

The DEXiCacao tool was tested on a plot of young cocoa trees to be rehabilitated. The global evaluation is presented in the form of a synoptic diagram (figure 5) or a spider diagram (figure 6). DEXiCacao can also be used to evaluate different cropping systems (figure 7).

Figure 5: Synoptic diagram of the aggregated criteria Rentability

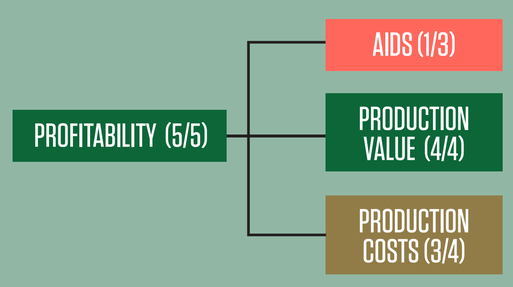


Figure 6: Spider diagram of the cropping system

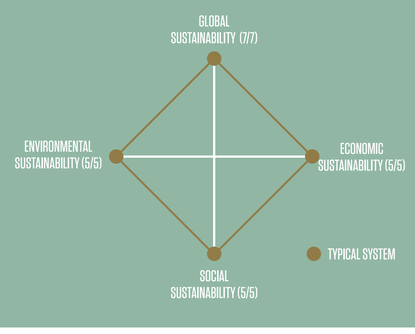


Figure 7: Comparison of the environmental branch of 2 cropping system

Branches	Grade range	Number of input criteria involved	
		CONVENTIONAL	ORGANIC
ENVIRONMENTAL	LOW SCORE	12	13
	MEDIUM SCORE	9	5
	HIGH SCORE	16	19
	TOTAL	37	37

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