Role of AMIS in Resolving Information Asymmetries in Agricultural Markets: Guidelines for AMIS Design

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Abstract:

Agriculture is an economic activity in which information plays a very important role as critical information asymmetry exists in transactions between various stakeholders – farmers, traders, government, policy makers and consumers. In this paper we analyze the information asymmetries in agricultural markets and how proliferations of Information and Communication Technologies (ICT)-based Agricultural Market Information System (AMIS) can help reduce these asymmetries. We also see how spatial and temporal arbitrage opportunities of perishables and staples vary with increase in available information.

We note that socio-political situations limit the effective utilization of market information by the farmers. They have limited outlets for their produce and they are bound by traditional trading relationships with middlemen. Thus the success of such an information system also depends upon the wider policy environment that prevails in the country.

Though many attempts have been made by a number of governments to provide AMIS, the success rate is poor. Two major reasons are economic unsustainability and ineffective implementation. There are not many farmers who can pay for these services. These services have to be offered as a "public good". At the same time, when such services are not financially sustainable, they are a drain on public resources. From a review of existing literature, we come up with some guidelines for designing AMIS for economic sustainability and effectiveness while defining the processes for data collection and information dissemination.

Keywords: Agricultural Market Information System, ICT, Information Asymmetry, Policy, Public Good

Introduction:

Agricultural Market Information System (AMIS) can be defined as "A service, usually operated by the public sector, which involves the collection on a regular basis of information on prices and in some cases, quantities of widely traded agricultural products from rural assembly markets, wholesale and retail markets, as appropriate, and dissemination of this information on a timely and regular basis through various media to farmers, traders, government officials, policy makers and others including customers." (Shepherd A. W., 1997)

> Information asymmetry can be defined *as a situation where some party in a transaction benefits from having preferential access to information*.

Growth in agriculture sector has a multiplier effect on any nation's socio-economic and industrial development. This sector feeds the growing population, provides raw materials to the industries, generates employment and earns foreign exchange. The agriculture sector is thus considered a major economic driver particularly in developing economies (Ogen, 2007). In developing countries a large percentage of the population lives in rural areas and they depend on agriculture as their main occupation. Decisions that farmers take have a long term impact and they have to take these decisions without prior knowledge of their future produce, its quality and the price they will get for it. Quality of these decisions depends upon the availability of timely and relevant information. Lack of this information and demand and supply fluctuations further aggravate the situation. Agriculture is an economic activity in which information plays a very important role as critical information asymmetry exists in transactions between various stakeholders – farmers, traders, government, policy makers and consumers. It is therefore essential to target reducing information asymmetries in agricultural markets to increase agricultural profits with minimal social and environmental consequences to the community.

Efficient market information provision can have positive benefits to all the players in the sector. It helps farmers and traders take better decisions. It increases the bargaining power of farmers over the traders. It reduces the costs of gathering information for the traders. It helps government and policy makers take informed decisions (Islam & Gronlund, 2010). Proliferations of ICT-based MIS can help reduce information asymmetry in the agriculture sector. Being both non-excludable and non-rivalrous, it can be viewed as a public good particularly as there is a large community of poor farmers who cannot afford to pay for the service. Thus it is essential that the government has a major role to play in the provision of these services.

Though many attempts have been made by a number of governments to provide Agricultural Market Information Services (AMIS), the success rate is poor. Two major reasons are economic unsustainability and ineffective implementation. Ineffective implementation results from lack of identification of the needs of the farmers and collecting data which cannot provide any commercially useful information. Inability of the government to support such programmes for a long period, unwillingness of the stakeholders to pay for the services (as they do not see any perceived benefit from the services) and donors who not provide consistent funding results in economical unsustainability (Shepherd A. W., 1997). From development perspective it is important that any development initiative aimed at adding value to the society must be both economically sustainable and effective (Simon, 1997).

Following are the definitions of some of the important terms that will be used in the paper. *Spatial arbitrage* is the process of exchange of commodities with the objective of taking advantage of price differences across markets which exceed the transaction costs. *Temporal arbitrage* is the process of exchange of commodities with the objective of taking advantage of price differences over time. *Perishable* agricultural products are products like fruits and vegetables which have a very short shelf life and they have to be consumed almost immediately. *Staples* are agricultural products like rice,

wheat, maize (corn), millet that constitute a dominant part of the diet of a community and have a higher shelf life.

Objective and Methodology:

The scope of this paper is to understand the information asymmetries in agricultural markets in developing countries and how AMIS helps in reducing these asymmetries. In particular this paper looks at information symmetry and its effect on opportunities of spatial and temporal arbitrage for different agricultural products - perishables and staples. The paper also provides some guidelines on designing AMIS for economic sustainability and effectiveness while defining the processes for data collection and information dissemination. These guidelines can also evaluate and find the inefficiencies in existing systems. The methodology adopted for this paper is a review of literature on Agricultural Market Information Systems. We examine thirteen papers on AMIS and five papers on market extension services.

Literature that supports the findings and the context is as follows:

Literature	Context	Findings
(Shepherd A. W., 1997)	The role of markets, information asymmetry, Market Information Systems, Case Studies	Importance of market information to different stakeholders, role of information in spatial and temporal arbitrage and relationship between type of produce and arbitrage.
(Holtzman & al., 1993)	The case of AMIS in The Philippines	Lack of information as an entry barrier to trade and production
(Evans & Lynton, 1997)	The role of Government in Market Information Systems, need to monitor markets	Importance of information for policy makers in evaluating market performance and managing reserves
(Colle & Roman, 2002)	Ability to afford services and the need for a public good	Market Information Systems to be provided as a public good
(Wellenius, 2003)	Telecentre sustainability	Situations when public good becomes a drain on resources
(Helder & Nyhoff, 1994)	Early warning system for reserve management	Market Information acting as a early warning system
(Thomas, 2003)	Agricultural markets in India	Functioning of agricultural markets in India
(Singh, 2006)	Stories of successful implementation of AMIS	Design principles that lead to the success of AMIS
(Simon, 1997)	Definition of development	AMIS as a development initiative
(Prakash & De', 2007)	ICTs in development context	Implications of the meaning of development on the design of ICTs
(Stiglitz, 1989) (Stiglitz, 2002)	Information asymmetries and transaction costs	Information asymmetries and transaction costs in agricultural markets
(Abraham & Rueben, 2008)	Role of ICTs in reducing information asymmetries in fishing industry	Reduction of information asymmetries in agricultural markets by use of ICTs
(Ogen, 2007)	Agricultural sector in Nigeria	Role of agriculture in the development of the nation
(Islam & Gronlund, 2010)	AMIS in least developed countries	Challenges in the implementation of AMIS
(Arokoyo, 2003)	Agricultural extension in Nigeria	Provision of unified services linking different sectors
(Bennette, 1996)	Funding of agricultural extension services	Inefficiency of private sectors in distribution of information
(Chappman & Tripp, 2003)	Privatization of agricultural extension	Utilization of private sector efficiency for data collection in AMIS
(Pavarala, 2008)	Electronic grassrooting of community by means of Community radio	Reach of Community radio
(Shepherd A. , 2001)	Farm radio for information dissemination	Farm radio as a means of information dissemination
(Dinar, 1996)	How much to charge for extension services	Revenue model that is sustainable
(Davis, 2008)	Extension in sub-Saharan Africa	Mobile telephones as a means of providing extension services

Theoretical Background:

In economics the concept of a market is any structure that allows buyers and sellers to exchange any type of goods, services and information. They represent any space where demand and supply meet. The exchange of goods or services for money is a transaction. Prices in market are determined by the demand and supply relations and they are in turn influenced by production costs, consumer preferences and costs of marketing. Such an economy is termed as a market economy. A basic assumption of a market economy is that information about the market conditions is available and accessible to all the market participants. Markets with *imperfect information* are different from markets with perfect information. Imperfection is reflected in some of the choices made by market participants who have preferential information compared to the others. Such markets are considered as markets with *Information asymmetry* (Stiglitz, 2002). Information asymmetry can be defined as a situation or transactions where one party has more or better information than the other. This causes power imbalances in transactions and they tend to go awry. George Akerlof, Michael Spence and Joseph E. Stiglitz were awarded the Nobel Prize in the year 2001 in Economics for their study of markets with information asymmetry.

The agricultural produce sector is one of the most important components of the economy in any developing country. Agricultural markets are where agricultural products are traded. Agricultural marketing covers the services involved in moving an agricultural product from the farm to the consumer. It spans across numerous interconnected activities such as planning production, growing and harvesting, grading, packing, transport, storage, agro- and food processing, distribution, advertising and sale. Information asymmetry in markets results in increased transaction costs and increased market frictions (Stiglitz, 1989). These asymmetries also lead to different power equations where some groups of stakeholders have higher power and influence over some other groups.

Elimination of these asymmetries is important in achieving economic efficiency, performance and equity. Market information systems can provide a means to reduce these inefficiencies and power inequalities. ICTs play a major role in providing this service to various stakeholders in the agricultural supply chain and to policy makers. By virtue of being carriers and conduits of information, ICTs help in correcting large scale asymmetries that exist in rural and unorganized markets. By doing so markets become more efficient and productivity increases by some extent (Abraham & Rueben, 2008). We, however, do not examine the question of whether ICTs create such asymmetries.

The use of ICT in Agricultural Market Information Systems (AMIS) in information processing and dissemination is imperative for any developing country whose economy is dominated heavily by agricultural activities (in India, for instance, agriculture and allied activities contribute about 30% of Gross Domestic Product). ICTs in this context refer to a combination of facilities provided by the internet and by mobile phones. These can be used in coordination with various media like newspapers, radio, television, blackboard displays and public addressing systems at the market place. This can be looked at from the development perspective where ICT are aiding the development of agricultural sector in an economy there by contributing to the development of the country as a whole. Human development can be defined as the process of enhancing individual and collective quality of life in a manner that satisfies basic needs (as a minimum), is environmentally, socially and economically sustainable and is empowering in the sense that people concerned have a substantial degree of control over the process through access to the means of accumulating social power (Simon, 1997). An effective and economically sustainable AMIS enhanced by ICTs can be viewed as a development initiative that empowers the marginal stakeholders in the agricultural value chain with information. In providing such services, there is a major challenge of economic sustainability as there are not many people who can pay for these services. These services have to be offered as a "public good" (Colle & Roman, 2002). At the same time, when such services are not financially sustainable, they are a drain on public resources (Wellenius, 2003).

Traditional Agricultural Markets:

In developing countries, traditional agricultural markets function poorly. They do not follow the principle that homogeneous goods sold at different locations have to have the same prices (net transportation). When spatial arbitrage does not match supply and demand in different marketplaces, transaction costs increase and thereby reduce trade flows and increase prices in the markets (Shepherd A. W., 1997).

In agricultural markets in India (Thomas, 2003), initially each neighbourhood had its own designated location where buyers and sellers engaged in trade, without the presence of a strong institution. After independence many policy decisions regarding agricultural markets came into being. The first was the government's policy of defining "primary commodities" for which government would set a minimum support price (MSP). The farmer had a choice of selling to the government if the market price fell much below the MSP. The second policy restricted the formal agricultural commodities market to localized wholesale markets. Price of commodities is set in these wholesale markets or *mandis*. Here, traders purchased the commodities from the farmers and the commodities are auctioned and sold to wholesale dealers. If the market price of the commodity is below the MSP, traders have to purchase the commodity from the farmers at MSP and the traders are later compensated by the mandi. Traders have to obtain a license from the mandi to buy and sell commodities. Mandis also charge the traders a market fee. The auction process has a fixed time at every mandi and as each lot is auctioned, a new price is set. The dissemination of information takes place only during this auction.

Let us look at the different stakeholders in the traditional agricultural market and how information plays a crucial role in their operations.

Lack of information and small size of land holdings places the many farmers in a very vulnerable position. They have limited outlets for their produce and they are bound by traditional trading relationships. These relations are generally due to their dependence on traders for credit or some other local power political or social settings. Lack of information leads them to a weaker bargaining position with the traders and fewer opportunities of spatial arbitrage. This is due to the lack of current information. Cumulative information of prices, rainfall and demand helps in understanding price trends, seasonal demand trends etc. This is the historic information which can help farmers take long term decisions. They lack this information in taking decisions concerning the crop, quantity of produce and best time to produce for maximizing returns.

Large traders collect the information for themselves from different markets. This is an expensive operation and also leads to increased transaction costs. Due to the concentration of information with the traders, they are in a better bargaining position over the farmers. Thus spatial arbitrage depends upon current information and traders spend a lot of money in gathering this information. But this is not the case with small traders who lack resources to set up their own information networks. This prevents the entry of a number of small traders to the markets. Traders also involve in temporal arbitrage, which entails storing produce for long periods until suitable price can be obtained. But storage costs (maintenance chemicals costs, capital and its depreciation costs) are also quite considerable. So, traders are dependent on information from the past to assess the viability of storage and its associated risks.

Traditionally, the government's role has been to observe the markets for differences in prices at which the farmers sell and the prices at which famers and retailers sell the products to monitor for inefficiencies.

Policy makers must also look at historic information and make policies with regard to food security. Market prices are only late indicators of food shortage. Historic information together with current information can help policy makers identify early warnings of food shortages and to manage food

security reserves (Helder & Nyhoff, 1994). Also, policy makers have to be aware of traders' associations lobbying to get their requirements met in the process of policy making.

Analysis of AMIS from prior literature:

Agricultural market information systems link and provide information on various important markets of a country. The information they provide is both current (up-to-date prevailing prices and market conditions) and historic data (collected over years). The system is a result of an information network for speedy collection and dissemination of market information for its efficient usage. Data collection and analysis and information dissemination are the two major activities involved in the provision of AMIS. Raw data is collected from the markets. This is the current information required by market participants. This includes market conditions, prices, arrivals, transportation details and issues, weather conditions, quality grades and standards, demand etc. Raw data is accumulated over a period and this is historic data. This data is analyzed by AMIS to provide important and useful information such as seasonal price trends, seasonal market trends and comparative analysis of prices and forecasts for production and prices etc.

Finding1: Information and arbitrage

Current information is generally useful for spatial arbitrage and historic information is useful for temporal arbitrage. Analysis of this current and historic data helps in identifying trends which can further help farmers and policy makers in taking decisions on production planning (Shepherd A. W., 1997).

Finding2: Information from staples and perishables

In case of perishable agricultural produce farmers will have to immediately sell their goods. They will not be in a position to take advantage of temporal arbitrage. Also the benefit of spatial arbitrage opportunities is limited. But in case of staples, they can benefit from both spatial and temporal arbitrage opportunities with the availability of information (Shepherd A. W., 1997).

Finding3: Benefits to farmers

With the availability of current information on prices and market conditions, farmers can check prevailing market prices. They can negotiate with the traders from a position of relative strength. They may even decide to try and improve the quality and presentation of the product. Information reduces the costs of selling by reducing risks. Farmers may even decide whether or not to harvest depending upon the prices. With more information on market conditions, farmers may change their marketing strategies and may even take the advantage of spatial arbitrage opportunities. Availability of information may also increase group marketing. On the other hand historic data can help the farmers in a number of ways. They can take more informed decisions on crop and quantity of produce. Information of fluctuating prices gives them an idea about the risks involved. They move beyond subsistence production to cropping patterns that have higher value returns (Holtzman & al., 1993).

Finding4: Benefits to traders

We can categorize traders as small and large traders. Large traders might lose their power and influence over both the customers and farmers with the introduction of AMIS. But at the same time they do not have to spend on independent networks for data collection and they can also benefit from historic data available in AMIS for their temporal arbitrage. With the increase in the available information, there might also be new small traders entering the markets, thereby making the markets more competitive and efficient (Shepherd A. W., 1997).

Finding5: Benefits to Government

Reliable market information that assesses the costs and risks involved for the traders helps the government evaluate the performance of markets for agricultural products and identify micro economic constraints. Information primarily helps in identifying the risk premium involved with fluctuating prices (Evans & Lynton, 1997).

Finding6: Benefits to policy makers

Monitoring prices of staple food items and others, helps policy makers in identifying early warning of food shortages. Price trends can be used to confirm indications from other sources such as rainfall and crop forecast data. Also comparison of price trends across years indicates the seriousness of food deficit. Detailed current price information and price forecasts helps the managers of food security reserves take decisions as to when to release the stocks to the market and when to replenish. They take these decisions based on current price information, price forecasts and seasonal price patterns (Evans & Lynton, 1997).

Finding7: Benefits to customers

Customers also benefit from the available information as they have a better stand while negotiating with the traders.

AMIS Process:

Provision of AMIS involves coordination of two processes. They are data collection and information dissemination. Prior research has investigated the spread and use of AMIS in least developed countries in terms of users, management, funding, infrastructure and data (Islam & Gronlund, 2010). Their findings show that while information dissemination can be enhanced by new technologies, collecting data economically and meeting high quality requirements remains a major challenge.

Donors are often prepared to assist in the establishment of AMIS but sustaining it efficiently after donor support is withdrawn is difficult; also, maintaining political support with very few visible benefits is impossible. It thus becomes very important that, if AMIS has to succeed as a development initiative, it has to be designed for economic sustainability and effectiveness. That is, it has to be financially independent and at the same time provide relevant, timely and correct information. This will increase data utilization and the benefits of AMIS can be completely utilized. Thus the meaning of development associated with this service is to have an economically sustainable and effective information system. This meaning therefore will have its impact on the design of the system (Prakash & De', 2007). Having analysed prior research in AMIS, we have come up with certain guidelines for designing AMIS for economic sustainability and effectiveness. For this purpose, AMIS design has been looked at from the angles of Data Collection and Analysis and Information Dissemination.

Guidelines for the design of AMIS

Design of Data Collection and Analysis Process:

Data collection process involves identifying the stakeholders and requirements of stakeholders, identifying resources for data collection, identifying the sources of funding, identifying the process of collecting data, training the resources and testing the quality of data collected. Data Analysis is the process of converting data into information that the stakeholders are looking for.

The following questions help us analyze the data collection and analysis process of AMIS for economic sustainability: *Who is funding the data collection and analysis process? Is there any duplication in the process?*

Who is funding the data collection and analysis process?

Public funding can be justified for extension programs that (1) contribute greater benefits to the public than to program participants, (2) compare favourably with and complement other programs, and (3) distribute public benefits not sufficiently provided through the private sector (Bennette, 1996). Thus, to ensure that there is no bias towards any perceived advantage, the process of data collection and analysis must be funded by the Government. But the data collection and analysis, if performed by government agencies, will be slow and ineffective (Chappman & Tripp, 2003). As suggested by Richard Chappman et al., the solution is to have a private agency which can provide skilled

resources, and be responsible for data collection and analysis. It is also possible to have an autonomous semi-government organization to take up this responsibility.

In India, e-Choupal is a private sector initiative that was setup with a unique idea of developing a business relationship with the farmers by providing them with real-time information on market prices. E-Choupal also eliminated middlemen as farmers can directly sell produce at e-Choupal centres. This is a robust and sustainable effort (Singh, 2006) as the costs of providing the information is borne by the private firm. The value extracted by the middleman is now shared between the farmer and the private agency.

Is there any duplication in the process?

Duplicate efforts in data collection make the process more expensive. AMIS design must aim to remove any of these duplicate efforts. They can be in the form of data collection by different agencies of the government.

As was seen in the case of agricultural extensions in Nigeria, introduction of unified services which link other sectors, made the system more cost-effective by eliminating duplication of efforts (Arokoyo, 2003).

The following questions help us analyze the effectiveness of the data collection and analysis process of AMIS: *Who are the beneficiaries of the service? Who is collecting the data? Are the data collectors sufficiently trained? Are we collecting the data that stakeholders are looking for? How reliable and up-to-date is the information? And how is the data being analyzed?*

Who are the beneficiaries of the service?

It is very important to identify the beneficiary of the project. Target audience must be surveyed and all the stakeholders must be identified. Stakeholders may potentially include the government, the middlemen, the stockists, the transporters, in addition to the farmers. This helps in understanding what information is of local importance and what information is required at the central level. This also helps in classification of current and historic data and methods of data analysis.

Indonesian market information system was setup in 1978 and the success of this project can be attributed to the fact that the planning process was very elaborate and they could very clearly identify the beneficiaries and their needs. They identified farmers as the beneficiaries who were most interested in farm level prices for vegetables (Shepherd A. W., 1997).

Who is collecting the data?

The data collectors must be full time employees solely responsible for the job of data collection. Forcing this job on to government employees as part time work has its own down sides of incorrect information which may result from collusion with traders, or laziness or heavy work load due to their other activities. The data collectors must also be paid for the transportation, fuel and maintenance costs. This will ensure that price reporting doesn't become mechanical. There must also be audits to monitor work of the data collectors so as to remove any bias towards perceived advantage.

Are the data collectors sufficiently trained?

Data collectors must be sufficiently trained to identify and report the right prices. They must also be trained in different data collection formats and calculation of averages. Refresher courses must be offered whenever there is any change in the process. Data collectors must also be trained to convey to the traders in the markets that accuracy of data is important and data is aggregated and that individual level records are not tracked.

How reliable and up-to-date is the information?

Data must be collected from the markets during the peak trading time. Depending on the data being collected, frequency must be determined. Data relating to horticulture crops must be collected more frequently (at least weekly) compared to data related to staple (at least fortnightly). Units of measure used in collecting data must be standardized. The design process must also identify the number of markets that have to be surveyed. This must be an optimal number that provides accurate information with minimum surveys.

The Indonesian market information system had dedicated staff to collect information and they were trained annually. Prices were collected at different timings of the day from different markets from Monday to Friday and the average price was sent for dissemination at the same time everyday (Shepherd A. W., 1997).

How is the data being analyzed?

Data analysis process must take care of processing data and providing the most relevant, current and historic information to the users. The ICTs used in this process must target reducing any delays due to the data analysis.

In the case of South Korea's Agricultural Information Service, data is analyzed for domestic and international agricultural trends, profitability analysis of agricultural and livestock production etc. and all national institutes are integrated into a high speed network to let farmers have the latest information (Singh, 2006).

Design of Information Dissemination Process:

Information dissemination is the process by which relevant information is made accessible to all the stakeholders by means of various information and communication technologies and media. In the case of AMIS, internet technologies in coordination with SMS-enabled mobile technology and media outlets such as newspaper, radio, television and market place black board displays and Public address systems play a major role in the dissemination of information. The quality of information that is disseminated determines the levels of system utilization. Media can be used for marketing these services and training the users. When the perceived value of information increases, system utilization increases.

The following questions help us design the AMIS information dissemination for economic sustainability: *Who is responsible for information dissemination? What are the modes of information dissemination? And what is the revenue model?*

Who is responsible for information dissemination?

Government should take the responsibility of information dissemination process to make sure that market information is a public good, but at the same time, private services must be engaged for effective dissemination of information. Private agencies are more cost effective as they have the incentive of retaining revenues. There is an urgent need to create public-private-community partnerships in agricultural information delivery, sharing and exchange to and between users (Singh, 2006).

What are the modes of information dissemination?

Modes of information dissemination must be decided based on the technologies available locally and their accessibility to the target audience. These modes of dissemination must also be economically sustainable. Here it is not the sophistication of the technology that matters, but the reach to the target audience in the most economic way. Local radio stations providing localized information have proved to be successful in dissemination of information in a very cost-effective manner (Shepherd A. , 2001).

During the design stage, media should be asked about the broadcasting charges and sponsors must be identified to support these broadcasts.

In Zambia (ZAMIS, Zambia Market Information Systems), market information is disseminated by radio stations and to make it economically sustainable, they take the support of local organizations (local bank) in the form of sponsorships. Similarly, in Srilanka, vegetable prices are broadcast through a private radio station and the local fertilizer company sponsors the programme (Shepherd A. W., 1997).

What is the revenue model?

To make AMIS more economically sustainable and at the same time equitable, one has to provide basic information on prices and market conditions (current information) free to all the target audience and the extension services (result of historic data and analysis) must be provided on a pay per use basis. It is important to determine how to price the services and what is the right combination of paid and free services (Dinar, 1996). This can be provided through SMS enabled mobile technology. For example callers can pay for the information through the cost of the phone call.

Market Information systems in many countries, including India, South Korea, Indonesia, Thailand and Vietnam have SMS services through cellular telephones for market prices of agricultural commodities. Many of these systems are commercial and operated by the private sector (Singh, 2006).

The following questions help us design the AMIS information dissemination for effectiveness: *Does the system provide information access to all the target groups? How useful are the extension services that are provided to them?*

Does the system provide information access to all the target groups?

For maximum utilization of information, it is important that information is available to all the people who need it, a proper medium of information dissemination makes sure of access to these services. Also proper marketing and training provided for these services help users utilize the services better. Thus AMIS design must also include modes of marketing and training on these services. Information provided to them must be in the form that they can understand. If it is not understood by all the target audience, then there is scope for information asymmetry where again only some market participants take advantage of the information. One must keep in mind that modes of dissemination of information must be used to cover large audiences and the information going across to them must be consistent. Newspapers and bulletin boards give comprehensive information, but they only cover a literate audience. Radio can be used to disseminate important information and it can be interspersed with analysis of market conditions and opportunities to hold the attention of the audience and it has the advantage of reaching people in their local language. "The reach and access of radio to deprived rural areas makes it an appropriate and powerful tool for development and education in developing countries. The ownership of radio sets among the rural poor is relatively high as compared to other forms of media." (Pavarala, 2008). Community radio can thus be a powerful tool for dissemination of local market and price information.

Nepal and Srilanka have successfully used community radio to broadcast agricultural commodity prices. Kothmale Community Radio is a project aimed at providing information to marginalized communities in Srilanka and the information provided is contextualized and explained to the listeners to increase the usefulness.

How useful are the extension services that are provided to them?

Extension services are the services provided by government departments or university agriculture departments regarding information relevant to farmers. The design of AMIS must target increasing the perceived value of these services. These services must help the target audience make important

decisions. They might include answering specific queries or providing information on crop decisions and advice on pesticides for the farms, transportation issues etc. Some field workers can also be employed to help people interpret the information received from extension services. Mobile phone services are a good means of providing specific information (Davis, 2008).

South Korea's agricultural information service provides customized services to farmers to help them resolve their specific problems. They also offer training courses to farmers and have subject matter specialists to serve as lecturers (Singh, 2006).

The following table summarizes the guidelines for design of AMIS.

Process	Dimension	Question	Ideal Design
Data Collection and Analysis	Economic Sustainability	Who is funding the data collection and analysis process?	Autonomous Semi-Government organization. Funding from Govt and Private agency responsible for data collection and analysis
		Is there any duplication in the process?	Account for any data collection or analysis efforts that can be leveraged
	Effectiveness	Who are the beneficiaries of the process?	Identify all the stake holders and survey the target audience for complete requiremts gathering
		Who is collecting the data?	Full time data collectors. Audits to monitor their performance.
		Are the data collectors sufficiently trained?	They must be trained on what data to collect, how to collect and when to collect.
		How reliable and up-to-date is the information?	Collection of peak trading data. Ideal frequency of data collection to be identified based on the commodity type.
		How is the data being analyzed?	Identify the ICTs required for data analysis and minimize data analysis and transmission time
Information Dissemination	Economic Sustainability	Who is responsible for information dissemination?	Government must take responsibility of the process. Private services to be engaged for effective information dissemination
		What are the modes of information dissemination?	Mode of information dissemination must be economically sustainable and must have maximum reach to target audience
		What is the revenue model?	Provide basic information for free and charge for extension services.
	Effectiveness	Does the system provide information access to all the target groups?	Complete access to all the target groups. Must be easy to use. Training on use must be provided.
		How useful are the extension services that are provided to them?	These services must help target audience take important decisions.

Conclusion:

In this paper we have looked at the information asymmetries in agricultural markets in developing countries and how AMIS helps in reducing these asymmetries. We have specifically focused on small-scale farmers in South Asia. Traditionally, traders had all the information about the markets and prevailing prices. As a result, farmers were marginalized. They could not negotiate with the traders and also could not take advantage of spatial or temporal arbitrage. AMIS provides current and historic information about the market conditions, prices, demand, weather etc. Current information is generally useful for spatial arbitrage and historic information is useful for temporal arbitrage. Analysis of this current and historic data helps in identifying trends which can further help farmers and policy makers in taking decisions on production planning. Availability of information to the market participants empowers the marginal farmers in their negotiations with traders. It also helps them take informed decisions about production. In the case of perishables, farmers benefit from some spatial arbitrage opportunities and in the case of staples, they can take advantage of both spatial and temporal arbitrage.

Socio-political situations limit the effective utilization of market information by the farmers. They have limited outlets for their produce and they are bound by traditional trading relationships with middlemen. These relations are generally due to their dependence on traders for credit or some other local political or social settings. Thus the success of such an information system also depends upon the wider policy environment that prevails in the country. Further research can study and explore how the policies can be framed to remove the socio-political barriers of utilization of this information by the farmers. Specifically the policies on credit, financial inclusion, public distribution and direct-to-market will have a bearing on the utilization of the information from AMIS.

We have seen that the process of providing AMIS to all the market participants in agricultural supply chain involves data collection from the markets and information dissemination to all the stakeholders. We have noted that community radio is a very effective medium for market information dissemination. Community informatics plays a major role in the information dissemination process of AMIS. From development perspective it is also imperative that AMIS must be designed for economic sustainability and effectiveness. We also came up with some guidelines on designing AMIS for economic sustainability and effectiveness while defining the processes for data collection and information dissemination.

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