

THE AGRICULTURAL CHARACTERISTICS EFFECTING THE INNOVATIVE PRODUCTION

I. HUSTI

Institute of Engineering Management,
Szent István University
Páter K. u. 1., Gödöllő, H-2103, Hungary
Tel.: +36 28 522-044, E-mail: husti.istvan@gek.szie.hu

Abstract

It is an old truth and I also have written it down several times: agriculture is a never-ending struggle; a fight between people and the forces of nature. Farming is a success if men can win against the natural resources or can make them serve humans in long terms. To achieve this, men must know the characteristics - originated from natural conditions - that make the difference between this branch of national economy and the others.

When we plan the innovative projects we need to see clearly the characteristics of agriculture that must be taken into account for the success. Several experiences justify that if we want to persuade industrial analogies onto the agriculture, the hoped advantages may get injured due to the agricultural characteristics. There are such classic factors which dramatically influence the success and result of the agricultural developments. In this paper I give an overview on these but not trying to mention each one of them.

Keywords

agricultural innovation, key agricultural factors of innovation, innovative agricultural production, agricultural technical development

Introduction

It is evident that agriculture, in essence, is an industry characterized by strong regional „uniqueness,” which is influenced by the natural and social environments of the region. Its industrial characteristics derive from its essence, that is, production activities comprising combined factors. Namely, the production activities are restricted by the natural conditions of each region (meteorological and geographical, as well as water conditions, etc.), which, along with the quality and quantity of natural resources (land, water sources, flora, etc.) are quite unique to each region. In addition, such regional characteristics are further amplified by its producers, that is, the localities and the societies around them. (Kawamura, 2012)

As we plan the innovative projects we need to see clearly the characteristics of agriculture that must be taken into account for the success. Several experiences justify that if we want to persuade industrial analogies onto the agriculture, the hoped advantages may get injured due to the agricultural characteristics. There are such classic factors which dramatically influence the success and result of the agricultural developments. In the followings I give an overview on these but not trying to mention each one of them. I will deal with:

- the natural conditions,
- some production's factors,
- the main elements of agricultural innovation flow and
- the basic elements of the technical development in the agricultural innovation.

Method

Based on my knowledge and former experiences I systemised the main characteristics which are affecting the success of innovation

in the agricultural sector. I have produced some simplified models on agricultural innovation flow and the technical development. The results of these were completed with information from personnel connection with farmers.

Results and discussion

1. Natural conditions are **objective**; their effects cannot be changed to favourable ones for us by technical-technological developments, or just to a limited extent.

Natural conditions, including climate, soil conditions and natural geography influence primarily what farming can be carried out on a given field. In this sense, these factors have fundamental influence on the value of a given field (or territory). Therefore, the **basic element** of organizing farming and planning the developments in agriculture is the precise enumeration of natural conditions.

Among natural conditions the followings are the **determining**:

- a/ climate, weather conditions,
- b/ soil conditions,
- c/ field conditions and
- d/ water conditions.

ad a/. Climate conditions can be observed in the changes of weather. Weather has „two faces” from agricultural aspects: it carries the opportunities and conditions at the same time. It is not surprising why there are several sayings for the relationship of weather and agriculture.

From the *measurable effects* of weather the followings can be underlined:

- temperature (in the different seasons and year by year);
- the quantity and the distribution of the annual precipitation in the seasons;
- heat units;
- relative humidity of air;
- the intensity, frequency and direction of winds;
- the appearance of hail and fog.

The **effects of the factors listed above** can be traceable on:

- the crops,
- the quality and quantity of products,
- the fluctuation in the quality and quantity of production,
- the directions of animal breeding,
- the organization of production and
- the profitability of farming.

Since the weather is objective, it is important to know well the local weather conditions and to pay continuous attention to the data and information of forecast services. It is useful though to record our own experience and findings, since weather can „repeat itself” any times”.

Reliable weather forecast has enormous importance in farming, since an unfavourable shift may baffle our original thoughts.

ad b/. Concerning the areas distribution of crops **soil** is one of the most determining factors. The „goodness” of soils primarily depends on its composition, nutrition-content and the characteristics of the „soil-life”. To evaluate the soils we can rely on the findings of several mechanical, physical and chemical etc. investigations.

Linking the development level of production sources and the natural features of soils we can talk about the economic productiveness of the soil which is presented in the real volume of yield.

The productiveness of soil – like the capacity of other production appliances – is potential, i.e. it is just a possibility. Though the utilization of this possibility depends on several factors.

ad c/. Field conditions refer to the natural location of the soil; they show the location over sea-level and the quality of soil surface (flat, aslope, mountainous).

The soils' surface influences the way of cultivation, the applicable instruments and their performance. Due to our conditions crop production is dominant on the flat and aslope areas, while on the mountainous areas the role of pasture-based animal breeding is important.

The very surroundings can influence either favourably or unfavourably the value of that given field: the protecting chains of mountains, forests, larger rivers and lakes usually represent advantages for the given agricultural field.

ad d/. Water conditions refer to the water-absorption ability. This depends on the proximity of water flows, their runoff, the height of ground water etc.

These factors have influence on crop production, but at the same time they may have significant impact on e.g. the creation of animal breeding farms, since we all know that these have high demand of water.

From the facts mentioned above we can see that who wants to live on farming, it is good to know that **nature is the governing lord**, and he needs to count with the effects of natural factors.

Due to natural factors the followings can be considered „agricultural characteristics”:

- Because of its dependence on nature, farming cannot be isolated from natural endowments and conditions.
- From the main activities of agriculture (crop production, animal breeding and horticulture) it is characteristic that mainly the crop production that the worker does its job in the open air, at the mercy of weather. (This exposure must be taken into account even if the modern appliances reduce it – let us think of e.g. the comfortable tractor box.) Weather sometimes tests the resistance and the tolerance ability of the farmer.
- In agriculture we work with live materials, live organisms, thus the works are limited to time. It means that every action has to be done in its own biological-agro-technical optimal period. It is highly recommended to take these periods, because if we do not do it, the chance for a successful farming reduces. Let us not forget that live materials behave similarly to humans. If he is hungry, he asks for meal, if he is thirsty, he asks for drink. If he is cold, he puts on warmer clothes, if he is hot, he takes off some clothes etc. One of the basic elements of successful

farming: to understand the major features of life-cycles of live materials, organisms, and with human activity to facilitate their favourable improvement.

- Most of the agricultural works are territorially spreaded, and they often need the change of place. The harmonization of works on different fields and the necessary instruments and workforce is a significant organizational task. Special tasks are to meet the social needs of workers and – if it is necessary – to organize the transport of workers between the workplace and home. Big problem can be – and it is not indifferent from logistics point of view – the condition and usability of agricultural roads.
- While doing agricultural work there are peak- or campaign periods, when the working day is longer than usual. There are also other periods (mostly from autumn to spring) when there is less work. The rhythm of work is also influenced by the weather. It is very embarrassing when unfavourable weather or event (rain) interrupts the work whose time-demand is very limited (e.g. harvest).
- Special problem is the quality control of the agricultural work already carried out. It is often the case that after the end of an operation the quality of the work cannot be controlled or just in an unpunctual way. E.g. in the case of sowing or plant protection works the mistakes are uncovered only later, due to which it cannot be corrected.
- The differences between the major branches are significant. As for crop production and horticulture, the territorial demand, the dependence on weather conditions, and the periodical campaign-terms are determining. In the case of animal breeding repeated, daily routine is dominant, so in this field there are no Sundays or holidays.

Production factors

The agricultural production is going among the above mentioned conditions. To illustrate this here are some interesting data given by Pepó (2004) based on Landonin's article (1999) about the role of cultivation (or production) factors in wheat cultivation. (Table 1.)

Table 1. The role of the cultivation factors in the wheat cultivation

Extensive ¹ technology	Cultivation factor	Intensive ² technology
20 %	Year	15 %
40 %	Soil	10 %
5 %	Type	20 %
20 %	Cultivation	10 %
10 %	Fertilization	30 %
5 %	Plant protection	15 %
100 %	Total	100 %

Source: Pepó, 2004

(1: Farming of large areas, usually with low production for each unit of land farmed, usually without using chemicals. (Source: Longman Business English Dictionary) 2: An agricultural production system characterized by a low fallow ratio and the high use of inputs such as capital, labour, or heavy use of pesticides and chemical fertilizers relative to land area. (Source: BBC School fact sheet on intensive farming))

According to data in Table 1. it is conspicuous that on the lower level of technological development (typically in case of extensive technologies) the total ratio of soil, type and cultivation is 65% while in case of intensive technologies (where the technological development is of a higher level) this ratio is much lower, totally it is 40%.

It is conspicuous that the importance („role”) of soil is 30% less in intensive case while the effect of type is 15% bigger than in case of extensive technologies.

In respect of the soil-plant relation the role of fertilization could also be important since in case of intensive technologies this factors weights the most, 30%. Knowing this, there is a risk that the use of chemicals in chemical fertilizers can grow to unlimited volumes. 'Fortunately' the economical considerations (above all the price of chemical fertilizers) hold rational farmers down. However there are some reasonable options that could reduce the use chemicals considering complexity.

Györfy's remonstrance regarding this topic still seems to be actual. According to him in order to reduce the use of chemicals, the opportunities given by the force crop should be taken into consideration. Beside this, the areas of force crop should be ecologically optimized, plants collecting nitrogen should be grown in a bigger proportion and the use of the biomass should be more rational in order to improve the fertility of soil. (Györfy, 1991.)

Pepó (2004) announced some data regarding the factors effecting the quality of wheat. According to him to reach the wished quality the weight of type should be 27% while that of soil should be 10%. (For completeness here are all the data: agronomy 41% direct factors – fertilization, plant protection 25%, indirect factors: force crop, seeding, harvest 16%. Ecological factors: 32% - weather: 22%, soil and other factors: 10%, type: 27%. Total 100%)

Since the agricultural characteristics cannot be separated from space and time, the list mentioned above can be expanded with several other aspects in the case of a specific enterprise. Therefore, during planning concrete development projects we need to take into consideration the things listed above space- and time-specifically.

3. Some elements of the agricultural production innovation

In the previous decades the Hungarian agriculture has proved several times that it is a favourable area for the innovation efforts.

We can say that innovation made the Hungarian agriculture known and recognized internationally. Between 1960 and 1980 the Hungarian agriculture significantly differed from the industrial sectors with its own values and system approach. This paradigm brought a dynamic development among countries within the same political systems.

Unfortunately the initial excellent results of the agricultural paradigm striving for priority were accompanied by the deteriorating economical conditions and expenditures exceeding the local optimum, then the Hungarian economy got into crisis blocking the development of the agriculture. However this does not decrease the value of the Hungarian agricultural innovation – leastwise in the mentioned period.

By the end of the 1980's the Hungarian agriculture's inability to develop was culminated by the problems in connection with the system change. These problems affected the system of innovation and its operation.

The cooperation between the parties interested in innovation is not that strong. The previous mechanisms are no longer, the new ones are not yet functioning. It is disconcerting that the imaginary actors of the agricultural innovation are busy with themselves and their money worries for a long time, and therefore has no energy to coordinate with the innovation partners.

It is sad that most of the times the inclination for coordination is missing as well. In my opinion this is a huge problem because the previously successful period of the Hungarian agriculture was due to the activities of the R+D sector as well as the work of the distributors and processing organizations.

I prepared and use a general model of agricultural innovation (Figure 1.). This model clearly demonstrates related and dependent works to be done. It shows that the innovation part-works can be systematized into two integrating umbrellas. These are marketing and knowledge. Marketing is important as the success of innovation is decided in the market. The whole innovation process should be guided by the endeavour for market success. Knowledge alloys earlier experience and recent information in the entire process.

The functional model is a proper instrument for:

- The review of the systematisation of the processes of agricultural innovation
- The introduction of the relation between the part processes
- The analysis of the status of the agricultural innovation
- Defining what to do in the area of development

We can say that the Hungarian agriculture was successful till the innovators could do their activities in a harmonized way as represented by the model. The situation has changed significantly by now. In theory the old practice would be successful, but the

SME's do not have the necessary conditions to be able to follow the model. The other problem is that the conditions of a harmonized cooperation between the actors has changed.

The agricultural innovation, the agricultural research and the technical development should be set on new basis in order to improve the competency of the agriculture. It has to be decided which sector should enjoy priority in respect of the sector's competency. We are no longer able to develop every area since our current financial possibilities do not cover it.

4. Some elements of the complex technical development

The main source of the agricultural production development is the technological development. This system of activity is the aggregation of continuous, complex and consistent activities, that have an impact on the elements of the agricultural production (soil, labour and capital goods) causing quantity and quality changes. By this, the production reaches a higher level and in favourable cases it becomes more efficient. The technological development has a number of economical functions besides the modernization of production.

In order to help to understand the definition we have created the 'matrix model' of the agricultural technical development. The model in the matrix expresses the relationship between the basic elements of the agricultural production and the effective factors of technical development. (Figure 2.)

Based on the model an organization can specify its technical development tasks at a point where a given row meets a given column. The matrix model cannot be considered statically, it is easy to adjust it to the given external and internal circumstances and to the changes of these circumstances in two dimensions (time and space).

In connection with the agricultural technical development it is obvious that during the production development the ecological conditions (opportunities and givens) cannot be ignored. On one hand these can be the conditions of production development on the other hand these can restrict it as well. The agricultural technical development has to ensure that it makes the best of the ecological opportunities and that it avoids the disadvantageous effects. This question is complicated by the fact that part of the ecological factors (above all the climatic circumstances) can hardly or not at all be influenced by humans. That is why it is important to focus on those factors that can be positively influenced by human intervention.

From this list we can highlight the soil which we consider the essential element of production. It is known that Hungary's land features and the shape of their surfaces are different in respect of the agricultural production and its automatisisation. The physical-chemical composition of land, its structure and the way it can be cultivated can differ in landscapes plants regardless of administrative, plant or natural borders. The same differences can arise in respect of the surface of the land. If we consider these as objective givens we can see that the effective factors of the technological development are partially applicable considering the ecological givens and opportunities. Based on our experience the features of land and its surface influence the applicable output of machines, the speed, the width of the work area etc. We can also see that the composition of soil has an effect on how the machine should be used and how safe the machine is, how long it can be used and the deterioration period.

In connection with the effective factors of technological development it is necessary to analyze the role and importance of complexity. Some practical examples prove that if the harmonization of development factors fails the expected advantages and ambitions cannot be realized. During the technical development, the effective factors need to be harmonized

otherwise as a result of the 'minimum law' the final result of development will be limited by a factor from the lowest level. One of the most important task of the technological development embedded in the innovation process is to provide an integration function between the factors mentioned above. Within the frameworks of this we have to ensure that the effective factors are optimised and that there is harmony between the development factors in time and space.

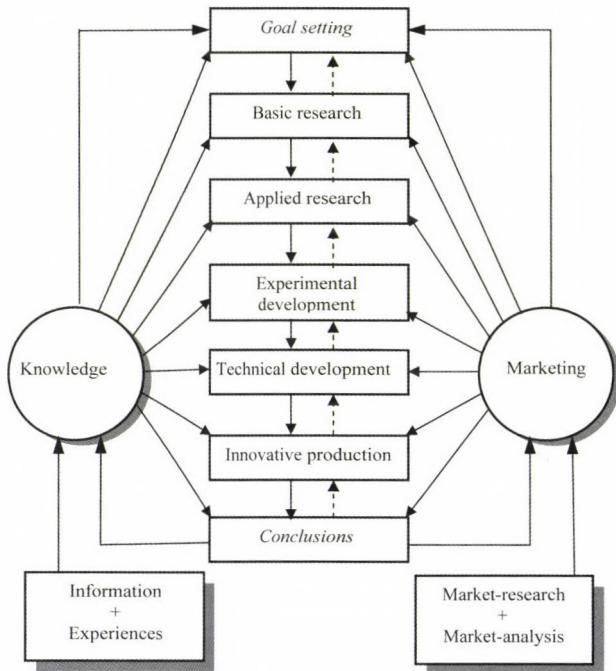


Figure 1. A general model of agricultural innovation (Source: Husti, 2005)

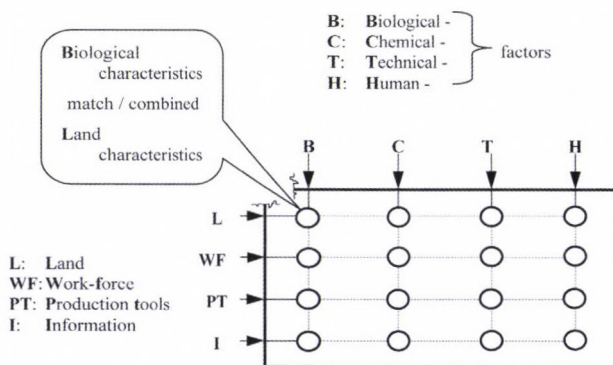


Figure 2. The simplified „combination-matrix-model” of the agricultural technical development (Source: Husti, 2005)

The model about the substance of technical development (Figure 3.) shows that technical development serving agricultural production has got a particular bridging role between the production and the previous innovation phases by integrating several factors at the same time. It is important that the marked biological, chemical, human and ecological factors should be in harmony, because otherwise the balance breaks effective factor being in relative minimum as per the minimum-law.

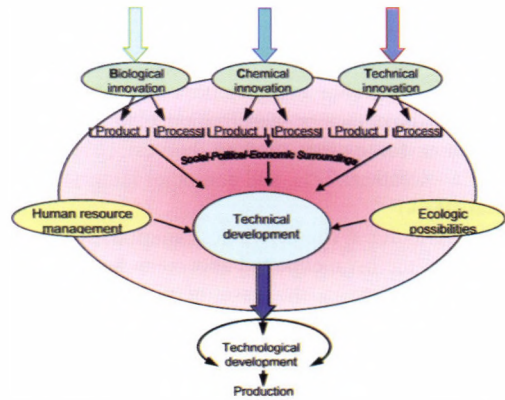


Figure 3. The substance of the agricultural technical development (Source: Husti, 2005)

Conclusion

The engine of development is innovation even in the field of agriculture. If we want the innovation to be successful, we have to avoid forcing the industrial analogies in the agricultural relations. Namely there are a number of agricultural characteristics that need to be considered when dealing with an innovation related project. Out of these particularities, this paper analyzes the natural conditions, some elements of agricultural cultivation, the process model of agro-innovation and the main components of technical development as part of the agricultural innovation.

We can say that in case the above listed aspects get sufficient attention in relation to agricultural innovation, the probability for success will grow, that is to say that agro-innovation processes promote the renewal of agriculture's partial areas, products and technologies.

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