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ICESI TU FUTURO A OTRO NIVEL
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Departamento del Valle del Cauca Gobernación
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2DO. CONGRESO
INTERNACIONAL EN
BIOECONOMÍA
Del 3 al 5 de octubre de 2024

Conectando mentes, cosechando soluciones:
bioeconomía en acción en la COP16

# Engaging ancestral knowledge through aquaponics systems

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ACREDITACIÓN DE Alta Calidad UNIBAGUE

**Introduction:** Projects present sustainability problems or have been abandoned due to difficulties in technology transfer to the communities. Therefore, productive projects should incorporate strategies that lead to the social appropriation of technologies. In this sense, aquaponics has re-emerged as a system that integrates aquaculture with hydroponics and allows the production of organic food, minimizing the use of water and polluting discharges. However, its implementation requires practical designs that facilitate the operation of the system, so that the undertaking for the communities is practical, affordable and adapted to their cultural conditions. Therefore, the incorporation of co-design processes of aquaponics systems with the community has been proposed, to facilitate entrepreneurship and food sovereignty, integrating ancestral knowledge. The study was developed with the Chaparralunas Women's Network for Peace, made up of rural, indigenous and afro-descendant women living in the rural area of the municipality of Chaparral.

## Graphical abstract:



01/feb/2024 First encounter — 26/abr/2024 1st Activity Participatory design — 16/ago/2024 2nd Activity Participatory design — 16/sep/2024 Agroecological Center "El Rubí"

10/abr/2024 RMCPP visits Colibrí — 30/abr/2024 Management Mayor Chaparral — 5/ago/2024 Management Governor of Tolimaa

**Methodology:** Community-based participatory research CBPR was considered for the development of the project. so that, to develop the project it is necessary to implement various pedagogical strategies at each stage of project development, which involves educational mediations of cultural aspects and dialogue of knowledge (Mejía, 2015), given that the Chaparralunas Women's Network for Peace has knowledge of agriculture and fish farming from their ancestral indigenous knowledge. So, although such knowledge is not specific to aquaponics, it is useful to be incorporated in the teaching-learning process of aquaponics systems. Therefore, it has been considered that the community be able to design an aquaponics system by itself, so that such knowledge will be useful for the development of their community (Schemelkes, 2008), which facilitates the engagement of adults with learning activities (Arzate-Salgado, 2018).

serious games is proposed to develop aquaponics system design competencies with communities (Mitgutsch, 2011), such methodology has been implemented to understand the interface with computers by users of different age groups (Ali et al., 2021) and in general, for iconographies to be representative of the social frameworks to which they correspond as part of cultural systems and to convey the identity of the communities from images (Ibero, 2023).

In this case, it is proposed to develop three types of serious games (Fig. 1): 1) design tools to determine the characteristics of machines according to the size of fish and plant crops, as well as the technical dimensioning of the system; 2) virtual practice environments where it is possible to assemble each of the parts of the aquaponics system; and 3) video games for learning the characteristic situations of aquaponics systems from operation and maintenance activities.

**Results and discussion:** The participatory community-based approach has facilitated the social appropriation of aquaponics technology for healthier food production.

Design tools have been developed that facilitate replication of the technology in community settings.

The results obtained indicate that the co-construction of design tools facilitates the understanding of the functioning of aquaponics systems and could be the key to facilitate appropriation of the technology by communities.
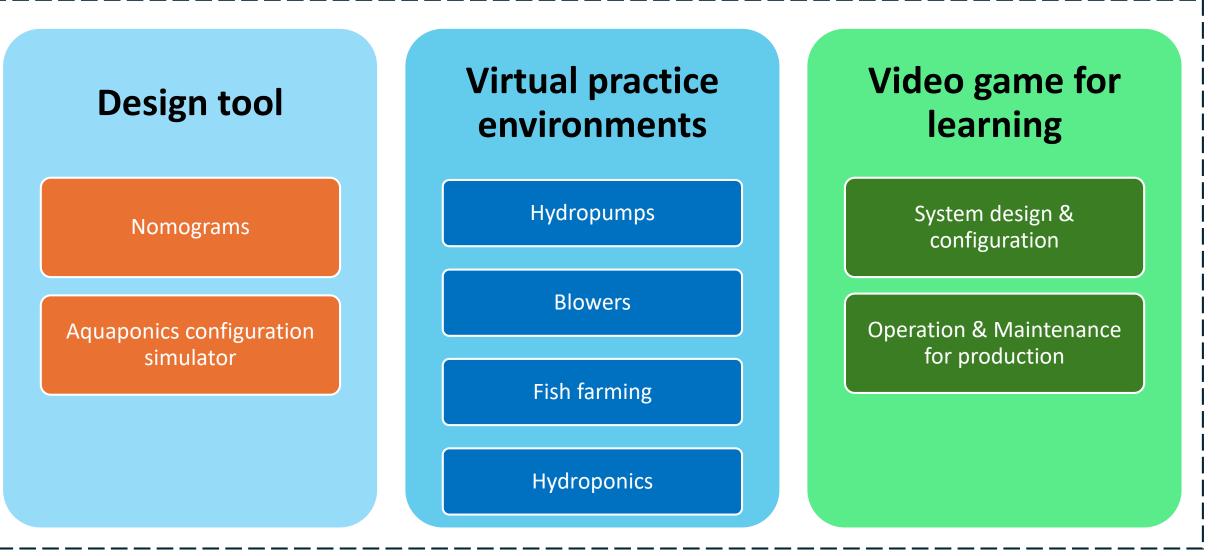
Interdisciplinarity is promoted and through the dialogue of knowledge, design tools are developed in the cultural context of the communities.

| Design tool | Virtual practice environments | Video game for learning |
|---|---|---|
| Nomograms | Hydropumps | System design & configuration |
| Aquaponics configuration simulator | Blowers | Operation & Maintenance for production |
| | Fish farming | |
| | Hydroponics | |

## Conclusions

The participation of community members in each part of the process facilitates the appropriation of the technology, since it is developed in the environmental, social and cultural context of the community.

Through CBPR, the community can relate to technology not as a mechanism, but as an instrument that incorporates their dreams, desires, feelings, so that people appropriate technology as part of themselves.

The key to success lies in listening to, respecting and incorporating ancestral ideas, dreams and knowledge into the process, so that the project products are enriched with the community's contributions.

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