



A New Wing of Production Function of Natural Resources Management – Divergence of Beneficial Services for Fostering People's Voluntary Adoption of Innovations and Practices

RC Yadav*

Former Head, ICAR - CSWCRTI, Research Centre, Agra, Uttar Pradesh, India

***Corresponding Author:** RC Yadav, Former Head, ICAR - CSWCRTI, Research Centre, Agra, Uttar Pradesh, India.

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Abstract

A production function was introduced and patternised for various natural resources management project in general and watershed management, in particular, in earlier endeavours. Recently, an innovation research entitled, 'Eco zero weeding agriculture', was created. The zero weeding agriculture produces multiple benefits, which prompted to add as a new wing in the patternised production function to make it as auto adoption of technologies of natural resources management. New concept of convergence of services vis a vis divergence of benefits are introduced and added as a new wing to the production function. Case study of innovation of eco zero weeding is presented, which produces multiple benefits and remains as panacea shrine for total solutions in agriculture. These benefits give an automation in the practice which will bring prosperity, livable healthy environment and social harmony among people. The eco zero weeding eliminates several risks involved in outdoor agricultural arduous field works. Thus, this innovation supercedes the Rogers theory of adoption of innovation, which identifies different groups of innovation adopters, as it is getting automatically adopted by itself and comes in to action for producing benefits.

Keywords: Innovation; Rogers Diffusion Theory; Extension of Technologies; Eco-Zero Weeding; Harmony among People; Natural Resources Management

Introduction

Agriculture has been basic activity of producing food chains right from its inception in the ancient history. The crops perform process of photosynthesis that forms carbohydrate and oxygen. In the process the carbohydrate is again used in nitrogen fixation that is utilized again for plant growth in the form of polymerized crop leaf, stem, flowers and production of fruits and grains. The intensification in agriculture produced huge volume dried agricultural tissues, popularly called straw-residue which encompasses many unpleasant products and gases having implication in environment pollution.

For any enterprise management various functional factors were organised in logical pattern (Figure 1), which was highly convincing and adopted in many scenarios of developments [1-7]. The production function Figure 1 (unshaded part of the Figure 1) served up to convergence of services in watershed management projects. This convergence sought cooperation and support of services of line departments to facilitate budget support and departmental cooperations, which capitalises judicious use of natural resources under unified action of watershed management. The production function had been used in such projects on watershed management for almost over three and half decade (1980--2017).

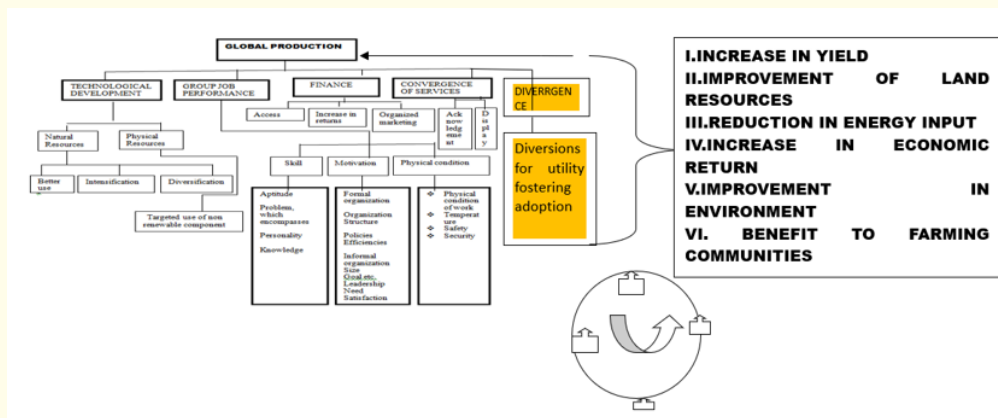


Figure 1: The production factors involved in natural resources management systems and the multiple benefits of eco- zero weeding.

The concept of creating a novel feasible technology being efficient, effective impact producing and sustainable for easy adoption. The concept was fully substantiated by a novel technology of Eco zero weeding elaborated in detail in studies [13-18]. The eco zero weeding has been documented on various aspects as new benefit of the eco zero weeding is further devised to overcome desertification. The N fixed by eco zero weeding enhances cation Exchange capacity (CEC) of soil. N is the most (13) dominating controller of plant nutrient absorption by attracting plant nutrients with positive ions. With this enhancement the eco-zero weeding has taken a form of nanotechnology with practically non monetary input in management of natural resources viz land which is getting degraded and undergoing desertification. This nanotechnology is an exact, perfect solution to degradation and combating desertification.

The objective of this study was to set requirements that enables it render liable to auto adoption of technology. The technology has to be relevant, effective, efficient and sustainable.

Materials and Methods

The eco-zero weeding

In the eco zero weeding a new concept of ecobalance was created where in Nitrogenfixing crop is sown in the solecrops of interest. The leguminous nitrogen fixing crop was sown at different rates of sole crop of pulse crop. The eco which produced the highest yield of crop was designated as the eco-zero weeding practice.

In the ecozero weeding the objective is not to bring the weeds to zero level ie fully weed free, but get level of yield where the yield of desired crop is the maximum. In the experimentation under field and practically possible method is to conduct experiment with successive increasing levels of seeding of the eco crop viz no crop as control ie 0%, 25%, 50%, 75%, 100% and 125% and noweedings were performed. The crop yield so obtained at different level of seed rate eco and yieldq/ha, to strike the optimum level of seed rate sown and eco established. Such field studies were conducted for garlic and onion.

Divergence of benefits

The nature based eco zero-weeding innovative practice was developed which acts as panacea shrine for total solution in agriculture [8-12]. The eco zero weeding replaces any kind of measure so far thought over and practiced viz manual, mechanical, hand and automaton, chemical and weedicid based weed management. The eco zero weeding not only suppresses weeds to overcome crop yield losses, but in addition it, enhances yield of crop to an unmanageable level. This technological breakthrough has created numerous benefits. The eco zero weeding is practical, non monetary input involving measure, hence its adoption by the people will spread by word of mouth, who have harnessed the benefits. A further development has been added to make it as a new wing of “Divergence of services”, which makes the practice as itself auto driven function. The conceptual details of the new wing is as under.

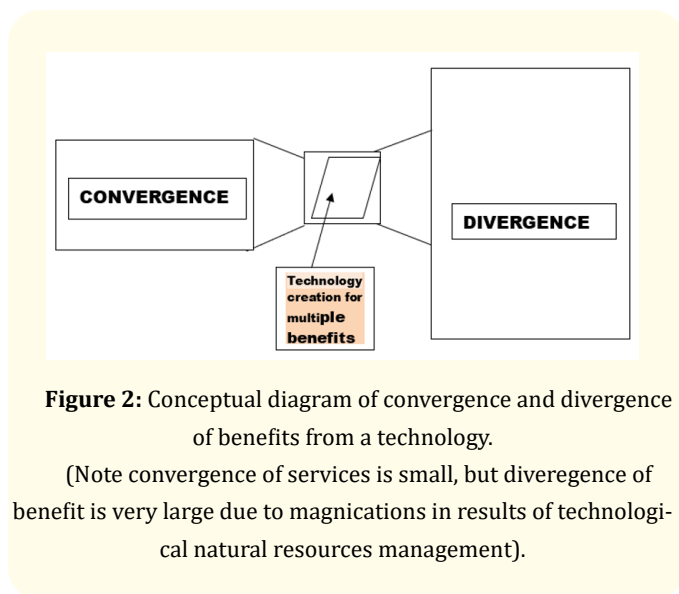


Figure 2: Conceptual diagram of convergence and divergence of benefits from a technology.

(Note convergence of services is small, but divergence of benefit is very large due to magnifications in results of technological natural resources management).

Characterizing of technologies to get qualified to be auto adoption

A technology should be simple to come to knowledge of adopters, it should be organizable with locally available materials. It should be least cost involving, relevant and problem solving, effective, efficient, and sustainable. It should also produce multiple benefits producing, meeting all requirements of strength, weakness, opportunity and threats (SWOT) analysis. The case of eco zero weeding had been evaluated and scaled down to fulfill such mandatory requirements. These aspects will be presented in the result part of the study.

Results and Discussion

The conceptual Figure 2 is devised to fortify convergence of services that will help develop projects on natural resources management, viz watershed management and the interactive result will get enlarged to many folds. This result will have potential to be harnessed in divergence of benefits for the various beneficiaries dependent on the land resources. Thus, it will bring lot of facility and prosperity for the society, people and the Government that will prompt people to adopt the production technology by themselves.

The technology of eco-zero weeding is presented as case to support view point of divergence of benefits, the new wing in Figure 1, Addendum to Figure 1 (Shaded part) i.e. result will get enlarged

to many folds. This result will be shared by various beneficiaries dependent on the land resources.

In the eco zero weeding a new concept of ecobalance was created where in Nitrogen fixing crop is sown in the sole crops of interest. The leguminous nitrogen fixing crop should be sown at different rates of sole crop of pulse of the season in any region. The eco which produced the highest yield of crop was designated as the eco zero weeding practice. In the eco zero weeding the objective is not to bring the weeds to zero level i.e. fully weed free, but get level of yield where the yield of desired crop is the maximum. In the experimentation under field and practically possible method is to conduct experiment with successively increasing levels of seeding of the eco crop viz no crop as control i.e. 0%, 25%, 50%, 75%, 100% and 125% and no weeding was performed. The crop yield so obtained at different level of seed rates of the selected eco crop is optimized with six point sets of seed rate eco and yield, q/ha, to strike the optimum level of seed rate sown and eco established. Such field studies were conducted for garlic and onion [9,12]. The incredible innovative technology of eco-zero weeding has produced multiple benefits and proved as panacea shrine for total solution in agriculture, This innovative scientific development by the author [9,11,12], proved to be of immense value and surpassing any known scientific innovation on weed control or management. This new innovation saves crops losses and robbing natural resources viz solar light, fresh air, soil moisture etc but also enhances unimaginable yields of crops and bring several other benefits. This innovative technological breakthrough inspired to create new wing of divergence of benefits. As it produces multiple benefit due to its action in different direction, as signified by symbol interaction (\cap) was added after the convergence of services with nomenclature of divergence of benefits, which signifies interactive function. There will be several example cases to cite, that will prosper in the domain of natural resources management. Additional note substantiates the interactions in development of novel technology.

This new wing (Shaded part in Figure 1) adds a new feature for attracting natural resources management as an example case of eco-zero weeding agriculture. It has inbuilt mechanism to make irrotational movement so that sustainability is maintained for all the time [14]:

- The eco zero weeding increases yield to unimaginably high level.
- It improves soil nutrients season after season by enriching residual plant nutrients in the soil after harvest of crops. Hence, eliminates occurrence of land degradation due to nutrient deficiency.
- It reduces washoff erosion due to green soil surface cover.
- It works continuously suppressing weeds and continues N fixation under all good and aberrant weather conditions.
- It eliminates need of any post sowing tillage viz secondary tillage for soil aeration or for weed control.
- Its successful working acts as crop insurance, hence there occurs stability in market price.
- Good and sustainable production facilitates harmony among people and effective trustworthy socio political governance.
- The ecozero weeding becomes a nanotechnology for combating desertification.
- It has surpassed requirements of an ideal technology and that resired for SWOT analysis.
- It is very relevant for weed control/management, eco friendly, ncarbon foot print creating, eco friendly, effective, efficient and sustainable. The documentation has proven as a useable science tht will bring multiple benefits.

With considerations of aforementioned qualities, the ecozero weeding works as a technology of autoadoption by words of mouth., without need of extra expensive extension services of agricultural technologies.

The benefits are fully developed and substantiated in several research publications [14-19]. Divergence of benefits will charter auto adoption of innovative technology of natural resources conservation -the ecozero weeding agriculture and many alike technology and practices for people's adoption [19,20].

This automation over takes many theoretical development viz. Rogers's theory of diffusion of innovation [20,21]. Rogers [20] devised theory of diffusion of technology adoption classes viz early adopters, early majority, late majority and laggard. The new development of nanotechnology fosters its fast adoption by early majority as it is a non monetary input involving nanotechnology based on most exact scientific principle. This is a technology for combating

land desertification by enabling productivity of soil. The technology should be so lucrative that it will strongly attract all classes of technology adopters for adoption of innovations. It is highly prospecting measure to prompt people's adopt new innovation [17,18] of natural resources management that will in turn build good livable environment, land resources conservation, cultivate people's harmony, develop stable markets and create good governance. The new wing will reduce burden of extension [20,21].

Once principle or theory of innovative technology is developed, it will form a universally applicable policy tool to bring solution to problems at any time and place in the global scenario. The factors interaction will result another route of the same policy tool. The local shortfalls can be made up by customized experimentations in any locality. Thus, Figure 3 depicts importance of theory and local experimentation. Theory based policy tool brings quick solution and local researches will bring the doses of treatments. Thus, adoption of both the routes will bring economy in research for resources conservation. The cases of adoption of innovations have already been covered. Thus, this research makes all nations conduct local research at their own level with limited resources and solve their problems. This style of functioning will create intellectual properties for the nations.

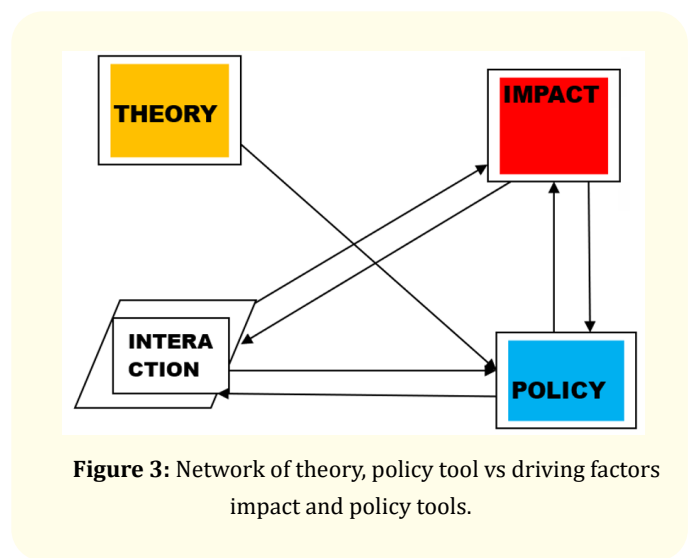


Figure 3: Network of theory, policy tool vs driving factors impact and policy tools.

Conclusion

The study adds a new wing that prompts its auto adoption by the user groups. The study recommends that any technological

innovation should also be gauged for its capability of enabling its auto adoption. The eco zero weeding fulfills all necessary requirements and accomplishing multiple benefits that makes it as an exemplary case of new wing in the production function. Thus, this study has objectively accomplished its worthiness as new wing in production function., which sets guideline for weighing and rating of innovations in agriculture.

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Conflict of Interest

It is declared that there exists no any financial conflict or any conflict of authorship.

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