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BRIDGING THE GAPS IN MARKET INFORMATION ON AGRICULTURAL COMMODITIES: A CASE STUDY OF ASSAM, INDIA

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ABSTRACT

Market Information and Intelligence (MII) is one of the most important inputs in agriculture, essential for the viability of farming as a business. A broad term, MII includes market prices, arrivals, price forecasts, marketing standards and specifications for different commodities and different grades of a commodity information on buyers and can be supplemented with weather intelligence (current weather, weather alerts, and weather forecasts) and advice on package of practices for different crops. Current gaps in Market information and intelligence (MII) in six districts of Assam in north-eastern India, each representing one distinct agro climatic zone of the state, were assessed as a prelude to setting up a Market Intelligence Cell (MIC) as part of the Assam State Agricultural Marketing Board (ASAMB). The study comprised a survey, field visits, stakeholder consultation, and expert opinions. A total of 285 progressive farmers represented the producers of agricultural commodities whereas 62 aggregators, 77 traders, and 77 processors represented the market. Field data were collected using a pre-tested schedule completed through personal interviews. Integrated MII services across the value chains of different commodities are unknown in Assam, and players in the value chain are unconvinced of the potential benefits of such services. Given the erratic and unevenly distributed supply of electricity, any proposed MII service for agriculture in Assam will have to be developed using the mobile telephone network. Quarterly price forecasts of agricultural commodities up to six months ahead and made available in local language will be the most important component of the MII service, which should also include stock arrivals in markets, a database of buyers, standards and specifications related to farm produce, and advice on better farming practices. Aggregators need MII to be updated daily; traders and farmers, weekly; and processors, monthly and these consumers should be charged accordingly. Lastly, it is not enough to set up such a service: to realize its full potential, training and capacity building of all the players in the value chain are equally important.

***KEYWORDS**: Market Intelligence, Prices, Forecast, Farmers, Aggregators, Traders, Processors*

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INTRODUCTION AND BACKGROUND

The application of market and weather intelligence to agriculture is not a new concept: studies have shown that most farmers have access to a variety of traditional information sources (TV, radio, newspapers, other farmers, government agricultural extension services, traders, input dealers, seed companies, and neighbours and relations), which they use regularly for relevant information (NSSO, 2005). These traditional sources played an important role in India's green revolution in the 1970s and 1980s. Radio broadcasts were initiated in the late 1950s and early 1960s. *Krishi Darshan* ('Glimpses of farming' is a near-enough translation) was the first television-based programme for farmers, which was launched in the 1960s on India's national channel. Many new television and radio programmes for farmers were launched in the 1990s. Although farmers continue to access such programmes, few attempts have been made to quantify the impact of such programmes.

Because the programmes were meant for a mass audience spread over the entire region where the language in question was spoken, their content was generic and mostly focused on major innovations and technologies. Evolution of the community radio was a step forward because it allowed dedicated transmissions tailored to much smaller groups. In India, tele-centres or telephone help-lines were also set up by the state but had only limited impact owing to the sparse and unreliable telephone network in rural areas and in adequate access to experts, although later developments such as phone-in programmes and proliferation of mobile phones improved communication to some extent.

As information and communication technologies (ICTs) improved, more ICT-based extension services were launched. Such projects and entities as 'ATMA' (Hindi for soul, and short for Agricultural Technology Management Agency), e-sagu, and e-choupal proved the potential of ICTs and were soon followed by mobile phones and web portals to deliver information to farmers.

Armed thus with the latest market information (MI), farmers can get higher returns for their produce and avoid distress sales. Information thus makes markets more efficient by lowering search costs, transaction costs and improving price realization. Information on prices is particularly useful because it strengthens the position of farmers in their negotiations with traders and helps in reducing arbitrage fees, waste and spoilage of farm produce.

CONTEXT AND A REVIEW OF LITERATURE

Context

Agricultural development in Assam, as elsewhere, has focused on increasing productivity through high-yielding varieties, application of fertilizers, crop diversification, and farm mechanization. On the other hand, the development of markets and marketing system has been ignored. Increased arrivals, rising population, greater awareness and literacy, and rising incomes and consumer demand have fuelled growth but farmers have been unable to reap the benefits for want of an efficient marketing system. The major challenges to an efficientagri-marketing system for Assam are briefly discussed below.

Multiple Pieces of Legislation: Three overlapping acts are relevant to agricultural marketing in Assam, namely the Assam Agricultural Produce Market Act, 1972; the Assam Panchayat Act, 1994; and the Assam Municipal Act, 1956. However, the Government of Assam is currently in the process of repealing the Assam Agricultural Produce Market Act, 1972 to bring in the new Assam Agriculture Produce and Livestock Marketing (Promotion & Facilitation) Act, 2020,which has been drafted on the lines of a model Act circulated by the Government of India in April 2017. The three essential

features of the new Act are (1) a single-point market fee, (2) a single unified license across the state, and (3) an electronic marketplace (electronic auctions and electronic trading) to reap the benefits of the e-NAM scheme (e-NAM, short forelectronicnational agriculture market, is an online trading platform for agricultural commodities in India).

Poor Rapport with Farmers: Agricultural and horticultural produce in Assamis sold through 1140 rural weekly, biweekly, or daily markets, of which 405 are primary wholesale markets and735 are retail markets. Besides these, are the markets run by town committees, district councils, etc. However, none of the mechanisms has managed to establish a strong rapport with local farmers.

Lack of Centralized Control: At least 60% of the agricultural and allied produce in Assam is sold through weekly markets in villages, and the market committees (MCs) under the Assam State Agricultural Marketing Board (ASAMB) have no control over them. These rural markets are poorly organized and managed, wherein the lessee collects arbitrarily set fees from sellers as well as buyers but offers little by way of infrastructure. This indirectly contributes to lower earnings for farmers.

Multiple Levy of Cess: The Assam Agricultural Produce Market Act, 1972, and the rules framed under the act, have aggravated the problem of multiple levies imposed by the regulated market committees (RMCs). Neither the Marketing Board nor the RMCs have been able to set up robust MI systems or develop the required infrastructure or to launch market-led extension services.

Inaccessible Markets: Although farmers in Assam have sufficient market surplus and71% of them live close(5 km or less) and 22% live fairly close (within 5–10 km), physical access to a market is constrained by poor roads, scattered production, and high transport costs. In many areas, rural markets are often waterlogged and become inoperable.

Insufficient Price Information: Farmers get to know the current price for a given commodity mostly through word of mouth, which is not a particularly reliable channel. Lacking this crucial information, farmers often settle for a low price. An efficient market and weather intelligence system is yet to be set up in Assam, and historical price data is not available.

Low Prices: The most serious problem faced by producers is un-remunerative price for their produce. Transactions within and out of market yards or market premises are personal negotiations rather than open auctions or any other fair and transparent method. The low prices offered for produce area constraint to profitable farming in Darrang, Cachar, Nagaon, and Karbi-Anglong districts. Also, natural disasters such as floods substantially increase the cost of marketing.

Poor Infrastructure: Development of the market for farm produce in Assam over the last ten years has been slow, and weekly markets have been the norm for the last 50–60 years. The marketing system – if there is one – is in dire need of improvement, especially in terms of infrastructure and market network and channels to enhance the opportunities of marketing farm produce.

Lack of Maintenance & Electricity: About 30% of the markets spend nothing on maintenance or on providing facilities, and the remaining 70% of the markets spend no more than 10,000 rupees a year. The income from a market (through a cess or a levy imposed on buyers and sellers, for example) is not ploughed back for the development of market yards but used for meeting other unrelated expenses of the municipality or the panchayat (the local government). A major shortcoming in market infrastructure throughout the state is lack of electricity or its erratic and unreliable supply. Because

most markets function in the evenings and continue well into the night, sellers have to use gas or kerosene lamps or diesel-powered generators, which add to the cost on the farmers (NIAM, 2012).

High Commissions Paid to Intermediaries: The farmer's share in the price paid by the consumer varies from 38% to 56% whereas the profit margins of wholesalers range from 11% to 16%. The wholesalers maintain that their margin must be related to the risk they bear and the cost they incur on marketing. The risks include physical losses and fluctuations in demand and in the price. The retailers have the highest margins, ranging from 7% to 24%, and justify their share by pointing out the higher physical losses especially in vegetables because of the long time spent in transit and on completing the formalities involved in clearing the goods through various channels (NIAM, 2012)[1].

Unauthorized Intermediaries: In rural and primary markets, unauthorized intermediaries or agents of buyers outside the district operate as buyers. They neither maintain any documents nor issue any receipts, and their negotiations are traditional, non-transparent, and coercive.

Review of Literature

The success of MII initiatives largely depends on sources, channels, accuracy and timeliness, and customization and responsiveness. In the present study, the point of generation of usable or critical information and intelligence is taken as the source, and the medium of transmission of MII as the channel. Any MII will be useful to recipients only if it is timely and accurate. Similarly, agricultural MII should be responsive to the current and changing needs of farmers and other players in the value chain. In this respect, the methods of MII can be categorized into those based on the push approach and those based on the pull approach. Mass transmission of MII without any opportunity for the recipients to communicate with the providers of information – a one-way street as it were – illustrates the push approach where as in the pull approach, the recipients can contact the providers of information for any follow-up questions, clarifications, or any specific information or advice. This system gives a farmer the option to subscribe to a given type of information service, which will be offered to subscribers through the short messaging service (SMS), voice calls, or any other appropriate app available for smart phones. As with television channels, farmers will have the option to subscribe to additional services or discontinue any of the existing services.

Benett (1964)sounded a note of warning to the providers and the users of market intelligence, namely that a grave responsibility rests on those who provide such a service to ensure that the published prices are accurate and accurately reflect the events in the markets concerned.

Swaminathan and Sivabalan (2016) reported that an efficient market intelligence service is essential to the agricultural sector as a whole and for small and marginal farmers (those with landholdings of 2 ha or smaller) in particular. Inasmuch as it provides outlets and incentives for increased production, Market Intelligence (MI) contributes greatly to bringing the advantages of commercialization to subsistence farmers. Failure to develop MI is likely to negate most of the efforts of the state to increase agricultural production. Marketing excellence is the result of appropriate marketing decisions, and all such decisions are based on MI.

Mittal and Mehar (2011) reported that that the mobile phone is increasingly proving to be an efficient and cost-effective means of transmitting MII. The results from a study carried out in India by the researchers at International Maize and Wheat Improvement Center (known commonly by its Spanish acronym CIMMYT) in 2011 are reproduced in Table 1.

[1]Market study of Agri & Horti products in Assam, National Institute of Agricultural Marketing (NIAM), Jaipur

Table 1: Topics on which Information is Obtained by Farmers through Mobile Phones

State	Proportion of Farmers (%) using Mobile Phone for			
	Agricultural Information	Better Connections to Markets	Better Prices	Higher Yield
Bihar	51	99.2	65.9	21.1
Haryana	65	99.4	79.5	42.9
Punjab	26	77.8	82.5	49.2
Uttar Pradesh	45	69.7	69.7	29.4
West Bengal	17	5.9	48.8	34.1
Average	**41**	**87.2**	**71.7**	**34.6**

Kumar *et al.* (2018) showed that agricultural information is crucial to agricultural development as well as for improvement in the livelihoods of farmers. Farmers use a combination of formal and informal sources of information. More than 90% of farmers reported that they access information from other farmers in their own village or from neighbouring villages. Farmers use multiple sources of information because no one source gives them complete information, nor do they trust any one source completely. Almost everyone (99%) of the farmers surveyed in the study by Kumar *et al.* (2018) said they had access to a mobile phone but only 1%saidthat they accessed agricultural information – mainly on prices of farm produce – through the Internet. The supply and targeted delivery of agricultural information to small and marginal farmers remain a challenge to extension programmes. The overall lack of extension facilities and inadequate access to agricultural inputs are the major constraints that farmers face in making full use of information. However, ICTs help farmers to be better informed. Using ICTs, farming can obtain higher yields, reduce their cost of production, and get a better price for their produce. Thus ICTs play a key complementary role in establishing a link to conventional information sources and thereby bridging the information gap or correcting information asymmetry. This approach can be strengthened by establishing more agri-clinics, which are privately run but subsidized through public funds and staffed by trained individuals and help in creating a competitive environment for sharing agricultural information.

Kandpal (2013) proposed that MII are crucial for enabling farmers and traders to make informed decisions on what to grow, when to harvest, which markets to choose for the produce, and whether to sell it soon after the harvest or to store it and await better prices. The most important item of MI for a farmer is price, although most farmers even today do not know how to use it to guide their production and marketing decisions. All states in India depend on interstate trade for major agricultural and horticultural commodities, and dissemination of MI (demand, production, and prices) is vital to the functioning of the nationwide market because it harmonizes the competitive marketing process. By helping ensure that produce goes to markets where it is in demand, information shortens marketing channels and cuts down on transport costs and helps to ensure that each marketing transaction is a fair one and that all participants share the risks and benefits. Recent advances in ICT shave made it easier to provide farmers with the information they need. However, farmers may not benefit from that information if the system is poorly managed or not designed for their needs. It is not enough to collect information: it has to be disseminated in a form accessible to farmers and adopted to their needs—and the existing agricultural market information services in India are often found wanting in one or more aspects. For instance, although farm-related information is available through the radio, TV, and newspapers, there is no mechanism to analyse, interpret, and convert that vast volume of information into simple, comprehensible trade intelligence, a farmer-friendly and easily accessible market intelligence system. At present, AGMARKNET is the largest network in India to provide real-time information by connecting major regulated markets across the country.

Fafchamps and Minten (2011) studied the Reuters Market Light (RML) model in Maharashtra and found that price information could help farmers if spatial arbitrage across agricultural markets is abandoned because markets are disorganized, segmented, or too thin to attract a steady flow of buyers or because sellers have a comparative advantage in transport, as reported by Jensen (2007). Even in such a case, price information is likely to be used first by traders, as documented for instance by Aker (2008). Price information could also help farmers who sell at the farm gate, such as the coffee growers in Uganda studied by Fafchamps and Hill (2008). A stronger effect on crop quality may be obtained if prices vary with the variety or the grade and if farmers are shown how to produce premium varieties and grades. These suggestions should help to steer policy intervention towards regions and markets where the effect of price information may be beneficial and to avoid wasting resources on markets where it is unlikely to matter.

Selvaraj and Chinnadurai (2018) reported that farmers can get a better price if they are empowered by giving them information on marketing of produce and on inputs as well. Their study of 120 farmers in Dharmapuri and Krishnagiri districts in Tamil Nadu in India showed that the use of MII was significantly influenced by a farmer's age, education, financial capacity motivation, and intention. The use of MII in agriculture increased employment by about 25%, total income by 26.5%, created new assets, promoted savings, increased consumption expenditure and also had the potential to increase profits and improve the farmers' standard of living. However, farmers need to be trained in obtaining market intelligence and profiting from it.

Johnson *et al.* (2010) found that sources of market intelligence and the type of information collected by small agribusinesses are closely related. Sources meant for the industry in general, such as press articles in trade press, tend to provide broader, but not necessarily less valuable MI. In contrast, more exclusive sources such as personal contacts provide information that is relevant only to a particular agribusiness. Their study also demonstrated that not all sources are equally used or valued. A particularly interesting finding in this context was that decision-makers appear to gravitate to their own networks of contacts, probably because social networks offer feedback that allows the decision-makers to know if their interpretation of the obtained MI was correct and thus to lower the risk associated with using that information.

Desai and Solanki (2013) examined the extent to which market intelligence was used by those who grow summer cabbage in Sabarkantha district of Gujarat. The researchers found that the high price during summer was what had prompted farmers in Sabarkantha to grow cabbage in summer. Nearly 80% of the respondents showed medium to high levels of overall adoption of market intelligence. More than half had chosen to grade their produce and had used the accepted ways of transporting and marketing it but only a few had tried to estimate the demand, to find out the selling price, and to use proper packaging.

Shinde (2018) proposed that agricultural market intelligence helps to ensure that produce reaches those markets where it is most in demand. Thus market intelligence shortens marketing channels, lowers transport costs, helps to ensure fair and transparent transactions, and makes all the participants share the risks and the benefits.

Shrivastava *et al.* (2019)supported the hypothesis that besides improved methods of production, widespread availability of MI can contribute substantially to raising the income of farmers. The authors therefore emphasized the need for a comprehensive system to obtain, connect, transform, and analyse relevant data from different ministries, departments, and other entities across the country to generate precise, appropriate, and timely MI.

Shrivastava *et al.* (2019) also designed and implemented a market intelligence system as a proof of concept using available datasets for a few agricultural commodities. The system takes daily market price and weather data as inputs,

transforms them into information, and generates actionable intelligence by applying forecasting and deep-learning techniques. The system provides trend analysis, short-term as well as long-term predictions of commodity prices, and suggestions on suitable markets as insights for farmers. The auto regressive integrated moving average (ARIMA) forecasting technique was used for short-term predictions and the recurrent neural network (RNN) deep-learning techniques for long-term predictions.

Christopher *et al* (2020) explored the contribution of information and communication technology (ICT)-based information sources to market participation among smallholder livestock farmers. They inform that while use of ICT-based market information sources significantly influenced market participation, the effect of using ICT-based information sources on the intensity of market participation was not significant. Other variables shown to influence both market participation and the intensity of market participation were age, additional income and membership of farmer cooperatives. Therefore, market interventions should consider the target group of farmers based on these factors.

APPROACH AND METHODOLOGY

The present study used a survey, field visits, stakeholder consultations, and expert opinions to gather the relevant material. Six (undivided as on 1st April, 2016) districts out of the 33 that make up the north-eastern state of Assam were chosen for the field work, each representing one of the six agro climatic zones into which the state is divided. The study was designed to cover all major segments of the agricultural commodity supply chain with special attention to the value chain components. The training programmes on good agricultural marketing practices conducted between January and March 2019 by the RMCs under ASAMB were leveraged as a suitable platform for collecting the required information.

A stakeholder consultation was organized in the initial phase of the study i.e. on 2nd March 2019 at Guwahati. The Consultation witnessed participation of more than 50 stakeholders. Among others, the consultation was attended by leading players in the market and weather intelligence space including the National Commodities and Derivatives Exchange (NCDEX), Skymet Weather Services, National Institute of Agricultural Extension Management(MANAGE), India Meteorological Department (IMD), Crop in Technology, and selected traders, processors, and farmers. Views of the stakeholders that emerged during the consultation as well as relevant suggestions and feedback were incorporated into the study.

Respondents for the study were selected using simple purposive random sampling from six districts, namely, Karbi Anglong, Cachar, Jorhat, Kamrup, Nagaon, and Sonitpur. The respondent's comprised 285 farmer-producers, 62 aggregators, 77 traders, and 77 processors, chosen at random but ensuring that each district was adequately represented. Roughly 50 farmers from each district were chosen at random from the lists of progressive farmers furnished by the district agriculture officers, the Assam State Warehousing Corporation, and RMCs. The study area is shown in figure-1.

Field data were collected using a pre-tested questionnaire, which was completed during personal interviews with respondents.

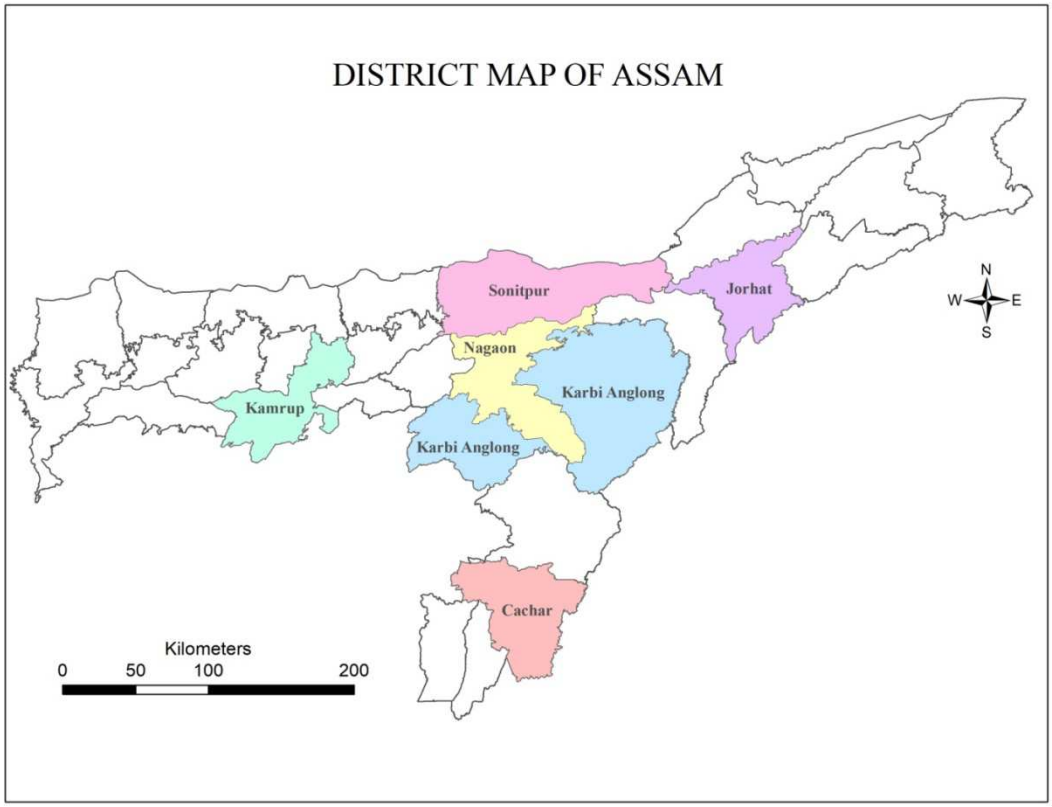

Figure 1: Study Area (Districts in Color Represent the Study Area).

RESULTS AND DISCUSSION

The findings from the field survey, the stakeholders consultations, interviews with respondents, and so on are presented below and discussed with reference to the(1) extent and quality of MII services provided by different agencies, (2) the MII services that farmers and other players in the value chain require, (3)different sources of information used by different categories of stakeholders, (4) constraints in obtaining and using information, and (5)the existing gaps between what is available and what is required.

Market Information and Intelligence Services Currently Provided in Assam

Lack of MII especially that on the price and quantity of farm produce, has emerged as one of the serious impediments to the development of an efficient marketing system in Assam. Although market news is disseminated by the mass media, the information is too general and not used by farmers—who need to be trained in using MI to take decisions related to selling their produce. Extension services related to marketing also need to be developed; such services will advise farmers not only on ways to minimize marketing risks but also on how to use market information for planning, production, harvesting, and marketing. Such services are equally needed by other players to help them to take optimal marketing decisions. The availability and dissemination of accurate and complete marketing information is therefore the key to operational and price efficiencies in a marketing system.

At present, MI about arrivals of agricultural commodities in the market and about their wholesale prices is collected by the ASAMB and RMCs and uploaded daily on the national portal (http://agmarknet.gov.in) as well as on the board's own website (http://asamb.assam.gov.in). In addition, market profiles are prepared based on market survey reports and uploaded on Agmarknet's and the board's websites so that they are publicly available. The profiles include general

information, market committee administration, staff, connectivity, market area, arrivals and dispatches of ten major commodities, the numbers of licensed wholesalers and other functionaries of all categories including cooperatives, facilities, and services including transport and storage, market changes, and financial position. However, given the poor connectivity and lack of electricity in villages, farmers cannot access this information.

Although the by-laws of the ASAMB provide for contracting out to All India Radio the broadcasting of educative talks on regulated markets, grading of produce, and marketing information from time to time, radio broadcasts as a source of information are steadily losing their popularity and are not of much help to farmers. The by-laws also provide for regular announcements of prevailing market prices of agricultural commodities using loudspeakers in local markets, principal markets, and other markets.

In addition, market functionaries and other players in the value chain are also being trained in Good Agricultural Market Practices (GAMPs) as part of the Assam Agribusiness and Rural Transformation Project (APART) financed by the World Bank. In each project district, three such training programmes were organized in 2018–19 and two are to be organized in 2019–20. The trainers were mostly market committee officials who themselves have been trained as trainers on GAMPs. The topics covered in these and similar programmes include the following: MII, ingredients of price discovery, designing of systems for efficient price discovery, quality assessment, challenges and solutions, post-sale processes, market operations, warehouse receipts, electronic pledging and funding of produce, market integration, alternative market channels, demand and supply aggregation, market linkages, grading and standardization, inspection and quality control, labelling, marketing standards, primary processing, auction and its types, scientific storage, warehousing, and packaging. However, given the poor physical facilities and infrastructure in most of the agricultural wholesale markets in Assam, many of these concepts are not operational on the ground and rarely find practical applications.

Market information is also being disseminated through Buyer–Seller Meets (BSMs) organized under APART: 16 such BSMs were organized in 2018–19 and another 16 are to be organized in 2019–20.The aim of these BSMs is to bring together the buyers and sellers of agricultural commodities on the same platform and to provide a learning platform to buyers on the quality, quantity, and probable prices and to sellers on the specifications and standards required by the market. Extension machinery can help farmers in choosing the right inputs including improved varieties, the time of sowing or planting, and crop operations and also help in carrying out primary processing to match the produce to requirements of the market.

However, most of the above initiatives are only recent, few and far between, and a great deal remains to be done, including bridging the gaps in MII.

Moreover, it may be noted that a large proportion of marketable surplus (60%–70%) is sold at the village level or at the farm gate, a practice that raises the problem of access to information on prices (farmers need to know the competitive price their produce fetches in large markets) because these transactions at the local level take place in a non-competitive setting with information asymmetry skewed in favour of buyers. Specifically, about 70% of the commercial produce – crops such as jute and mesta (hemp or kenaf, *Hibiscus sabdariffa*) – out of almost the entire marketable surplus, 40% of paddy out of about40% of marketable surplus, and 50% of pulse crops out of 60% of marketable surplus are sold either at the farm gate or at traders' premises directly. In unregulated markets, trading volumes are low, with many sellers and fewer buyers. Although regulated markets clearly spell out the rules of price discovery, traders in these markets show collusive tendencies, which works against a fair price being discovered and lowers the returns to farmers from such markets.

Most of the information on agricultural marketing is disseminated and shared among the value chain players including farmers through informal means. Although 40% farmers were aware that transport cost should be considered in determining the market price, this is seldom done in practice, and 20% farmers insisted on prices based on the cost of production. About20% farmers, however, said they depended on fellow farmers and traders in deciding the price and in choosing the market in which to sell. Only 10% of the farmers acquainted themselves with the ruling market prices for their produce before marketing their produce. Fellow farmers are the predominant source of information for most farmers in Assam, and more than 60% of the farmers were not able to arrive at a firm price for their produce.

Market Information and Intelligence Required by Stakeholders

Before providing information to farmers, it is essential for the providers to know the information needs and information-seeking behaviour of farmers. The most important item of marketing intelligence the farmers need is price. At the same time, it is vital to know the channel through which the information and intelligence provided would have the most impact.

Need for Market Information and Intelligence: Most farmers fail to realize that they do not need MII services, nor do they know what other information would be useful to them to make farming profitable. Even if they know what information they need, they do not know how to go about obtaining that information. However, once the likely benefits of MII were explained to them, they realized that they needed MII. This ignorance of the relevance and the worth of MII was the result of many factors including (1) limited availability of MII, (2) poor access to MII,(3) limited reach of the existing information services, (4) lack of a price forecasting system, and (5) limited capacity to understand and use market intelligence. The major sources of information for farmers were the mobile phone, family members, neighbouring farmers, farmers' organizations, and TV and newspaper. Most respondents sought information informally. These findings underscore the need to make farmers aware of the benefits of timely information and to train them in obtaining such information from reliable sources.

Type of Information Required: Different categories of players in the value chain differed in the information they required, as shown below.

Information Required by Farmers: A majority of farmers (52.28%) required information on the likely price of a given commodity in the next six months in nearby markets (Table2). The other topics on which they sought information were Package of Practices (PoP) recommended for a given crop (34.04% of the farmers),current prices in the local market (6.67%), prices paid by aggregators (3.86%), and weather related(3.16%).The other topics included crop varieties suited to particular seasons and locations, availability of seed, fertilizer doses, methods of field preparation, crops tolerant to floods, management of pests and diseases and especially their identification and the choice of appropriate crop protection chemicals, and post-harvest management. The farmers also wanted to know the price likely to be offered by aggregators in advance, to decide whether to sell to the aggregator at the farm gate or to take the produce to the market for sale. In addition, some farmers also wanted to know the prices offered by processors to get some idea of theprice spread and price escalation along the value chain.

Table 2: Items of Information Required by Farmers before each Crop Season

Information Required	No. of Farmers	% of Total
Price of commodity in next 6 months	149	52.28
Package of practices	97	34.04
Local Market price	19	6.67
Aggregators price	11	3.86
Weather information and others	9	3.16
Total	**285**	**100.00**

Information Required by Aggregators and Traders: The aggregators in the study wanted to know the current stocks and inventory available with the farmers and in the market (43.55% of the aggregators), local market price (43.55%), and the likely price six months ahead (12.90%) (Table3), whereas the traders were more interested in local market prices (67.53%), current stocks in the market, and likely price six months ahead (32.47%) (Table 4).

Table 3: Items of Information Required by Aggregators before Aggregating a given Commodity

Information Required	No. of Aggregators	Percentage of Total
Local market price	27	43.55
Current stock and inventory	27	43.55
Price of a commodity in next six months	8	12.9
Total	**62**	**100**

Table 4: Items of Information Required by Traders before Buying a Commodity in the Market

Information Required	No. of Traders	Percentage of Total
Local market price	52	67.53
Price of commodity in next six months	25	32.47
Total	**77**	**100.00**

Information Required by Processors: Lastly, the processors were interested in the historical price data so as to forecast the prices on their own. The processors also wanted to know the commodity prices in local market, likely prices six months ahead, current stocks and inventory, and the demand for their final (processed) product or products. These finding are depicted in table 5.

Table 5: Items of Information Required by Processors

Information Required	No. of Processors	Percentage of Total
Historical price data	29	37.66
Demand for final (processed product)	19	24.68
Likely price six months ahead	18	23.38
Local market price	9	11.69
Current stock & inventory	2	2.60
Total	**77**	**100.00**

Preferred Channels, Media and Channels: The most preferred channels were mobile phones, TV, newspapers, and radio. It is important to distinguish the source from the channel. For example, the mobile phone has been classified in the present study as a channel or a tool for transfer of information and not a source of knowledge: the source of information is the point of origin of that information. It is worth highlighting here that nearly all farmers (99%) owned a mobile phone; however, only 52% owned a smart-phone. Although SMS and voice-based content can be transmitted effectively even through basic mobile phones or feature phones, app-based solutions require a smart phone. The implication is that the mobile phone can be a suitable tool to deliver customized and timely information if the way in which such information is delivered matches the capabilities or features of the handset or the receiving device.

The World Bank's independent evaluation group made the following observations (1) Farmers who regularly connect with extension staff are more likely, and earlier than others, to adopt improved technology. (2)Progressive farmers connect to extension agents faster than do other farmers. (3) The technology that provides returns quickly is accepted quickly and its use is more widespread (Mittal and Mehar, 2012). If these three observations are equally valid to the current study, modern mobile phone can be an efficient tool to get non-progressive farmers connected to extension information and to make them adopt improved methods faster. This possibility is supported by the findings of a study by CIMMYT (2012) that most of the smallholders(respondent farmers) reported greater convenience and savings as a result of using mobile phones to seek information on such topics as availability of inputs and market prices.

For the mobile phone to be used as an effective channel, the information to be transmitted has to be formulated, customized, and written or recorded in the local language. The transmission mechanism requires appropriate infrastructure; an agency to source, develop, and manage content; and a helpline for two-way communication. The perceived benefits of various items of information vary with the region, crop, infrastructure, and socio-economic status of farmers and will accrue only if farmers act on such information.

The mobile phone can be used in three ways to transmit MII: (1) as text messages, (2) as voice messages, (3) through apps. Whereas text and voice messages can be received through even a basic device (handset), app-based information requires a smart phone. Although most farmers who owned a basic phone wanted both text messages and voice calls, they preferred text messages (in local language) because they could be referred to later and at the receiver's convenience. For the service provider, the problems are translating and transcribing the text messages into the local language, fitting the content within limited space (normally no more than 160 characters), and compatibility between the script of the local language and the handset's display abilities—assuming that the farmer is literate. Although voice messages may be free of such constraints, they are more expensive to deliver, the reception is usually poor (especially in the case of mass delivery at a pre-defined time), and retrieving the information subsequently could be difficult for farmers.

The benefits of using mobile phones, especially in the form of better prices, was demonstrated by Aker (2008) and Muto and Yamano (2009) but such benefits were more evident in the case of commodities or regions where information asymmetry in terms of price was very high or where the markets for specific high-value commodities were not well developed, *a situation similar to that in Assam*. Mobile phones can lower these costs, thereby lowering the transaction costs substantially and enabling greater farmer participation in commercial agriculture (De Silva and Ratnadiwakara, 2008).

Channels, Media and Tools used by Farmers: It was observed that27.02% farmers used newspapers as the primary channel; 15.44% farmers used the mobile phone as a primary tool, but in combination with other channels such as TV and the Internet; the same proportion used the radio; another 15.44% farmers used radio is the primary channel. Mobile phone alone is used by around 13.44 % farmers. TV alone is used by 8.77% farmers and only about 4.91% of farmers used TV as the primary channel, to access MII (Table 6). Newspaper alone is used by 5.26% farmers; similarly radio alone is used by 5.26% farmers. Other channels are used by 4.56% farmers. These proportions indicate that the mobile phone and newspapers together with other channels will be the most suitable means of disseminating MII in Assam.

Table 6: Channels, Media & Tools used by Farmers to Obtain Market Information and Intelligence

Media, Channels, Tools	No. of Farmers	Percentage of Total
Newspaper and others	77	27.02
Mobile and others	44	15.44
Radio and others	44	15.44
Mobile phone alone	38	13.33
TV alone	25	8.77
Newspaper alone	15	5.26
Radio alone	15	5.26
TV and others	14	4.91
Others	13	4.56
Total	**285**	**100**

Media, Channels, and Tools used by Aggregators: The mobile phone was the primary tool used by 53.23% of the aggregators to access MII; TV/ radio, by 30.65%; and newspapers, by 16.12% (Table 7).

Table 7: Media, Channels and Tools used by Aggregators to Obtain Market Information and Intelligence

MII Tool	No. of Aggregators	Percentage of Total
Mobile phone	33	53.23
Radio/TV	19	30.65
Newspapers	10	16.12
Total	**62**	**100.00**

Media, Channels, and Tools used by Traders: Nearly half of the traders who were interviewed used mobile phones for accessing MII, followed by around 37% who used TV and radio and then by about 14% who used newspapers for the purpose (Table 8).

Table 8: Channels used by Traders to Obtain Market Information and Intelligence

MI Tools	No. of Traders	Percentage of Total
Mobile	38	49.35
TV and radio	28	36.36
Newspaper	11	14.29
Total	**77**	**100.00**

Media, Channels, and Tools used by Processors: Most of the processors (94.81%) used mobile phones and internet to obtain MII whereas the rest (5.19%) depended on TV, radio and newspapers (Table 9).

Table 9: Channels used by Processors to Obtain Market Information and Intelligence

Tools	No. of Processors	Percentage of Total
Mobile & internet	73	94.81
TV, radio and newspaper	4	5.19
Total	**77**	**100.00**

Sources of Information

The sources from which the different categories of people involved in marketing farm produce in Assam showed some overlap but the categories differed in the relative importance they placed on those sources.

Sources of Information used by Farmers for Knowing Commodity Prices: In general, small and marginal farmers had access to fewer sources of information than medium and large-scale farmers did. Farmers use multiple sources of information because no single source gives them complete information nor do they trust any one source completely (Kumar *et al.*, 2018). Farmers who access MII through recommended sources were shown to be better connected to markets than those who were dependent on scattered sources instead of a specialized source (CIMMYT, 2011). In the

present study, nearly 60%of the respondent farmers said that for them, other players in the value chain were the primary sources of information on commodity prices prevailing in a particular market. This source was followed by fellow farmers, who were named as the principal source by 35.09% of the farmers, whereas there maining 5.26% mentioned government agencies, agriculture workshops, etc. as their sources of information (Table10).

Table 10: Farmers' Sources of Information on Commodity Prices

Source	No. of Farmers	Percentage of Total
Other value chain players	170	59.65
Fellow farmers	100	35.09
Govt. agencies, agriculture workshops etc.	15	5.26
Total	**285**	**100.00**

Sources of Information used by Aggregators: The aggregators were requested to name their primary source of information on the availability of a commodity (including its quantity) in an area. Slightly less than half (46.77%) of the aggregators named their fellow aggregators; 38.71% named dealers in agricultural inputs as the source; and 14.52% said they obtained such information from other sources such as government officials (Table 11).

Table 11: Aggregators' Sources of Information on Availability of Commodities

Source of Information	No. of Aggregators	Percentage of Total
Fellow aggregators	29	46.77
Input dealers	24	38.71
Others- Govt. officials	9	14.52
Total	**62**	**100.00**

Sources of Information used by Traders: The traders differed in the sources they used depending on the kind of information. For information on *arrivals* of commodities to the market (Table 12), fellow traders were the most common source, mentioned by more than two-thirds (68.83%) of the traders, followed by other players in the value chain (20.78%) and government officials, typically market secretaries in the case of regulated markets (about 10.39%). For information on *prices* (Table 13), the corresponding proportions were other players in the value chain (62.34%), government officials (35.06%), and other sources (2.60%).

Table 12: Traders' Sources of Information on Arrivals of a Commodity in the Market

Source of Information	No. of Traders	Percentage of Total
Fellow traders	53	68.83
Other value chain players	16	20.78
Govt. agencies	8	10.39
Total	**77**	**100.00**

Table 13: Traders' Sources of Information on Commodity Prices

Source of Information	No. of Traders	Percentage of Total
Other value chain players	48	62.34
Govt. agencies	27	35.06
Other sources	2	2.60
Total	**77**	**100.00**

Sources of Information used by Processors: The market itself, through market functionaries, was the main source of information used by processors to find out details of arrivals and prices of raw materials of interest to them in the market (Table 14): for a little more than two-thirds (68.83%) of the processors, this was the source of choice; local traders were the trusted source for 18.18%, followed by other processors (10.39%) and government agencies (about 2.60%)

Table 14: Processors' Sources of Information on Arrivals and Prices of Raw Materials in the Market

Source of Information	No. of Processors	Percentage of Total
Market (functionaries)	53	68.83
Local traders	14	18.18
Other processors	8	10.39
Govt. agencies	2	2.60
Total	**77**	**100.00**

Constraints in Obtaining and using Information

Major constraints in accessing information were insufficient availability and low reliability of information, lack of awareness of information sources, untimely supply of information, low ICT literacy, lack of appropriately packaged information products in the local language, and disinclination to use information available on the Internet. None of the providers of MII who attended the stakeholder consultation had an Assamese version of their text-or voice-based offerings as of March 2019.Moreover, information on most of the portals was not being regularly updated. The constraints more specific to different categories of stakeholders are briefly discussed below.

Constraints Faced by Farmers: When asked about the challenges they faced in obtaining MII, most farmers (nearly 90%) said that there were none, probably because they did not realize the importance of MII. Further probing revealed the following challenges:(1) lack of a suitable channel to access MII, (2) lack of information from other players in the value chain such as traders and aggregators, (3) poor connectivity, (4) lack of skill in using the Internet, and (e) lack of information from government agencies.

Constraints Faced by Aggregators: All the aggregators save one said they faced no challenge in availing MII, and one aggregator declined to respond.

Constraints Faced by Traders: The traders too said they faced no challenges in obtaining MII, probably because very little actual MII is available at present, and no major agency in Assam supplies such information.

Constraints Faced by Processors: Nearly 90% of the 77 processors said they faced no challenge in obtaining MII. However, two of them mentioned dependency on traders for MII as a challenge; three said that it was lack of correct information and intelligence; and only one said that verifying the information received from traders was a major challenge. Two processors also pointed out that commission agents were a severe constraint in obtaining MII. These findings are depicted in table 15.

Table 15: Constraints Faced by Processors

Challenge	No. of Processors	% of Total
No challenge	69	89.61
Dependency on traders	2	2.60
Lack of correct information and intelligence	3	3.90
Verifying the information received from traders	1	1.30
Commission agents- a severe constraint	2	2.60
Total	**77**	**100.00**

To conclude the section on what the difference players, particularly farmers, need as MII, it is apparent that farmers have varied needs. Farmers find information to be scarce as well as inaccessible; if farming is to prosper, farmers should have access to well-organized, relevant, and customized information and appropriate facilities to make use of that information.

Existing Gaps in the Market Information and Intelligence Services

None of the items of information that the stakeholders said they need is currently available to them: whether it is feasible for the proposed market intelligence cell to supply those items is indicated in Table 16.

Table 16: Key Items of Information Required by Different Categories of Stakeholders and the Feasibility of Supplying those Items

Key Item of Market Information and Intelligence Required	Feasibility of Providing Required Information through MIC
Farmers	
Likely price of a commodity in next six months	Yes
Current price in local market	Yes
Price offered by aggregators	May be
Price offered by processors	May be
Weather	May be
Package of cultivation practices	Yes
Post-harvest management	May be
Aggregators	
Current stock and inventory	Yes
Current price in local market	Yes
Likely price of a commodity in next six months	Yes
Traders	
Current price in local market	Yes
Current stocks in the market	Yes
Likely price of a commodity in next six months	Yes
Processors	
Historical price data	No
Current price in local market	Yes
Current stock and inventory in the market	Yes
Likely price of a commodity in next six months	Yes
Demand for final product	No

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary of Supply-Side Findings

On the supply side, the study covered five providers of MII. Major findings from the supply side are given below.

- Assam has only a couple of providers of MII.
- Language is a major constraint to effective supply of MII, particularly to farmers. None of the service providers use Assamese fonts for text messages and in apps for mobile phones.
- No service provides both MII and weather-related information.
- Most of the services require a mobile phone (whether smart or basic) and an Internet connection (except SMS based).
- Accurate price forecasting would require extensive historical data (which is scarce in Assam) and excellent analytical skills.
- Connectivity to the Internet is low: about 5000 villages in Assam still lack 4G connectivity. 2503 villages in Assam are yet to be covered by mobile connectivity (Times of India, 19th Dec. 2018, Guwahati edition)

- Many of the tools (including apps) for digitizing maps of farms and for crop advisories depend on big data analytics and artificial intelligence (AI).
- Weather information and forecasts currently offered are for larger areas and cover only the more important cities in Assam and the rest of the North East. Village- and block-level weather data, forecasts, and crop advisories are not provided.

Summary of Demand-Side Findings

The demand-side findings are summarized by stakeholder categories, namely farmers, aggregators, traders, and processors.

Farmers: Of the total of 285 farmers surveyed, for slightly more than half (52%), the most important item of information in a crop season was the likely price of a commodity six months ahead. Mobile phone and newspapers together with other channels were used as the preferred media or tools to access MII. Most (60%) use other value chain players as the source to access MII. Farmers did not face any challenge in accessing the available MII.

Aggregators: The principal information required by most (44%) aggregators was current stock and inventory available with the farmers and in the market and local market price. For 53% of the total of 62 aggregators surveyed, mobile phone was the principal tool for accessing MII, and 47% said that they sought information on the availability of a given commodity from fellow aggregators. Nearly all (98%) the aggregators faced no difficulty in accessing MII, but they also said that there was no organized agency to provide them MII on a formal basis.

Traders: About68% traders said that price in the local market and current inventory were, for them, the most essential items of information before buying a commodity About half of total of 77 traders surveyed used the mobile phone as the primary tool to access MII. Roughly70% cited fellow traders as the source of information on arrival of commodities in the market. The source of information on the price of a commodity for62% of the traders was other players in the value chain players. Most of them faced no difficulty in accessing MII.

Processors: Around 38% processors wanted historical price data to make their own forecasts. The mobile phone and internet were the primary tools for obtaining MII for majority (95%) of processors. For 69%, the principle channel for accessing MII was the market itself (through market functionaries). Only two processors were acquainted with the leading agencies that provided MII in Assam, namely RB Commodity India Pvt. Ltd and Vyapar Bikriti.

Conclusions

Market information and intelligence services in Assam are at the nascent stage; few organized players provide MII services regularly to stakeholders in the agricultural value chain, and integrated supply of MII services across the value chain is still a distant reality for Assam. Although it will take some time to improve connectivity in rural hinterlands, the problem of MII not being available in the local language can be solved more quickly and with less effort. The mobile phone is the principle tool used by most stakeholders across the value chain for accessing MII, given that power supply in villages continues to be inadequate and erratic. Providing historical data on markets, particularly on prices and trading volumes, however, is a daunting challenge.

Most farmers fail to recognize the potential of MII, and traders make no effort to access MII from sources outside their usual network. Only a few traders access MII from its original source and pass it on to others through their network. Traders seemed unaware of its potential benefits to their business. For aggregators, the source of information on the

availability of a commodity was their fellow aggregators, and the item of information they needed most was the prices of commodities in the local market. The processors estimated the likely demand mostly based on past experience and wanted MII to be given to them once a month.

Recommendations

Based on the findings discussed above, it is recommended that the proposed market intelligence cell as part the APART project be set up keeping in mind the following considerations.

- Two separate agencies, each independent of the other, should be hired, one for MII services and the other for weather information, because no single agency can provide both as an integrated service.
- The team to be recruited for the proposed cell should represent diverse backgrounds and expertise including agriculture, marketing, agribusiness, statistics, and econometrics.
- The offerings of the cell should be channel led to farmers and other players in the value chain mainly through mobile phones and served up in the local language. For app and Internet-based solutions, MII can be supplied to the last point up to which Internet connectivity is available (preferably a common service centre); beyond that point, the information can be disseminated through farmer-to-farmer and trader-to-trader contacts and other means.
- One of the prime offerings should be forecasts of prices of agricultural commodities three months and six months ahead, in addition to the prices in local markets. This information should also be displayed in the markets because farmers and traders often visit the markets to know the prices of commodities. Stock arrivals in markets could be another related and useful offering particularly for traders and processors. The information supplied should be adequate as well as correct. Other possible offerings are crop advisories, package of practices for each crop, arrival volumes or stocks in the market, and databases of buyers, market standards and specifications of different grades of the commodities vis-à-vis their prices.
- Training and capacity building of farmers and other players in the value chain on the necessity of MII, access to MII, and its proper use should be another major activity.
- A fee should be charged for all these offerings although the amount can be varied as appropriate.
- The frequency of MII should be daily for aggregators, weekly for farmers and traders, and monthly for processors.

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