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DIGITAL TECHNOLOGY TO SUPPORT ORGANIC GROWERS ? MESCLUN: A WEB APP TO HELP DESIGNING COMPLEX ORGANIC VEGETABLE PRODUCTION

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Abstract: For organic vegetable growers, combining long rotations involving a high level of plant diversity with intercropping can bring economic and ecological benefits but often increase management complexity and workload. To support the decision making of farmers facing such challenges, the research-action objective of the MESCLUN programme is to develop a web application based on the innovative computer technologies of knowledge graphs and semantic web. In this French transdisciplinary project, we articulate methods and frameworks from different fields (agronomy, economy, design, knowledge and computer engineering) with expertise of agricultural practitioners (organic growers, advisors, teachers, organic farming students). Through an iterative and participatory approach based on co-innovation workshops in 4 contrasted regions of France, we design, develop and test web app prototypes to help farmers to appropriate systemic thinking, explore and assess their "own" solutions in the organisation of complex organic vegetables systems. We will present functionalities/interface of the first web app prototype. We will for example show how the web app can help growers to plan their crops in space and time considering contrasted fertility and plants health strategies as well as marketing requirements. We will also illustrate how different simulations can be assessed from a socio-economic perspective (workload and income). Based on those first results, we will examine the specificities, added value and blind spots of our web app compared to other decision making tools in the organic agricultural sector. To feed a more general debate, we will provide critical discussion points on the potentialities and limitations of innovative digital solutions to support decision making in complex organic farming systems.

Introduction: For organic vegetable growers, combining long rotations involving a high level of plant diversity with agroecological practices such as intercropping can contribute to a better management of economic risks and an improved stability of the agroecosystem. However, such strategies can increase management complexity, workload and mental load (Dumont and Baret, 2017). There is thus a need for tools to support the growing number of current and future farmers (students) aiming at implementing agroecological practices in highly diversified organic vegetable systems, e.g inspired by

permaculture (Morel et al., 2017). As agroecological approaches (as we understand them) aim to consider situated expert knowledge of farmers, they cannot promote one-size-fits-all “recipes” (Méndez et al., 2013). In this regard, it is rather crucial to empower growers to build on other farmers’ experiences and appropriate systemic thinking to design their “own” solutions. Supporting such processes calls for a renewal of decision making tools and pedagogical methods for which the development of interactive and digital technologies is promising.

In this communication, we will present the first results of a French participatory action research programme (called MESCLUN) exploring how a digital web application could support the spatial and temporal planning of complex organic vegetable systems combining long rotations with a high diversity of crops (till 50-60 crops) and intercropping.

Material and methods: The French transdisciplinary MESCLUN programme gathers scholars (mainly agronomists and economists), designers, computer/knowledge engineers from a social economy start-up, civil organisations working with organic farmers and agricultural teaching institutions. To develop a web app for the planning of complex organic vegetable systems, we implement an iterative and participatory approach based on co-innovation workshops with practitioners (organic growers, advisors, teachers, organic farming students) in 4 contrasted regions of France.

For each iteration, we articulate the following elements: (i) workshops with practitioners carried out in a design thinking perspective (Stickdorn et al., 2018); (ii) collection and synthesis of available scientific and grey literature as well as expertise of the practitioners on a specific topic judged relevant to support the decision making (e.g impact of different strategies of intercropping on soil fertility and workload), (iii) integration of knowledge and needs into a service design proposal (Stickdorn et al., 2018); (iv) development of a web app prototype using innovative technologies of knowledge graphs and semantic web (Bonatti et al., 2019). Depending on the phase of the project, workshops aim at exploring expectations/needs of practitioners, testing the web app prototype in concrete situations (e.g supporting a student in designing his/her future farm) and formulating possible improvements for the next iteration. At the end of the project, the final planning web app will be disseminated through organic extension and teaching networks.

Results: The MESCLUN programme has started in autumn 2019 and will run till the end of 2021. At the organic world congress in 2020, we will present the first results of the participatory design and development phase (based on 8 workshops). By September 2020, we will be able to provide an analysis of needs and expectations from the crop planning web app according to the context of use (teaching, design of a new farm, redesign of an existing farm). We will highlight the functionalities of the first web app prototype and show how digital technologies of knowledge graphs and web semantic can be used to match agricultural practitioners’ requirements. The web app will allow farmers to simulate different innovative vegetable systems with an intuitive and ergonomic interface and to easily upload his/her own farm data to make estimations more precise if required. To illustrate our results, we will specifically focus on the following points: (i) design of long rotations integrating intercropping according to contrasted management strategies of soil fertility and plants health, (ii) integration of a marketing module to ensure that the designed system can match specific commercial requirements (e.g combination of short supply chains constraining the farmer to provide a given quantity and diversity of crops along the year), (iii) socio-economic assessment of the designed system (estimated income and workload).

Discussion: We will base our discussion on the analysis of the first feedbacks from practitioners using the first web app prototype in concrete situations. For that purpose, we will use the concepts of credibility (scientific adequacy), saliency (relevance to decision makers) and legitimacy (fair and unbiased information production respecting stakeholders’ values and beliefs) as defined by Cash et al. (2003). We will examine the specificities, added value and blind spots of our web app compared to other decision making tools in the organic agricultural sector. Based on our preliminary experience, we

will provide critical discussion points on the potentialities and limitations of innovative digital solutions to support decision making in complex organic farming systems.

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