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INTENDING THE UNINTENDED: THE ACT OF BUILDING AGENT-BASED MODELS AS A REGULAR SOURCE OF KNOWLEDGE GENERATION

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SUMMARY

Poverty is a complex issue that is rarely conducive to analysis in laboratory or field experiments. Effective interventions that aim to decrease or eliminate poverty require an understanding of the intricate web of associated social issues. The need for this increased comprehension necessitates the use of alternative robust means of analysis: one such being agent-based modelling. The strengths of agent-based modelling to disaggregate complex social behaviours and understand them are well known. However, while people have explored how the modelling process can prove to be fruitful, the usually unintended insight gained and the knowledge engendered during the model design process goes largely unnoticed. In this paper, we aspire to show precisely how the model building process is critical in leading to unintended knowledge generation for modellers by drawing from three US based examples where agent-based modelling was used to aid research into the effects of interventions that address poverty and human development through programs and issues facing low-income families. With these examples, we illustrate some of the means to harness new knowledge generated. In our discussion, we also highlight the advantageous nature of agent-based model design as an independent source of knowledge generation.

KEY WORDS

methods, agent-based modelling, knowledge generation, policy informatics

CLASSIFICATION

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JEL: I32

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INTRODUCTION

The authors of this paper have found agent-based modelling (ABM) to be a useful tool when exploring complex social issues. This paper articulates a commonly shared, but rarely discussed aspect of agent-based modelling: unintended knowledge discovery during the model design process.

Generating new knowledge using ABM is a topic that has already been covered in various studies. *Generative Social Science* [1] is a collection of papers that demonstrates very well the benefits of using modelling to create artificial worlds that lead to new forms of understanding. Numerous articles [2 – 4], show how iterative modifications made during the modelling process are valuable sources of information. However, papers have paid less attention to the aspect of potential knowledge generation of ABM during the model design process. While some articles identify advantages of participatory and thoughtful research design or model building [5], the question of how design originated knowledge generation is achieved goes largely unaddressed. One of the common, but rarely discussed, advantages of agent-based modelling, and most modelling to one extent or another, are the unintended discoveries that occur during the creation of the model. A well-designed model will normally be developed through an iterative process with a deliberate plan for validation at the onset of the modelling process. A model will progress through stages of grounding, calibrating, and verifying. The creation of a model forces the articulation of any number of individual design decisions, and thoughtfully done, each can be a starting point for new understanding.

The increased availability of information and tools for processing information is giving rise to a new suite of methods for understanding how to address the issues surrounding poverty and other policy issues. The unique characteristics and the empirical strength of ABM make it an appropriate method by which to study various interventions in programs that target low-income families. Within an ABM, computer-simulated agents serve as experimental "subjects" whose behaviours are controlled by specific behavioural rules. Interactions among agents induce social structures, group level behaviours, and differences in performance outcomes. Individual choices can be formalized as strategic behaviours in a game-theoretic framework [6 – 12]. A model serves as an artificial collaboration environment where we can easily manipulate different parameters, visualize individual and combined effects during the growth process, and eliminate confounding influences that would be unavoidable in the real world.

Policy informatics studies how tools, models and simulations are used to aid individuals and groups make informed policy choices. Complex issues such as poverty do not lend themselves to laboratory experiments. Field experiments are costly in both time and resources and thus we look to alternative approaches to increase our understanding of various problems. One such option is agent-based modelling. In this paper we show how the process of building agent-based models can lead to unintended knowledge generations for modellers by drawing from three policy informatics examples in the US that address poverty and issues facing low-income families.

AGENT-BASED MODELLING

ABM can also be used to test competing hypotheses and generate explanations of complex group behaviour. Understanding the dynamics, history, and relations between agents in such an environment can complement field studies and may provide a more satisfying explanation of behaviour directly observed [13]. Compared with traditional social science paradigms, such as statistical estimating and differential equations, ABM has five unique characteristics. First, it takes a bottom-up approach. Rather than seeking a centralized control mechanism for orderly behaviours of a system, ABM explores whether decentralized interactions among autonomous actors can lead to system-level regularities [14 – 15]. Second, an agent-based framework assumes adaptive rather than fully rational behaviours of actors [16]. Each actor, given its assigned limited information and foresight, adopts strategies through interacting with other actors. Third, ABM allows heterogeneity among actors, whereas traditional social scientists often suppress agent heterogeneity in order to make their models tractable [17]. Fourth, ABM focuses on dynamic processes that produce or disrupt equilibrium rather than the static nature of equilibrium [17]. Last, traditional statistical or multi-equation modelling assumes linear, deterministic or predictive relationships among parameters, whereas an agent-based framework explicitly takes account of nonlinear, nondeterministic, or recursive interactions among multiple levels of actors.

Unintended discoveries made during the modelling process tie the following three examples together. The first example is a case where the designer of the model experienced metaphors of real worlds in the process of evaluating various design choices. Consequently, the designer was able to refine the understanding of the research which ultimately led to the stipulation of a new set of research questions. The second example is a case where the creator of the model found that a design decision could not be made without external assistance, particularly the program managers from the program of study. Again, the perspective from which the problem had been viewed by the modeller, and the program directors, was informed. The third example illustrates how design choices were dependent on availability of data which led to new theoretical constructs being created for the model. The constructs provided an additional benefit in aiding the communication of the research's key findings. In each case the design process was the source of new knowledge generation.

In sum, the first and third examples are of an ABM that was built to simulate usual and unusual activities in a complex policy delivery system. The second example is of an ABM that was used to compare different implementations strategies of a program that targets health information to low-income first time mothers.

EXAMPLE 1: METAPHORS OF REAL WORLDS

Context of research: Public service delivery programs

The context of first example is the Women, Infants, and Children (WIC) program that aims to safeguard the health of low-income women, infants, and children up to age 5, who are at nutritional risk. The program provides nutritional supplementary foods, nutritional education, and referrals to health care and other social services. The WIC program originated as a direct consequence of growing concerns about malnutrition among low-income mothers and children in the 1960s [18]. The United States Department of Agriculture (USDA) is responsible for administrating the program. The main mechanism to deliver WIC services to the program participants is contracting local stores who are interested in delivering WIC foods as part of their usual business items. Therefore, this program is run by a system of heterogeneous stakeholders, such as Federal and State government, private stores, local clinics, and program recipients.

Brief description

We focused on building a model of routine activities in Ohio WIC. In terms of participation, Ohio WIC was the eighth largest program in the US as of July 2006, serving approximately 277 000 participants each month with a budget of over $150 million each year. Ohio WIC has contracts with over 200 local clinics and 1400 local stores. Each month, participants receive three or four vouchers with food benefits at local clinics. These participants are expected to redeem their benefits at WIC stores within a specified period since Ohio WIC uses the retail delivery system. Each voucher specifies what products and quantities the participant can purchase, as well as maximum prices that the state will pay for an allowable food. The state monitors the overall flow of transactions in the WIC system. The basic business mechanism of Ohio WIC provided a framework of our agent-based model [19].

The model building process of our ABM provided an opportunity to experience the common metaphors of real worlds that were possible within the structure of object-oriented programming. It has been conceptually well discussed that public policy systems such as WIC and their stakeholders are interdependent and dynamically interact [20] and that a holistic approach is needed to manage complexity in such policy systems [21]. While this view has been persistent among several policy scholars, in classroom settings these concepts are not easily experienced by students who have not been exposed to real decision-making situations. These concepts have remained as just metaphors of real worlds rather than constructs that can be modelled or examined using analytical tools and techniques. Therefore, while the policy system such as WIC needs to be considered as a whole to understand the dynamic of the system, the components had been usually and quickly reified as separate independent entities.

Experiencing the metaphors of real worlds

In ABM, agents are intrinsically interdependent within the simulation model, representative of the complex policy system. The interdependency among program recipients, local stores, and public agency can be specified in the model and experienced by the modeller. Local decisions made by an agent or trivial revisions done by the modeller have subsequent influence on other agents or to the system. Often, the complexity of the model leads modellers not to pay attention on the interdependency that they previously built. As in simulation models, it is not unusual to see such an effort to correct local issues without considering larger impacts to the whole system in real worlds. What the modeller experienced is the need to be aware of hidden interdependencies built in any social systems that aim to address such an issue of poverty, and the potential consequence of not paying attention to such.

EXAMPLE 2: STAKEHOLDER PARTICIPATION

Context of research: Civic collaborations

Civic collaborations, also known as collaborative partnerships, are alliances among community stakeholders and organizations from multiple sectors that work together to improve conditions with the aim of promoting and sustaining community health; as a strategy, such civic collaborations are increasing in frequency [22]. Federal and State health agencies routinely support, and often mandate, the formation of collaborative partnerships to design and implement community health initiatives [23]. The Institute of Medicine defines “mobilizing community partnerships” as an essential public health service.

A highly effective example of such a collaborative program is the Nurse Family Partnership (NFP) [24]. Conceived by Dr. David Olds, the Partnership sends specially trained nurses on weekly or bi-weekly visits to low-income, first-time mothers, beginning as early as possible in the pregnancy – typically between 16 and 28 weeks – and continuing until the child’s second birthday. The nurses help mothers improve their health and nutrition during pregnancy, learn effective early parenting skills, develop healthy family support systems, and reach program goals like completing school and finding employment.

Brief description

To fully leverage the value of civic collaborations, we aimed at identifying and formalizing best practices of such collaborations [25]. Specifically, Hicks et al. [23] found a correlation between program outcomes and the process quality of the early phases of civic collaboration development in Colorado. It was during this early phase that the collaboration grew from just a few participants to a functional group. By evaluating implementations of these programs, and particularly by understanding the successes and struggles during the growth process when employing civic partnerships used to implement uniquely successful programs, we can derive insights into best practices.

During the early stages of designing the ABM used to find best practices of implementation of civic collaborations, the model was intended to explore how the rate of growth was related to the ability to coordinate the actions of groups of participants. Overall the modelling process for this project spanned two years and over twenty versions of the model. During the grounding process of the model, one of the biggest design decisions was how to add new participants to the existing group. Instead of making an independent choice of how new participants joined the group, we asked the directors that were part of the implementation process in the real-world programs. When asked how new people were included in the civic collaborations communities, the Executive Director of the program responded:

> **Executive Director:** There are a lot of stories about how we have engaged additional people. We just did an orientation last week and we walked through a history of the program and it was a really thoughtful orientation. Other places were like – hi, I am so and so and I am replacing so and so.
>
> **Modeller:** Did you notice a difference in performance between those different styles of including new participants?
>
> **Executive Director:** Oh sure – one of the key things that we have seen was if the implementing agencies continue successfully the agency engaged in substantive discussion. When it is only information sharing with just updates then it is hit or miss if people are choosing to attend. If there is thoughtful and productive discussion, I think that at the end of the day is where there are the ones that are the most successful.

Recognizing that the manner in which people joined a civic collaboration differed in nature between the programs, and suggested outcome differences, our understanding of the role that including new people played in the program development changed. For the thoughtful inclusion of new people, we found that in the more successful communities, time was taken not simply to slowly include new members, but to gradually involve them into the activities of the group. In the less successful groups, new members were frequently thrust into participating in the group without knowing the history of the group. To model slowly joining the existing group, new members started interacting with only a subset of the existing population. As they continue to form part of the group, the number of participants they interact with gradually increases.

Stakeholder participation

A reasonable choice of how to include new agents could have been made independently by the model designer. However, including people with knowledge of the context of interest can be a source of knowledge generation during the design process and grounds the model. We claim that grounding establishes the reasonableness of the model, showing that simplifications made from the real world do not trivialize the model and that other researches have successfully made similar assumptions to capture the key elements of the theory. The conversation that occurred during the modelling design process led to a valuable, yet unintended discovery. At the beginning of the design process the main focus was on rate of growth, as the first version of the model was completed, the design focused on the nature of including new participants, a change in focus emerging through conversations during the design process.

EXAMPLE 3: ADAPTING TO DATA

Context of research: Same as first example

The third example is also extracted from the context that first example was illustrated, but focuses on unauthorized activities in the public service delivery program. In this example, the modeller focused on designing a construct to model agents' fraudulent behaviour informed by empirical data.

Fraud is a crime that violates social norms, uses secretive processes, injures victims, and benefits perpetrators unfairly [26 – 27]. In the public sector, fraud in welfare, health care, and child care programs have been well-documented by government agencies such as Government Accountability Office and USDA. These unauthorized activities ultimately damage the integrity and endeavour of the public program that aims to alleviate social issues such as poverty and health. Unfortunately, fraud has been a persistent and difficult issue to address especially due to its non-stationary nature. Once a fraud detection method is put into place, it begins to lose effectiveness because the pattern of fraudulent behaviours changes as a response to the method [28]. Nevertheless, traditional fraud prevention or detection methods have been developed based on the static assumption of human behaviour. To understand the adaptive nature of fraud in a public service delivery program, a construct called “risk propensity” was designed by the modeller [29].

Brief description

The goal of this simulation model was to replicate the spatial and statistical patterns of fraud found in empirical data. One of the difficulties was how to model agents' changing propensity toward risky behaviour which is influenced by, and will influence, their decision on their level of involvement in fraudulent activities. Two separate simulation models were built. One was solely based on a hypothetical construct and its functions. The construct ranged from 0 (extremely low propensity toward risky behaviour) to 1 (extremely high propensity toward risky behaviour). We tested several scenarios of risk propensity distribution in the simulation to replicate the patterns observed from empirical data. The other model was built using the construct informed by empirical data. In Ohio WIC, local stores contracted with State government are categorized with four different risk levels based on the state's routine monitoring activities. In this simulation, we converted the distribution of risk levels of local stores in the empirical data for the hypothetical construct.

The modeller could also conduct a survey to examine the prevalence of fraud among local stores in order to design the construct. However, the validity of survey data on unauthorized behaviour (e.g. fraud and crime) is often questioned because respondents may not reveal true story. Existing data from routine monitoring activities which already revealed actual behaviour can have relative advantages. This process led us two separate questions: how to model a construct working with existing data and which source might provide better information of human behaviour.

Designing a construct working with existing data

These two activities ended up as reciprocal processes to improve the construct. The modeller realized that this construct can be designed to absorb personal or socio-economic characteristics of agents into a fundamental hypothetical construct in modelling agents' decision-making for fraudulent activities. Modelling a propensity toward certain behaviours is a certainly challenging task. This is not a finished work. We are at the beginning of this endeavour. If properly done, this effort can yield valuable insights to improve the model building of adaptive behaviours in complex policy systems based on empirical evidence.

DISCUSSION

A popular example in modelling courses is to have people create a model to simulate the standing ovation phenomenon. In doing so most people struggle to think of a system wide rules and orders and the exercise reveals a bias for top-down thinking. Through the design of a bottom-up system that helps to shape a new understanding of how individual choices can aggregate to group level behaviours [30]. Similarly, when used for research it is the design process itself that changes perceptions as demonstrated by the three previous examples. We will now suggest a basic framework for understanding the nature underpinning this source of knowledge discovery.

VIRTUE OF THE MESSY PROCESS

In the current paradigm, knowledge is generated from findings or results of research. Analytical procedures of certain tools are mostly preset. The question is asked to whether the research finding adds values to the existing body of knowledge, often assuming that the researcher followed the standard procedure. It is assumed that knowledge is generated mainly by sharing the findings rather than exploring the messy process of analysis. The model building process of ABMs leads researchers to examine the messy process and forces them to make critical design decisions. Depending upon the complexity of the system, there are almost unlimited numbers of decision points that create equally unlimited logical consequences to the system at different levels. Therefore, ABM exposes researchers to and learn from the unintended discoveries – not only from the findings, but also from the process itself. This messy process of model building becomes a regular source of knowledge generation because of two crucial components of model building: decision points and contextual knowledge.

ROLE OF DECISION POINTS

Models are created to describe, understand, explain, or predict certain aspects of contexts. Modellers make assumptions on whether the context is static or dynamic. They can build static or dynamic models corresponding to these assumptions. Depending upon the assumptions made, the frequency of decision-making in the model building process also changes. In other words, there are not many decision points when the modeller assumes a static context and builds a static model; whereas the modeller will confront various decision points when building dynamic models for dynamic contexts. In a simplistic form, the area covered by linking both axes of context and model is a potential knowledge generation space which requires decision-making in the model building process (Fig. 1).

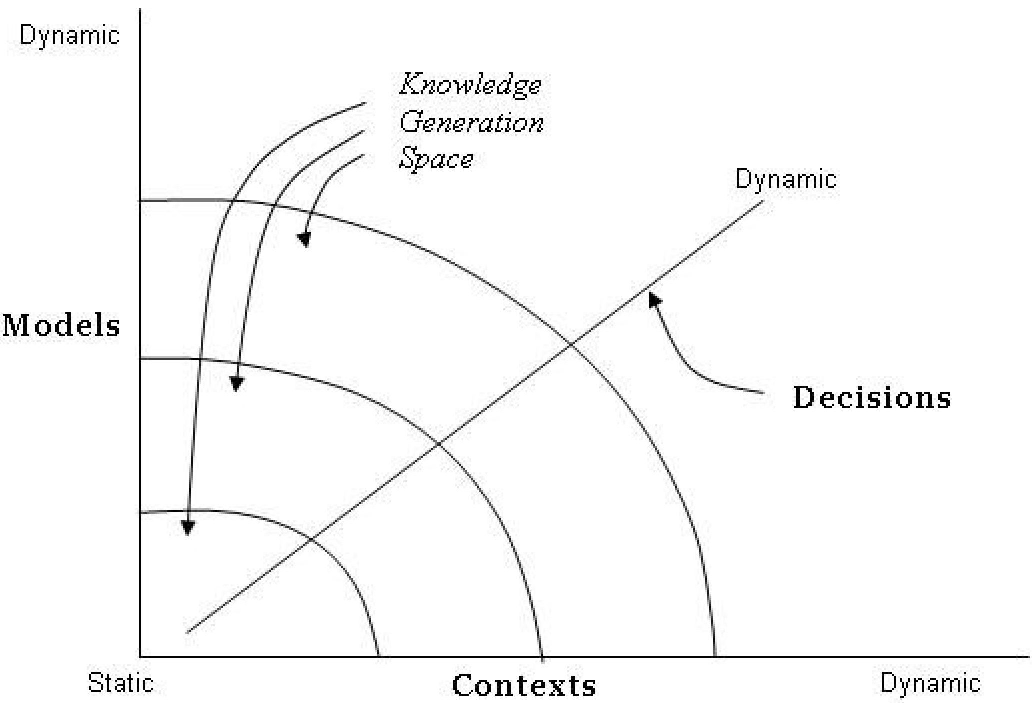

Figure 1. Constructing Knowledge Generation Space.

Knowledge can mean very different things depending upon whom we talk to. Knowledge is not something that exists independently from the person who uses it or something that can simply be stored as substance [31]. Personal knowledge is presented when a person must make a decision in a given context. Decision points force a person to use or show this knowledge and to improve their understanding. We saw that the model building process leads people to make decisions at several decision points. Providing the safe environment of trials and errors, the model building process helps researchers improve their research by experiencing the metaphors of real worlds, creating negotiated meaning, and developing crucial constructs for modelling.

POWER OF CONTEXTUAL KNOWLEDGE

It is useful to distinguish contextual knowledge from general knowledge. Imagine building a constructed world using simulation tools. You may have to have both programming skills and the context (or the system) that you are building. Programming rules are the kind of general knowledge that modellers can learn and share; whereas what the components of the constructed world imply is solely based on contextual knowledge of the specific system. Often modellers have advanced modelling skills, but lack contextual knowledge they need to have in order to build a model of social systems. Therefore, there can be at least two stages where the model building process becomes a regular source of knowledge generation for modellers at different levels. First, contextual knowledge can be elicited by the modeller while working with those who have experience in or of the system. Second, modellers must convert contextual knowledge to general knowledge by exploring such knowledge in different contexts. When one makes a decision in a certain situation, the motivation behind that decision is mainly contextual knowledge. Contextual knowledge influences us to make relevant and appropriate decisions; whereas general knowledge guides us with a broad boundary of actions. Model building process allows modellers to make relevant decisions eliciting contextual knowledge and to increase a stock of useful knowledge in the form of general knowledge.

In sum, this leads us to believe that there will not be a specified way of building ABMs as there is no single most effective solution of poverty. First, the contexts within which ABM can be based are very different. It is difficult to imagine any two social contexts that are identical over time and space. Social contexts are fundamentally defined and redefined over time and space. All contexts are unique at the moment so that general knowledge will not be able to fully capture the uniqueness. In that sense, contextual knowledge is an untapped source of regular knowledge generation. Understanding that many novel discoveries occur during the design process encourage model designers to be aware of the choices they make. In addition, including members of the models target audience in the construction of the model and be as powerful a research and learning tool as is the presentation of the final model.

REFERENCES

[1] Epstein, J.M.: *Generative Social Science: Studies in Agent-Based Computational Modelling.* Princeton University Press, Princeton, 2006,

[2] Gong, X. and Xiao, R.: *Research on Multi-Agent Simulation of Epidemic News Spread Characteristics.* Journal of Artificial Societies and Social Simulation **10**(31), 2007, http://jasss.soc.surrey.ac.uk/10/3/1.html,

[3] Nan, N; Johnston, E.; Olson, J. and Bos, N.: *Beyong Being in the Lab: Using Multi-Agent Modelling to Isolate Comepeting Hypotheses.* In van der Veer, G.C. and Gale, C. (eds.): Proceedings of the SIGCHI conference on Human Factors in computing systems 2005, 1693-1696, ACM, 2005,

[4] Möhring, M. and Troitzsch, K.G.: *Lake Anderson Revisited by Agents.* Journal of Artificial Societies and Social Simulation **4**(3), 2001, http://jasss.soc.surrey.ac.uk/4/3/1.html,

[5] Axelrod, R.: *Advancing the Art of Simulation in the Social Sciences*. In Rennard, J.-P. (ed.): Handbook of Research on Nature Inspired Computing for Economy and Management. Idea Group Inc. Global, Hersey, 2006,

[6] Skyrms, B.: *Evolution of the Social Contract.* Cambridge University Books, Cambridge, 1996,

[7] Skyrms, B.: *The Stag Hunt and the Evolution of the Social Structure.* Cambridge University Books, Cambridge, 2004,

[8] Van Huyck, J.B.; Battalio, R.C. and Beil, R.O.: *Tacit Coordination Games, Strategic Uncertainty and Coordination Failure.* American Economic Review **80**(1), 234-248, 1990,

[9] Camerer, C.F. and Knez, M.: *Increasing Cooperation in Social Dilemmas by Establishing a Precedent of Efficiency in Coordination Games.* Organisational Behaviour and Human Decision Processes **82**(2), 194-216, 2000,

[10] Knez, M. and Camerer, C.F.: *Creating Expectational Assets in the Laboratory: Coordination in Weakest-Link Games.* Strategic Management Journal **15**(8), 101-119, 1994,

[11] Cachon, G.P. and Camerer, C.F.: *Loss-avoidance and Forward Induction in Experimental Coordination Games*. Quarterly Journal of Economics **111**(1), 165-194, 1996

[12] Chaudhri, A.; Schotter, A. and Sopher, B.: *Talking Ourselves to Efficiency: Coordination in Inter-generational Minimum Games with Private, Almost Common and Common Knowledge of Advice.* C.V. Starr Centre for Applied Economics Working Papers, 1-11, New York University 2001,

[13] Lansing, S.J. and Kremer, J.N.: *Emergent Properties of Balinese Water Temple Networks: Coadaptation on a Rugged Fitness Landscape.*
American Anthropologist **95**(1), 97-114, 1993,

[14] Holland, J.H.: *Hidden Order: How Adaptation Builds Complexity.*
Perseus Books, Reading, 1995,

[15] Holland, J.H.: *Emergence: From Chaos to Order.*
Perseus Books, Reading, 1998,

[16] Axelrod, R.: *The Complexity of Cooperation: Agent-Based Models of Competition and Collaboration*.
Princeton University Press, Princeton, New Jersey, 1997,

[17] Epstein, J.M. and Axtell, R.: *Growing Artificial Societies: Social Science from the Bottom up.*
Brookings Institution Press, Washington, D. C., 1996,

[18] Oliveira, V.; Racine, E.; Olmstead, J. and Ghelfi, L.M.: *The WIC program: background, trends, and issues.*
Research Report No. 7, United States Department of Agriculture, 2002,

[19] Kim, Y.: *Analysis for Adaptive Complex Public Enterprise.*
Unpublished PhD Dissertation, Ohio State University, Columbus, 2006,

[20] Pfeffer, J. and Salancik, G.R.: *The External Control of Organizations: A Resource Dependence Perspective.*
Stanford Business Books, Stanford, 2003,

[21] Leat, D.; Seltzer, K. and Stoker, G.: *Towards holistic governance: the new reform agenda.*
Palgrave, New York, 2002,

[22] Roussos, S.T. and Fawcett, S.B.: *A Review of Collaborative Partnerships as a Strategy for Improving Community Health.*
Annual Review of Public Health **21**, 369-402, 2000,

[23] Hicks, D.; Larson, C.; Nelson, C.; Olds, D. and Johnston, D.: *Collaboration in Community Health Initiatives: The Relationship between Process Quality and Attrition in the Colorado Nurse-Family Partnerships.*
National Communication Association, Chicago, 2007,

[24] Isaacs, J.B.: *Cost-Effective Investments in Children*
Brookings Institute, 2007,

[25] Johnston, E.: *Growth Matters: Identifying Best Practices in Growing Civic Collaborations.*
PhD Dissertation, University of Michigan, Ann Arbor, 2007,

[26] Barker, T. and Roebuck, J.: *An Empirical Topology of Police Corruption: a Study in Organizational Deviance.*
Thomas Publisher, Springfield, 1973,

[27] Vandenburgh, H.: *Feeding Frenzy: Organizational Deviance in the Texas Psychiatric Hospital Industry.*
University Press of America, Lanham, 1999,

[28] Bolton, R.J. and Hand, D.J.: *Statistical Fraud Detection: A Review.*
Statistical Science **17**(3), 235-255, 2002,

[29] Kim, Y. and Xiao, N.: *FraudSim: Simulating Fraud in a Public Delivery Program.*
In Liu, L. and Eck, J. (eds.): Artificial Crime Analysis Systems: Using Computer Simulations and Geographic Information Systems,
Idea Group Inc. Global, Hershey, forthcoming,

[30] Gilbert, N. and Troitzsch, K.G.: *Simulation for the social scientist.*
Open University Press, 1999,

[31] Jacob, F.: *The Possible and the Actual*
Pantheon Books, New York, 1982.

NAMJERAVATI NENAMJERAVANO: IZGRADNJA MODELA TEMELJENIH NA AGENTIMA KAO REGULARNI NAČIN GENERIRANJA ZNANJA

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SAŽETAK

Siromaštvo je kompleksna pojava koju je rijetko moguće analizirati u laboratorijskim uvjetima ili eksperimentima na terenu. Učinkovite mjere smanjivanja ili suzbijanja siromaštva zahtijevaju razumijevanja složene mreže povezanih socijalnih pojava. Potreba za povećanim razumijevanjem vodi na uporabu alternativne, robusne analize, u što ulazi modeliranje pomoću agenata. Snaga modeliranja pomoću agenata u raščlanjivanju kompleksnog socijalnog ponašanja i njegovom razumijevanju dobro je poznata. Međutim, tijekom istraživanjā kako iskoristiti modeliranje uvid, stečen često nenamjeravano, kao i pripadno znanje stečeno tijekom modeliranja većinom su nezapaženi. U ovom radu, nastojimo pokazati kako je proces izgradnje modela kritičan za stručnjake u uočavanju nenamjeravanog generiranja znanja. Kao primjere koristimo tri situacije iz Sjedinjenih Američkih Država u kojima su modeliranjem pomoću agenata potpomagana istraživanja učinaka intervencija u području siromaštva i ljudskog razvoja, provođena za obitelji s malim prihodima. Navedenim primjerima ilustriramo neka o sredstava za prikupljanje generiranog znanja. U diskusiji također ističemo prednosti modeliranja pomoću agenata kao neovisnog sredstva za generiranje znanja.

KLJUČNE RIJEČI

metode, modeliranje pomoću agenata, generiranje znanja, informatika javnih mjera