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New approaches to sustainable forest management: a study of service innovation in conserving forestry resources

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Abstract

Sustainability has been a primary concern for the forestry professionals. This paper is concerned with the continuing evolution of approaches to monitor sustainable forest management. It summarises the existing knowledge base and primary techniques and strategies for achieving socially and environmentally acceptable SFM in various forest formations. Service innovation is one means for the improved monitoring of SFM through the introduction of scientifically based criteria and indicators. This set has been developed on the basis of Dry Forest Asia Initiative. In addition, their implementation has played a key role in interactions with local beneficiaries. Yet, research on the link between service innovation and natural resource management is scant. The paper identifies innovation orientation, external partner collaboration, and information capability as operant resources along with the operand resources captured under the 8 criteria and their respective field level indicators. These antecedents are analyzed to know impact of overall service innovation on social economic development of the area.

Keywords: sustainable forest management, service innovation, C&I, community participation

1. Introduction

The United Nations Conference on Environment and Development (UNCED) in 1992 led the general adoption of a concept of sustainable development based on the equilibrium between three prime components i.e., economic development; conservation of the environment and social justice. Forestry resources have been featured prominently at the conference and have remained high on the international agenda for sustainable development. In pursuance of the 'Forest Principles' and of Agenda 21 (chapter 11) adopted at UNCED, the notion of sustainable forest management has been adopted in more specific and operational terms. Criteria and indicators were identified in order of planning, monitoring and assess the forest management practices at the national as well as for the individual forest management unit (FMU) level. The selection and use of suitable criteria and indicators are thus one of the keys to progress in the practice of sustainable forest management.

These criteria and indicators are mainly intended for defining objectives and priorities for Sustainable Forest Management (SFM) and for monitoring progress during their implementation. The objective of SFM is, to increase the adoption of forest management practices to sustain and enhance the yields of multiple products, services and values for multiple stakeholders, over the long term. However, the intermediate goal is to contribute, sustain and enhance the benefits from natural tropical forests like India, by increasing opportunities and benefits to various stakeholders. The end benefit of the project includes rural livelihood promotion; industrial timber production; and environmental services. In a way, improving the level of adoption of scientific findings in forest management, leads to adoptive management process and hence use of best practices. In India, all the forestry resources are under the direct control of the government. Hence, it provides a very less scope for the innovative management. However, the latest management practices such as, Sustainable Forest Management (SFM), Joint Forest Management (JFM) bring the inputs from various stake holders and a hope to bring the service innovation in the management of the forestry resources.

These service innovations in the management of natural resources have been an effective way for the forestry organizations to accelerate its growth rate and profitability as products or services become more or less homogeneous or an original competitive advantage cannot be sustained (Berry, Shankar, Janet, Susan and Dotzel, 2006). Accordingly, researchers and practitioners are interested in explaining and predicting key antecedents of and outcomes associated with service innovation in managing forestry resources. Much of the research on service innovation in the last few decades has addressed many considerations, including decisions of service innovation adoption (Frambach, Barkema, Bart and Wedel, 1998; Kleijnen, Ruyter, and Andreassen 2005), typologies (Avlonitis, Papastathopoulou, and Gounaris 2001) of service innovation, service innovation strategy and process (Blazevic and Lievens 2004), and drivers of service innovation (Berry et al. 2006) mainly in the corporate scenario of the western countries. However, the present work focuses on the importance of innovation practices in conserving forestry resources and highlights the need of future research in this area. By shedding light on the short and long-term benefits and different goods/ services for different stakeholders, this forest management practice contributes both to the environment as well as to its various stakeholders.

As suggested by Berry et al. (2006), service innovation aims to create new markets and hence possibilities of extending the organizational service reach. Research seeks to contribute to sustainable forest management by increasing the understanding of the costs and benefits for different stakeholders of sustaining or replacing, managing well or degrading natural forests, by enhancing the incentives for improved forest management through contributions for institutional development and policy decisions; and by evaluating harvesting and management recommendations to sustain commodities and environmental values from natural tropical forests.

However, this topic has recently attracted increasing interest from academics and practitioners (e.g., Blind 2006; Dean 2004; Pavlovski 2007; Verganti and Buganza 2005; Zomerdijk and de Vries 2007), there is little evidence of significant innovation in managing forestry resources. We argue that there is no full and adequate understanding of the concept of service innovation and its role in managing forestry resources. Recently, the field of marketing has evolved toward a service-dominant (S-D) logic (Vargo and Lusch 2008) through which we can re-examine the role of innovation in service delivery. Compared to traditional goods-dominant (G-D) logic, service in S-D logic is the application of specialized competences (knowledge and skills, i.e., operant resources) to provide through goods (operand resources) that benefit an entity.

In the present article, we argue that service innovation is the process of applying specialized competences, consistent with S-D logic. Innovation in this context is the process of applying new ideas or current thinking in fundamentally different ways, resulting in significant changes. According to S-D logic,

innovations had significantly changed the user preferences and their perception about the service quality (Madhavaram and Hunt, 2008). Therefore, by implementing innovative practices in service delivery, organizations could change their method of creating stakeholders value and hence positively impact their perceptions. Accordingly, we argue that service delivery innovation in the SFM context, involves an entire organization viewing and addressing both value creation and environmental services within an S-D logic framework.

The purpose of this article is to contribute to the literature on Sustainable Forest Management through service delivery innovation by developing and empirically testing a model that attempts to explain what motivates service delivery innovation and, in turn, influences performance in terms of optimum utilization of forestry resources. Here the performance has been measured on the basis of Bhopal-India initiative for SFM, which in itself is an outcome of Dry Forest Asia Initiative. We had three research objectives: (a) to understand the role of service innovation in SFM (b) to investigate the antecedents of service delivery innovation based on the Local Unit Criteria and Indicator Development (LUCID) for SFM, and (c) to examine whether proposed service innovation can result in better social economic development in terms of rural livelihood promotion.

This article makes three contributions to the literature. First, we try to identify the nature of service delivery innovation in the management of natural resources. By studying innovation within the framework of S-D logic, we view service delivery innovation as ability of a firm to create stakeholder value (Lievens and Moenaert, 2000). Second, based on resource advantage (R-A) theory (Lusch, Vargo and Brien, 2007), we test the links among organizational innovation orientation, service delivery innovation, and performance through an empirical survey with samples from 126 JFMC's. Third, the results provide practical steps for managers to understand service innovation that can result in better social economic development in terms of rural livelihood promotion. The article is structured as follows. First, we review Sustainable Forest Management in terms of S-D logic framework to identify the key operant resources that facilitate service delivery innovation. Then, after describing the research framework (Figure 1), we report the results of a study conducted in the Forest Management Committees aimed at empirically testing the research model (Figure 2). At last, we conclude with a discussion of theoretical and managerial implications and directions for future research.

2. Theoretical Background and Conceptual Framework

Looking into the service innovation literature, most of the prior innovation literature has treated service innovation as product innovation. However, extensive literature review includes the interaction (i.e., co-production with end users) between new service development and service delivery (Zaltman, Duncan and Holbek, 1973). Although strategic innovation theory (Markides, 1997) addresses a new way of delivering new products or services to existing or new customer segments and most adequately explains service innovation, it focuses mainly on goods (i.e., operand resources) but not on operant resources.

As we know, R-A theory is compatible with the S-D logic's emphasis on competences, value propositions, and operant resources. In this study, we view service delivery innovation from the R-A theory to better understand the relationships among strategic and organizational issues. R-A theory is a process theory of competition, which asserts that firms achieve superior financial performance by occupying marketplace positions of competitive advantage. Here in terms of forest management, the competency may be achieved in terms of optimum utilization of forestry resources, socio-cultural benefits and better ecosystem function and vitality.

Hence it relies on those resources that provide the firm a comparative advantage over its competitors. These comparative resources, in the S-D logic perspective, are mainly operant resources. Figure 1 presents our research framework.

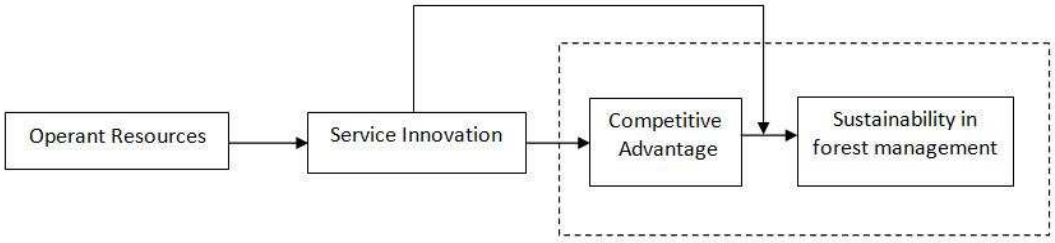

Figure 1: The Research Framework

Operant resources that can be leveraged to develop innovation practices, a source of sustained competitive advantage, produce superior performance in terms of improved sustainability indicators. Further, we are also suggesting a direct effect between innovation practices on sustainability of forestry resources. In our discussion, we refer to the concept of applying R-A theory to support service delivery innovation research. To determine which operant resources facilitate service delivery innovation, however, one needs a model describing the resources/capabilities of a firm and how these enable service delivery innovation. The model has been based on the study Verganti and Buganza (2005) that describes service delivery as being facilitated by organization (internal and external) and technology. We therefore propose a research model and suggest that innovation practices in service delivery are mainly influenced by organizational, relational, and informational resources (Hunt 2000). In R-A theory, organizational (e.g., cultures), relational (e.g., relationships with partners), and informational (e.g., technology) assets are operant resources.

We further identify organizational resources as innovation orientation, relational resources as external partner collaboration, and informational resources as IT capabilities. The emphasis in the literature is the discussion of organization, relationships, and technology and their influence on service delivery innovation and monitoring of sustainable management of forestry resources. It shows the relationships that we hypothesized exist among innovation orientation, external partner collaboration, IT capability, service delivery innovation, and performance of sustainability indicators.

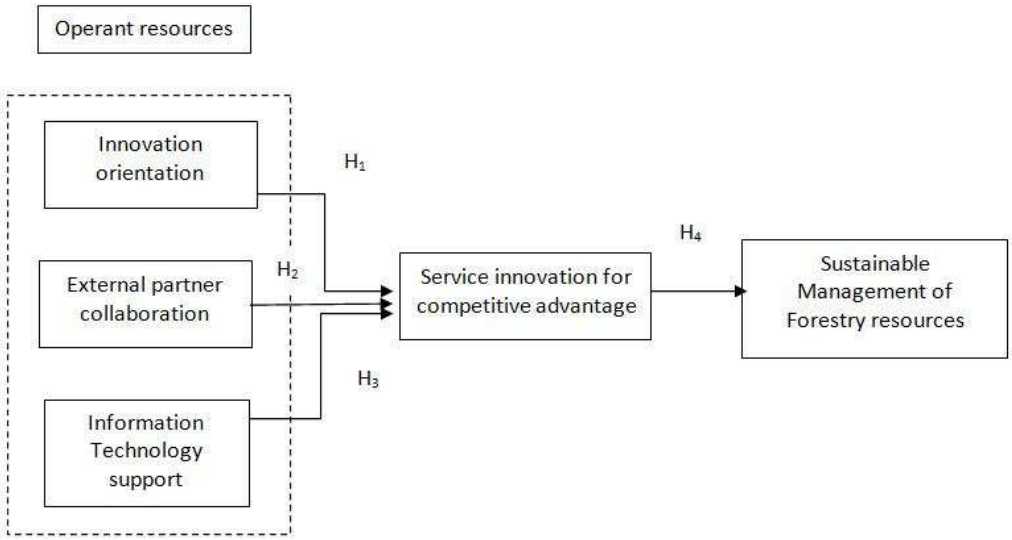

Figure 2: The Research Model

3. Operationalization of Constructs

Innovation orientation of a Stakeholder: refers to an organizational openness to new ideas and propensity to change through adopting new technologies, resources, skills, and administrative systems (Zhou, Gao, Yang, 2005). Innovation orientation consists of both openness to innovation (Zaltman, Duncan, and Holbek 1973) and capacity to innovate (Bolton, 2003). Here it has been measured on the basis of individual efforts for conserving the forestry resources.

External partner collaboration: It's an important parameter for conserving ecosystem biodiversity as high degree of networking efforts took place while conserving the forestry resources. It has been measured using modified scales of Kalaignanam, Shankar and Varadarajan (2007). Apart from institutional efforts (forest committee), the organizational participation in exchanging resources and capabilities with external partners such as universities, research institutions, customers, and suppliers have also been studied.

IT capability: It includes the availability of IT infrastructure, human IT resources, and IT-enabled intangibles. It also includes the availability of GPS, palmtops at the beat level. It has been measured the scale by Bharadwaj (2000). It also includes the computerization of land records and computer awareness at the grass-root level.

Service Delivery Innovation: It refers to the actual delivery of a service (Zeithaml, Berry, and Parasuraman 1988) and the delivery of services and products to the stakeholders (Lovelock and Gummesson, 2004). In forest management terms, it is a process of applying specialized competences (knowledge and skills) to maintain and enhance the ecosystem function and vitality. It has been measured by using 10 items adapted and modified from research on the S-D logic perspective by Vargo and Lusch (2004).

Measuring the forest sustainability: Standards for sustainable forest management typically consist of a number of principles which are the components of the overall goal and objective, and of criteria and indicators which are meant to enable an assessment as whether or not the objective and its components are

being accomplished. In the present study, criteria have been formulated to describe a desired state or dynamics of the biological or social system and allow a verdict on the degree of achievement of an objective in a given situation. A scale consists of 8 criteria and 44 indicators have been used to monitor the forest sustainability at the National Level.

4. Hypothesis Development

In a study conducted by Zhou et al, (2005) the innovation orientation has been determined as one of the factors for service innovation. It has been noted as a key driver for overcoming hurdles and enhancing organizational ability to successfully adopt or implement new systems, processes, or products. In case of conserving forestry resources, it comes in the form of individual efforts to maintain the forest resource productivity. Therefore, innovation orientation represents the extent to which (a) an organization is open to new ideas (i.e., culture) through the adoption of new technologies and integrated resources and (b) encouragement of forest management committee members to consider the adoption of innovation. Hence, we propose that the organizational ability to adapt to changing or existing service depends upon innovation orientation of its individual members. We formulate the following hypothesis:

Hypothesis 1: Innovation orientation of individual JFMC members has a positive impact on service innovation in forest conservation scenario at 95 percent confidence level.

The Inter-organizational collaboration is important in supplementing the internal innovative activities of organizations (Deeds and Rothaermel 2003). Therefore, firms need to collaborate to build greater innovation practices and lock-in partners for the long term. Due to this firms may improve their ability to engage in process innovation by managing their relationships with suppliers and customers (Kaufman, Wood, and Theyel 2000). Therefore, we propose that innovative service delivery that a firm creates is based on support from external partners' collaboration (e.g., stakeholders, research institutions, and universities). Hence, we propose that firms having stronger collaborations with external partners will be better at developing new methods (approaches) of service innovation for conservation of natural resources. Therefore, we hypothesize the following:

Hypothesis 2: External partner collaboration has a positive impact on service innovation in forest conservation scenario at 95 percent confidence level.

Based on the study on operant resources that bundle basic resources (Hunt 2000), we propose that IT capability is a hierarchy of composite operant resources (COR) that includes IT infrastructure, human IT resources, and IT-enabled intangibles. Technology may influence organizational ability to create value that will transform the way customers interact with an offering. To create a new channel or method of service delivery, organization needs to possess this infrastructure. In terms of managing the sustainable resources, it comes in the form of latest GPS supported infrastructure; Satellite based forest fire fighting equipments etc. Thus, IT capability is the operant resource for a new service that offers an opportunity to provide new and innovative services. We hypothesize the following:

Hypothesis 3: IT capability has a positive impact on service innovation in forest conservation scenario at 95 percent confidence level.

Prior research has studied business performance from different perspectives, such as financial performance,

business unit performance, or organizational performance (Wiertz, Ruyter, Keen and Streukens, 1986). Based on R-A theory, once competitors achieve superior performance through obtaining marketplace positions of competitive advantage, firms attempt to leverage the advantages through major innovation practices. We therefore propose that if organization is able to innovate in more varied ways to deliver service, they will achieve superior performance objectives. The criteria and indicators; are used to describe a systematic approach to measuring, monitoring and reporting SFM. C&I indicate the direction of change as regards the forests and also suggest the ways to expedite the process of SFM. Hence, we postulate the following:

Hypothesis 4: Service innovation in forest management has a positive impact on sustainability of forestry resources.

5. Research Methodology

The Study Site: ***To achieve the purposes of the study, the field data has been collected through 126 JFMC members under localized community biodiversity programme (L-CBP) at Marwahi (North Bilaspur) Forest Division in the state of Chhattisgarh, India. It is one of the project site where C&I approach for SFM is being implemented with the help of International Tropical Timber Organization (ITTO), Japan. The division is rich in species diversity and the dependency of local community on the forest resources is relatively higher. The forest division is located between 81^0 48' to 82^0 24' E longitude and 22^0 8' to 23^0 7' N Latitude. As per the Champion & Seth's (1968) classification of Forests Types of India, forest of the division has been classified under the 5B / C_{1c} Dry Peninsular Sal Forest. The criteria and indicator approach has been used to develop a site-specific set of criteria and indicators for Marwahi Forest Division, North Bilaspur. This set has been developed on the basis of Bhopal-India initiative for SFM, which in itself is an outcome of Dry Forest Asia Initiative.***

Design/methodology/approach: The research plan is deductive in nature as the theory building process precedes the data collection process. The data collection has been done using a 24 item scale (Forest Sustainability Index) refined from previous studies. To measure the scale internal reliability consistencies, alpha value has been found out between 0.76 and 0.87, exceeding the 0.70 benchmark suggested by Nunnally (1978). A set of hypotheses has been developed pertaining to potential predictors of two distinct facets (Operant and Operand resources) of service innovation and the impact of the latter on the measures of forestry indicator performance in terms of, increase in bio-diversity, soil and water conservation, forest production of NTFP's and socio-economic development of the village. Path analysis using SEM technique has been used for the data analysis.

Measure: All constructs in the study has been measured using multiple items. A five-point likert scale has been used to capture the variables and indicator items. The scale has been adopted from previous studies and checked for scale reliabilities (coefficient α). It consists of total 30 (6+24) items to operationalize 5 construct level variables. The 6 item scale has been used to measure service innovation (SI) and 24 item FMU level Criteria and Indicator scale has been used to measure the construct of Innovation Orientation, External Partner Collaboration, Information Technology Capability and Forest Sustainability Index. However, the final questionnaire for IO, EPC and IT has been adopted from various authors apart from ITTO scale.

S. No	Measure	Construct and indicator	Scale	Questionnaire adopted from

		variables	**Reliability (α)**	
1	IO	Innovation Orientation	0.76	Burns and Stalker (1977)
2	EPC	External Partner Collaboration	0.79	Faems, Looy, and Debackere (2005)
3	IT	Information Technology Capability	0.81	Bharadwaj (2000)
4	SI	Service Innovation	0.76	Vargo and Lusch (2004)
5	SFM	Forest Sustainability Index	0.87	Kotwal P.C. et.al (2006)

Table 1: Construct indicator variables and scale reliability values

The Descriptive statistics for the selected variables are,

Variables	**IO**	**EPC**	**IT**	**SI**	**SFM**
Sample Size	126	126	126	126	126
Mean	3.563	4.453	2.113	3.652	4.120
Standard Deviation	1.467	0.564	0.478	1.510	0.893
Skewness	-0.913	-0.343	-0.221	-0.212	-1.513

Table 2: The Descriptive statistics for the studied variables

The correlation table among the variable and cronbach's alpha along the diagonal is as,

		1	**2**	**3**	**4**	**5**
1	Innovation Orientation	(0.76)				
2	External Partner Collaboration	0.231**	(0.79)			
3	Information Technology	0.198**	0.301**	(0.81)		

	capability					
4	Service Innovation	0.495**	0.201**	0.256**	(0.76)	
5	Forest Sustainability Index	0.219**	0.136**	0.436**	0.524**	(0.87)

** Correlation is significant at the 0.01 level (2 –tailed), * correlation is significant at the 0.05 level (2 –tailed), Note: alpha values in the parenthesis along with the diagonal

Table 3: The correlation table among the variable and cronbach's alpha along the diagonal

6. Data Analysis and Results

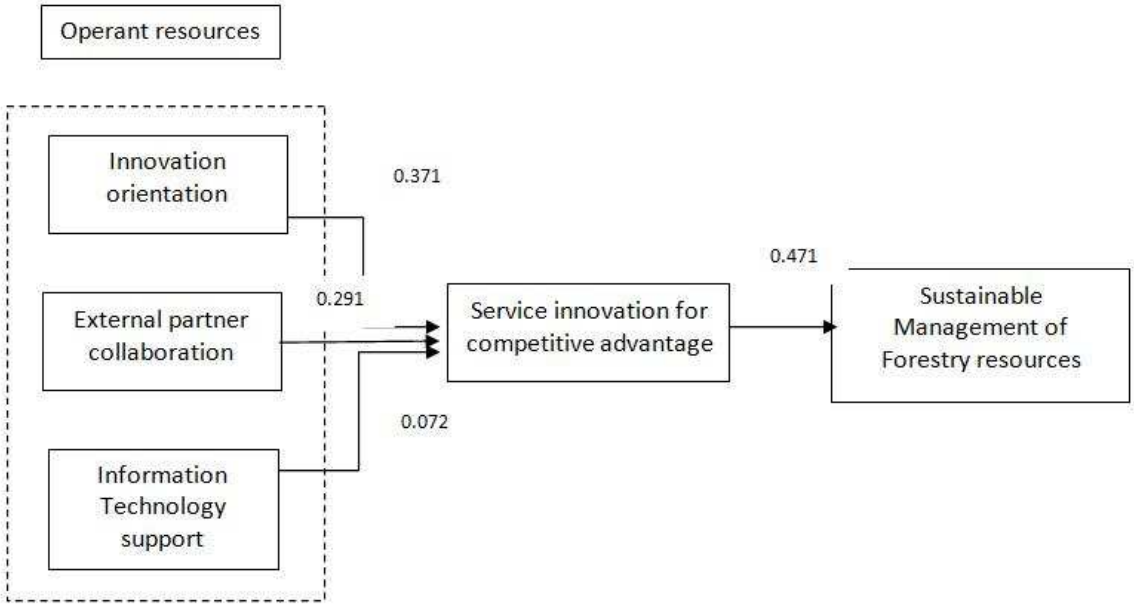

Figure 3: The path coefficient values in the studied model

We used structural equation modelling technique for the data analysis. AMOS 18.0 has been used for the path analysis. A review of the literature indicated that empirical testing of service innovation in forestry performance is quite less, it worked as a pioneer study in this domain. Based on the 4 proposed hypotheses, the effect of mediator variables has been studied. Result shows the significant relationship of innovation orientation and external partner collaboration with service innovation. Both together explained 15.6% of the

total variance. Collaborative competence has found to have a positive and significant effect (r=0.403, p< 0.001).

The main effect model has been explained using the structural equation modelling. The structural model with relevant path coefficients has been mentioned in the Figure 3. SEM takes a confirmatory approach to test the dependence relationships and account for measurement errors in the process of testing the model. The assessment of model fit has been done using the various fit indices. The testing of moderator effect has been done using a interaction variable. The results of the SEM for main effects are shown in the table,

χ2/df	AGFI	PGFI	NFI	TLI	CFI	PNFI	RMSEA	RMR
3.115	0.751	0.812	0.962	0.855	0.862	0.813	0.721	0.026

Table 4: SEM model fit summary

The chi-square/ df ratio of 2 to 3 is taken as good or acceptable fit (Bollen, 1989; Gallagher, Ting and Palmer, 2008). The various incremental fit indices include the Normal Fit Index (NFI), comparative Fit Index (CFI) or the Tucker-Lewis Index (TLI), with suggestions for a cut of 0.90 for a good fitting model (Hu and Bentler, 1999). Further the absolute fit index of Adjusted Goodness of Fit Index (AGFI) is greater than the minimal 0.75 cutoff (Gallagher, Ting and Palmer, 2008). The multiple R square for the model is 0.612.

The first hypotheses (H1) focus on the interrelationships innovation orientation and extent of service innovation among the stakeholders. Similarly second and third hypothesis (H2 and H3) focused on the external partner collaboration and IT support with extent of service innovation respectively. In the present model the direct effect and indirect effect (mediated by burnout) has been summarized as,

Hypothesized Relationship			**Estimate**	**P-value**
Service Innovation	←	Innovation orientation	0.371	0.002
Service Innovation	←	External Partner Collaboration	0.291	0.000
Service Innovation	←	Information Technology support	0.072	0.004
Forest Sustainability Indices	←	Service Innovation	0.471	0.050

Table 5: Path coefficients from the SEM analysis

It can be seen from the SEM results that all the direct and indirect relationship has been found significant (p<0.05). The direct estimate of Job demand and Job resource on performance and turnover intentions have been found significantly higher than the indirect effect (mediated by burnout). It signifies that the burnout partially mediates the overall effect (lowering the estimate value with a significant relationship).

7. Discussion and Conclusion

With the rapid pace of structural change in the forest management practices, service innovation and its relationship with forest sustainability performance have increasingly attracted the attention of both researchers and practitioners. In this study, we investigated the role of service delivery innovation as a mediator in a causal framework concerning the link with service innovation antecedents and the impact of innovation on SFM practices. The Assessment of model fit in SEM using the model fit indices ($\chi 2 = 15.04$, $p = .087$, RMSEA= .072, NFI = .96, NNFI = .95, CFI = .86, SRMR= .026) explains 62% of the total variance.

The primary findings suggest that (a) innovation orientation and external partner collaboration are the key drivers that lead to service delivery innovation, (b) service delivery innovation leads to improved management of forestry resources and in turn sustainability of forestry resources. Further, result shows that incorporating service innovation in sustainable forest management techniques significantly contribute to the rural livelihood generation and hence socio-economic development of the area.

8. Implications for Research

Our results have three significant implications for research. First, our study highlights the S-D logic perspective to link service delivery innovation, with the overall performance of the sustainable forest management programme. The study has been found pioneer in this direction as no previous other study has been made in this direction till date. Further, the study has investigated the role of operant resources in the service innovation on overall performance of the programme.

This study provides encouraging evidence for the service innovation modes that integrate service providers' competences, services, service channels and stakeholders. Delivery innovation reshapes the user's behaviour and helps organizations innovate service value with end users (co-creation value with the end users). Further, this study develops robust insights into the effects of innovation orientation and IT capability on system performance. More importantly, we propose that this research model is a more suitable framework of service innovation than others in the literature because it includes not only intra organizational components (i.e., innovation orientation and IT capability) but also inter organizational ones (i.e., external partner collaboration).

9. Implications for Practice

This study is having has various significant implications for practice. If an organization can create an advantage in operant resources, it not only can gain competitive advantage in the marketplace but also sustain its resources for the longer term. In the preview of sustainable forest management practice, forest managers as well as forest conservation group members need to foster creativity in conservation practices, train employees to accept or adopt any radical new ideas for putting up into the indicator list and develop an innovation environment or culture of openness within the organization. With regard to IT capability, IT plays a critical role in the implementation of service innovation practices, especially in corporate firms.

However in the current study, with regard to the sustainable forest management practices, it includes use of GPS in forest monitoring and satellite based equipments in forest fire fighting.

As for external partner collaboration, inter organizational collaboration is important for supplementing the internal innovative activities of organizations (Deeds and Rothaermel 2003; Kalaignanam, Shankar, and Varadarajan 2007). This means that forest development authorities need to collaborate with agencies like, soil and water conservation, horticulture and other biodiversity conservation authorities that offer different operant resources to facilitate service innovation in forest conservation. Second, considering the different types of service innovation already popular with the forest department, we recommend that organization evaluate the risks/benefits of offering new service for both existing and new stakeholders. Third, these service innovations in forestry sector will play a critical role in facilitating superior forest management practices. Once successfully implemented in one forest management unit, the same can be replicated to different other units and hence larger forest area may come in the preview of SFM practice of criteria and indicator approach.

10. Limitations and Future Research

Even though this study offers valuable insights into service innovation in forest management practices, it still has some limitations. First, the study was conducted with only 126 JFMC's of Marwahi Forest Division, so the generalization of the results may not be applicable to other forest areas especially belonging to other forest types. Second, the research model is based on the cross sectional data and is thus essentially a static perspective. It may be worthwhile to study the relationship between service innovation and sustainability of forestry resources over time to explain the effects of innovation on performance indicators and also taking the time lag effect in picture. This consideration is especially important because of the central role of innovation in this study. The effects of service innovation on forestry indicator performance may not be immediately apparent. Third, the three operant resources may not be sufficient to cover the entire scope of the study. Here we did not address the properties of the partner collaboration (e.g., governance structure, power, trust, etc.).

Further, as this empirical study included only self-reported data, future research should capture the points of view of external partners. The in depth case studies might add to our knowledge in the same subject especially in the preview of national and localised indicators of forest sustainability measurement.

Appendix 1: Refined set of Criteria and Indicators at FMU Level (2006) based on Bhopal- India Process

Criteria	**Indicators**	
Criterion 1: Increase in the extent of forest and tree cover	1.1	Forest area under encroachment
	1.2	Area of dense, open and scrub forests
	1.3	Tree cover outside forest area
Criterion 2: Maintenance, conservation and enhancement of biodiversity	2.1	Area of protected eco-systems (Protected Areas)
	2.2	Status of locally significant species (a) Animal and (b) Plant species
	2.3	Status of non-destructive harvest of wood and Non-Wood Forest Produce
Criterion 3: Maintenance and enhancement of ecosystem function and vitality	3.1	Status of natural regeneration
	3.2	Incidences of forest fires
	3.3	Incidences of pest and diseases
Criterion 4: Conservation and maintenance of soil and water resources	4.1	Area under watershed treatment
	4.2	Area prone to soil erosion
	4.3	Soil fertility/Site Quality
Criteria 5: Maintenance and Enhancement of Forest Resource Productivity	5.1	Growing stock of wood
	5.2	Increment in volume of identified species of wood
	5.3	Efforts towards enhancement of forest productivity: (a) Technological inputs

Criteria 6: Optimization of forest resource utilization	6.1	***Recorded collection of Non-Wood Forest Produce***
	6.2	Direct employment in forestry and forest based industries
	6.3	***Contribution of forests to the income of forest dependent people***
Criteria 7: Maintenance and enhancement of social, cultural and spiritual benefits	7.1	***(a) Number of JFM committees and area(s) protected by them***
		(b) Degree of people's participation in management and benefit-sharing
		(c) Level of participation of women
	7.2	Use of indigenous technical knowledge: Identification, Documentation and Application
	7.3	Extent of cultural/sacred protected landscapes: forests, trees, ponds, streams, etc. (a) Type and area of landscape (b) Number of visitors
Criteria 8: Adequacy of Policy, Legal and Institutional framework	8.1	Existence of policy and legal framework
	8.2	Number of forest related offences
	8.3	Forest Resource Accounting (a) Contribution of forestry sector to the GDP
		(b) Budgetary allocations to the forestry sector

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