SmartFood: Engaging citizens in food diversity in cities

D4.1. Working prototype of hydroponic cabinet and insect farm box (lab-scale version)

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Responsible author	Rafał Majzer (RIC)		
Contributors	Iwona Adamkiewicz (RIC) Andżelika Drutowska (RIC) Łukasz Gontar (RIC) Maksymilian Kochański (RIC) Katarzyna Korczak (RIC)		
Reviewer(s)	Ewa Duda (MGU)		
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Executive Summary

A significant part of the food consumed in cities today is:

- ⇨ produced outside cities
- ⇨ grown with the use of pesticides and fossil fuel energy
- ⇨ processed and filled with ingredients that negatively affect human health
- ⇨ packed in plastic, which creates environmental problems in landfills and in the oceans
- ⇨ transported over long distances, which emits large amounts of greenhouse gases
- ⇨ wasted, which negatively affects the pockets of households.

The Polish-Norwegian research and innovation project SmartFood was created to show that this situation can be changed. SmartFood consortium proposed the following vision: *Grow your own food in the corridor of your building, reduce greenhouse gas emissions, waste of food as well as energy and transportation costs! Improve your physical health by changing your eating habits and engage with your neighbours!*

Following the co-design phase that took place in SmartFood Work Package 1 (*Co-design of environmental innovation*), this report is the opening study of SmartFood Work Package 4 (*Development and lab-scale tests of SmartFood solutions for environmental innovation*). The present study describes building of prototypes of lab-scale solutions of environmental innovation that will enable the implementation of the SmartFood vision: hydroponic cabinets and insect farm boxes. Therefore, the report comprises two main parts.

In the first part, this report presents an overview of requirements and functionalities that were set for lab-scale prototypes of hydroponic cabinets (in other words: hydroponic cabins or SmartFood Cabins, or in Polish: SmartFood Kabiny). The division of the cabinets into modules is explained and the internal and external construction of these systems is described, including an internal frame, a movable platform for the nutrient solution container, countertops, walls and doors. A special focus is placed on the nutrient solution circuit, involving a container for nutrient solution and shelves allowing for implementation of hydroponic growing of plants using nutrient film technique (NFT). The parameters of the selected lighting system are described as well. Finally, the subsequent phases of building three prototypes of SmartFood Cabins are outlined.

In the second part, this report presents requirements and functionalities that were set for lab-scale prototypes of insect farm boxes (in other words: SmartFood Insectarium, or in Polish: SmartFood Robaczkarium). Insect boxes for farming of superworms (*Zophobas morio*) and mealworms (*Tenebrio molitor*) were built and tested. A commercially available product for farming of house crickets (*Acheta domesticus*) was acquired and tested as well. Among the tested solutions, the prototype dedicated to farming of mealworms was found fully working. The produced prototype of insect farm box for mealworms will allow for investigating the possibilities for feeding edible insects with parts of plants from hydroponic cabinets (e.g., roots from harvested plants not consumed by humans) in the laboratory experiments planned in SmartFood. Solutions based on this prototype could be used directly by households, in case they are interested in engaging in such activity.

As a result, the report showcases the technological base for testing of novel urban agriculture solutions in further tasks in lab-scale conditions, in SmartFood Work Package 4 (*Development and lab-scale tests of SmartFood solutions for environmental innovation*). The experiences collected in the lab-scale research in Work Package 4 are expected to provide valuable insights for the subsequent research in operational, real-life conditions in SmartFood Work Package 6 (*Urban Living Labs implementation of Smart Food innovation*), which will involve households living in urban residential blocks.