Modifying the Bass System Dynamic & Rodgers Agent Based diffusion of innovation models to explore the adaption of industrial hemp cultivation in Ireland.

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Poster Abstract

The area of multi-method modelling is gaining attention for its ability to provide insights from both top-down and bottom-up perspectives using System Dynamics and Agent-Based Modelling. The aim is to explore the relationship between the two modelling paradigms and contribute to our understanding of complex systems. The original contribution to new knowledge is a multi-method Hemp in Agriculture for Carbon Sequestration (HACS) System Dynamic (SD) and Agent Based Model (ABM), which includes a Network Analysis (1)

The research problem is that the hemp industry in Ireland has been slow to grow compared to France, the largest industrial hemp producer in Europe and third largest in the world. The research question is what conditions would need to change for Irish landowners to adapt faster to cultivating Hemp Sativa. The purpose of the HACS-SD-ABM model is to explore the rate of diffusion of landowners' decisions to apply for licenses to cultivate Hemp Sativa in Ireland and to test the determinants based on the availability of processing facilities and the loosening of strict regulations. The SD model will apply the mathematical equations of Bass (2) and Rodgers (3).

The HACS-SD-ABM model includes two types of entities: farmers/landowners and policymakers. Landowners can decide to apply for a license to cultivate Hemp Sativa or not, while policymakers can ease or restrict application rules. Proto agents are represented as availability of processing facilities and changes in regulations made by decision-makers. The environment is mapped using a polygon shapefile obtained from Ordnance Survey Ireland, and the GIS extension is used to visualize the observed adaptation and rate of speed of landowners in applying for a license to cultivate Hemp Sativa.

The HACS-SD-ABM model is programmed in NetLogo (4) using the System Dynamic modeller and the Network extensions. Future work includes simulating the diffusion of industrial hemp cultivation with an integrated GIS, coded in NetLogo. The behaviours from the multi model can be compared to each other and known outcomes regarding the national adoption of industrial hemp cultivation. The study concludes with thoughts on the design of hybrid simulation models.

In summary, this study presents a multi-method SD-ABM model to explore the rate of diffusion of landowners' decisions to apply for licenses to cultivate Hemp Sativa in Ireland. The model includes two types of entities, farmers/landowners, and policymakers, and is programmed in NetLogo using the System Dynamic modeller and Network extensions. The model will act as a visualization tool for stakeholders to represent the diffusion of landowners in applying for a license to cultivate Hemp in Ireland.

References

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