Institutional Modelling: A Case Study of the Swedish Organ Donation System

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Abstract. Understanding the potential impact of policy changes before implementation is vital, and can be achieved through modelling and simulation. To adequately model stakeholders and regulative constraints, we propose the use of Institutional Grammar to facilitate institutional modelling in Agent-based Social Simulations. We present an early-stage case study exploring the Swedish organ donation system.

Keywords. Agent-Based Social Simulation, Policy Support, Model Formalisation

1. Introduction

Organ donation (OD) systems involve a multitude of stakeholders as well as logistical and medical constraints, disciplined by legal regulations. Hence, introducing new or adapting existing donation policies is challenging as the health of patients could be jeopardized. Agent-Based Social Simulation (ABSS) has proven to be a suitable paradigm for analyzing complex systems within healthcare scenarios and to investigate the potential consequences of policy changes [1,2]. To date, model formalisation does not follow a fixed methodology; its execution relies on the expertise of modellers [3]. Additionally, when developing ABSS aimed at policy support, a focus on scenarios and transparency is required [4]. Institutional modelling is the practice of developing agent-based models leveraging the social aspects of the target system [5]. In this work, we demonstrate how an ABSS model of the Swedish OD system can be formalised through institutional modelling and Institutional Grammar (IG) 2.0 [6].

Institutional modelling is based on institutions, here divided in three types: *rules*, *norms* and *shared strategies*. Institutions can be individuated using IG [7], defining institutional statements from sources such as interviews, field observations and law documents. Institutions are agglomerates of institutional statements, which can be formed of six components: *Attribute* (actor), *Object* (target entity), *Deontic* (enforcement level), *Aim* (activity), *Context* (context), and *Or else* (consequence of violation). The varying level of definition of each statement (i.e. which components are present within it) de-

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termines which type the institution belongs to. The entirety of the target system can be described via institutions [5].

2. Modelling the Organ Donation System of Sweden

Our project "*Facilitators and barriers to the use of agent-based social simulation in organ donation*" explores the potential of ABSS to support policy making in the Swedish national OD system. The target system presents multiple scenarios for implementing ABSS, such as the recent change to Donation after Circulatory Death, the withdrawal of family veto, new rules concerning organ preservation treatment and a logistical optimization of organ procurement zones. In the system analysis phase, domain knowledge of the infrastructure was sought. This process led to the discovery of relevant policy documents, namely the Swedish Transplantation law 1995:831 and proposition 2021/22:128. We analysed these documents according to IG 2.0 principles. Headings and sections pertaining activities outside the scope of the model (e.g. living donors) were removed, the components were individuated, text split into atomic institutional statements from horizontally nested statements [7]. An additional step necessitated by the nature of the document (Swedish text) was that of translating the original text to English by means of DeepL [8]. The text can then be processed with IG Parser [9]. Thanks to the atomization of statements, areas in which the legal text does not provide sufficient details are discovered and targeted questions to stakeholders can be compiled. We speculate that the same is true for interviews with stakeholders, which can generate a discovery loop between top-down and bottom-up sources. Applying the method to stakeholder interviews will allow agents to deliberate on the top-down regulatory structure of the system, providing a key element of ABSS which is agent *autonomy* [10].

The method structures the process of model formalisation, which has been methodologically deficient, and increases its traceability, while funneling stakeholder participation in the modelling process. Validation practices might be incorporated within the pipeline in future work. The process has similarities with the one proposed in MAIA [11], but grounds itself in IG 2.0, rather than IAD. Furthermore, the predetermined scope of the project guides modellers to focus on relevant aspects of the law and disregard information not relevant to the model. This approach allows the modellers to investigate the system in a structured manner which is replicable and increases procedural transparency. We propose that the approach can be generalised to other cases once remaining questions are answered: does the method produce blind-spots or error patterns in the resulting simulations? Is there an imbalance between agent behaviour generated via top-down and bottom-up approaches? The increased transparency of the proposed method reinforces trust in the simulation, which is key to incorporating ABSS into data-driven policy making mechanisms [12].

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