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Enriching value chains through maps: reflections from spatial group model building in Myanmar and India

Karl M. Rich, Jared Berends and Gregory S. Cooper

ABSTRACT
Recent research has highlighted the valuable contributions that participatory processes contribute in developing system dynamics models of value chains with stakeholders. A new participatory process known as spatial group model building (SGMB) expands these insights, using maps and GIS concepts to improve the facilitation and modelling process. This practical note provides an overview of SGMB, its recent applications in informing development interventions, and proposed innovations to expand its use and dissemination.

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Value chains; system dynamics; spatial group model building; Myanmar; Bihar

Introduction

The past decade has witnessed the gradual transformation of value chain research towards a market systems development approach, in which gaining deeper knowledge of the characteristics of the broader market system is of critical importance in generating sustainable, equitable solutions for the poor (Moores and Hunter 2018). A parallel development within this larger transformation has been the use of system dynamics (SD) as an analytical tool to understand and model the interactions of social, economic, biological, and environmental drivers of value chain dynamics and to quantify the impacts of prospective interventions (Rich et al. 2011). A vibrant ecosystem of research employing these methods, particularly within the CGIAR, has emerged (see for instance Dizyee, Baker, and Rich 2017; Lie et al. 2018).

In a previous issue of *Development in Practice* (2017, Vol. 27, No. 6), Helene Lie and colleagues showcased the application of *group model building* (GMB) in the development of quantitative SD-based value chain models. Group model building involves the co-creation of system dynamics models with stakeholders, whose collective knowledge and expertise provide insights on structure and parameters associated with system phenomenon. Lie, Rich, and Burkart (2017) used GMB to understand and identify key problems in the dairy value chain in the Matiguás region of Nicaragua, which then led to the co-development of a quantitative model together that identified the dynamic returns to different technological and programmatic interventions on critical constraints in the feed sector. Work by Ouma et al. (2018) further highlighted the utility of GMB tools in the context of assessing the impact of animal disease (in this case, African swine fever) on value chain dynamics and the design of sustainable mitigation options at value chain level.

This practical note provides insights on the further evolution of participatory processes in value chain modelling, specifically through the use of *spatial group model building*, or SGMB (Rich, Rich, and Dizyee 2018). Initially conceived to further explicate the role that space and place have in the co-evolution of value chain processes and solutions, the processes and tools that SGMB sessions use to engage with stakeholders have generated a number of exciting innovations that have enriched modelling efforts and informed important development outcomes. This note documents these innovations and provides ideas on ways to further mainstream and institutionalise their usage.

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The spatial group model building process

Spatial group model building extends the process of group model building as pioneered by *inter alia* Vennix (1996) and Richardson and Andersen (1995). Both SGMB and GMB are stakeholder-mediated participatory processes that use collective knowledge to build models that address common problems. In SGMB, typically four to five focus group sessions are administered over a half-day with approximately 12–15 participants chosen from different nodes of the value chain. Participant selection is made in close collaboration with local partners and is sensitive to gender and power dynamics within a particular context to ensure diversity of views and participation. In parallel, a smaller reference group is convened with six to eight participants who typically have more technical expertise and are drawn from academia, research, private sector bodies, or extension. SGMB sessions are facilitated by a team comprised of a lead facilitator, a board writer, note-takers, process coach (whose role is to monitor session dynamics), and a gatekeeper who acts as a liaison between the facilitation team and SGMB group.

Both types of model building are meticulously prepared and organised through the use of what are termed scripts. Luna-Reyes et al. (2006, 294) define a script as:

> … a series of "fairly sophisticated pieces of small group processes" … conceptualised as a series of divergent or convergent activities to facilitate the cognitive processes of eliciting information, exploring courses of action, and evaluating situations.

Stated more simply, a script provides the facilitation team with a prepared set of tasks and timelines for achieving a particular activity within a GMB session. The nature of scripts differs between GMB and SGMB sessions, as noted in Table 1, which also highlights the timing of when different scripts are used within an SGMB session. In the first session (whether SGMB or GMB), the discussion begins with an assessment of participant expectations and concerns with regards to participating in the sessions ("hopes and fears") and an introduction to the language of system dynamics ("concept model").

The first SGMB session subsequently diverges from GMB in the "variable elicitation" and "reference mode elicitation" scripts, using participatory geographic information systems (GIS) concepts to document the characteristics of the space in which system-level problems exist. The participatory GIS tool that has been employed to date for SGMB is called Layerstack, developed at Lincoln University in New Zealand through a KiwiNet grant. Layerstack is an offline participatory GIS that houses facilitation materials in a foldable A3-size plastic folder (Figure 1). Participants use either an A2-size map or two A3 maps side-by-side (often of different resolutions – this has been used to contrast national and regional level maps) as a base layer. On top of the base map are plastic acetates, which like a computerised GIS represent different data layers that are pre-defined by the facilitation team.

Table 1. A comparison of scripts in group model building and spatial group model building.

GMB script	SGMB script
Scheduling the day	As per GMB (pre-session)
Logistics and room arrangements	As per GMB (pre-session)
Hopes and fears	As per GMB (session 1)
Concept model	Introducing the language of system dynamics (simple "water" example) (session 1)
Variable elicitation	Participatory GIS session (Layerstack) (session 1)
Reference mode elicitation	Problem prioritisation (session 1) Causes and consequences (session 2) Module identification (session 2)
Structure elicitation	As per GMB during module development (sessions 2–4)
Reflector feedback	
Transferring group ownership from one image to another	As per GMB between sessions (sessions 2–4)

Source: GMB scripts based on Luna-Reyes et al. (2006).

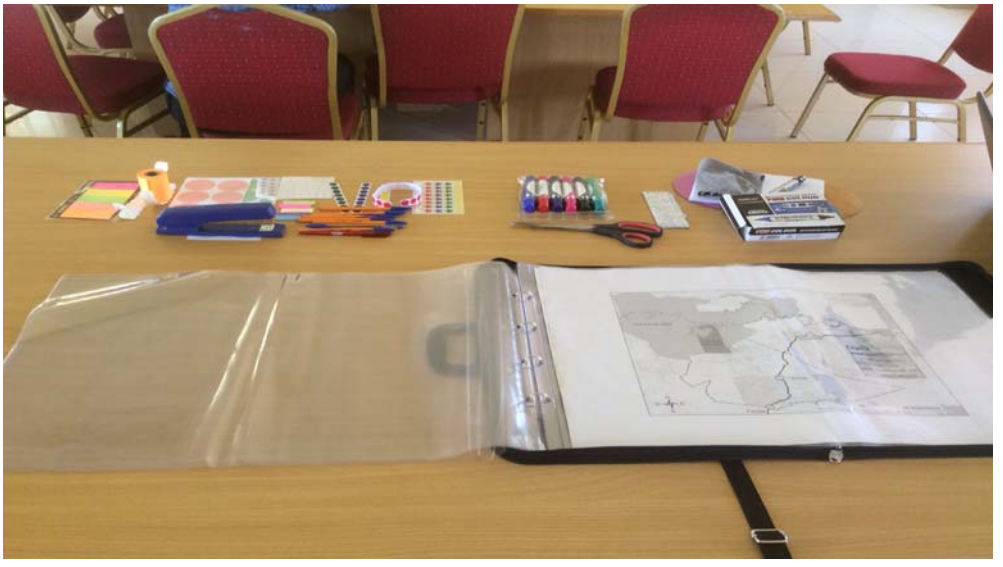

Figure 1. Layerstack: an example of a participatory GIS toolkit. Source: Photo credit from the lead author (2016), own collection.

These can represent, for example, livelihoods zones, markets, cropping patterns, disease hotspots, and various other socio-economic and/or biophysical data.

During a participatory GIS session, for a given layer, participants are asked a set of guiding questions (prepared in advance) by the facilitation team on specific characteristics of that space and trends in such characteristics over time. These can include dimensions such as trade patterns, specific farm locations, land use zones, and so on. Different types of stickers and consumables are included within Layerstack to allow participants to denote these spatial locations of system attributes on a given layer, while markers can be used to denote specific zones, reference modes of behaviour (trends over time of variables), and trading patterns. A running legend is maintained to keep track of the symbols used (Figure 2). Participatory GIS sessions using tools like Layerstack take place over a 90- to 120-minute period and typically address system characteristics on between three and five data layers. Reflection, feedback, and interpretation with stakeholders are part of the process.

The GIS session is followed by scripts that identify and prioritise system problems (which concludes session 1) and later unpacks their causes and consequences qualitatively through the development of causal loop diagrams, which show how system attributes are linked (session 2). These scripts are rooted in their spatial context, with inputs from Layerstack iteratively used to understand how space and spatial attributes shape these problems. The remaining SGMB processes in sessions 3 and 4 largely follow conventional means of module and structure development, reflection, and feedback. These two sessions are the core sessions in which model structure and parameters are obtained from participants to build a skeleton concept model of the value chain. A final session is convened some months later to feedback on the final model and engage in scenario analysis.

The use of participatory GIS tools at an early stage in the facilitation process greatly enriches team building and mutual understanding of the system in question. Even if stakeholders are not fully geographically literate, their association with place can be grounded and visualised with tools like Layerstack to develop that knowledge on an open canvas. In doing so, it increases individual stakeholder contributions to the collective information generated through a stakeholder-mediated modelling session while giving the facilitation team an added dimension of spatial data that is often omitted from conventional modelling or value chain assessments.

Figure 2. A facilitated SGMB session using Layerstack in Palaw, Myanmar. Source: Photo credit from the lead author (2019), own collection.

Applications and impacts

Spatial group model building was first applied in qualitative applications of urban agriculture in New Zealand (Rich, Rich, and Dizyee 2018) and socio-economic drivers of East Coast Fever control in Zambia (Mumba et al. 2017). More recently, SGMB has been applied to develop quantitative value chain models to inform development interventions in southern Myanmar (Berends, Rich, and Lyne 2020), and to investigate the role that aggregation systems, such as the "Loop scheme" of the non-governmental organisation Digital Green, play in making horticulture value chains more nutritionally sensitive in the state of Bihar in India and the district of Jessore in Bangladesh (Cooper et al. 2021). Lessons from these two projects are discussed below.

SGMB in Myanmar

Our work in the Tanintharyi region of Myanmar is an exemplar of the means by which SGMB can inform development outcomes. In this project, an SGMB process was initiated to identify and quantify the *ex-ante* returns of prospective intervention options in two value chains (pigs and paddy), from which such interventions would be piloted through a combination of institutional innovations (producer group and organisation development) and tailored micro-finance products.

The SGMB exercise quickly revealed that, to meet rising consumer preferences for leaner pork, slaughterhouses in the pig value chain were increasingly purchasing hybrid pigs at a premium rather than local breeds. These urban slaughterhouses imported 70% of their pig supply from trading towns situated 570 km to the north, due in part to the high transaction costs that slaughterhouses faced in dealing with individual small-scale producers. Producers closer to urban centres had experienced more success in the transition to hybrid pigs and this was related to the spatial elements of critical services and inputs. The breadth and quality of technical trainings, veterinary services, affordable credit, commercial feed, and breeding stock all decreased in relation to the distance from urban

centres. Combined, these made pig producers in the project's rural target area highly vulnerable to the price and disease shocks which plagued the system. The SGMB process allowed the parametrisation of the pig SD model to accommodate spatial differences in farm size and service quality which improved scenario testing of collective action options to overcome these challenges.

In paddy, SGMB tools revealed the comparatively small proportion of commercially orientated paddy farmers given the prominence of pelagic, rubber, betel leaf, and areca nut production in the region. Most paddy farmers only grew a single paddy crop for household consumption needs and given its low profitability, limited investments in quality inputs or farm assets took place. The resulting low cash income meant farmers financed annual production costs through loans and typically sold 70% of paddy yields immediately post-harvest to pay off debts. This paddy was sold when prices were at their lowest point and predominantly flowed to large commercial rice mills in urban centres who also import 50% of their paddy from outside the region to satisfy steady retail demand. The increasing dominance of large commercial mills meant there was little opportunity for village mills to upgrade their machinery and engage with local paddy farmers to source higher quality paddy varieties which targeted premium retail markets.

As a highly participatory process, SGMB requires trained and skilled facilitators. In Myanmar, a three-day training seminar and a one-day practise workshop helped the team to transition from a "teaching" to "facilitation" mindset. Prompting was still required to ensure facilitators allowed participants to lead and could pivot discussions away from dominating personalities towards less confident participants. A mixed-gender and ethnic team helped ensure the active participation of all, as did tactile materials (Layerstack) which created a more familiar platform through which less vocal participants could express themselves.

SGMB in Bihar

In Bihar, SGMB played a major role in uncovering the spatial distribution of fruit and vegetable (F&V) flows to urban and rural markets, as well as the associated infrastructural and informal governance-related barriers regulating the access of producers and consumers to horticultural marketing environments. For example, in Bhojpur district, it quickly became apparent that various marketing decisions are based on locational-specific barriers to timely and profitable market access. These include the presence of toll booths along particular roads or the tendency for traffic jams to form at junctions to certain bridges and villages. That farmers, traders, and commission agents participating in the SGMB sessions could use participatory GIS tools to help them visualise market locations, transport routes, and supporting services (e.g. seed providers) proved critical to the parameterisation of farmer and trader decision-making processes within the formal quantitative SD model.

On top of providing a diversity of quantitative and qualitative data, SGMB facilitated a *horizon-scan* of future scenarios perceived to have the potential to increase the availability of F&V in small, often rural markets, whilst simultaneously minimising trade-offs on the revenues and costs of farmers participating in the aforementioned aggregation scheme (Figure 3). Through Layerstack, participants discussed feasible locations to establish new F&V markets, based upon their experience of road qualities, travel times, and transport costs. In turn, the trade-offs which emerged during stakeholder debates (e.g. locational-specific barriers to cold storage access in Bihar) have helped to prioritise and refine the list of formal scenarios simulated in the quantitative SD-model.

Conducting SGMB sessions in Bihar presented its own set of logistical and practical challenges. First, the one or two stakeholders that dropped out after each session tended to be external to the aggregation scheme, and thus may have not felt bound by the same responsibility as the farmers and transporters involved in the aggregation scheme. Second, given the sociocultural context of Bihar, separate male-only and female-only sessions were organised. However, given the need to conduct the female-only sessions within their home villages (rather than at local hotels), the use of the full range of participatory GIS tools provided by Layerstack was partially limited. Lastly, and in relation to the two challenges above, the need for clear but adaptable

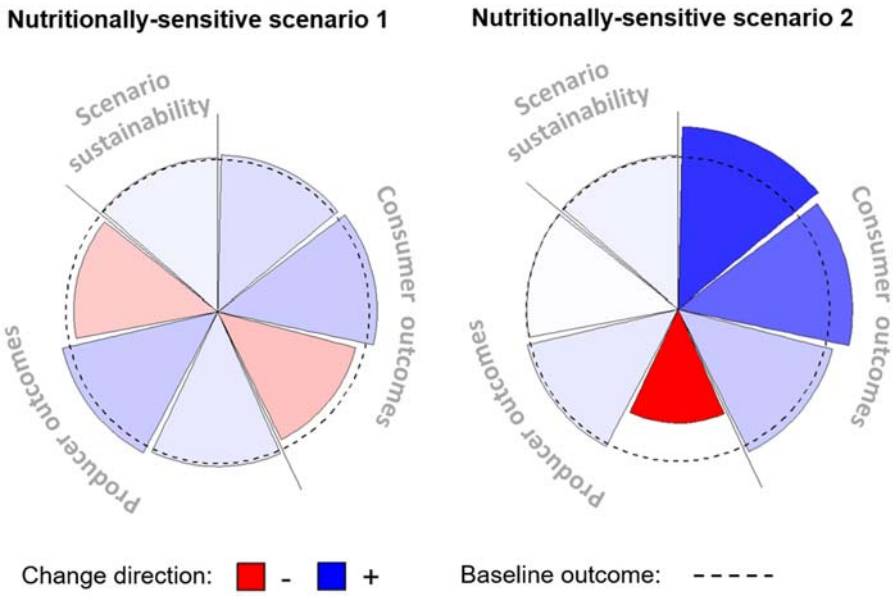

Figure 3. Example of trade-offs between producers and consumers resulting from two hypothetical nutritionally-sensitive value chain interventions generated from SGMB.

session scripts became increasingly important as the SGMB campaign progressed. For instance, keeping the discussion going whilst switching from a digital projection of a time-series to a hastily drawn reference mode on Layerstack was particularly key during any number of the frequent power outages experienced in Bihar.

Conclusions: the future of spatial group model building

As the project examples showcase, SGMB is emerging as a powerful facilitation tool to improve stakeholder engagement within value chains and support model development that directly informs development outcomes. Further applications of SGMB are on-going, particularly in the context of animal disease to help tease out the spatial drivers and interactions of disease alongside market, gender, public health, and livelihoods dimensions. This will further enhance our evidence base to broaden out and mainstream the use of SGMB in value chains and food systems.

The ongoing Covid outbreak currently presents challenges in conducting face-to-face participatory sessions. However, a set of training materials exploring the use of a variety of online tools has been developed, with piloting of such methods planned for mid-2020 (Rich 2021). Further updates on the lessons generated from this process will be documented and communicated in due course.

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