

A decision support system for CAP2020 regionalization design in national level

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Abstract. The latest Common Agricultural Policy reform provides national authorities with several implementation options for fine tuning individual goals. Among other, member states can opt for regionalization, i.e. vary the basic payment unit value between national agronomic or administrative regions that have been defined at the beginning of the programming period. We propose a Decision support System that will support national authorities to implement regionalization in a transparent way facilitating collaboration with different shareholders. In this paper we present an overview and give a proof-of-concept implementation.

Keywords: Common Agricultural Policy, Decision Support System; Basic Payment Scheme

1 Introduction

The latest Common Agricultural Policy reform (CAP2020) provides national authorities with several implementation options for fine tuning individual goals. 30% of the national CAP funding is connected to the farmers' compliance to a predefined set of pro-environmental practices. Up to 5% can be devoted to farms of areas with natural constraints, up to 13% to couple payments, up to 10% to small farmers' scheme, up to 2% to new farmers' scheme and up to 3% to the national rights stock. The rest, called basic payment scheme (BPS) is the main layer of income support (over 50% of the national budget), based on payment entitlements activated on eligible land and decoupled from production.

Within this scheme, among other options, Member States (MS) can opt for regionalization, i.e. vary the BPS unit value between national agronomic or administrative regions that have been defined at the beginning of the programming period. Indeed, six MS (Germany, Greece, Spain, France, Finland and United Kingdom) have enabled this option while the rest have applied a uniform national BPS unit value (Henke et al., 2015). Among the regionalization countries only

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Greece has used a purely agronomic criterion while the rest used administrative regions.

The only regulation guideline regarding regionalization is that it should be *in accordance with objective and non-discriminatory criteria, such as their agronomic and socio-economic characteristics, their regional agricultural potential, or their institutional or administrative structure* (European Parliament, 2013). Practically MS are totally free to draw the regions and allocate the BPS budget.

This flexibility provides to policy makers numerous different alternatives on how to form regions and allocate the budget. Additionally the fact that different stakeholders are affected in a distinct way, call for a transparent design process. Towards this end we propose a Decision Support System (DSS) that will support national authorities to implement regionalization in a transparent way facilitating collaboration with different shareholders. In this paper we present an overview and give a proof-of-concept implementation.

2 CAP2020 Regionalization

Regionalization is composed of two distinct components:

Drawing the different regions: As already noted, the distinction of regions can be based on administrative, agronomic or both dimensions.

In the first case, the basic payment of the farm in euro/ha (BP_f^F) equals to the basic payment of the administrative region that the farms belongs to ($BP_{r(f)}^R$), as in equation 1.

$$BP_f^F = BP_{r(f)}^R \quad (1)$$

In agronomic-based regionalization this equals to the sum of the basic payment for each crop family (agronomic) weighted by their relative area share to the total utilized agricultural area of the farm in a baseline year, as in equation 2. In this second case farms do not form clear partitions, i.e. one farm may be affected by more than one agronomic region.

$$BP_f^F = \frac{\sum_r \sum_{c(r)} (BP_r^R \cdot X_{f,c})}{TL_f^E} \quad (2)$$

Allocating the budget between regions: A national basic payment budget (B) has to be divided among regions. If A_r is the percentage of budget allocated to region r, then the basic payment unit value equals to the total amount allocated to the region ($B \cdot A_r$) divided by the total eligible land of the region as in equation 3.

$$BP_r^R = B \cdot A_r / \sum_{f(r)} TL_{f(r)}^E \quad (3)$$

3 An Overview of the Decision Support System

National authorities have a great flexibility on how to draw regions and allocate budget. Consequently they can potentially pursue a wide range of objectives. This means that the required data in order to evaluate the objectives can only approximately be determined during the development of the DSS and very probably new data will be requested during the consultation with other stakeholders.

The DSS shall address this data flexibility requirement by using a Data Warehouse (DW) solution, which is ideal for gathering and keeping policy data from many independent sources of information (Malliapis & Kremmydas, 2016). The underlying DW will contain socio-economic data with spatial and administrative dimensions attached. For instance the database could contain the current direct payment allocation per farm size and prefecture from the National Payments authority; the income indicators per farm size and farm activity from the national Farm Accounting Database Network microeconomic database (FADN); the regional GDP per sector from the national statistical authorities; etc.

Nevertheless, given an established strategic goal, the DSS shall provide a clear picture of how that goal is affected for any selected scenarios. The DSS usage is expected to be in an iterative mode: policy makers and stakeholders draw regions, try some budget allocations and observe the effects and then restart the process to fine tune policy results.

Thus we distinguish three DSS use cases that correspond to the above workflow:

Exploratory region formation use case: Policy makers form a regionalization scenario, i.e. define regions, by means of exploratory analysis. The definition of regions is based on some partition variables, e.g. the NUTS nomenclature, the altitude or some crop classification like arable vs. permanent crops. Thus the user selects the partition variables, which identify the different regions. The user very probably will further consolidate those regions to more homogeneous ones. In order to do so, he will examine certain regions' property variables, e.g. the prevailed crop pattern, the importance of agriculture, the current single payment unit value, etc. He can thus refine initial region creation either manually or through a clustering tool that will suggest him the regions that are as homogeneous as possible. The activity diagram of this use case is provided in Figure 1.

Budget allocation effects use case: When the user has concluded to a region formation scenario he is ready to set budget allocation. This is expected to be a trial and error exercise where policy makers investigate the effects across different stakeholders for different allocations. Users can either manually set the budget share or can use tools of predefined allocations, e.g. budget share proportional to the number of entitlements or to the gross value of direct payments in each region. Then the DSS engine will calculate the indicators and present them to the user. Based on the results the user can save the regionalization scenario and restart the process. The indicators of the scenario effect will span to different stakeholder classes, e.g. farms per NUTS administrative level or per type of farming or per farm income class. The activity diagram of this use case is provided in Figure 2.

Dissemination and collaboration use case: Due to the different interests of stakeholders, collaboration is a very important aspect of the regionalization decision process and thus is incorporated into the DSS. When a user is satisfied with a scenario (region definition + budget allocation) he can save it and choose to share it, either with other users of the system or in public. A discussion channel, e.g. a forum thread, will be automatically created so that other users can comment and discuss scenarios. Users will also be able to load the scenarios of other users in order to adjust them to their point of view.

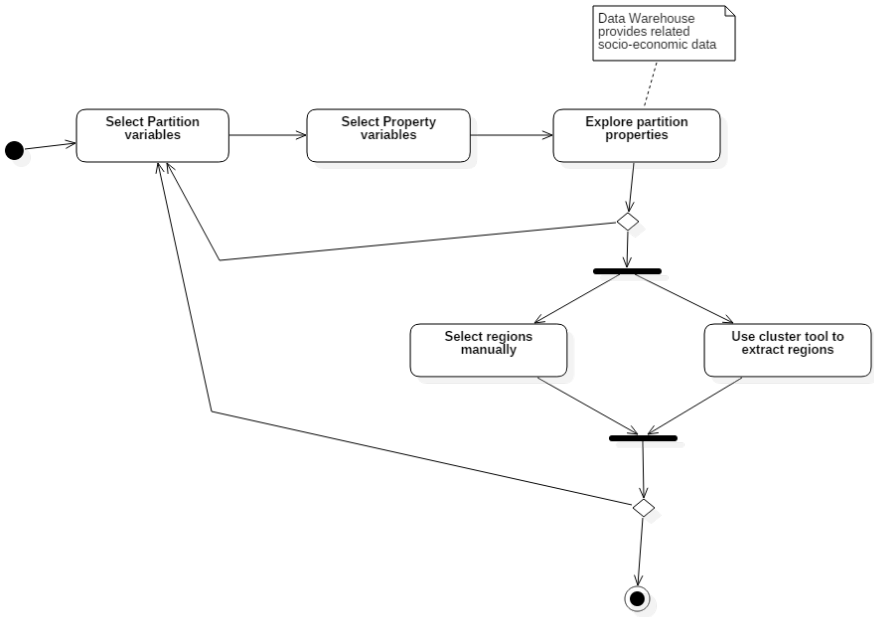


Fig. 1. Activity Diagram for exploratory extraction of regions

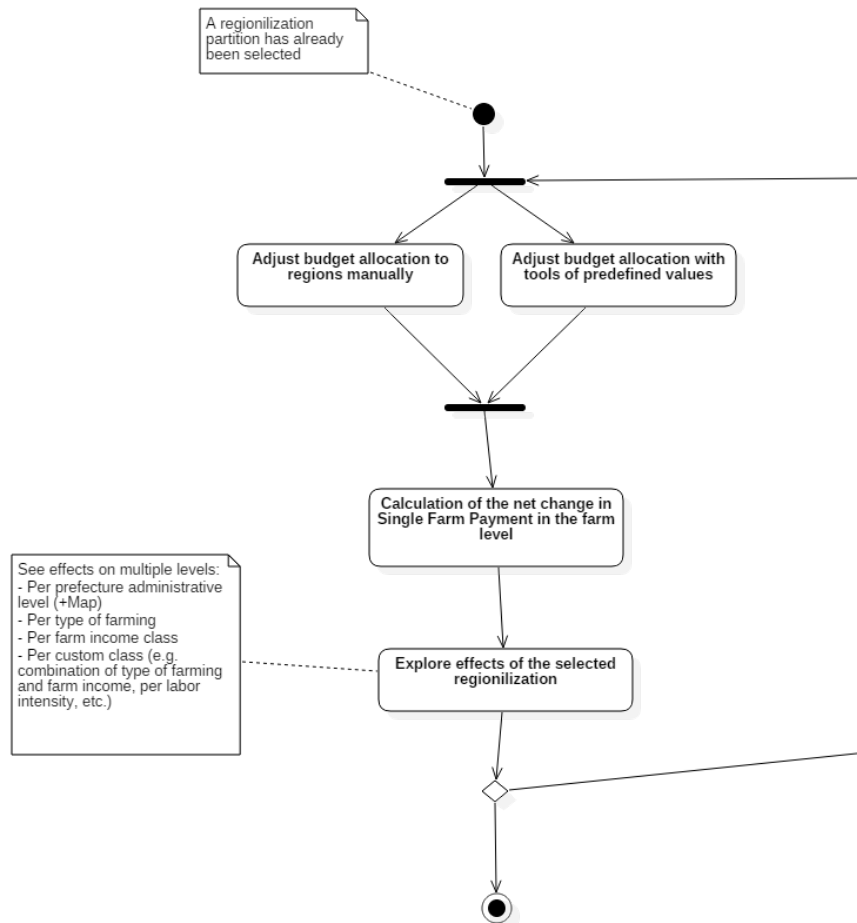


Fig. 2. Activity Diagram for exploring the effects of various budget allocations between regions

4 A proof-of-concept implementation

We used the R-Shiny web application framework (Chang et al., 2017) for agile development of a proof-of-concept implementation. The data source was the Greek FADN database without resorting to a Data Warehouse solution.

For the exploratory region formation stage, we used the following partition variables: NUTS-2, NUTS-3, Altitude and the Less-Favored-Area status. For deciding on the region homogeneity we provided the following property variables:

Farm Gross Income, Farm Gross Income per ha, cereals and permanent crops area, percentage of subsidies on gross income, Single Farm Payment value, sum of Single Farm Payments, Irrigated area. A screenshot of this first use case can be seen in Figure 3. User selects partition and property variables and by clicking GET STATUS he gets an information table where he can further refine region formation. There is also a CLUSTER VARIABLES button that triggers a hierarchical clustering of the regions.

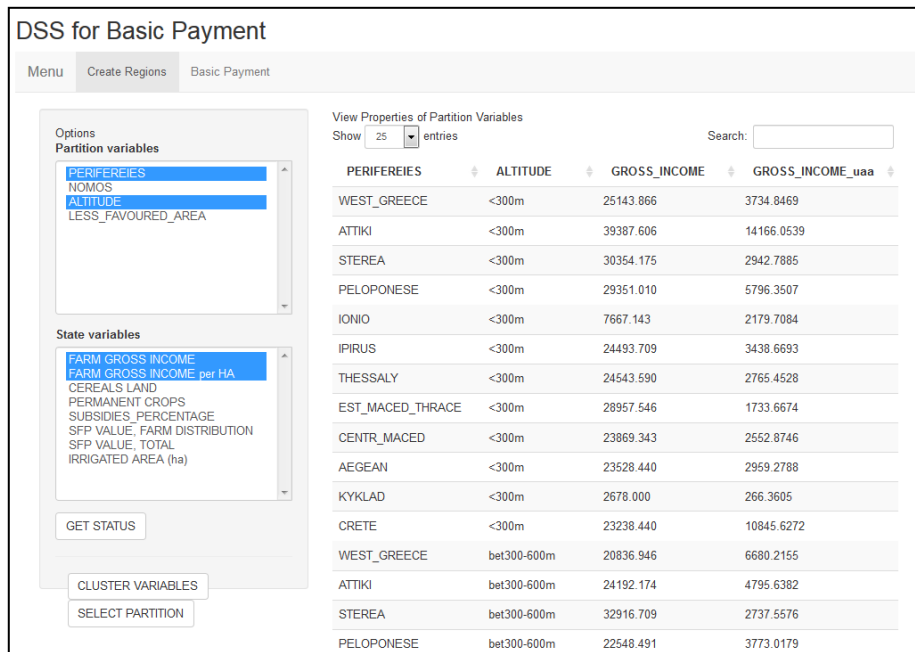


Fig. 3. Exploratory region formation use case

When he is satisfied with the selected region formation scenario he can click SELECT PARTITION that will take him to the next step (Figure 4). There he can set the national budget and adjust the allocation to regions. Then by pressing UPDATE ALLOCATION, the DSS calculates the effects and present him results in various ways. Administrative level gross income positive or negative effects are shown in a NUTS-3 map. A table of the effects on different type-of-farming within a NUTS-2 context and on different farm size classes is also given in a different tab.

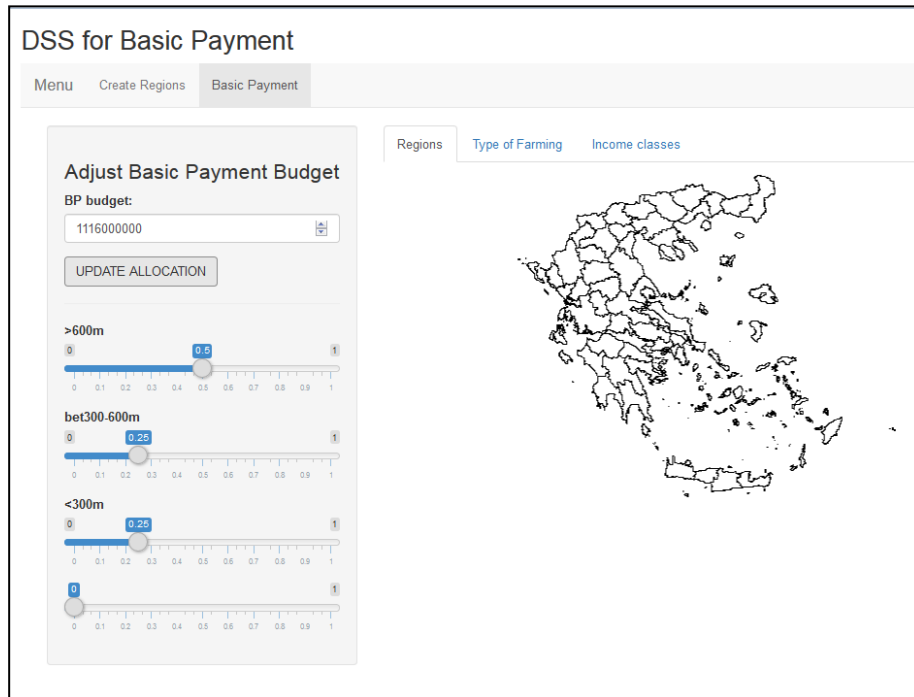


Fig. 4. Budget allocation use case

5 Conclusions

In this paper we present an overview of a Decision Support System for assisting in the design of EU-CAP regionalization scheme. The proof-of-concept implementation shows that the DSS can greatly enhance the policy design process and provide insights to policy makers. Furthermore it can serve the cause of transparency to different shareholders.

The next step is to implement the DSS in a real case study, where in collaboration with the policy makers and the stakeholders, different regionalization scenarios and budget allocations will be drawn, the various trade-offs will be revealed and a consensus will be reached, employing group decision making methods.

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