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A Hybrid Approach for Spatial MSM

Computer simulations/models have now become more important in modelling complex systems including the social systems. Modern policy problems often require disaggregate information with great details. IBM (Individual Based Model) models the system at the individual level. IBM can provide individual characteristics to assist decision making in contrast to the traditional models where individual characteristics are often blurred or even disappeared.

MSM (Microsimulation Model) and ABM (Agent Based Model) are the two important approaches in IBM. MSM is an extensively applied and well proven approach in social modelling. Especially in the public policy domains, its application has ranged from tax-benefit, pension, health to transport policies (Redmond *et al.* 1998; Sutherland, 2001; Curry, 1996; Morrison, 2003; PTV AG, 2000). Spatial MSM simulates virtual populations in given geographical areas (Ballas et al, 2005) so that local contexts can be taken into account when studying the characteristics of these populations and analysing the policy impacts (Birkin and Clarke, 1995; Clarke, 1996).

Although limitations such as data and computation requirements have been greatly improved nowadays, two criticism against MSM remain to be addressed: MSM are less strong in behaviour modelling and most MSM only models one-direction interactions: the impact of the policy on the individuals, but not the impact of individuals on the policy (Krupp, 1986; Williamson, 1999; Citro and Hanushek, 1991; O'Donoghue, 2001; Gilbert and Troitzsch, 2005).

ABM can provide the capability for behaviour modelling. It allows us to study the interactions between the policy and population at both macro and micro levels, as well as in both directions. Agent based social simulation can provide insight into the structure and effects of policies and can assist in understanding and modifying behaviour and interaction patterns (Luck et al., 2003). However, despite the usefulness of the ABM as described in previous discussion, being a relatively new technology, sometimes it is felt that it can benefit from more refined and well-established theories and concepts of other approaches (Gilbert and Troitzsch, 1999; Conte *et al.*, 1998). Such features make the MSM and ABM naturally complement each other.

MoSeS proposes a hybrid modelling approach that brings the strength of the MSM and ABM together based on four considerations:

- MSM and ABM complement each other;
- Geography provides a bridge to link the MSM and ABM;
- Previous attempts of hybrid approaches have resulted in fruitful outcomes;

- This hybrid approach may provide a new angle to view classical problems (Boman and Holm, 2004).

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