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Valuation of Agricultural Extension Information

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Abstract

The agricultural sector is heavily dependent on information about weather, pest and disease management, inputs, improved cultivation practices, markets and prices to deal with prevailing uncertainties. However agricultural extension information is still characterized by quality (timeliness, relevance, completeness or adequacy, accuracy and appropriateness) challenges if addressed, can enhance its value and hence increase profitability on the farm. The purpose of this study is to understand how information is valued, the different contexts of information valuation that exist in literature and propose a theory that can guide valuation of agricultural extension information which is the first step to enable smallholders extract more value from agricultural extension information. To fulfill the main objective of this paper, a comprehensive literature review on information valuation was conducted to establish existing knowledge in literature and also identify existing gaps in valuation of agricultural extension information. The study found that information valuation is context specific and varies depending on the reason for valuation and therefore a value-in-use approach grounded in subjective use value of information was proposed to value agricultural extension information. However, the proposed approach is theoretical and therefore there is need to validate this theory by means of case study or action research.

Key words: *Information Valuation, Agricultural Extension Services, Information Assets*

Introduction

Information is at the heart of decision making in every organization (Eroğlu and Çakmak, 2020). With increasing recognition that information is an important resource (Barrachina, 2019), organizations are taking measures to understand how it is valued so that they can utilize it to achieve their goals. Information assests in an organization that may possess value are related to; markets and customers, products, specialist knowledge, business processes, management, human resources and suppliers (Varadarajan, 2020; Bužinskienė, 2017). The agricultural sector is one area that is heavily dependant on information. Farmers need reliable information about weather, pest and disease management, inputs, improved cultivation practices, markets and prices (Aker, 2011) to deal with prevailing uncertainties. However agricultural extension information is still characterized by quality (timeliness, relevance, completeness or adequacy, accuracy and appropriateness) challenges if addressed, can enhance its value and hence increase profitability on the farm (Babu, 2012). Although different researchers have attempted to study how information is valued, there are still gaps in research in terms of valuation of agricultural extension information. In this paper, an extensive literature survey and review was conducted to examine different information valuation methods and how they relate to agricultural extension information. Value-in-use (Repo, 1986) approach that emphasizes observations of the role information plays in a given agricultural activity and benefits that results from the utilization of information was adopted as an attempt to value agricultural extension information.

The rest of the paper is organized as follows; In Section 2 we highlight the methodology. In Section 3 we review literature about information attributes which are critical in measuring the value of information, in Section 4 we discus information valuation, the valuation methods and their relationship to agricultural extension information. In Section 5 we explore information valuation in different sectors and the attributes based on to determine its value, In Section 6 we discuss how Engelsman's framework is adopted to guide valuation of extension information while highlighting the effect of context on information valuation. Section 7 we discuss how agricultural extension information is valued using Repo's (1986). Section 8 summarizes the theme of this paper, the conclusion and future work.

Methodology

To fulfil the main objective of this paper, a comprehensive literature review on information valuation was conducted to establish existing knowledge in literature and also identify existing gaps in valuation of agricultural extension information. A combination of keyword searches including information valuation, information assets, measuring the value of information, information valuation approaches, cost of information, information resources in organizations, valuation of knowledge, knowledge assets, utility of agricultural extension information, consumption of agricultural information were used to search through the existing literature using various research based search engines including Google Scholar, Ingenta Connect,Elsevier, DOAJ,JSTOR. The peer reviewed articles were categorized into characteristics of information and information attributes information assets and information valuation methods. The inclusion criteria for the research articles were based on relevance of the article, whether the articles were peer reviewed and the journal where it was published (Littleton et al., 2004).

Relevant information was extracted from the abstract based on the keywords and also related articles were reviewed based on citation indexes on web of science and Google scholar (Aveyard, 2014). Mathematical models derived from information theory and probability theory were not considered for this research. The goal was to get the key concepts that different authors identified and derive a common conceptual strategy and relate these concepts to agricultural extension information.

Information Attributes

Data and Information

Data refers to raw input that when processed makes meaningful output. Information is processed data (Sanders, 2016). McCreadie and Rice (1999) proposed the following four major assumptions about information; (i) information as a commodity to be produced, purchased, replicated, distributed, manipulated, passed along, controlled, traded and sold. (ii) Information as data in the environment gained as individuals interact with objects in their environments, from experiences, events or natural phenomena. (iii) Information as a representation of knowledge and (iv) Information as a part of the communication process which is inherently in people rather than in words or data (Madden, 2000).

Information as an Asset

Information valuation is linked with attributes of information and therefore it is necessary to understand how it behaves in relation to other assets in the organization (Batini and Scannapieco, 2016). As an asset , information has a cost and a value (Glazer, 1993; Moody & Walsh, 1999). Unlike physical assets information; (i) increases with use. (ii) is able to be summarized. (iii) is substitutable. (iv) is transportable (v) diffusive. (vi) is sharable, not exchangeable. (vii) is human. It exists only through human perception (Engelsman, 2007). These differences complicate efforts to value information using traditional asset valuation approaches (Steinarsson & Gunnarsson, 2003). As an economic resource and asset, Moody and Walsh (1999) assert that information should have these characteristics: (i) it should have service potential or future economic benefits and (ii)It should be controlled by the organization and should be the results of past transactions.

Information assests in an organization that may possess value are related to; markets and customers, products, specialist knowledge, business processes, management, human resources and suppliers (Varadarajan, 2020; Bužinskienė, 2017). Moody and Walsh (1999) proposed seven general principles that govern information as an economic resource and how information behaves in relation to other variables (amount of usage, time, accuracy, integration, and volume). The seven principles of information are; (i) It is infinitely shareable without a loss of value,(ii) Its value increases with use, 3 (iii) It is perishable and it depreciated over time,(iv) Its value increases with accuracy, (v) Its value increases when combined with other information, (vi)more information is not necessarily better.(vi)It is not depletable. Information does not obey the same laws of economics that other assets do, the attributes explored above must be understood in order to be able to measure its value effectively.

Measurable Information Attributes

The value of information is not a function of the information itself but rather of measurable attributes (Viscusi and Batini, 2014). According to (Viscusi and Batini, 2014), information attributes or dimensions considered crucial in measuring value of information are accuracy, completeness, accessibility, relevance, and timeliness. Intrinsic attributes in the nature of information including relevance, timeliness, availability, comparability, objectivity, sensitivity might form as the starting point to measure its value (Steinarsson & Gunnarsson, 2003). The context and coverage in which information is studied is crucial in assessing value of information and therefore should be considered (Batini and Scannapieco, 2016).

Information Value Adding Attributes

Skyrme (1994) summarized ten different value adding attributes of information. In order to increase user experience and usefulness of information, these attributes have be to taken into account. These are also consistent with information quality frameworks and taxonomy procedures in studies by Steinarsson and Gunnarsson (2003), Engelsman (2007) and Batini and Scannapieco (2016). They are; (i)Timeliness (Information should be used within the stipulated time), (iii) Accessibility (Some types of information are easy to find and retrieve), (iv) Usability (A user can manipulate to suit application), (v) Utility (Is suited and usable for a variety of applications), (vi) Quality (Accurate, reliable, credible, and validated), (vii) Customized (Filtered, targeted, appropriate style and format), (viii) Medium (It should be packaged for portability and ongoing use), (ix) Repackaging (Reformatted to match onward use), (x) Flexibility (Easy to process and can be used in different ways) and (xi)Re usability (Extra use should refine its quality; the more people that can access and use, the better).

Agricultural extension Information

Agricultural extension can be defined as the entire set of organizations that support and facilitate farmers to obtain information, skills, and technologies to improve their livelihoods and well-being (Issahaku, 2014). This can be through transferring of knowledge/advice from research to farmers, advising and educating farmers in decision making in order stimulate progressive agricultural development (Anderson and Feder 2007). Agricultural extension services include; provision of information about agronomy, soil fertility management, post-harvest handling and markets, weather patterns, etc (Barungi et al., 2015). According to Feder et al. (2007), 80% of extension services are publicly funded and developing countries boost more than 90% of the world's extension personnel. This is because it is where the majority of the world's farmers are located and where efforts are being made to commercialize smallholder farms typically characterized by rudimentary farming practices, low productivity, inadequate extension information, poor access to markets and inputs, poor financing options, etc (Salami et al., 2010). Benefits from extension services include; timely response to pests and diseases, increased diversification of crops, better environmental conservation, reduction in cost of cultivation, increased access to markets and better yields (Aker,2008; Anderson and Feder, 2007;Raj et al., 2011).

Information Valuation

The term value is majorly shaped by subjective perceptions either qualitatively or quantitatively. Value interpretation according to Huatuco et al. (2001) falls into these categories; (i) Cost reduction which is the traditional view when measuring the value of information due to the quantitative nature of cost. (ii)a commodity in the marketplace which means information value is determined by market forces. (iii) information is valuable when it allows quality decision making. (iv) value of information depends on when, where and which format information is in. (v) the value information contributes in meeting the goals and objectives. Purohit et al (2015) defines value of information as the difference in benefits or outcomes or profits in the presence of information or when information is availed.

Information Valuation Methods

Valuation in risk perspective

In information valuation for risk management we assess the appropriateness for controls and justification of budgets for information security management (Spencer, 2000). The motivating factors for this valuation approach are: (i) Exclusive possession (In this aspect information remains valuable as long as it remains exclusive). (ii) Utility (Information is valuable as long as it remains useful to the organization). (ii) Liability (The value the information depends of the ramifications if a trust is breached). (iii) Convertibility (When information is representative for value that is convertible to other assets, the information should be valued to at least the conversion value). (iv) Operational impact (The value of information is based on the impact the absence of the information and/or data could have on the organization).

Historical cost valuation

Here the information is valued based the original cost of information acquisition. The principle is that the asset value is estimated based on the cost at acquisition time. The assumption is that a firm, under normal circumstances, will only spend money to acquire an asset if it believes the economic benefits received can justify the costs. Information is represented by the costs of capturing, producing or purchasing information (Moody &Walsh, 1999). The advantage of this is that costs for collecting information are quantifiable but benefits are subjective and the disadvantage is that undesirable results can be obtained if the historical cost method is used in its standard form because it supports the creation of more information regardless of how it is used.

Moody and Walsh (1999) propose several modifications to the method, which are; (i) Cost of information should be the baseline for measurement of operational information value. (ii)The management of information should be valued based on information extraction costs. (iii) Information that is collected redundantly should have zero value to avoid double counting. (iv) Unused information should have zero value. (v)The value of the information should be multiplied with the number of users and accesses to information. When used for the first time, information will be valued at cost of acquiring. (vi) Each subsequent use will add to this value. (vii) The value should be depreciated based on the information shelf life. (viii) The value should be

discounted by its accuracy relative to what is considered to be acceptable. In practice, this would probably have to be done based on perceptions of accuracy, because of the cost of empirically measuring accuracy. By using this approach for valuing information companies can highlight which information is most valuable (most used) and which information gives the most benefits (cost compared to value).

Usage over time valuation

The main context for this method is to differentiate information values for Information Lifecycle Management (Chen, 2005). The approach is based on two fundamental principles: Value is reflected through usage and value changes over time. The valuation model is derived from two measurable and observable metrics: usage and time. The model captures both the information value changes over time and the value differences between different information sets.

The baseline model assumes that the past usage history serves as an indication of the importance of the information for the present time. It indirectly infers the information value at present time by factoring in the recency (information is more valuable if it is used more recently) and the degree of the information usage (used more heavily than others). The model must combine both recency and degree of usage aspects with strong bias towards one aspect or another. It must consider the tradeoffs between the two. To eliminate bias, the recency and degree of usage factors are normalized to a scale of 0 to 1. By combining both recency and usage allows the model to capture information value changes over time and the differences among information. The model does not define the financial value of information, but it generates a scale which information is more valuable. Also, cost factors were not incorporated in the model.

Utility valuation

Valuing information based on its utility means that the revenue generation based on the information that is used can be attributed to the value of information in part or whole. This methodology is based on the role of information as a component in the value-add chain (Glazers, 1993). From any given transaction between a firm and stakeholders there are valuable information which describes the transaction that took place or some related information that can be stored within the organizations data repositories. Glazer identifies three components of value that can be derived from these transactions, which are; (i) Transaction information can aid in future selling/buying of complementary products. (ii) Transaction information can contribute to more efficiency in future transactions. (iii) The transaction information can have an exchange or market value to a third party.

In the same fashion, the value of the exchange of information within the organization can be computed from its contribution to the reduction of production or operations cost. According to Glazer (1993), the sum of the information value that can be derived from these exchanges of information gives the total information value for the organization. One of the key benefits of Glazers methodology is that it can assist companies in identifying information that are valuable but not been exploited for its value. The major weakness of this method is that the estimation of the value of information are highly subjective and time consuming to put together.

Repos information value-in-use approach

In contrast with economic theories of measuring value of information, Repo (1986) suggested an information valuation approach from an information in use point of view. Information in use is based on two principle considerations. One on the philosophical value and the other on the practical value also known as the instrumental value. Repo asserts that philosophical values are difficult to assess because emotions and beliefs of individuals have to be taken into account which is always problematic. Practical value according to Repo is either use value (value-in-use) or exchange value. Repo states that "Value-in-use is the benefit the user obtains from the use and the effect of the use of information". It is normally measured by the willingness the user exhibits to pay for the information or the time the user saved as a result of utilization of information. Exchange value is relevant when comparing value of information in relation to value of information channels, value of information product or service or determining the price for a particular piece of information.

Repo (1986) states that assessment of value of information constitutes subjective expected value-in-use of information, subjective value-in-use of information, objective value-in-use of information. Subjective expected value-in-use of information. "This valuation takes place when an individual decides whether to seek and use the information product or service or not. The valuation is based on past experiences and/or expectations of the information products and services available." Subjective value-in-use of information. "Opinions of individuals of the value of information while used in their work. Reduction of uncertainty is a commonly used expression of this value." Objective value-in-use of information. "The value of real effects the information has had on a task and its results."

Repo (1995) adopted Choo's (1995) framework to demonstrate how value in use can be explored in a typical knowledge task. Choo's (1995) information management process framework provides a step-by-step approach to investigate the value of information to the users while they are performing their knowledge work task. The phases in Chao's framework include identifying information needs, information acquisition, information organization and storage, information products and services development, information distribution and information use.

The subjective expected value-in-use (Repo, 1986) can be determined at the initial stages of identifying and acquiring information in Choo's model. For example extension information must first have expected value-in-use to trigger the interest of the smallholder, who actually decides whether to use the information or not. According to Repo (1986), actual value-in-use can be identified if it is possible to trace the role of information for a knowledge-work task. This is called subjective value-in use and can be studied at the stages of information storage and organization, development of information products and services, and dissemination of information in Choo's model. The value of real effects the information has had on a task and its results are called objective value-in-use which can be studied at the information use the process model of information management proposed by Choo (1995).

Choo's approach also helps minimize subjectivism. In Repo's words, "in order to avoid subjectivism, the basis for determining the value of information even from an information use viewpoint has to be in the knowledge work itself". Furthermore, this model enables thorough investigation of factors that affect the value of information such as access issues (e.g., availability and accessibility), technical issues (e.g., data formats,

presentation format, interoperability, etc), and issues related to information quality (e.g., accuracy, comprehensiveness, timeliness, etc). The less the barriers to accessing and acquiring this information, the less the technical problems associated with it, and the higher its quality and relevance, the greater the value and overall effectiveness.

Information Valuation in Different Contexts

We show how different researchers in various sectors value information and the various foundational context dependent attributes used to value information. Valuation of fleet information in asset management and valuation of clinical research information contexts are highlighted in the following subsections. Engleman (2007) asserts that to have an accurate measure of value of information, the context in which information is valued is paramount.

Valuation of Fleet Information in Asset Management

Kinnunen et al. (2016) conducted a study on how the value of fleet information can be quantified. The study utilized a cost benefit approach in which the costs involved in fleet information management were quantified. The costs include data collection, investments in connectivity, and systems integrity. The benefits achieved in the management of fleet information come as a result of making accurate analysis and developing models that support decision making. The resultant framework that was developed from this study capitalizes on the factors (the size of fleet, the selected time period and the level of data refining) that affect costs and benefits which in turn influence the value of fleet information. In this framework the value consists comparison of the costs of data refining, including hardware, software and data processing work related costs, and the benefits that can be achieved through data utilization in maintenance management at fleet level.

Valuation of Clinical Research Information

Steinarsson and Gunnarsson (2003) conducted a study to determine the value of clinical research information from a risk management perspective. After analysis of several methods, they found that clinical information valuation may be approached from a multidimensional view point and therefore based on several reasons different information value can be established e.g exclusive possession, utility, cost or cost of recreation, potential liability and operational impact. In this study information valuation methods like utility value, historical cost and various knowledge management methods were not practical to use when it come to valuing clinical research information. Furthermore the more advanced methods that measure value of knowledge management initiatives, intellectual capital information, value in decision-making, transaction value and information in use were misleading and time consuming especially in measuring how information is used (access time, access frequency and relevancy). Therefore there was no conclusive approach to precisely measure the value of clinical research information. However, the researcher leaned towards the historical cost approach and suggested that more studies were needed to explore this approach further.

All in all, the value of information depends on the context and audience of valuation. The different scenarios above affirm this statement. Literature explicitly mentions that context has a direct effect on the valuation of

information but fails to explore the different contexts (Engelsman, 2007). Each context relying on varying attributes to measure value of information.

Engelsman's Guidelines for Information Valuation

Engelsman (2007), proposed a framework for which information could be valued and he outlined steps that the researcher can follow to value context dependent information. These steps are described below;

a) **Identify information asset:** Engelsman (2007) recommended a list of information assets as listed by Oppenheim et al. (2003). Example of the suggested assets include customer information, competitor information, product information, business processes, management information, etc
b) **Determine audience:** The audience of the valuation comprises an external audience which shows the contribution of information to the overall value of an organization and internal audience shows the value of the information to encourage improved decision making (Viscusi and Batini, 2014). Historical Cost is used for external audience. The methods by Spencer, Chen and Glazer can be used for an internal audience.
c) **Determine context:** The value of a relevant part of information depends heavily on the context it is used or valued in. The methods by Glazer, Spencer and Chen are examples of these different contexts. Engelsman emphasizes the appropriateness of this step for valuing information for an internal audience.
d) **Value information:** a) Use a method to value the information based on the outcomes of the previous phases. b) Devise a model using the relevant context and information attributes. Since most authors agree that the value of information changes within different contexts, it is possible that no valuation method exists for the valuation attempt.

Valuation of Agricultural Extension Information

Based on Engelsman's (2007) guidelines, the information asset in this context is agricultural extension information. Extension information include, anticipated future prices for farm products, advice on treating pests and diseases, advice on technology adoption, advice on subsidized inputs (Anderson and Feder, 2007). The audience identified in this context is the internal audience. This is because the goals of extension involve the transferring of knowledge and advice from researchers to farmers (Buehren et al.,2017). The context in this research is the contribution of information in improving the livelihood of smallholder households in terms of farm productivity and food security. Onwuka et al. (2017) state that the investment in extension services is important for improving agricultural productivity and increasing farmer's incomes.

Agricultural Extension Information Valuation using Engelsman's Approach

The information asset, the audience and the context in which agricultural information operates was identified using Engelsman's guidelines. However the methods suggested for internal audience by Engelsman (2007) are not sufficient in valuation of agricultural extension information. Valuation of information for security risk management emphasizes having exclusive possession of information yet agricultural extension information in

most developing countries is free to all smallholders (Fleisher et al., 2002). This defeats the idea of exclusive possession of information.

Valuation for Information life cycle management is based on two fundamental principles: Information value is realized and reflected through its usage and information value changes over time. For this approach to work there is need for tiered storage hardware and software stack that consists of storage software, middle-ware such as content management systems and databases so as to monitor and track the changing nature of the information value throughout its life-cycle (Chen, 2005) yet most smallholders lack this infrastructure (Hosseini et al., 2009, Anor-Frempong et al., 2006).

The utility method by Glazer focuses on transactions as the unit of analysis which he defines as the exchange between a firm and the consumer of goods or services for money. This may not be sufficient in the agricultural context because it mostly focuses on the information collected as a result of past or current transactions and stored in internal organizational databases which may not apply to extension information. Extension information is delivered by extension agents and its main goal is to aid the smallholders in the production process (Aker, 2010) and not necessarily in transactions with external entities which is a major unit of analysis. More so the benefits of agricultural are not bound to revenue or costs only as emphasized in this information valuation approach. Measuring agricultural information is complex (Anderson & Feder, 2007). Some information will have quite enduring value, such as when transferred managerial skills are encapsulated in the human capital of the farm manager, and such values are generally increasing over time as more complex and increasingly integrated managerial challenges are faced.

At another extreme, some information may have a short lived value, such as a forecast of tomorrow's maize price in a local market. Clearly, different types of information can thus have many different inherent valuations to concerned smallholders (Anderson & Feder, 2007). In some cases, where the consequences of using the particular information include environmental outcomes, such as reduced soil erosion that might come with adoption of no-till farming (Pieri et al., 2002), the value of the information may go to many beneficiaries beyond the farm gate. In other instances value may not be immediately realized since agriculture is affected by so many uncertainties that may distorted information value (Purohit et al., 2015). Therefore delivery systems for supplying information can have diverse values to different smallholders, so getting a handle on the value of extension information to smallholders is difficult, which may explain why it has so seldom been tackled (Longhorn & Blakemore, 2007; Longley et al., 2001; Repo, 1989 and 1986). The task is made more challenging by the multitude of alternative sources and varying formats. Engelsman (2007) stated that if a model does not exist, the researcher should devise a model using the relevant context and information attributes. Therefore there is need for a more encompassing approach to account for all nuances of agricultural extension information.

Repos Information Value-in-use Approach to Valuation of Agricultural Extension Information.

The value-in-use describes the value of information from the information user's and use point of view. According to Repo's (1986) value-in-use approach, valuation of information arises out of the process of use and seeking of information in the knowledge work. The value-in-use of information can only be stated by the user of information while he is performing his knowledge-work task and from the results of the task. Value-

in-use approach is appropriate for valuation of agricultural information because each smallholder's information needs can vary widely, depending on the smallholders' situation at hand. The variation of information needs causes users to exhibit specific information seeking behavior (Rosenfeld and Morville, 2007) and hence makes valuation of agricultural information subjective. Repo (1986) states that information must first have expected value-in-use to awaken the interest of the user, who actually decides whether to use the information or not. Repo (1986) defines this as subjective expected value-in-use. In relation to agricultural information, smallholders decide to use or seek for agricultural information only when their information needs are properly aligned with their information seeking behaviour (Oboko,2018). Information-seeking behavior "is a broad term encompassing the ways individuals articulate their information needs, seek, evaluate, select, and use the needed information" (Nwone and Mutula, 2018). According to Kopiyawattage et al.(2018), information seeking behaviour is associated with finding the right information sources, information seeking strategies and characteristics of information. Subjective expected value-in-use can be assessed based on previous application and experience (Easdown and Starasts, 2004; Repo, 1986). After information is obtained, the user can assess the value of information while performing a specific task (also referred to as subjective value-in-use). Repo (1986) further states that subjective value-in-use can also be identified if it is possible to trace the role of information for a knowledge-work task. One of the most common ways to express the subjective value-in-use is reduction of uncertainty as a result of use of information. To illustrate this in agricultural terms, the examples below show how subjective value-in-use in agriculture can expressed (role agricultural information plays in a task);

a) Availability of market information gives smallholders the potential to bargain, to seize market opportunities through the adjustment of production plans and better allocation of production factors, and also to use the information to make choices about marketing (Asenso-Okyere and Mekonnen, 2012).
b) Availability of climate information can help smallholders identify and undertake different actions to better withstand the effect of climate change related events, and utilise the opportunities that may arise from change (Ospina and Heeks, 2010).
c) Availability of pest and disease control information, weather changes, new varieties of seeds and cultivars helps reduce risks and uncertainties, such as poor soil, drought, erosion and pest and diseases (Nwankwo, 2012).

Repo (1986) posits that the use of information starts by expected subjective value-in-use and continues or stops by actual subjective value-in-use when information is used in the task. Objective value-in-use is often impossible to measure in full, only some indicators may be available from individuals how the information influenced the task and the results.

Discussion, Conclusion and Future Work

Information valuation remains a topic of interest to researchers. This research attempts to understand how agricultural extension information is valued by exploring what information is, what value is, different information valuation methods, and their contexts and how they relate to agricultural extension information. The study finds that information valuation is context specific and varies depending on the reason for

valuation. For example, the historical cost valuation method is relevant if the cost of acquisition, capturing and management are the reasons for valuation. If one needs to understand the degree of information usage and how recently information has been used, they will find the usage overtime method relevant. Steinarsson and Gunnarsson (2003) attempted to value clinical research information but encountered difficulty in determining an appropriate valuation approach due to the theoretical nature of most information valuation methods.

In valuation of agricultural extension information, we show that Repo's (1986) value-in-use framework can be a starting point to determine the value of agricultural extension information by assessing the likely contribution of information in an agricultural activity (expected subjective value-in-use) or observing the role information plays in an agricultural activity (actual subjective value-in-use) or examining benefits that resulted from utilization of information (objective value-in-use). We also show that this approach can be a rigorous task for smallholders since there are numerous uncertainties that may distort the benefits gained from application of extension information (Purohit et al., 2015).

In conclusion, information is a key resource and a valuable asset in an organization (Barrachina, 2019). The agricultural sector like other sectors is heavily dependent on information and therefore smallholders should know how information is valued so that they can evaluate benefits of collecting it when faced with uncertainty. Understanding evaluation of agricultural information can also inform policy decisions related to agricultural information dissemination interventions that create lasting impact. The value-in-use approach proposed to value agricultural extension information is mainly theoretical and therefore there is need to validate this theory by a case study or action research.

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