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REVIVING TECHNOLOGY DEMONSTRATION IN FARMER'S FIELD – AN APPRAISAL

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ABSTRACT

Technologies, awareness of management practices to overcome diseases, role of stakeholders has been crucial for well-being of livestock and farmers. Efforts are made to provide quality health care with advent of modern techniques, advocating as well as sharing considerable resources with livestock institutions. However, the key component which enhances effectiveness of service delivery is Farm Management. This review paper reinforces necessity to attempt different incubation models for technology demonstrations in improvising it. Collaborative approach involving primary stakeholders (farmers) has been stressed in this endeavour. Models like *Non Linear Innovation System* [NLIS] and *Open Source Innovation System* [OSIS] has been shared. Features like development of utilize system, trust, social reciprocity, involvement of information gatekeepers can enhance scope of large scale utilization and diffusion of technologies. The challenge for livestock system is to minimize technological gap between research stations and end users stations. The accessibility of technical know-how depends on several criteria such as gender, availability of technology, reinforcement strategies among farmers and resource personnel's, networking among institutions, nature of demonstrations and ethical values. It is to be reiterated that more literature evidence needs to be generated in livestock science for *In-situ incubation Model of Alternative Technologies* [IMAT]. The paper argues for standardizing and providing simple solutions based on revival of knowledge systems. Widening knowledge gap between formal institutions and primary stakeholders can be reduced through IMAT. This enhances bonhomie among different stakeholders during interface through scientific intervention.

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1 Introduction

Livestock farmers in most regions of the world consider difficulty in affording treatment cost for livestock (Siegmundschultze et al., 2012). This necessitated need for public spending in control of livestock ailments as productivity of farm animals had direct bearing on livelihood. Measures have to be advocated through suitable risk as farm intensification causes welfare challenges among livestock (Taylor, 2013). It was also opinion to channelize efforts to bring sustainable solutions after assessment of eco-toxicity in veterinary therapeutics (Beynon, 2012). This involves solutions that are economically, biologically safe and acceptable in the social context wherein livestock production system operate (Peacock & Sherman, 2010). Alternative to synthetic therapies that are not eco-friendly were initiated to overcome inherent weakness of conventional treatment approach (Kyrimpa et al., 2014). Further, empathize is stressed for veterinary professionals to compassionately look into natural resources while devising such strategies (Fitzgerald, 2013). It is pertinent to know community or farm level constraints during development, implementation of technologies (Ravikumar et al., 2016). It is appropriate to look into livestock system as it provides employment opportunity close to place of dwelling and food security (Kumar & Ravikumar, 2016). Developmental efforts in farmers premise try to optimize abilities of local system through community oriented on-farm experimentation for sustaining innovation (Hauser et al., 2016).

Trends are emerging to minimize resource demanding and ecologically limiting food production in future for global sustainability (Roos et al., 2016). Tailor-made technological alternatives are essential to sustain educated youth and to utilize farmers time effectively (Kadivendi et al., 2015). Availability of niche specific technologies at farmers' field can improve their conditions and impacts daily life. Means of such meaningful engagement with stakeholders, understanding social settings assist village institutions towards diffusion of technologies (Choudhary et al., 2016). A single framework encompassing farm management, research and advisory system is yet to evolve (Gal et al., 2011). Intense studies on demonstration of technologies in farmers' field have to be carried out to gain necessary knowledge of implementation, farm management. Brem & Wolfram (2014) argue to advance research in respect to concepts of new product development in terms of social, ecological context of sustainability.

2 Technological requirement(s) in Agricultural System

The principal source of income in regions receiving less rainfall in Africa and Asia is provided by livestock (Salem & Smith, 2008). The livestock management strategies include improvised diet supplementation along with quality forage, genetic improvement of breeds so as to enhance production with reduced greenhouse gas emissions (Shikuku et al., 2016). It was observed that poor involvement of youth cause difficulty in agricultural system (Jothilakshmi et al., 2013) and

necessitates condition to improvise the situation. The ability to control nearby resources empowers farming communities and it is appropriate to identify different approaches effective agricultural productivity (Meinzen-Dick et al., 2011). It includes features of technologies that reduce cost of production and enable farmers to take less risk so as to cope with farm intensification (Aune & Bationo, 2008).

There is also stress in channelizing agriculture system towards climate smart technologies and to minimize adverse effect on environment. Tacit knowledge of local community can generate needful technical knowhow in climate mitigation strategies, however there needs to be enhanced interaction between formal systems with society (Munda et al., 2016). Critically these necessitate conditions wherein suitable, ethical relationship needs to be built with smallholders of livestock farming (Cooper et al., 2016). It is argued that technologies need to be oriented towards capacity of ecology that determines its usage and enhanced livestock production in fragile ecosystem (Diab, 2015; Roos et al., 2016). Diverse rate of adoption among farmers depends on nature of requirement in financially supporting a new technology (Feder & O'Mara, 1981). The knowledge of farmers was found to be major limiting factor in adoption of innovation (Thirunavukkarasu & Narmatha, 2016).

3 Nature of Technology Demonstration for livestock welfare, productivity

Presently with nature of intensification challenges faced by small holder production system, technology component assumes huge prominence (Tarawali et al., 2011). Among resource poor farmers' technology provision involves sharing of technical knowhow through demonstration as well as their social context (Aklilu et al., 2008). Most agricultural system across different countries had developed institutionalized and refined method of demonstration. However, common livestock ailments affecting productivity, transmission of diseases and welfare of livestock needs to be addressed. The major threat in this endeavour is tick infestation as it causes severe economic loss worldwide and complete eradication is justified (Tisdell et al., 1999).

In spite of research over several decades, resistance developed by these species were quicker and present method acaricide were found to be toxic to ecology. Wall (2007) argued that acceptable level of such parasites through suitable action at local level essential. These features indicate need to take up necessary steps for enhancing public health concern as well (Steele, 2008). Available literature search did not effectively demonstrate wider diffusion of technologies through units of demonstration with veterinary service departments owing to several reasons. Hence efforts need to be reinforced to achieve large scale demonstration, diffusion particularly in livestock sector.

4 Gender specific orientation of Technology requirement & Demonstration

Adoption rate of technologies lies with nature of gender it has to be applied and implemented. Orienting research actions by suitably looking at technologies for which resources are accessible by women with ease is felt appropriate (Doss & Morris, 2001). The context of affordability and social settings are other factors influencing rate of adoption among female members (FAO, 2014). It is also reiterated that technology demonstration program provide features of training which do not consider female as equal partners in farming (Berger et al., 1984). However, livestock sector provides immediate opportunity for asset building and play crucial role in women empowerment (Ramkumar et al., 2004).

Ability of women to share farming task depends on lesser degree of struggle in executing household activities like childcare (Quisumbing, 1996). Development program needs to be gender specific and skewed orientation have to be reviewed as it hampers women ability to contribute (Sraboni et al., 2014). The lack of access to credit had limited their participation their participation as well (Sambo et al., 2015). Technical, social and economical support can enable women to contribute meaningfully and such models need to be replicated (Ponnusamy et al., 2015). It is to be acknowledged that association of earlier experience had significant impact on female agri-entrepreneurs in management of constraints (Chahal & Ponnusamy, 2014).

5 Nature and Adoption of Technologies in Agricultural System

Research initiatives need to understand established role of farmers while implementing participatory work. Livestock holding plays significant role in adoption of technologies (Rathod & Chander, 2016). However accessibility to extension service is still a challenge to farming community (Baloch & Thapa, 2016). It has be reiterated that feedback mechanism from field to researchers, planners were limited (Ravikumar & Chander, 2011). While advocating agricultural innovation program interaction among farmers were taken into consideration but lesser attention towards engagement of collective process between them (Dolinska & d'Aquino, 2016). Timely service at farmers doorstep can enhance scope of diffusion of technologies/innovation (Athilakshmy & Rao, 2013). Innovation attributes like ease of use, performance and suitable at farming situation plays predominant role in technology adoption (Thirunavukkarasu & Narmatha, 2016).

Technologies should focus on specific context and requirements for enhancing productivity (Marzban et al., 2016). Rathod & Chander (2016a) refer that majority of technologies originated from research stations were inappropriate and not suitable at farming situation. Sungirai et al. (2016) indicated that strategies to control ailments depend on consistent supply of medications, affordability, suitable strategies shared with farmers in minimizing resistance. It is

well established that scientists view direct impact of technologies whereas farmers looks into different indirect linkages in their social settings before implementation (Schindler et al., 2016). Social transitions of farmers in effective utilization of technologies have to be noted (Hauser et al., 2016). Experimental evidences wherein knowledge network had effectively implement technologies and involve people while undertaking researches were demonstrated (Ravikumar et al., 2016c). The social network plays important role among farmers and diffusion of technologies can happen upon knowing positive impact (Magnan et al., 2015).

6 Characteristics of Institutions

Recently it has been felt that necessary knowledge systems to minimize concerns of agriculture were not developed in time bound manner (Ibrahim et al., 2014). It was also opinion that involvement of farmers in each of step like identification, refinement and practice is necessary as present improvements were not revolutionary (Norman, 2015).

Pascucci & de-Magistris (2011) suggest that public extension system should improvised with reinforcing farmers interaction with local network and other rural actors. In India, animal husbandry department had multitude of functions and extending functional role of extension was found limited (Ravikumar & Chander, 2011). The constraint is compounded by limited man power for extending veterinary service by public institutions (Jothilakshmi et al., 2013). The national agricultural research system work in close coordination with state agricultural universities (Borthakur & Singh, 2013), however percolation of technologies to line departments need to be strengthened. Resource personnel's in livestock institutions differ due to subjective experience in terms of goal, values (Lawrence et al., 1999).

7 Characteristics of Communities/Farm Holdings

Economics of farmer play key role in farming system and technologies, intervention strategies have to be need based, user friendly and economical. Kong et al. (2014) refer that situational factors like farm size, infrastructure, financial capital play predominant role and management of realities may not merely depend on knowledge, attitude. The coping mechanism of farmers during distress need to be supported through social facilities and affordable solutions (Keshavarz & Karami, 2014). Sathyanarayan et al. (2010) refer that due to constraints farmers tend to reduce rearing large number of livestock.

The income in off-farm activity is increasing and depending on such options farm families may not be completely rely on income generation from farm alone (Weersink et al., 1998). Difficulty to seek inputs from scientific research by farmers has been an impediment in disease control (Alarcon et al., 2014). Lack of adequate scientific manpower at farm-field and availability of such human capital in times of need will be a challenge. Hence measures are adopted to generate new

learning experience for enabling farmers to embrace technologies. Evidence based practice had gained greater attention of farming community to adopt quickly (Sewell et al., 2014). This can enhance refinement of technologies as the acquired knowledge of farmers can enhance scope of adoption. Adaptability to change can effectively execute through social capital linked to trust between farmers that increase utilization of innovation (Koutsou et al., 2014). Responsible exchange of knowledge is paramount to effectively utilize innovation system between formal and informal institutions (Gupta et al., 2016).

8 Integration of Indigenous Knowledge Research System [IKRS]

Technological requirement has been felt by farming communities with change in rearing pattern and other socio economic challenges. The immediate feedback is felt by public system as it provides the service on day to day basis and have interface with farmers. There is imminent necessity to listen knowledge system close to farming communities towards farm management. Indigenous Knowledge Research System can provide an opportunity in enabling technological options at farmers' premise (Ravikumar et al., 2015).

Knowledge holders had established social network and farmers rely on them in overcoming ailments in areas that were not accessible to public veterinary service (Devkania et al., 2015). Systemic efforts have to be organized in making availability of this technological knowhow with help of formal institutions. It has to be noted that inspite of lack of meaningful support at their locale, knowledge holders share their technological practices for livestock welfare and continuously enrich knowledge system (Ghorai et al., 2016).

There is a necessity to recognize these frugal innovations by formal service systems for realizing its true potential at farm field (Ravikumar et al., 2016c). National Innovation Foundation-India's efforts in utilizing affordable solutions (Low Cost Locally Available (LCLA) derived from knowledge of society with support of farmers were acknowledged (CAPSA-ESCAP, 2015).

9 Accessing Knowledge Systems: Incubation Models For Technology Demonstrations

There were efforts to describing models of implementation viz., *Non Linear Innovation System* [NLIS] and *Open Source Innovation System* [OSIS] (Ravikumar & Kumar, 2015). Development of technologies based on society's knowledge reflects NLIS approach which differs from conventional linear approach. With shrinking resources and to enhance ability of society to address niche specific challenges such solutions derived by listening and working with farming communities were defined as NLIS (Ravikumar & Kumar, 2015). Experimental evidence where shared in exemplifying such

knowledge evolved from outstanding knowledge holders in different regions of India (Ravikumar et al., 2016a; Ravikumar et al., 2016c; Raot et al., 2016). A peer group pressure innovation model, wherein indigenous healer had shared a novel medication while interacting among knowledge holders were shared (Munda et al., 2016). This helps farmer through their co-learning process to enrich society with new ideas, innovation (Koutsouris, 2012). Social interaction called by traditional livestock healer had illustrated importance of empathetic innovation model, wherein knowledge holder shared new knowledge that can minimize farmers' constraints (Devkania et al., 2015). These features indicate farm management can effectively addressed by local knowledge system which exists over generation.

Practices commonly known among society have to be value added to thwart ailments affecting livestock. This can be widely shared as open source knowledge by demonstrating utility of knowledge in farm situation. The functional efficacy of these practices can be observed through execution of community oriented methodologies. Such methodological approach viz., *Insitu Incubation Model of Alternative Technologies* (IMAT) can enable accessibility of these valuable knowledge system.

Such practices that were socially acceptable (Raot et al., 2016) needs to be scientifically tested either at farm field/university research system and implemented. Demonstrations at various geographical regions suggest that IKRS can provide affordable, ecologically desirable solution at farm field (Thakur et al., 2016). These can complement quality livestock welfare activities and a framework was shared by Ravikumar et al. (2016b). This framework features wide difference among formal institutions with informal institutions in-terms of priorities of working arrangements, systems to innovate, seeking and utilization of technological alternatives.

However, farmers' rely on both systems as per social, technological requirements. The role of line departments' viz., state department of animal husbandry or dairy societies are crucial in this endeavour. Line departments either by themselves or with help of research system can able to understand necessity of societal knowledge in their locale. It provides opportunity to minimize extraneous intervention and enhance utilization of sustainable technologies derived from IKRS. Identification of suitable practices from IKRS based on available natural and human resource is critical for successful implementation.

The foremost step is to look at preferred dosage range that can control ailments. These demonstrations wherein technology formulation carried out at farmers' field will lessen constraints of veterinary stakeholders and enhance quality advisory input. Farmers in turn aware of their surrounding and will be driven by local knowledge system for sustaining livestock healthcare with less or optimal input.

Table 1. 'Framework for IKRS' as adopted from Ravikumar et al. (2016b).

Formal Institutional perception	>	Confirmation of livestock ailments through clinical symptoms and etiology
	>	Solutions derived by application of technology through formal training, mostly rely on parametric experimentation
	>	Organized and defined support system
	>	Less knowledge and skill to utilize plant based local resources
	>	No or less favourable working arrangement in scaling up or to provide handholding support for local wisdom viz., plant based medications to complement livestock welfare
	>	Keenness to solve livestock problem through medications derived from elsewhere
	>	Lesser opportunity to innovate: Need for strengthening feedback loop
	>	Regular training and reinforcement of formal knowledge system
	>	Peer group pressure oriented towards scaling up of technologies acknowledged from outside
	>	Lesser ability or lack of priority towards social mobilization for sustaining native wisdom/skills
Farmer's perception	>	Limited prospect of utilization of social learning for livestock welfare
	>	Ability to identify nature of problem to certain extent and to seek resource personnel
	>	Understand value of plant based livestock welfare
	>	Require support for strengthening their established knowledge and utilization of local (natural) resources
	>	Capacity to recognize different plants in their vicinity
	>	Keenness to learn and solve problem based on availability of medications /resource constraints
	>	Readiness to be part of research system to generate innovative solutions
	>	Livestock Service, Research System extend and reiterates formal knowledge system through awareness campaign, training etc.,
Informal Institutional perception [Knowledge holder]	>	Social influence are prevalent in utilization of sustainable technologies
	>	Readiness to be part of social interaction as livestock activities (services) are based on cooperative nature eg., Health camps, Dairy societies
	>	Proven capacity to imbibe social learning through support system
	>	Confirmation of livestock ailments through clinical symptoms for common ailments
	>	Application of technology or practices through non-parametric experimentation with the help of locally available solutions
	>	Has ability to organize themselves but requisite support system need to be defined to scale-up
	>	Has requisite knowledge, skill to utilize plant based local resources
	>	Empathetic in addressing social problems
	>	Sharing of novel technological solutions when faced with different and difficult situation
	>	Reinforcement of indigenous knowledge system have to be strengthened: Presently there is lesser or no opportunity of reinforcement of native wisdom/skills
	>	Peer group pressure can enhance sharing of unrecognized experimental knowledge
	>	Demonstrated ability to be part of social mobilization and be part with formal institutions
	>	Non-monetary incentive have greater role in extending their service for livestock welfare
	>	Social learning is a part of IKRS ethics and spirit

Conclusion

Various efforts were made for strengthening engagement of different stakeholders in livestock sector viz, formal system, farmers, knowledge, skill of community. The domain of knowledge with different actors has to be recognized and indigenous knowledge holders can play key role in these endeavour. There is greater stress among farming community as healthcare provision is going to be difficult by relying exclusively on public service alone. In this context, dynamic knowledge of society have to be harnessed. This review

suggests imminent need for technologies that can be implemented at farm level and sustainable. As livestock sector is an important entity for poor and women, orientation of technology demonstration have to be simple, readily available at farm-field. This can only enable service department to visualize impact of demonstration and to share its applicability to farmers. Indigenous knowledge research system can enhance such scope and social network at village level will play significant role in diffusion of these knowledge systems. This helps in involvement of farmers and strengthens evolution of local acquaintance, familiarity of indigenous wisdom.

Common, collective perception and empathetic feeling among stakeholders can nurture *Insitu Incubation Model of Alternative Technologies*. The review suggests livelihood strategies through natural resource management based on knowledge system can be strengthened.

Conflict of interest

Authors would hereby like to declare that there is no conflict of interests that could possibly arise.

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