

## Digital Farmer-Producer Organisation (FPO) Design:

### The Development of an Institutional-Socially Responsible Supply Network Framework

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#### Abstract

Socially responsible supply networks remains a nascent research area in operations management. This paper examines societal needs, social impacts, and strategic behaviours of farmer-producer organisations (FPOs), and their emerging role in developing socially responsible supply chains in India. The concept of a 'Digital FPO' is also introduced.

While agriculture contributes to c.14% of India's GDP, and remains the source of income for c.60% of households, small and marginal farmers are beset with issues linked to the continued fragmentation of land and difficulties in accessing markets on their own. The concept behind the FPO is that farmers can form collectives that then benefit from economies of scale and enable better bargaining capacity. It is estimated that 4000 FPOs are now in operation across various regions of India (i.e., growth of 2000% in the past five years).

It is argued that societal pressures have increased complexities and presented ambiguous challenges that many (current) environmental and supply chain management techniques may not adequately address. A key issue this research looks to address is how to balance the often conflicting pressures created by the need for sustainable development e.g., overall industry and FPO-level economic performance versus environmental degradation and social disruption (and other unintended consequences).

Previous research on multi-organisational network 'concepts of operation' and supply network 'stages of emergence' in technology commercialisation are extended, to develop an Institutional-Socially Responsible Supply Network framework in order to (i) promote capacity building across FPO networks (ii) establish linkages between FPO networks and markets; (iii) facilitate the adoption of technology matrix interventions; and (iv) provide design criteria for new forms of FPO.

Keywords: Socially Responsible Supply Networks; Farmer-Producer Organisations (FPOs); Stages of Emergence; Digitalisation

#### 1. Introduction

Socially responsible supply networks remains a nascent research area in operations management (Tang, 2018) and is explored here as part of the TIGR2ESS programme. TIGR2ESS (Transforming India's Green Revolution by Research and Empowerment for Sustainable food Supplies) is a UK-India initiative that aims to improve crop science and food security as well as develop sustainable livelihoods.

The focus of this paper is the agricultural sector in India, which is one of the most vulnerable due to issues around water use and supply security (FAO, 2017). While agriculture contributes to c.14 % of India's GDP, and remains the source of income for c.60 % of households, small and marginal farmers are beset with issues linked to the continued fragmentation of land and difficulties in accessing markets on their own. It is argued that the sector requires a transformative change in terms of productivity and the strengthening of relationships between public and private sector organisations (Brown, 2018).

This study examines societal needs, social impacts, and strategic behaviours of farmer-producer organisations (FPOs), and their emerging role in developing socially responsible supply chains in India. The concept behind the FPO is that farmers can form collectives that then benefit from economies of scale and enable better bargaining capacity. It is estimated that 4000 FPOs are now in operation across various regions of India. A key issue this research looks to address is how to balance the often-conflicting pressures created by the need for sustainable development e.g., overall industry and FPO-level economic performance versus environmental degradation and social disruption (and other unintended consequences).

Lee and Tang (2017) recently outlined Operations Management (OM) research directions in socially and environmentally responsible value chains that fundamentally expand existing OM research in three dimensions: (i) *contexts* (emerging and developing economies); (ii) *objectives* (economic, environmental, and social

responsibility); and (iii) *stakeholders* (producers, consumers, shareholders, for-profit/nonprofit/social enterprises, governments, and non-governmental organisations). Hence, we focus on relational elements and the processes key to network integration within supply networks in order to inform a set of operating principles and protocols— i.e., new concepts of operations (“ConOps”) —that are applicable to all stakeholders ‘cooperating’, within a ‘shared’ environment.

Previous work in this area has focused on economic impact, in terms of the adoption of Advanced Manufacturing Technologies and Product-Service Systems (e.g., Harrington and Srαι, 2016). Due to rapid technological developments and rising customer expectations (e.g., wider and greater data access to suppliers), digitalisation has also become an opportunity, with organisational entities recognising that their collaborative networks may have to be transformed to capitalise on a wider variety of digital innovations.

In deriving practical solutions linked to the TIGR2ESS programme, specifically the “User-Technology Adoption Matrix” (FP5; Project #14), this study looks at both economic and social impacts and how digital technologies and societal needs may influence future FPO operating philosophies. As well as introducing social impact constructs based around ERG Theory (Alderfer, 1969; de Haan et al., 2014), i.e.,

- *Existence* – e.g., Health and wellbeing;
- *Relatedness* – e.g., Social cohesion and ecological health;
- *Growth* – e.g., Purpose and expression, influence and respect, freedom and autonomy

the overall goal is to identify different user (FPO) profiles, develop a portfolio of resource-efficient technology interventions, to better understand potential application of such technology interventions, and document a series of exemplar case studies.

Finally, a set of exploratory research questions are introduced here as a guide and are based on preliminary FPO profiles and research opportunities recently reported in the area of socially responsible supply chains (Tang, 2018), around (i) the economic and social value of information and technology, (ii) the establishment of norms for social responsibility in supply chains and (iii) the creation of more value for user groups (selected FPOs).

## 2. The Digital FPO concept

Commensurate with new technology developments and rising end-customer expectations, multi-stakeholder networks and consortia have been employed to institute new types of collaborative knowledge exchange (Srαι and Alinaghian, 2013) and associated risk management practices for, e.g., ‘coopetition’ arrangements between organisations which could impact all entities in a network and across sectors as a whole (e.g., Pathak et al., 2014). In facing tomorrow’s societal needs, organisations and their networks will face ‘non-traditional’ supply chain challenges, hence, will need to develop a new set of competencies across people, processes, products, technologies and data to support new business models (Harrington and Srαι, 2016). Indeed, we are increasingly seeing traditional industrial efficiency dimensions and measures being re-orientated to capture greater consumer participation, social considerations and multi-stakeholder service outcomes (Harrington et al., 2016).

Drawing on emerging technologies (e.g., User-Technology Adoption Matrix) and contexts (e.g., nascent, emerging, and mature supply networks and FPOs) in this programme, we can also explore theoretical implications that a series of digital interventions could bring to theory and practice. For example, how relevant are ‘conventional’ theories of supply chain innovation today in addressing network-centric digitalisation, complementary digital innovations, and the ‘digital’ organisation? (Snow, 2017).

Here, we introduce the idea of the “Digital FPO” as an extension of the traditional/conventional co-operative and producer organisation (Raju, 2017) – see table 1. For example, while ‘registration’ for co-operatives and producer organisations are bound by the Co-op societies Act and Amended Companies Act (2012) respectively, this study will look to promote hybrid forms, each with discrete ‘ConOps’ applicable to all stakeholders. And in terms of e.g., ‘relationships’, while transactional in the case of co-operatives and where joint ventures and alliances are possible for producer organisations, the digital FPO may be designed to have local legitimacy – both informal and formal.

**Table 1.** Towards a Digital FPO? (adapted from Raju et al., 2017).

<b>Characteristic</b>	<b>Co-operative</b>	<b>Producer Organisation</b>	<b>The 'Digital' FPO?</b>
<b>Registration</b>	Co-op societies Act	Amended Companies Act (2012)	<i>Hybrid forms, each with discrete ConOps</i>
<b>Membership</b>	Open to any individual or co-operative	Only to producer members and their agencies	<i>By design e.g., open or closed network</i>
<b>Board</b>	Not provided	Can be co-opted	<i>Experts co-opted by design</i>
<b>Area of operation</b>	Restricted	Throughout India	<i>Unrestricted</i>
<b>Relationships</b>	Transactional	Joint ventures and alliances possible	<i>Local legitimacy – informal &amp; formal</i>

<b>Characteristic</b>	<b>Co-operative</b>	<b>Producer Organisation</b>	<b>The 'Digital' FPO?</b>
<b>Shares</b>	Not tradable	Tradable within membership only	<i>Tradable within a defined network</i>
<b>Member stakes</b>	No linkage with no. of shares held	Articles of association can provide for linking shares and delivery rights	<i>New measures of fairness</i>
<b>Voting rights</b>	One person one vote, but e.g., government have veto power	One member one vote	<i>Devolved sub-networks (coalitions)</i>
<b>Reserves</b>	Can be created if profit made	Mandatory to create reserves	<i>Co-opted scenarios linked to services</i>
<b>Profit sharing</b>	Limited dividend on capital	Based on patronage; reserves a must and limit on dividend	<i>New incentives &amp; gain share mechanisms</i>
<b>Role of government</b>	Significant	Minimal	<i>Enabling (legal, digital infrastructure)</i>
<b>Disclosure and audit requirements</b>	Annual report to regulator	Very strict as per the Companies Act	<i>Digital audit capability; Blockchain?</i>
<b>Administrative control</b>	Excessive	None	<i>Governance based on local laws</i>
<b>Borrowing power</b>	Restricted	Many options	<i>Multiple including community-based options</i>
<b>Dispute settlement</b>	Through co-op system	Through arbitration	<i>Platform governance protocols as per ConOps</i>

Future studies will look to validate the dimensions outlined in table 1, and it is argued that these may be more applicable to 'mature' FPOs. Hence, in order to better capture FPO profiles associated with technology emergence and disruptive business models, these dimensions will be used as a basis to capture 'transitions' for both nascent and emerging FPOs and explore if particular 'archetypes' or 'forms' of supply network may best support FPO emergence.

Sections 2.1. and 2.2. now outline stages of emergence in terms of the traditional (conventional) FPO, and supply networks in technology commercialisation, respectively.

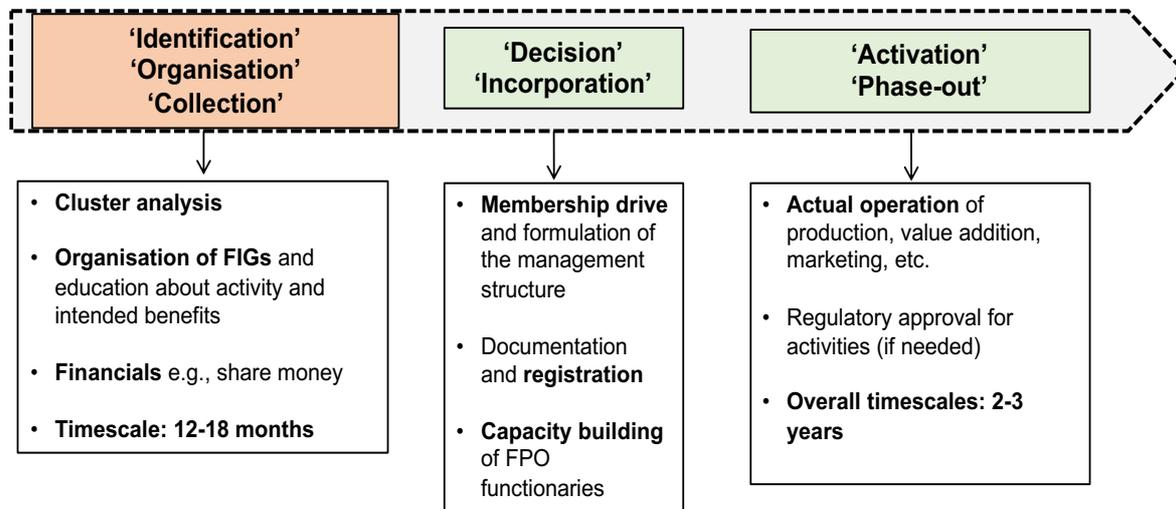
### 2.1 Stages of traditional FPO emergence

In terms of small farmholders, the pathway to 'maturity' is lengthy and needs supportive investment through a range of planned and sequenced business services (Poole and Frece, 2010). There is no 'one size-fits all', and no guarantee that individual successes can be up scaled and replicated (ibid). However, in terms of traditional stages of emergence for FPOs in India, Shah (2016) proposes four phases for success. In summary, critical factors include:

- Communicating a compelling vision of a potentially successful enterprise with significant rewards to farmer-members.
- Creating (and registering) the member organisation best designed to deliver.
- Utilising early success to institute rules/norms that reinforce patronage cohesiveness, governance effectiveness, and operating performance.
- At 'maturity', utilise the strength from enterprise growth to enhance member, patronage and domain centrality.

While, for example, formalisation refers to the degree to which increasingly complex supply networks are controlled by explicit rules, procedures, and norms (Choi and Hong, 2002), our focus here relates to roles and responsibilities and what influence central nodes play in integrating multi-organisational networks in 'pre-formation – formation – implement' phases of 'traditional' FPO emergence.

In Figure 1, we propose a stages of emergence model, based on Raju et al (2017), where the first 'pre-formation' phase involves a 'identification-organisation-collection' stage. Next the 'formation' phase involves 'decision-incorporation', with finally, an 'activation-phase-out' stage in the 'implement' phase.

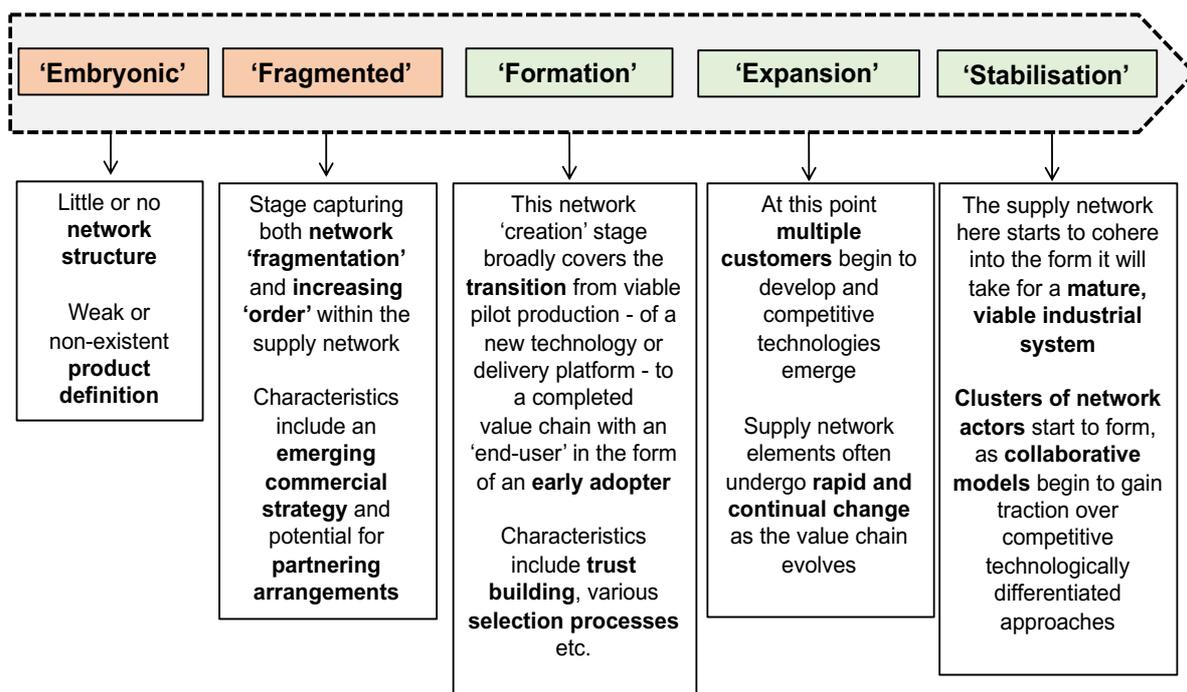


**Figure 1.** Stages of traditional FPO emergence (adapted from the Ministry of Agriculture Policy and Process Guidelines for FPOs; Raju et al. (2017).

## 2.2 Stages of supply network emergence in technology commercialisation

In extending our theoretical understanding of 'stages' and 'emergence' from traditional technology and product perspectives towards that of FPOs (section 2.1) and supply networks, it is argued that supply networks never quite reach a stage of 'maturity', as organisations continuously look to re-configure elements of their legacy networks, leveraging existing capabilities where possible, in response to changes in strategic priorities and the emergence of new market opportunities and threats (Harrington and Srail, 2017). Figure 2 summarises this previous research on Nascent – Emerging – 'Mature' phases, where a nascent phase consists of two stages ('embryonic-fragmented'), and an emerging phase in three stages ('formation-expansion-stabilisation').

We aim to extend this model in this study to incorporate 'Conventional– Digital' supply network transitions, where digitalisation increasingly sees networks mutually dependent on their surrounding environments and constantly adapting to it, the coupling of internal and external ecosystems, and network integration involving new systems and new regulations (Harrington et al., 2018).



**Figure 2.** Stages of supply network emergence in technology commercialisation (adapted from Harrington and Srail, 2017).

### 3. Conclusions

This study looks to inform industrial policies and strategies to support nascent, emerging and mature FPOs, and conventional-digital FPO capability development in specific regional contexts. An Institutional-Socially Responsible Supply Network ‘stages’ model to better understand supply network evolution — in terms of a portfolio of resource-efficient technology interventions — is developed by integrating stages of emergence for FPOs and supply networks (see figures 1 and 2). FPOs and their network partners can collectively assess the consequences of adopting conventional and digital process technologies on supply network designs and business models in different development–launch–supply scenarios and how they may compare to existing supply models. Based upon six dimensions, derived from initial scoping studies and the academic literature (Tang, 2018), a series of research questions have also been formulated to guide this research:

- *Inclusive Design*: how should socially responsible supply networks be configured that deliver specific FPO objectives and mission statements?
- *Ethical Norms*: How can FPOs establish ethical norms as they collectivise and grow?
- *Measures of Fairness*: If FPOs really create shared value, how should/can this created value be shared between its members?
- *Platform Thinking*: How can digital platforms promote the creation of both economic and social value?
- *Information Provision*: How can FPOs expand product portfolios to include e.g., information services?
- *Market Decisions*: How can FPOs use market information to make crop planning and selling decisions?

At the practice level, this framework model may inform how best to manage critical network resources - supporting the design of alternative business models and associated supply network strategies and inform existing network analysis approaches (applicable for ‘mature’ FPO networks) so as to better ‘fit’ nascent and emerging FPO contexts. In summary, the ‘stages’ model may serve as:

- An evaluation tool for FPOs to appraise their existing supply network competencies, their ‘fit’ with respect to business strategy, and overall interactions within an emerging industrial system.
- A supply network strategy demonstrator to inform effective supply network design for specific industrial emergence modes and new FPOs/entrants.
- A performance indicator of emerging FPO development, as a whole, from a supply network perspective with the potential of capturing emergent and mature contexts.

The aim is to apply the framework model in User-Technology Adoption Matrix case studies for selected FPOs in the Punjab region of India and for region-specific crops (e.g., wheat, rice, kinnow). This research provides a first basis for understanding (a) current and future ‘socially responsible’ supply network configurations using scenarios based on changing customer demand profiles, emerging technologies, and adoption of innovative cropping systems for sustainable water use (b) critical interconnections between industry actors and selected FPOs and (c) overall industry structures for the region.

Further potential case studies will involve FPO cases piloting intervention models that aim to balance the interests of farmers, the food industry, and consumers in other regions of India e.g., community-based organisations and the design of millet supply chains in the Odisha region, and the Mahila Umang Samiti female collective in the Kumaon region of Uttarakhand.

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