

## FACTORS DETERMINING ORGANIC FARMING ADOPTION: INTERNATIONAL RESEARCH RESULTS AND LESSONS LEARNED FOR INDONESIA

### *Faktor-Faktor yang Menentukan Adopsi Pertanian Organik: Hasil-Hasil Penelitian Internasional dan Pembelajaran untuk Indonesia*

Ashari<sup>1</sup>, Sharifuddin<sup>2</sup>, Mohamed ZA<sup>2</sup>

<sup>1</sup>Indonesian Center for Agricultural Socioeconomic and Policy Studies  
Jalan Tentara Pelajar No 3B, Cimanggu Bogor

<sup>2</sup>Department of Agribusiness and Bio-Resource Economics,  
Universiti Putra Malaysia, Serdang Selangor 43400

\*Korespondensi penulis: E-mail: ashari\_sp@yahoo.com

Naskah diterima: 6 Februari 2017

Direvisi: 2 Maret 2017

Disetujui terbit: 10 Mei 2017

#### ABSTRAK

Indonesia memiliki potensi besar untuk mengembangkan pertanian organik karena tersedia lahan dan teknologi pendukungnya. Permintaan produk organik juga diperkirakan meningkat pada masa mendatang seiring dengan meningkatnya kesadaran masyarakat tentang pangan yang aman dan sehat. Hal ini menyiratkan bahwa pertanian organik memiliki prospek bagus sebagai bisnis berbasis pertanian. Namun, nampaknya respon petani untuk mengadopsi teknologi pertanian organik sangat lambat yang ditunjukkan oleh rendahnya tingkat adopsi. Sebetulnya banyak negara yang memiliki pengalaman dalam adopsi pertanian organik seperti dikemukakan sejumlah literatur. Tujuan makalah ini adalah untuk mengetahui faktor penentu adopsi pertanian organik berdasarkan pengalaman penelitian di manca negara dan menarik pelajaran untuk meningkatkan tingkat adopsi di Indonesia. Sumber literatur adalah hasil hasil penelitian terkait dengan adopsi pertanian organik baik di negara maju maupun berkembang. Hasil tinjauan menunjukkan bahwa faktor penentu adopsi pertanian organik terdiri dari berbagai aspek, yaitu (1) tersedianya informasi dan pengetahuan, (2) motif ekonomi dan keuangan, (3) keterampilan teknis dan manajemen, (4) pertimbangan sosial, (5) kepedulian lingkungan, (6) lingkungan kelembagaan, dan (7) latar belakang sosial ekonomi dan demografi petani. Dengan demikian, untuk mendorong adopsi pertanian organik sejumlah aspek tersebut harus dipertimbangkan dalam perumusan kebijakan dan program. Peran pemerintah sangat penting terutama untuk meyakinkan petani tentang manfaat pertanian organik, penyediaan informasi, maupun bantuan teknis bagi petani.

**Kata kunci:** *pertanian organik, adopsi, kebijakan pertanian, Indonesia*

#### ABSTRACT

Indonesia is potential to develop organic farming as it has suitable land and supporting technology. Demand for organic product is supposed to increase in the future due to people's awareness about safety and healthy food. It implies that organic farming has a good prospect to develop as agriculture-base business. However, it seems that farmers' response to adopt organic farming technology is very low indicated by low rate of adoption. Actually, many countries have experiences in term of organic farming. This paper aims to assess determinant factors of organic farming adoption based on international research experiences and to withdraw lessons learned to raise adoption rate in Indonesia. The results showed that the determinant factors of organic farming adoption consisted of various aspects, i.e. (1) information and knowledge availability, (2) economic and financial motives, (3) technical and management skills, (4) social consideration, (5) environmental concern, (6) institutional environment, and (7) farmers' socio-economic and demographic background. Accordingly, those aspects should be taken into account in policy formulation to encourage organic farming adoption. Indeed, government's role is very crucial, mainly to convince farmers about organic farming benefit and to provide information as well as technical assistance.

**Keywords:** *organic farming, adoption, agricultural policy, Indonesia*

#### INTRODUCTION

It is not debatable that Green Revolution (GR) technology has played a significant role to increase rice production; and eventually GR helped Indonesia to achieve self-rice sufficiency

in 1984. The rice production and productivity had increased drastically from 3.7 million tons and 2.5 tons/ha (1968) to 8.2 million tons and 4.4 tons/ha (1984), respectively (Jahroh 2010). Even, the benefit of GR also has been experienced by all of the ASEAN countries (Terano et al. 2011).

Apart from its benefit, unfortunately the GR also generated some detrimental problems. This condition is emerged due to GR has massively relied on the application of high external inputs, i.e., the use of high yielding rice varieties and agrochemicals (Sukristiyonubowono et al. 2007). Several critics have been addressed that GR caused environmental degradation and exacerbated the income inequality, inequitable asset distribution, and worsened absolute poverty (IFPRI 2002; Pingali 2012).

Further, IFPRI (2002) outlined that the worst issue highlighted pertaining the impact of GR was environmental damage. The excessive use of chemo-synthetic inputs as main components in GR caused inefficiency, and also emerged a negative impact such as the presence of chemical residues on foods and destruction of land fertility or productivity due to long-term chemical fertilizers or pesticides applications. In addition, inappropriate use of fertilizers and pesticides has polluted water, poisoned agricultural workers, and killed beneficial insects and other wildlife.

In respect to farmers' behavior, the GR technology has shaped the farmer's habit in utilizing agricultural inputs. They tended to be highly dependent on agro-chemical industry, mainly in use of fertilizers and pesticides; even in some cases the use of input was excessive. Buresh et al. (2007) reported that the overuse of N and P fertilizers in paddy fields was very common in Indonesia. In addition, the intense utilization of insecticides has generated the negative externalities, mainly for the environment (Pretty and Hine 2005) and human healthiness (Kishi 2005).

Entering the early of 21st century, the issue of organic farming began popular in Indonesia. The "back to nature" lifestyle was emerged and people are more conscious about the negative impact of agro-chemical inputs (Jahroh 2010). Likewise, Shiotsu et al. (2015) revealed that organic farming has attracted attention due to the consumer's tendency to choose safety and healthy product. This phenomenon potentially stimulates the increase of organic product's demand and indicates the prospect of organic business is very promising in the future.

According to Ellis et al. (2006) amongst the food industries, organic product is one of the most quickly-growing and dynamic sectors in globe. FiBL and IFOAM (2015) reported that international transaction of food organic and drink attained 72 billion US \$ in 2013. Meanwhile, the income has risen approximately five-fold since 1999. Organic product trades have increased at

a beneficial rate over the last decade, and the growth is predicted will be stable in coming years.

Further, the organic farming also positioned as one of the methods to uphold agriculture-base business (FAO 1999). Thus, the benefit of organic farming is not merely related to economic facet, but also in line with the sustainable agricultural development. In addition, Wheeler (2008) claimed that organic farming was commercially feasible and also deemed as a breakthrough to address the problems materialized by conventional farming.

The severe impact of agro-chemical uses has been aware by Indonesian government. Therefore, the government tried to eliminate such negative effect by promoting the sustainable agricultural development through organic farming practice. In 2001, the Ministry of Agriculture has launched "Go Organic 2010" program to support the organic farming development. Budiarta (2004) revealed that the mission of program was to establish the eco-agribusiness, with objective to raise food security and social welfare. The "Go Organic" encompassed few actions, namely: (1) the development of organic farming technologies, (2) formation of farmer groups, and (3) marketing strategies of organic products. Meanwhile, the ambitious goal was to promote Indonesia as the foremost organic market players in the world and to improve the farmers' income (Hidayat and Lesmana 2011).

In fact, the "Go Organic 2010" has not succeeded yet to raise farmers' engagement in organic farming practice. As an example, in case of organic rice, Indonesian Organic Alliance (2013) reported that the extent of certified organic paddy in 2013 was 1,537.16 ha (monoculture), 81.81 ha (rice and secondary crops) and 5.93 ha (processing of rice/flour). Meanwhile, the DG of Processing and Marketing of Agricultural Products, Ministry of Agriculture/MoA (2014) reported the area of certified organic rice was only 1,542.38 ha. The data demonstrate the extent of organic rice farming is tremendously low as compared to total of rice area in Indonesia amounted to 13.4 million ha. It also implies the rate of organic farming adoption very slowly among farmers.

The low rate of organic farming adoption, most probably due to the existence of this farming system is relatively new (or called as innovation). Although some practices of organic farming might be regarded as not a new practice; however, according to Padel (2001) it was still considered as an innovation due to representing a complex system change for conventional producers. For some countries especially in the Europe and

America the organic farming practice/industries have been developed in the last decades. Wahana Bumi Hijau (2011) mentioned in those countries organic farming placed as the fastest growing sector and the sales growth was 20-30% per annum.

To encourage the organic farming adoption rate in Indonesia, it requires to acquiring the knowledge and experience from other countries. There are many studies/literatures focusing on understanding the factors that motivate farmers to adopt organic farming in various countries. Therefore, the purpose of current study is to review the literatures as to the determinant factors of organic farming adoption. Then, it will come up the lessons learned as a discourse to trigger adoption rate in Indonesia. The method used by reviewing a number of research results both in developed and developing countries. Prior to elaborate the experience of multinational countries; firstly, it is important to have an understanding on the concept of adoption and organic farming to gain a deep insight as to this issue.

## THE CONCEPT OF ADOPTION AND ORGANIC FARMING

There are various factors that contribute to the growth of agricultural sector; one of the most significant roles is technology. Sunding and Ziberman (2002) noted that the change of technology was a primary element which fashioned agricultural sector in last 100 years. Due to the importance of technology, the adoption of new agricultural technologies (mainly in developing countries) has attracted the scholars to ascertain this phenomenon. They consider that agriculture sector still occupy a notable position in those countries. Similarly, Doss (2006) revealed that one of significant ways to raise agricultural productivity was through the introduction of improved agricultural technology. Hence, this paper will outline briefly the concept of adoption and organic farming as well.

### The Concept of Adoption

The studies related to adoption of innovation have been undertaken more than four decades. One of the most prominent adoption models is what Rogers' proposal in his remarkable book called as "Diffusion of Innovation". This adoption model has been widely utilized as basic concept to arrange a framework in various disciplines such as economics science, communications, public health, history, politic, technology, and

education (Dolley 1999). Certainly, in term of agricultural technology adoption Rogers' model was also vastly employed by numerous studies.

Rogers (2003) recommends distinct definition of technology and innovation phrase, although such phrase occasionally might be interchangeable. Technology is defined as "a design for instrumental action that reduces the uncertainty in the cause effect relationship involved in achieving a desired outcome". Meanwhile, the innovation is "an idea, practice, or project that is perceived as new by an individual or other unit of adoption". Thus, as long as the idea is regarded as a new by people, it is an innovation. Referring to such definition; therefore, the term of innovation encompasses a broader area than technology. The notion of innovation underscores the creation process (both new development and modification), while technology is more related to the function.

Meanwhile, Sunding and Zilberman (2000) defined innovation as "a new method, customs, or devices use to perform new task". Innovation plays a crucial role because it constitutes the basic elements of technological and institutional change. The innovation could be categorized into mechanical, chemical, biological, agronomic, biotechnological, and informational. Another criterion is distinguished between process and product innovations. Further, innovations also can be differentiated by their impacts on economic agents and markets. Based on this type, the innovation has functions to increase the yield, reduce cost, upgrade the quality, minimize the risk, raise the environmental protection, and enhance shelf-life.

Related to the technology, it consist of two parts i.e., hardware and software. The former means "the tool that embodies the technology in the form of a material or physical object", while the latter related to "the information base for the tool" (Rogers 2003). As software, the technology usually has a low level of observability. Consequently, it tends to be slow rate in adoption. Meanwhile, Feder *et al* (1985) mentioned that the hardware consist of indivisible technologies (i.e., machinery and other tools), and also divisible technologies (e.g., high-yielding seeds and fertilizers). The software part arises as the information package such as communication approaches and marketing strategies.

Once the technology is developed, then it entails to be delivered to the user. This process can be stated as the technology diffusion or adoption process. According to Rogers (2003), adoption process is "a mental process through

which an individual passes from hearing about an innovation to final adoption". The adoption process in practice does not occur instantaneously. It means that farmer's decision to accept or reject a new technology will consider several phases and involves sequence of thoughts and decisions. Feder et al. (1985) proposed that to obtain an accurate analysis of adoption, it requires an appropriate quantitative definition. Hence, the definition should be distinguished between individual or farm level adoption and aggregate adoption.

Indeed, Rogers (2003) has differentiated the term of adoption and diffusion. He stipulated the diffusion as "*the process in which innovation is communicated through certain channels overtime among the members of a social system*". It is obviously stated that diffusion is a social process while adoption is individual manner. However, the diffusion and adoption are closely interrelated concepts and processes. In addition, Stoneman (2002) provided another definition of diffusion that is "*the process by which new technologies spread across their potential markets over time.*" There is similarity of both authors to include "the process" and "the overtime" as keywords in diffusion term to articulate the importance of two aspects.

Feder and Umali (1993) claimed that the diffusion process is an accumulative product of individuals' decision making in adoption of an innovation. Further, they remark that the adoption is the acceptance or use of an innovation by an individual (or firm). Meanwhile, the diffusion is the wide spread adoption of the innovation by many individuals (or firms). Sunding and Zilberman (2000) also proposed an identical definition, since they used the term "adoption" in depicting individual behavior towards a new innovation and "diffusion" in describing the aggregate behavior or aggregate adoption.

In association with technology diffusion, Rogers (2003) defines it as "*a communication process that mainly involves information exchanges, new ideas, observations and objects, which then result in some effect in the society*". Therefore, technology diffusion enacts a critical role to make a technology widely known and utilized by people.

Further, the process of diffusion mainly relies on how the adopters perceive towards the technology attribute. The perception results from the adopters' evaluation of the following criteria: (1) relative advantage, (2) compatibility, (3) complexity, (4) trialability, and (5) observability. Consequently, the technology diffusion process ought to consider these criteria in order to ensure

adopters have a positive perception toward technology. A better perception against certain technology characteristic will lead potential to adopt such technology more quickly and vice versa. Based on Roger's technology diffusion/adoption paradigm, it is obviously that the structure of decision making of adopters is influenced by adopters' perception on the technology characteristics as well as their own characteristics.

### **The Concept Sustainable Agriculture and Organic Farming**

The agriculture ability to constantly provide food and other resource to a growing world population is crucial for human existence and activities. However, there are a great number of problems (for instance: land degradation, pollution) have threatened the capability of agriculture to fulfill human being need now and in the future (Velten et al. 2015). Hence, the sustainable agriculture development is very relevant to deal with this issue.

According to Bello (2008), the sustainable agricultural system has a broad aspect; it covers the issues of environmental, economic and social sustainability in its approach. Earlier, Ikerd (1993) has defined sustainable agriculture more comprehensively as "*capable of maintaining its productivity and usefulness to society over the long run....it must be environmentally-sound, resource-conserving, economically viable and socially supportive, and commercially competitive*".

In term of to sustainable agriculture development, the existence of organic farming is fundamental. Some argue that organic farming and sustainable agriculture are synonymous, due to the main purpose of organic farming is to create a sustainable agricultural production system (Padel 2001). But, others consider them as separate concepts that should not be equaled (Rigby and Caceres 2001). Lampkin (1994) stated that "*sustainability lies at the heart of organic farming and is one of the major factors determining the acceptability or otherwise of specific production practice*". Similarly, Henning et al. (1991) ever claimed that "*organic farming could serve equally well as a definition of sustainable agriculture*".

According to Narayanan (2005), organic farming is one of several approaches to meet the objectives of sustainable agriculture. Likewise, FAO (1999) mentioned that organic farming is one several approaches to sustainable agricultures. Meanwhile, Rigby and Caceres

(2001) have recapitulated a number of “alternative” approaches in association with practice of sustainability. These are included the integrated pest management (IPM), integrated crop management, low input agriculture, low input sustainable agriculture, low external input sustainable agriculture, agro-ecology, perm culture, biodynamic farming and organic farming.

Especially for organic farming, there are various definitions provided in the literatures. According to Bello (2008) whatever the definition of organic farming, the basic concept of organic farming is referred to a holistic view point. For instance, Mannion (1995) defined organic farming as “*a holistic view of agriculture that aims at reflecting the profound interrelation between farm biota, agricultural production and the overall environment*”. Meanwhile, Lampkin and Padel (1994) described organic agriculture as “*an approach to agriculture that aim at creating integrated, humane, environmentally, and economically sustainable agricultural production systems, by maximizing reliance on farm-derive renewable resources and the management of ecological and biological processes and interactions*”.

Similarly, IFOAM (2014) defined organic agriculture as “*a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effect*”. Thus, the organic agriculture incorporates tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved.

Meanwhile, Wallace (2001) defined briefly organic farming as “*an integrated system of farming based on ecological principles*”. Consequently, in organic farming systems should avoid applications of chemical fertilizers and pesticides; instead of relying on organic inputs and recycling for nutrient supply and emphasize cropping system design and biological processes for pest management (Rigby and Cáceres, 2001).

Particularly in Indonesia, the concept and application of modern organic agriculture is relatively new and sometimes there are many misconceptions about this term (Las et al. 2006). Therefore, they proposed a simple definition of organic agriculture as “*a way or system for plant cultivation using organic or natural inputs*”. In such system, agro-chemical inputs and chemical pesticides are not allowed to apply or at least their uses should be reduced.

## DETERMINANT FACTORS OF ORGANIC FARMING ADOPTION: INTERNATIONAL EXPERIENCE STUDIES

The adoption of organic farming necessitates a favorable condition to magnify the likelihood of conversion process. On the other hand, the adoption process also encounters some barriers that reduce the possibility of adoption. Multi-factors can facilitate and inhibit the success of adoption. The drivers and barriers of adoption to engage in organic farming practice may vary over countries. The following sections delineate the determinant factors of organic adoption both in developed and developing countries.

### Developed Countries Cases

In the developed countries (i.e., Europe, USA,) organic agriculture has been developed more than 4 decades. Many studies have been done to uncover the factors affecting organic farming adoption. It appears that the economic and financial reason is the most important factors that motivate farmer to be organic producer. A rational farmer usually considers the profit and income as the incentive to carry out conversion to organic farming. Study of Padel (2001) demonstrated the benefit gained from higher prices and cost reduction in U.K. dairy organic farming can offset the output decreased in the long period.

Several researches also have attested economic reason as a key factor to undertake convention. For example, Entz et al. (1998) stated that wheat and alfalfa hay organic farm in Canada were more lucrative although no price premium imposed. Similarly, Sholubi et al. (1997) uncovered that organic dairy farms also more profitable than conventional one. Pietola and Lansink (2001) revealed that low of output prices and the escalation of direct subsidies by government have driven to be organic farmer in Finland.

Lohr and Salomonson (2000) elaborated the role of subsidy requirement as determination factors to encourage Swedish farmers for organic conversion. Their study exhibited that presence of services was more powerful than subsidies to promote organic practice’s engagement among farmers. Acs (2006) examined the conversion process to be organic arable farming systems in Holland. The results showed that although in conversion stage underwent a difficulty in economical term, but organic farming was still more attractive in term of economical aspect.

Meanwhile, Sterrett et al. (2005) anatomized the organic conversion's process in Virginia and concluded that the main barriers were the high cost and uncertainty process of certification. The other hindrances were the shortage of marketing and cost of information and labor. In addition, Läßle and Kelley (2010) found that the decisions of abandonment were particularly caused by structural and economic element. Farmers who belong to non-farm job were more possibly to abandon; whereas a more 'intensive' farm system had tendency to maintain the organic practice.

The technical aspect also recognized as deterrents of farmers' interest to undertake organic conversion, besides the greater labor needs (Fairweather, 1999; Schneeberger et al., 2002). The technical problems usually related to fertility of soil, variability of yield and also weed problems. In addition, it should not be overlooked the management skills requirement as determinant of adoption. The organic agriculture entails more specific management skill than other farming practice. It involves a sophisticated ecological relationship, farming expertise and also experience.

Schneeberger et al. (2002) examined the impediments for the organic agriculture adoption in cash-crop farmers Austria and found that technical defiance in cropping and extra labor needs were deemed the most significant barrier. In addition, study of Darnhofer et al. (2005) also revealed that farming method choice was influenced by technical aspect of agriculture production and farm structure.

Further, the availability of information is extremely critical in adoption process. Frequently, lack of information becomes a constraint to organic farming's conversion. According to Padel (2001) the organic farming was not purely of technical innovations. Rather, it was information-based innovation. Consequently, the farmers those engage in organic farming have to seek information more actively from outside and other farmers. Midmore et al. (2001) revealed the shortage of information as one of the primary barriers for conventional farmer to convert to be organic producers.

Wynen (2004) revealed that in term of decisions to be organic farmer, the role of information acquisition was very significant. Meanwhile, Midmore et al. (2001) spotlighted that the activeness of farmers to seek information would lead them more likely to be organic farming adopters. The other studies conducted by Fairweather (1999) in New Zealand highlighted that the activeness of farmers to seek information

of organic would lead them more likely to be adopters.

The next aspect that potentially influences the adoption is social considerations. According to Michelsen et al. (2001), the organic practice could be viewed as a social movement which reflecting an alternative to conventional agriculture. Several studies showed that sociological aspects such as adoption behavior, farm or farmer personal characteristics, and farmers' motivation were notable to engender the conversion process (De Buck et al. 2001; Midmore et al. 2001). The differences of attitude between organic and conventional farmers have been discovered in these studies.

Lobley et al. (2005) claimed that the social relationship of the farmer was essential in decision-making to be organic farmer in England, especially to acquire suggestion or searching of organic farming information. Study of Läßle and Kelly (2010) addressed farmer's intention to alter the conventional farming to organic using the social-psychology. They found that conversion was certainly influenced by the farmers' attitude, social pressure and the perception toward farmer's capability to carry out the conversion process.

Further, the issue of environmental and health problem emerged by conventional practice has significantly contributed in forming the sustainable agriculture movement (Anderson, 1995). Organic farming is deemed has close related to environmental-friendly lifestyle that concern to cope with environmental and health problem. Duram (2000) revealed that the farmers with greater environmental interest and better attitude against challenge were more possibly to settle organic farming as a potential choice.

Meanwhile, Marshall (1999) found the respondents in France considered the values offered by organic farming as main motive to be organic producer. Further, Burton et al. (2002) proposed a model to examine the adoption of organic horticultural technology in UK. The result of study demonstrated that environmental attitudes, gender and information system were significant drivers on adoption decision. Similarly, Peterson et al. (2012) mentioned. The younger farmers were more likely motivated by environmental and lifestyle goal than older. It asserts that environmental judgments as the primary reason to transform from conventional to organic farming.

The other aspect cannot be neglected in term of adoption process is the role of institutional support, mainly from the government. Based on six European countries experiences during 1985-

1997, Michelsen et al. (2001) summarized that political agency had significant relationship with organic farming practice. The institution surrounding of the agricultural field such as government policy, social circumstance, markets structure, and organizations have played a key determinants in conversion.

Lynggaard (2001) revealed that the institutional performance's gap between the Danish and Belgian eventually influenced the organic farming sector's development in both countries. Meanwhile, Howlett (2002) claimed that the farmer's judgment to convert their farm to organic practice greatly depended on government and EU assistance. It covers the promotion of organic product that required to be supported by a favorable policy. Further, the issue still encountered by farmers included the financial concern, marketing, environmental consideration, disease control, and insufficiency of market outlet.

Läpple and Kelly (2010) examined the behavioral decision making whether to adopt or abandon organic farming in Ireland. They discovered that government payment was the significant factor for organic farming adoption. This study also underlined the importance of attitude toward environment and risk, experience and influence of other organic farmers. Acs et al. (2005) also supported the importance of incentive and agricultural policy to engender the organic farming adoption process in Holland case.

### **Developing Countries cases**

Basically, the topic studies of organic farming adoption in developing countries are almost similar with developed countries. However, in developing countries the subject of research also paid attention quite intensively on socio economic and demographic aspect. For instance, the study of Niemeyer and Lombard (2003) about organic producers in South Africa had objective to examine the socio-economic aspects such as operational farm, reasons, and problem of conversion process. Their study proposed a recommendation that the direct financial support is not crucial, instead providing infrastructure to strengthen networking, marketing aspect and share of information are more important.

Herath and Wijekoon (2013) conducted research in Sri Lanka and found that non-organic had no strong motivation to practice organic farming as the yield would decrease, even though organic coconuts have a slightly higher price. Conventional farmers were also reluctant to shift from chemical fertilizers and pesticides because they have been using them for a long time.

Conversely, organic growers performed the organic farming mainly due to the marketing assistance and inputs. Organic grower also has favorable attitudes towards the environment. Knowledge about organic farming and extension worker contacts greatly influence motivation towards adopting organic farming.

Pornpratansonbat et al. (2011) reported that the early adopter of organic farming in Thailand closely related to water accessibility, ability to seek higher farm-gate price and attitude. Meanwhile, Pattanapant and Shivakoti (2009) highlighted the constraints inherent to organic farming practices. Several impediments, including off-farm works and perceptions of organic agriculture, also the complication related to organic certification and standards process. These factors in some extent could weaken extension efforts in promoting organic agriculture. In order to improve organic farming, they suggested the collaboration among all stakeholder, i.e., government agencies, NGO, consumers and farmer organizations.

Yamota and Tan-Cruz (2007) studied in Philippines and found that the attributes such as age, years in formal schooling, number of seminars attended, number of household members involved in farming, and tenure exhibited positive relationship towards the rate of organic adoption. Meanwhile, study of Oyesola and Obabire (2011) in Nigeria discovered the significant relationships between sources of information and farmers' perception toward organic farming. Farmers who have more access to information and better knowledge tend to have a favorable perception towards organic farming.

Karki et al. (2011) conducted study in Nepal and claimed the farmers located in a distance from regional markets, older in age, better trained, affiliated with institutions and larger farms are more likely to adopt organic farming. In addition, the environmental awareness, good market prospects, observable economic benefit and health consciousness are the major factors influencing farmers' decisions on the conversion to organic production.

The study of Sudheer (2013) in India, confirmed that organic farming is generally more profitable in terms of financial costs and returns than chemical farming. An analysis of the farmers' perception of organic farming reveals that electronic media (television) is the prime motivator for farmers to adopt organic practices. Farmers believed that organic farming improves soil fertility and their profits in the long run. Meanwhile, the research of Ullah et al. (2015) in Pakistan uncovered that age, education and land

tenure status positively affect farmers' assessment regarding adoption of organic farming. Other attributes such as land tenure status and irrigation availability also exhibits a positive impact.

Kennvidy (2008) reported that in Cambodia, the motivation of farmers to start joining the organic farming primarily to improve their incomes and reduce the cost of farming inputs. They have improved the income through the increased yields, premium pricing, and reduced expenditures on chemical fertilizers. Moreover, all farmers believed organic farming has enhanced their health condition and food quality, strengthened the family and community ties and secured their livelihoods.

Further, Soltani et al. (2014) revealed the socio economic aspect and demographic cannot be neglected for Iranian farmer in term of to adopt organic agriculture (OA) adoption. Experience is one factor that affect farmer to adopt OA. Gender is also a determinant factor of OA adoption and woman is a better adopter. The other variables, such as knowledge, income, land area and productivity have positive impact on farmers' adoption. The finding also showed that the adopters of OA are characterized by more positive attitude toward OA, have access to communication technologies, are members of cooperative, and are supported by the government.

### **INTERNATIONAL EXPERIENCE ON ADOPTION AND LESSONS LEARNED FOR INDONESIA**

According to Hidayat and Lesmana (2011), there are four important reasons why the organic farming is viable to promote in Indonesia. First, organic agriculture product has many benefits such as healthier, safer and more nutritious. Second, it has a potency to create employment due to require more labor. Third, organic farming is parallel with the effort to sustain environment quality; and the last, organic farming has higher factor productivity compared to conventional one.

In term of supply side, Mayrowani (2012) asserted Indonesia has a great potency as organic producer due to some comparative advantages, i.e. (1) the availability of land resources, (2) supporting technologies are available e.g.: composting, planting no-tillage, biological pesticides and others, and (3) the price of agro-chemical tends to increase steadily; thus, farmers have alternative to utilize the cheaper, abundant and accessible input in rural areas (viz.

organic materials). In demand aspect, Sukristiyonubuwono et al. (2011) revealed that emergence of customer's concern to quality and food safety has increased the organic products needs.

However, the potency as producer and positive trend of demand has not influenced yet the farmers to perform organic farming. As aforementioned, the adoption rate of organic farming is relative slow. Farnia (2008) reported although the productivity of organic rice increased steadily, but the cultivation area of organic rice farming remained low due to the problems originated from farmers, extension workers, market and local government.

However, probably the biggest issue in term of conversion process to organic farming in Indonesia is farmer' anxiety about the decreased of productivity. It also occurred in other developing country as reported by Herath and Wijekoon (2013) that mentioned non-organic farmers did not motivate to practice organic farming due to its productivity was low. Sukristiyonubowono et al. (2011) described in the early stage conversion, the harvest would drop and yielded merely 1 to 2 tons/ha (1st season), 1.5 to 2.0 tons/ha (2nd season) and 2.5 ton/ha (3rd season). De Ponti et al. (2012) have compiled and analyzed a meta-dataset of 362 published organic-conventional comparative crop yields across countries. The result showed that organic crop yields are on average 80% of conventional with standard deviation 21%.

Obviously, there are many challenges faced by Indonesia to increase adoption rate and promote organic farming. As a new actor in organic producer, Indonesia necessitates to learn from the international studies. Certainly, not all of the determinant factors in other countries are appropriate since there is difference condition in each country. However, the result of studies could be as "lessons learned" or complement idea to develop organic farming in Indonesia.

Based on international studies mentioned before, the various aspects should be considered to promote organic farming adoption. Such aspects can be outlined in this subsection as follows:

#### **Economic and Financial Aspects**

Economic and financial reasons are probably as the main motive for farmer to practice organic farming. Conversely, uncertainty as to economic or financial profit could be as major barrier to implementing organic farming practice. By



implementing organic farming, farmers expect their income improved. This issue should be paid attention to increase adoption rate. To obtain economic profit; therefore, the premium price and stability of price could be applied. The low cost of input also contributes toward financial benefit; hence the input subsidy is important. As an infant industry (farm), organic farming practice is deserved to obtain a privilege treatment in order to be existed. It is congruent with study of Serra et al. (2008) who attested that organic price premiums and subsidies are found to be powerful instruments to motivate the adoption of organic techniques.

Unfortunately, some factors affecting the economic benefit are out of farmer control. Hence, the government should help the farmers to ensure their farming will be sustained. For instance, the government can develop marketing strategies to guarantee organic farmers obtaining a viable price. Organic product could be promoted as premium goods which has a segmented or a niche market. The promotion of organic product in the local market is also an alternative. In earlier stage of organic farming development, the local government can assist to sell organic product for instance to government staffs as the buyers.

The other effort can be done by forming a partnership among marketing actor with government as facilitator. In addition, the high cost and sophisticated procedure for certification application could be paid attention. This issue is suspected as the essential barrier and discourages the farmer and to engage in organic farming practice.

### **Information and Knowledge of Organic Farming**

The results of studies disclose that for conventional farmers, the lack information is major hindrance to organic conversion. To cope with such problem, the government has to provide information comprehensively related to organic farming. The content of information should encompass broader aspects such as price prospects, providing advice on what to plant in new crop year, guidance on market prospects based on the quality and quantity that farmers have grown, and providing farmers with agronomic information. Farmer's association could be functioned as channel to disseminate the information. In this effort, the role of extension worker is extremely essential. Apart from the routine extension activities, the government also

should encourage the farmers to seek actively the information their selves.

Further, the lack of knowledge and skills to manage the organic farm is also the most important reasons for not employing organic farming. In fact, technical assistance is very crucial to upgrade farmer skill in term organic practice. Hence, farmer' field school (FFS) of organic farming and intensive guidance of extension worker are essential to be developed. FFS is strategic to deliver and share information and knowledge among farmers. This endeavor also supported by study of Herath and Wijekoon (2013) that suggested the better knowledge about organic farming and contact intensity with extension worker greatly influenced motivation toward adoption.

### **Technical and Managerial Issues**

As aforementioned, the organic farming is sophisticated system due to involving complex ecological relationship. It needs the extra knowledge of farmer in order to achieve best practice. Moreover, in organic farming the use of chemical materials (fertilizer, pesticide/herbicide) is prohibited; thus, most likely the problem such as weed problem, soil fertility or yield variability will emerge. To deal with this concern, the technical assistance is very crucial to be prioritized by government. The FFS of organic farmer is benefit to improve technical and managerial skill. In addition, the regular meeting (weekly/monthly) and "study visit" to successful organic farming practitioner are also recommended.

Further, cited from Farnia (2008) revealed that to increase the capacity (knowledge and skill) of organic farmer, several programs could be undertaken. She proposed three programs as follows: (1) farmer's involvement in FFS, (2) farmer's engagement in workshops, education and training to improve their entrepreneurial skill with regard to organic products, and (3) the guidance on farmer group dealing with administrative affair, finance management and technical activities in order to become more expert in management discipline.

### **Social Considerations**

Interestingly, the studies also revealed that not all farmers motivated to perform organic farming solely to obtain better income; instead, social factors such as peer pressure can affect farmers' decision. Khalidi et al. (2010) also mentioned there was the influence of friends and family during this phase of considering organic

farming as a future option for the farm. This phenomenon implies that to encourage farmer' engagement in organic practice, the role of people whom the farmers appreciate them is also important. Therefore, the involvement of public figure, both formal and informal is an accurate strategy.

It is common that among farmer societies, there are persons regarded as public figure or leader that has the strong influence on farmer decision making. The public figures/leaders should be involved; moreover, they could be appointed as a pioneer to execute the program for promoting the organic farming as innovation. In term of Rogers (2003), they considered as change of agent. However, it cannot overlook the role of other important variables, i.e., perceived attribute of innovation, type of innovation decisions, communication channel and nature of social system.

### **Environmental and Health Concerns**

The environmental concern is identified as the most important factor for organic farmers. This finding is also in accordance with study of Ashari et al. (2016) that revealed the environmental concern has positive impact toward farmer's attitude on organic farming. The better attitude; in turn, positively affect for farmer' intention to adopt organic farming. Other study showed that unlike conventional producers, the organic farmer believes that organic food has better taste, is healthier and better for the environment (Beharrell and Crockett, 1992).

The significance of environmental concern implies the role of perception and mindset toward environment and health are very crucial the adoption process. As implication, the government has to convince that farmers that organic farming provides benefit for them both environmental and health concern. Therefore, it requires the effort to raise the awareness of sustainable agricultural development and the healthy lifestyle among farmers and society. The activity such as "Go Green Campaign", may be useful to address this concern.

### **Institutional Environment**

Institutional environment encompass a broad parties, both formal (the market, laws and regulations) and informal (norms, traditions, beliefs and attitudes) institutions. According to Khalidi et al. (2010), the institutional environment is powerful in shaping farmer's choice. In agricultural sector, the institutional environment

including organic market, agricultural policy, self-organization and social context are all important factors (Michelsen et al. 2001).

However, the most important of institution in term of organic development is the government. Howlett (2002) claimed that the farmer's judgment to convert their farm to organic practice greatly depended on government assistance. It covers the promotion of organic product that required to be supported by favorable policies.

The other essential institution is the certification bodies that can improve organic farming by providing efficient and timely certification, providing objective certification, providing affordable certification, helping farmers and buyers get connected with each other, providing production/agronomic information, performing research in agronomy and marketing, distributing research knowledge to members, and participating in the creation of a mandatory national standard. Briefly, to accelerate the adoption rate organic farming all of institutional therefore should be involved since each of institution has unique role.

### **Socio-Economic and Demographic Aspects**

The studies in developing countries revealed that some variables of socio economic and demographic have a significant relationship against organic farming adoption. The variables such as gender dimension, education level, member of household, age, farm size, income, etc., give impact on adoption behavior among farmers. However, there are varieties in term of sign (+/-) and also the level of significance. As part of developing countries, the socio economic and demographic aspect probably still relevant and should be taken account in study/research to address determinant factor influencing organic farming adoption. Specifically, in term of program formulation for organic farming, the acquisition of socio economic and demographic aspects are more appropriate to apply in preliminary study stage. By understanding the characteristic of socio-economic and demographic, the opportunity of success will be more prospective.

### **CLOSING REMARK**

Organic farming has a very strategic role in the future as one of the approaches to support the sustainable agriculture. Apart from many definition of organic farming, the basic concept of such farming system is referred to a holistic

perspective. It creates the integration of humane, environmentally, and economically sustainable agricultural production systems.

The experiences in both developed and developing countries showed that the various aspects could facilitate and impede the success of organic farming adoption. The aspects cover the accessibility of information and knowledge, economic and financial motive, technical and management skills, social concerns, environmental awareness, institutional/policy supports, and farmers' socio economic and demographic conditions. Therefore, the efforts to promote organic farming could not neglect the existence of these issues.

Particularly in Indonesia, the development of organic farming is still very slowly indicated by the low rate of adoption. Some parties regard such condition is plausible due to organic farming is new (an innovation) and is also sophisticated farming system. Therefore, many constrains are emerged to practice the organic farming, especially in the early stage. However, it does not mean that the organic farming is not feasible to expand more massively. An appropriate strategy is able to cope with the barriers of organic farming adoption. The comprehensive approach by involving all of the stakeholders and considering the whole aspects will enlarge the opportunity of success for organic farming adoption. Certainly, the program to promote organic farming cannot execute instantly and should be undertaken gradually as the multiyear programs. In addition, monitoring and evaluation is obligatory to ensure the project run smoothly.

## ACKNOWLEDGEMENT

We gratefully acknowledge the full support of the Sustainable Management of Agricultural Research and Technology Dissemination (SMARTD) Project-IAARD. We also thank for the reviewers who provide insight for improving this paper.

## REFERENCES

- Anderson M. 1995. The life cycle of alternative agriculture research. *American J Alternative Agric.* 10(1):3-9.
- Acs S. 2006. Bio-economic modelling of conversion from conventional to organic farming [Dissertation]. [Wageningen (NL)]: Wageningen University.
- Ashari, Sharifuddin J, Mohammed ZA, Terano R. 2016. Rice farmers' perception and attitude toward organic farming adoption. *J Agro Ekon.* 34(1):35-46.
- Beharrell B, Crockett A. 1992. New age food! New age consumers. *British Food J.* 94(7):5-13.
- Buresh RJ, Witt C, Pasuquin JMC. 2007. Fertilizer best management practices in Southeast Asia. Paper. The International Fertilizer Industry Association (IFA) International Workshop on Fertilizer Best Management Practices, 7 – 9 March 2007. Brussels (BE): International Fertilizer Industry Association.
- Budianta E. 2004. Organik terpadu (integrated organic). *Trubus.* 413/XXXV, April 2004.
- Burton M, Rigby D, Young T. 2002. Modeling the adoption of organic horticultural technology in the UK using Duration Analysis. *The Australian J Agric Res Econ.* 47(1):29-54.
- Bello WB. 2008. Problem and prospect of organic farming in developing countries. *Ethiopian J Environ Stud Manag.* 1(1):36-43.
- Dooley KE. 1999. Towards a holistic model for the diffusion of educational technologies: an integrative review of educational innovation studies. *Edu Technol and Society.* 2(4):35-45.
- Duram LA. 2000. Agents' perceptions of structure: How Illinois organic farmers view political, economic, social, and ecological factors. *Agric and Human Values.* 17:35–48.
- De Cock L. 2005. Determinants of organic farming conversion. Paper presented at the XI International Congress of the European Association of Agricultural Economic. Copenhagen (DK): European Association of Agricultural Economic.
- Doss CR. 2006. Analyzing technology adoption using micro studies: limitations, challenge, and opportunities for improvement. *J Int Assoc Agric Econ.* 34(3):207-219.
- De Buck AJ, van Rijn I, Röling NG, Wossink GAA. 2001. Farmers' reasons for changing or not changing to more sustainable practices: an exploratory study of arable farmers in the Netherlands. *The J Agric Exten Edu.* 7(3):153-166.
- Darnhofer I, Schneeberger W, Freyer B. 2005. Converting or not converting to organic farming in Austria: farmer types and their rationale. *Agric and Human Values.* 22:39-52.
- De Ponti T, Rijk B, and van Ittersum MK. 2012. The crops yield gap between organic and conventional agriculture. *Agric System.* 108:1-9.
- DG of Processing and Marketing of Agricultural Product, MoA. 2014. Kebijakan pengembangan pertanian organik (The policy of organic agriculture development). Paper presented at National Seminar of Organic Agriculture, Bogor, 18 June. Bogor (ID): Ministry of Agriculture Republic of Indonesia

- Entz MH, Guilford R, Gulden R. 1998. Productivity of organic cropping in the Eastern Prairies: on-farm survey and database development. Winnipeg, Manitoba (CA): Department of Plant Science, University of Manitoba.
- Ellis W, Panyakul W, Vildoza D, Kasterine A. 2006. Strengthening the export capacity of Thailand's organic agriculture: final report. An EU-International Trade Centre Asia Trust Fund Technical Assistance Project.
- FAO. 1999. Organic farming: demand for organic products has created new export opportunities for the developing world. Magazine, Food and Agriculture Organization of United Nations. Rome (IT): Food and Agriculture Organization.
- Feder G, Just RE, Zilberman D. 1985. Adoption in agricultural innovation in developing countries: a survey. *Econ Dev Cultural Change*. 33(2):255-298.
- Feder G, Umali DL. 1993. The adoption of agricultural innovations: a review. *Technol Forecasting Soc Change*. 43:215-239.
- Fairweather J R. 1999. Understanding how farmers choose between organic and conventional production: results from New Zealand and policy implications. *Agric Hum Values*. 16:51-63.
- Farnia A. 2008. Development of organic rice farming in rural area, Bantul Regency, Yogyakarta Special Region Province, Indonesia. *J Dev Sustainable Agric*. 3:135-148.
- FiBL, IFOAM. 2015. The world of organic agriculture. Statistics and emerging trends 2015. In: Willer H, Lernoud J, editors. FiBL-IFOAM Report. Research Institute of Organic Agriculture (FiBL), Frick, and IFOAM-Organic International Bonn (GE): Research Institute of Organic Agriculture.
- Henning J, Baker L, Thomassin P. 1991. Economic issues on organic agriculture. *Canadian J Agric*. 39:877-889.
- Hidayat AS, Lesmana T. 2011. The development of organic rice farming in Indonesia. *Revi Indonesian Econ Business Stud*. 2(1):71-87.
- Herath CS, Wijekoon R. 2013. Study on attitudes and perceptions of organic and non-organic coconut growers towards organic coconut farming. *IDESIA*. 31(2): 5-14.
- Howlett B, Connolly L, Cowan C, Meehan H. 2002. Conversion to organic farming: case study report Ireland. Robert Nielsen, Working Paper DL 3.1, Prepared under the project "Conversion" QLK-2000-01112 of the European Commission's Fifth Framework Research Programme, The National Food Centre.
- Ikerd J. 1993. Two related but distinctly different concept: organic farming and sustainable agriculture. *Small Farm Today*. 10(1):30-31.
- [IFPRI] The International Food Policy Research Institute. 2002. Green Revolution: Blessing or Curse? International Food and Policy Research. 2033 K Street, NW, Washington, DC 20006-1002 USA Washington DC.
- [IFOAM] The International Federation of Organic Agriculture Movements. 2014. Definition of organic agriculture. [Internet]. [cited 2014 Feb 19]. Available from: <http://www.ifoam.org/en/organic-landmarks/definition-organic-agriculture>
- Jahroh, S. 2010. Organic farming development in Indonesia: lessons learned from organic farming in West Java and North Sumatra. Montpellier (FR): International Swaps and Derivatives Association (ISDA).
- Khaledi M, Gray R, Wessen S, Sawyer E. 2007. Assessing the barrier to organic farming: an institutional analysis. Final Report. Saskatchewan (CA): Department of Agricultural Economics, University of Saskatchewan.
- Kishi M. 2005. The health impacts of pesticides: what do we now know?" In: Pretty JN, editor. *The Pesticide Detox: Towards a More Sustainable Agriculture*. p. 23-40. London (UK): Earthscan.
- Kennvidy SA. 2008. Organic rice farming systems in Cambodia: potential and constraints of smallholder systems in Takeo Province. [Thesis]. [Berlin (DE)]: Humboldt University.
- Karki L, Schleenbecker R, Hamm U. 2011. Factors influencing a conversion to organic farming in Nepalese tea farms. *J Agric Rural Dev Tropics and Subtropics* 112 (2): 113–123
- Läpple D, Kelley H. 2010. Understanding farmers' uptake of organic farming: an application of the theory of planned behavior. Paper presented at The 84th Annual Conference of the Agricultural Economics Society. Edinburgh, 29th-31st March 2010. Edinburgh (UK): University of Edinburgh.
- Lohr L, Salomonson, L. 2000. Conversion subsidies for organic production: results from Sweden and lessons for the United States. *Agric Econ*. 22: 133-146.
- Lobley M, Reed M, Butler A. 2005. The impact of organic farming on the rural economy in England. Final Report to DEFRA. Research Report No. 11. Exeter (UK): Centre for Rural Research, University of Exeter.
- Lampkin, N.H. and S. Padel. 1994. Organic farming and agricultural policy in western Europe: An Overview. In: Lampkin NH, Padel S, editors. *The Economics of Organic Farming*, CAB International. Oxon (UK). p. 437-456.
- Las I, Subagyono K, Setiyanto AP. 2006. Isu dan pengelolaan lingkungan dalam evitalisasi pertanian (Issue and Environmental Management in Agriculture Revitalization). *J Litbang Pertan*. 25(3):106-114.
- Lynggaard KSC. 2001. The farmer within an institutional environment: comparing Danish and Belgian organic farming. *Sociologia Ruralis*. 41(1):85-111.

- Marshall A. 1999. Conversion to organic farming in Scotland and France. [Thesis], [Edinburgh(UK)]. Edinburgh (UK): University of Edinburgh.
- Midmore P, Padel S, McCalman H, Lampkin NH, Fowler S, Isherwood J. 2001. Attitude to organic production: a survey of producers. Final report to MAFF, Institute of Rural Studies. Aberystwyth (UK): University of Wales.
- Michelsen J, Lynggaard K, Padel S, Foster C. 2001. Organic farming development and agricultural institutions in Europe: a study of six countries. In: Dabbert S editor. Organic farming in Europe. Economics and Policy. Vol. 9. Stuttgart (DE): University of Hohenheim.
- Mannion AM. 1995. Agriculture and environmental change: temporal and spatial dimension. 1<sup>st</sup> ed. Wiley (UK): Chichester.
- Mayrowani H. 2012. Pengembangan pertanian organik di Indonesia (The development of organic agriculture in Indonesia). Forum Penel Agro Ekon. 30(2):91-108.
- Narayanan S. 2005. Organic farming in India: relevance, problem and constrain. Occasional Paper 8. Department of Economic Analysis and Research National Bank for Agriculture and Rural Development. Mumbai (IN): National Bank for Agriculture and Rural Development.
- Niemeyer K, Lombard J. 2003. Identifying problems and potential of the conversion to organic farming in South Africa. Paper presented at the 41st Annual Conference of the Agricultural Economic Association of South Africa (AEASA), October 2-3, 2003. Pretoria (ZA): Agricultural Economic Association of South Africa.
- Oyesola OB, Obabire IE. 2011. Farmers' perceptions of organic farming in selected local government areas of Ekiti State, Nigeria. J Organic Systems. 6(1):20-26.
- Pingali PL. 2012. Green revolution: impact, limit, and the path ahead. In: Clark WC, editor. Harvard University, Cambridge. Bill & Melinda Gates Foundation, Agricultural Development, Seattle, WA 98102. Seattle (US): Bill & Melinda Gates Foundation.
- Padel S. 2001. Conversion to organic farming: typical example of diffusion of innovation. Sociologia Rurali. 41(1):40-62.
- Pornpratansombat P, Bauer P, Boland H. 2011. The adoption of organic rice Farming in Northeastern Thailand. J Organic System. 6(3):4-12.
- Pattanapant A, Shivakoti GP. 2009. Opportunities and constraints of organic agriculture in Chiang Mai Province, Thailand. Asia-Pacific Dev Journal. 16(1):115-147.
- Pretty J, Hine R. 2005. Pesticide use and the environment. In: Pretty JN. editor. The Pesticide Detox: Towards a More Sustainable Agriculture. London (UK): Earthscan.
- Pietola KS, Lansink AO. 2001. Farmer response to policies promoting organic farming technologies in Finland. Europ Rev Agric Econ. 28:1-15.
- Peterson HH, Barkley A, Cascante AC, Kastens TL. 2012. The motivation for organic grain farming in the United States: profits, lifestyle, or the environment?. J Agric Applied Econ. 44(2):137-155.
- Rigby D, Cáceres D. 2001. Organic farming and the sustainability of agricultural systems. Agric Systems. 68:21-40.
- Rogers E M. 2003. Diffusion of innovations. 5th ed. New York (US): The Free Press.
- Sholubi YO, Stonehouse DP, Clark EA. 1997. Profile of organic dairy farming in Ontario. American J Alternative Agric. 13(3):133-139.
- Sunding D, Zilberman D. 2000. The agricultural innovation process: research and technology adoption in a changing agricultural sector (For the Handbook of Agricultural Economic). Revised January 2000. Berkley (US): University of California at Berkeley.
- Stoneman, P. 2002. The Economics of technological diffusion. Oxford (UK): Blackwell Publishers.
- Schneeberger W, Darnhofer I, Eder M. 2002. Barriers to the adoption of organic farming by cash-crop producers in Austria. American J Alternative Agric. 17(1): 2002.
- Sterrett S, Groover GE, Taylor DB, Mundy K. 2005. Describing organic agricultural production in Virginia results of the 2004 Farm Survey Virginia's Rural Economic Analysis Program, Department of Agricultural and Applied Economics, College of Agriculture and Life Sciences, Virginia Tech.
- Serra T, Zilberman D, Gil JM. 2008. Differential uncertainties and risk attitudes between conventional and organic producers. The case of Spanish COP farmers. Agric Econ. 39(2):219-229.
- Sukristiyonubuwono R, Wiwik H, Sofyan A, Benito HP, De Neve S. 2011. Change from conventional to organic rice farming system: biophysical and socioeconomic reason. Int Res J Agric Sci Soil Sci. 1(5):172-182.
- Sudheer, PSK. 2013. Economics of organic versus chemical farming for three crops in Andhra Pradesh, India. J Organic Systems. 8(2):36-49.
- Soltani S, Azadi H, Mahmoudi H, Wiltox F. 2014. Organic agriculture in Iran: farmers' barrier to and factors influencing adoption. Renewable Agric Food Systems. 29(2):126-134.
- Shiotsu F, Sakagami N, Asagi N, Suprapta DN, Agustini N, Nitta Y, and Komatsuzaki M. 2015. Initiation and dissemination of organic rice cultivation in Bali, Indonesia. Sustainability 7:5171-5181.
- Terano R, Mohammed ZA, Rezai G. 2013. Farm management analysis in paddy granary areas in

- enhancing on-farm income. *Agris on-line Papers in Econ and Informatics* 5(1): 73-81.
- Ullah A, Shah SNM, Ali A, Naz R, Mahar A, Kalhoro SA. 2015. Factors affecting the adoption of organic farming in Peshawar-Pakistan. *Agric Sci.* 6:587-593.
- Velten S, Leventon J, Jager N, Newig J. 2015. What is sustainable agriculture? A systematic review. *Sustainability.* 7:7833-7865.
- Wallace, J. 2001. *Organic field crop handbook*. 2<sup>nd</sup> ed. Canadian Organic Growers Inc. Michigan (US): Michigan State University Extension.
- Wahana Bumi Hijau [internet]. 2011. *Prospek pertanian organik di Indonesia*. [Internet]. [cited 2017 Oct 24]. Available from: [http://wbh.or.id/index.php?option=com\\_content&view=article&id=95%3Aprospek-pertanian-organik-indonesia&catid=43%3A pertanian&Itemid=34](http://wbh.or.id/index.php?option=com_content&view=article&id=95%3Aprospek-pertanian-organik-indonesia&catid=43%3A pertanian&Itemid=34).
- Wheeler SA. 2008. What influences agricultural professionals' views towards organic agriculture. *Ecological Econ.* 65(1):145-154.
- Wynen E. 2004. Conversion to organic grain farming in Australia. *Eco Land Use Systems*, Canberra, ACT, 2615.
- Yamota JRG, Tan-Cruz A. 2007. Farmers' adoption of organic rice farming in Magsaysay, Davao Del Sur: factors and practices. Paper presented in 10th National Convention on Statistics (NCS). EDSA Shangri-La Hotel, October 1-2, 2007. Manila (PH): University of Southeastern Philippines.