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SIMULATIONS AND DECISION-MAKING IN GEOGRAPHY.

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Abstracts

Decision making in Geography is a routine activity that is common to different phenomena. Spatial decision making problems are multi-facetted challenges. Not only do they often involve numerous technical requirements, but they may also contain economical, social, environmental and political dimensions that could have conflicting objectives. Solving these complex problems requires an integrative use of information, domain specific knowledge and effective means of communication. The paper gave an highlight on decision making process and simulations in handling geographical problems.

Keywords: *Geography, Simulations, Model, decision-making, spatial problems.*

Introduction

Simulation means imitating the behaviour of some situation or process by means of a suitably analogous situation or apparatus, especially for the purpose of study or personal training (Mondal, 2016). In its broadest sense, simulation is imitation. Simulations (and models, too) are abstractions of reality. Often they deliberately emphasize one part of reality at the expense of other parts. Sometimes this is necessary due to computer power limitations. Sometimes it is done to focus the viewer's attention on an important aspect of the simulation. Whereas models are mathematical, logical, or some other structured representation of reality, simulations are the specific application of models to arrive at some outcome. The act of simulating something first requires that a model be developed; this model represents the key characteristics, behaviors and functions of the selected physical or abstract system or process. The model represents the system itself, whereas the simulation represents the operation of the system over time (*Sokolowski and Banks, 2009).*

The term 'model' has been defined differently by different geographers. In the opinion of Skilling (1964), a model is "either a theory, a law, a hypothesis, or a structured idea. Most important, from the geographical point of view, it can also include reasoning about the real world (physical and cultural landscape) by means of relation in space or time. It can be a role, a relation or an equation". In the opinion of Ackoff, "a model may be regarded as the formal presentation of a theory or law using the tools of logic, set theory and mathematics". According to Haines-Young and Petch, "any device or mechanism which generates a prediction is a model". Accordingly, modeling, like experimentation and observation, is simply an activity which enables theories to be tested and examined critically (Mondal, 2016). Most of the geographers of the post-Second World War period have widely conceived models as idealized or simplified representation of reality (geographic landscape and man-nature relationship). Geography is a discipline which deals with the interpretation of man-nature relationship. The earth—the real document of geographical studies—is however, quite complex and cannot be comprehended easily. The earth's surface has great physical and cultural diversity. In geography, we examine location, landforms, climate, soils, natural vegetation and minerals' spatial distribution and their utilization by mankind which lead to the development of cultural landscape. Moreover, geography is a dynamic subject as the geographical phenomena change in space and time. The subject matter of geography, i.e., the complex relationship of man and environment can be examined and studied scientifically by means of hypotheses, models and theories. The basic aim of all models is to simplify a complex situation and thus render it more amenable to investigations. In fact, models are tools which allow theories to be tested. A more restricted view of models is that they are predictive devices (Mondal, 2016).

Decision making in Geography

The field of geography deals with spacial phenomena and its decision is based on spartial analysis. It focuses attention upon locations and distribution of these phenomena; interactions of people, goods and services between places and regions; spartial structure, arrangements, and organizations and spatial processes (Van-Groenigen and Stein, 1998). The problems related to all these phenomena have a spatial dimension. Cowlard defines geographical problems, as those issues and questions, which are the result of the relationships between people and their environment (earth surface). This can be anywhere within the range of decisions to maintain, improve or restore people-environment relationships. A typical geographical problems may involve ecological issues (relationships between people and physical environments), or locational issues (relationships between people and spatial environments), and require the decision making to work with:

1. A wide range of physical and human factors and complex relationships between issues, between options and between evidences. There is usually a variation in intreast, requiring value-adjustments.
2. Uncertainty in space and time: about future developments and rapidly changing situations and imperfect or incomplete evidences. Spatial issues require to address a range of scales, from local to global.
3. Diffent cognitive styles and individual differences in human behaviour, leading to conflicting objectives and views and a potentially wide impact of decisions.
4. Short and long term views (more production is a good strategy in short term, however, that may not be a good one if one puts it in long term persprctive).

Geographical decision making therefore is an attempt to solve the complicated problems, which can arise from people-environment relationships (Van der Meer, 1995). This can be facilitated through a systematic approach. The management science approach adopts the view that managers can follow a fairly systematic process of silving problems. Therefore it is possible to use scientific approach to managerial decision making. This approach includes indentification of problem or opportunity, gathering

important data, building a model, experimenting with the model, analysing results and making a sound decision (Van der Meer, 1995). To assist decision makers with complex spatial problems, geoprocessing systems must support a decision research process, rather than a more narrowly defined decision-making process, by providing the decision maker with a flexible, problem-solving environment. Such an environment empowers the decision maker in two ways; first, the problem can be explored to increase the level of understanding and to refine the definition; and second, the genetion and evaluation of alternatives solutions enables the decision maker to investigate the possible trade-offs between conflicting objectives and to identify unanticipated, and potentially undesirable, characteristics of solutions (Densham and Goodchild, 1989).
Spatial decision support systems (SDSS) are explicitly designed to support a decision research process for complex spatial problems. SDSS provide a framework for integrating database management systems with analytical models, graphical display and tabular reporting capabilities, and the expert knowledge of decision makers. Such systems can be viewed as spatial analogues of decision support systems (DSS) developed in operational research and management science to address business problems (Densham and Goodchild, 1989).

Three types of simulations

Simulations generally come in three styles: live, virtual and constructive. A simulation also may be a combination of two or more styles. Within these styles, simulations can be *science-based* (where, for example, interactions of things are observed or measured), or involve interactions with humans (*Davidovitch, Parush and Shtub, 2008).*

1. ***Live simulations*** typically involve humans and/or equipment and activity in a setting where they would operate for real. Think *war games* with soldiers out in the field or manning command posts. Time is continuous, as in the real world. Another example of live simulation is testing a car battery using an electrical tester (*Davidovitch et al., 2008)*.
2. ***Virtual simulations*** typically involve humans and/or equipment in a computer-controlled setting. Time is in discrete steps, allowing users to concentrate on the important stuff, so to speak. A flight simulator falls into this category (*Davidovitch et al., 2008)*.
3. ***Constructive simulations*** typically do not involve humans or equipment as participants. Rather than by time, they are driven more by the proper sequencing of events. The anticipated path of a hurricane might be "constructed" through application of temperatures,

pressures, wind currents and other weather factors. Science-based simulations are typically constructive in nature (*Davidovitch et al., 2008)*.

A simulator is a device that may use any combination of sound, sight, motion and smell to make a person feel that He/She is experiencing an actual situation. Some video games are good examples of low-end simulators. For example, you have probably seen or played race car arcade games. The booths containing these games have a steering wheel, stick shift, gas and brake pedals and a display monitor. You use these devices to "drive" your "race car" along the track and through changing scenery displayed on the monitor. As you drive, you hear the engine rumble, the brakes squeal and the metal crunch if you crash. Some booths use movement to create sensations of acceleration, deceleration and turning. The sights, sounds and feel of the game booth combine to create, or simulate, the experience of driving a car in a race. Most people first think of "flight simulators" or "driving simulators" when they hear the term "simulation." But simulation is much more. Because they can recreate experiences, simulations hold great potential for training people for almost any situation. Education researchers have, in fact, determined that people, especially adults, learn better by experience than through reading or lectures. Simulated experiences can be just as valuable a training tool as the real thing. Simulations are complex, computer-driven *re*-creations of the real thing. When used for training, they must recreate "reality" accurately, otherwise you may not learn the right way to do a task (*Sokolowski and Banks, 2009).* For example, if you try to practice how to fly in a flight simulator game that does not accurately *model* the flight characteristics of an airplane, you will not learn how a real aircraft responds to your control. Building simulator games is not easy, but creating simulations that *accurately* answer such questions as *"If I do this, what happens then?"* is even more demanding. Over the years, government and industry, working independently with new technologies and hardware, developed a wide range of products and related applications to improve simulation science. This independence, however, often led to sporadic or redundant research efforts. To benefit from each other's latest advances, researchers from across the country needed better communication and, ideally, a common source of supporting academic studies (*Davidovitch et al., 2008)*.

Scope of Simulation usage

Simulation is used in many contexts, such as simulation of technology for performance optimization, safety engineering, testing, training, education, and video games. Often, computer experiments are used to study simulation

models. Simulation is also used with scientific modelling of natural systems or human systems to gain insight into their functioning, as in economics. Simulation can be used to show the eventual real effects of alternative conditions and courses of action. Simulation is also used when the real system cannot be engaged, because it may not be accessible, or it may be dangerous or unacceptable to engage, or it is being designed but not yet built, or it may simply not exist (*Sokolowski and Banks, 2009).*
Key issues in simulation include acquisition of valid source information about the relevant selection of key characteristics and behaviours, the use of simplifying approximations and assumptions within the simulation, and fidelity and validity of the simulation outcomes. Procedures and protocols for model verification and validation are an ongoing field of academic study, refinement, research and development in simulations technology or practice, particularly in the field of computer simulation (*Davidovitch et al., 2008)*.

Conclusion

This paper has attempted to highlight the complexity of spatial decision making and system integration problems. From the above discussion, it is clear that spatial decision making is a highly complex process and most spatial decision problems are complex and ill structured. It was also noted that, dealing with the complexity nature of decision making in Geography, requires a well structured simulated model, in order to present them in a simpler form.

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