

Staff Paper

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EVOLUTION OF THE CEREALS MARKET
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CEREALS MARKET INFORMATION SYSTEM IN MALI**

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ABSTRACT

This paper develops a framework for analyzing alternative organizational arrangements of the cereals market information system in Mali. Examination of both theoretical and empirical issues that influence the organization of the production of market information products suggests that the initial design of an MIS should be an integrated structure. That is, the MIS functions including data collection, transmission, processing, analysis and diffusion are most effective when controlled by a single institution. However, as the needs of the end-users evolve, the organizational structure of the MIS must also evolve. The purpose of this paper is to offer guidelines for the design and evolution of MISs by highlighting the trade-offs of alternative organizational arrangements.

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I. Introduction

In this era of liberalization and increasing privatization, where economic incentives are replacing administrative decrees, agricultural production and marketing systems are dramatically changing throughout the world. In the Sahel, under the auspices of programs of structural adjustment and market liberalization, it became clear to policy makers that improved market transparency was necessary for the efficient functioning of a private-sector marketing system. To alleviate some of the uncertainties associated with opaque markets, emphasis is now being placed on the creation and strengthening of public market information systems (MIS). COMAC's (Cereals Market Knowledge Network) efforts to strengthen MIS capacity in the Sahel is a prime example (CILSS, Club du Sahel/OECD).

One of the key factors facilitating the transition to a market-oriented commercial agriculture is farmer access to and understanding of how markets work. Market participants with timely access to information hold competitive advantages over those who lack such access. Given the often dispersed, atomistic nature of farmers in low-income countries and the more concentrated nature of buyers, equalizing access to information between these two groups has important equity implications. Given the scale economies inherent in information collection and analysis, larger traders often enjoy information advantages over smaller producers in the absence of a public market information system. Public dissemination of market information can help correct this imbalance.

By lowering the cost of information, the MIS reduces uncertainty, thus facilitating better planning and decision making, which allows specialization and hence faster economic growth. However, as specialization and commercialization occur, contract enforcement mechanisms become increasingly necessary to promote development. North (1991) identified agency problems as a major constraint to commercial trade. For example, in Mali, the traders

(principals) who send apprentices (agents) out with the transporter to engage in transactions for the trader are forced to believe that the transaction took place at the price the agent maintains. In the absence of an MIS, the principal has no way of assuring that the sale did not occur at a higher price and the agent is pocketing the difference. Public dissemination of market prices can reduce this problem by allowing traders to cross-check the prices with the MIS, thus providing traders with greater incentives to expand their scope of operation.

By making price information more broadly available, an MIS signals market opportunities, stimulates competition, and decreases seasonal and erratic price variations and associated risks. Similarly, improved capacity to monitor market developments is critical to designing effective food policies. This is particularly important in countries where the cereals markets are evolving very rapidly in response to liberalization policies. In short, lowering the cost of information reduces uncertainty and facilitates the adjudication of disputes, making enforcement of contracts easier and less costly. The MIS also provides the public sector with an instrument to monitor liberalization efforts. The reliable diffusion of market information also fosters improved overall market performance and leads to a broader distribution of the country's wealth.

Although there is broad recognition of the need for MISs, relatively little attention has been paid to how to develop these in newly liberalizing economies. For example, should a country just import models from the West? The aim of this paper is to move away from an ad hoc approach to the design of MISs and provide a framework for analyzing how to build an MIS in a developing country. We use Mali as an example. This framework incorporates three elements:

- a. Insights from the literature on the economics of information to examine how the characteristics of information influence how it is produced and demanded.

- b. Use of transaction-cost analysis to examine the trade-offs involved in different organizational designs of MISs.
- c. Placing the issue of MIS design in a dynamic context, where we examine how MIS activities and design need to change as the economy evolves.

The paper is organized into six sections. Section II discusses the problem in the Malian context. Section III outlines the components of a market information system, while section IV examines the factors affecting the supply and demand of information. Section V examines alternative organizational arrangements of MISs, and section VI concludes the paper by addressing the evolutionary process of the MIS. The paper draws heavily on a more detailed analysis by Aldridge (1992).

II. Problem Statement

A major hypothesis underlying cereals market reform in Mali is that improved predictability will induce farmers to increase the quantity of foodgrains marketed, encourage traders to invest in the marketing system, and ultimately reduce real food prices for consumers. Thus, in 1988, in an effort to make the cereals market more transparent and encourage private-sector investment in the cereals subsector, the Malian government, with donor support, implemented a market information system. The SIM (Système d'Information du Marché)¹ was conceived as a coordinating unit that would centralize, process, analyze and disseminate timely market information.²

¹ SIM is a French acronym for market information system, and is used throughout this study to refer specifically to the Malian cereals market information system, while the acronym MIS refers to market information system in a general context.

² Until early 1993, the SIM regularly collected and disseminated only price information. Methods for obtaining reliable quantity information were tested in mid 1992 and in early 1993 the SIM began collecting and disseminating information on quantities of grain available in selected markets.

However, since its inception, user demand has gone beyond the system's ability to supply information in the short run. Policy makers would like to see more in-depth analysis, while traders would like the SIM to provide more detailed information on quantities, export potential and prices in neighboring countries. According to Dembélé *et al.* (1990), if the current system tries to respond to these new demands in the short run, it runs the risks of compromising the reliability of its basic information and delaying its dissemination. Therefore, the challenge becomes one of re-organizing the SIM to meet user needs better. In order to strengthen the Malian MIS it is necessary to understand what comprises a market information system. The following section outlines the components of an MIS and discusses some related concerns.

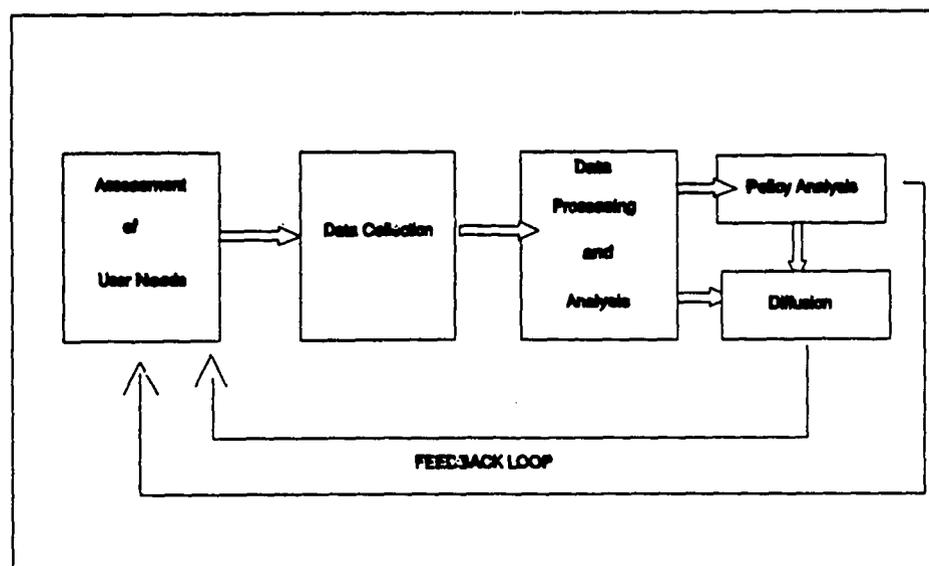
III. Components of a Market Information System

It is important to distinguish among data, information and an information system. Data are attempts to capture reality quantitatively or qualitatively. Information is data that have been processed, organized, interpreted and communicated to provide utility in a specific decision or problem context. An information system is a service-oriented organization whose purpose is to collect, process, analyze and disseminate information that helps answer specific practical problems. Specifically, Bonnen (1977) describes information systems as including three inherent functions or services: 1) data collection; 2) data analysis and 3) policy analysis. We add a fourth function, dissemination. See figure 1.

A. Data Collection or Statistical Unit

There are three distinct steps that must be taken before data which "purports to represent reality" can be produced: 1) conceptualization, 2) definition of empirical variables to represent concepts and 3) measurement (Bonnen 1977). These steps comprise the components of the data system. Data processing follows measurement. However, the reliability of

FIGURE 1 MARKET INFORMATION SYSTEM COMPONENTS



measurement depends in part on how accurately the defined variables match the concepts. The relevant measurement issues involve a series of questions. The answers to these questions influence the level of sampling and non-sampling error in the data.

- What statistical methods are most appropriate?
- What statistical tests should be applied to the data in order to check for consistency, accuracy and representativeness?
- Who should undertake data collection at the field level?
- What incentive structure should be implemented for field enumerators?
- What is the minimum extent, frequency and type of coverage required to provide the information sought by the different user categories?
- What is the data processing capacity?

This is not meant to be a comprehensive list of questions, yet it illuminates several key concerns for the MIS designer. Reliable information is the end result of better statistical methods such as random sampling techniques. However, there is a trade-off between non-

random sampling techniques, which can provide quick insights and economize on time and resources, and the reduced capacity to generalize. There are also tradeoffs between having a large, representative sample to reduce sampling errors and the level of non-sampling errors that may arise in handling the resulting large data set (enumerator errors, data entry errors, etc.) Another important potential trade-off for an MIS is between the level of detail of data collected and the timeliness of analysis, which affects the usefulness (value) of the information for many MIS clients.

The aim of this paper is to present a framework in which trade-offs among alternative organizational arrangements for the MIS can be analyzed. Although important, it does not focus on micro issues such as appropriate data collection methods or processing systems.

B. Data Analysis Component

An information system includes not only the production of data but also analysis and interpretation of these data in some purposeful policy-making or decision-making context. Decisions are not usually based on raw data but on some intervening interpretation of the data through, for instance, application of statistical aggregation (*e.g.*, frequency distributions) and economic theory, effectively transforming raw data into a useable form, *i.e.*, information. In general terms, Tefft (1990) defines analysis as the search for meaning among observed relationships in collected data. Interpretation and analysis, however, can range from simply organizing, formatting or encoding data for presentation, to descriptive statistics to complex economic modeling. The analytical technique should depend on the type of data and the objective of the analysis, which is a function of user needs. In any case, some preliminary data analysis is always needed to check the quality of the raw data being collected.

Additionally, changes in the agricultural sector and/or changes in the agricultural policy agenda demand changes in the system supplying the information. If data analysis or

interpretation is to remain meaningful, the "symbolic representations called data" must continuously evolve to reflect adequately the changing environment they were designed to represent (Bonnen 1977). For example, liberalization policies theoretically induce increased legal participation of the private sector, which could potentially create a new transaction level or change the market typology. Therefore, data observations should reflect the evolving nature of the subsector.

C. Policy Analysis Component

When designing a market information system, clearly identifying the questions that the system is designed to answer is imperative to ensure the usefulness and thus the sustainability of the system. That is, by giving the user a voice, the MIS can avoid producing and diffusing irrelevant information. Policy analysis as a function of a market information system links the policy-maker or end-user to the data collection and analysis functions, making policy analysis an integral part of earlier stages of the information system and vice versa.

A 1991 review of Niger's agricultural data bases concluded that the fundamental discrepancy between what statistical offices are capable of delivering and what policy-makers expect of information services lies at the heart of Africa's data problem. All too often, statistical agencies develop information systems reflecting the collectors' perspective without proper attention to the real needs of potential users. This is compounded by policy-makers and other potential users not always knowing what kinds of data they need (USAID and Abt, 1991). Thus, the policy analysis function of the MIS is a critical component that determines the effectiveness as well as drives the evolution of the market information system. This function is laden with normative judgements and can put at risk the integrity and objectivity of the entire information system. Therefore, how this component is linked to the other components is critical. In

particular, it is essential that preferences of the policy analysts for specific policy outcomes not be permitted to compromise the basic integrity of the data.³

D. Dissemination System

In theory, the design and coordination of this component depends on the needs and circumstances of the priority users. However, in reality, its design may be heavily influenced by the users with the strongest voice and power. Therefore, a critical question during the design process is whom the market information system should serve. Once this strategic question has been confronted, an appraisal of the proposed users' characteristics (e.g., literacy rate) and circumstances (e.g., dispersed) should be undertaken to help guide the design of the dissemination system. Some key issues: What mode of transmission reaches the greatest number of the intended beneficiaries? Should multiple modes be used? In what language should the information be communicated? When and how frequently should the information be disseminated? Should there be a user fee, and if so, what would be its impact on accessibility of the information to the different categories of users?

Further, the MIS must be a service-oriented institution and not purely an administrative or regulatory unit. A feedback mechanism such as a customer service department or users' advisory panel should be an integral component of any market information system. Additional concerns include how to protect the integrity of the basic data while retaining user needs as the driving force in the system. How do users exogenous to the system articulate their preferences? Trust and credibility are significant factors that influence every facet of the market information system.

³ For a review of experience in designing MISs in other countries, see Holtzman *et al.*, 1993.

E. Other Strategic Design Questions

In addition to the organizational questions, MIS designers must address other key issues that ultimately influence the organization of the production and demand for information products, namely who is the target audience, what commodities should be covered and what type of information products to supply.

In the midst of liberalization in the grain market, policy makers in Mali discovered that the private sector (including farmers, traders and consumers) had a real demand for reliable, timely and accessible market information. That is, suddenly able to trade the fruits of their labor legally, farmers now demanded information on prices in urban centers, traders aspired to know about planned food aid releases, and urban consumers wanted to know which urban markets had the most affordable grain prices. Bankers needed to know current prices to value inventories for the assessment of collateral, and policy makers needed a mechanism to monitor liberalization.

Which users and commodities receive priority? For example, should the largest disadvantaged group (e.g., small-scale grain farmers) be the main clientele for the SIM? If a country's comparative advantage lies with export commodities, should producers and exporters of these commodities receive higher priority? Problems arise when the options are mutually exclusive. Target group preference should be aligned with national policy. Dembélé and Steffen (1988) argue that because there is a gap in information between the private and public sector in Mali, initial efforts to implement an MIS should focus on supplying the private sector, particularly farmers, with relevant and timely market information.

Broadly defined, MISs produce three broad types of information products: market news, analytical products, and credit reports. Market news refers to the collection and dissemination of price and quantity information, along with minimal analysis of the major factors influencing

current trends in the market. Using the processed data from the market news reports and complementary information on market structure and conduct, analytical reports take the market news one step further by performing in-depth and longer-term analyses. For example, the market news may report consistently high prices in a particular market over a specific time period. An analytical report may explore the determinants of those high prices and examine how policies could influence them.

Credit reports are evaluations of the credit-worthiness of various buyers in the market. This information is usually produced in nearly all markets, typically by the private sector. In Mali, for example, traders have informal mechanisms for evaluating and sharing information on the credit-worthiness of various buyers. A public market information system can be complementary to the functioning of the private provision of credit reports in at least two ways. First, providing reliable price information allows lenders to use that information to value grain inventories pledged as collateral. Although this is seldom an issue in the use of informal credit among traders (since informal loans are secured more by the reputation of the borrower than by collateral), such information has been important when traders have applied for credit from commercial banks, e.g., through the PRMC credit programs. Second, to the extent that reliable market information makes trading less risky, the risk of extending credit to buyers falls. Hence, better market information reduces the amount of effort that private traders have to devote to developing detailed credit information about potential customers. Because publicly funded MISs do not typically produce credit reports, the rest of this paper will focus primarily on market news and analytical reports.

Reliability, accessibility and credibility are important attributes of all information products; however, the relative importance of timeliness as an attribute varies with the type of

information product being supplied. For instance, timeliness is crucial for market news products but less important for longer-term analyses of market dynamics.

Having outlined the components and some associated issues relevant for the design and organization of an MIS, we next examine the factors that influence who can supply and demand market information, which ultimately influences the organizational arrangement of the MIS.

IV. Factors Affecting the Supply and Demand of Information

When used in a decision-making context, information takes on the characteristics of an economically valuable good. The economics of information analyzes the process by which information as an economic good is supplied and demanded. In this context, "supply of information" refers to the provision of a market information system and "demand" refers to the demand for the output of the system, the information products. The inherent properties of information as a commodity as well as the structural characteristics of the political and economic environment influence how information will be supplied and demanded. This section reviews the characteristics of information and based on these properties examines the determinants and consequences of why information systems are publicly or privately provided.

A. High Exclusion Costs

Information as a commodity exhibits "public good" characteristics. A public good is a good that has value for society as a whole, but for which there are insufficient private incentives for entrepreneurs to produce the good at socially optimal levels. In the case of information, this lack of private incentives results primarily from the difficulty of excluding those who don't pay for the product for using it.⁴ The essence of the argument is that the private sector cannot

⁴For a detailed application of the concept of public goods to the analysis of potential roles for OPAM, including the provision of market information, see Steffen and Dembélé.

recover, due to high exclusion costs (nonappropriability) of market information, the substantial costs for establishing the facilities and providing the information services required. Therefore, the private sector will supply information at socially suboptimal levels. This is one reason why agricultural MISs around the world are most often publicly financed or directly provided by the public sector. However, it is necessary to note that the information production supported by the public sector is not always accessible or relevant to the needs of the private sector. Hence, often private sector participants operate additional informal or private information systems.⁵

Whether market information is privately or publicly provided also depends on the type of information product demanded. It is generally believed that the public sector should support fundamental market news services, while more specialized analytical products could effectively be provided by the private sector. Bonnen (1986) argues that the information sold by the private sector (*e.g.*, market analysis firms in high-income countries) is purchased for the convenience of format or timeliness of access. He further argues that most of the specialized analysis demanded by a particular decision-maker can be effectively produced by the private sector only because public-sector data bases provide many of the necessary components. In this sense, private firms are only paying for part of the cost of collecting data. Without the public sector, insufficient data or information would be collected or developed, and without the private sector, many information services, including the information and analysis required for most specialized problems, would not be available. An appropriate balance between public and private roles is therefore needed.

⁵ Prior to the implementation of the SIM, traders in Mali would often send an apprentice along with the transporter. The apprentice's principal function was to monitor cereals flows and prices in the various markets or assembly points. However, information generated among traders is generally inaccessible outside the trading partnership.

B. Uncertainty

The nature of information is such that its value cannot be determined until the information is used. Yet, to use the information, a cost must be incurred. Thus, the *a priori* returns to investing in information are uncertain. Moreover, the demand for information is derived from its perceived value in reducing uncertainty in the decision-making process. Therefore, risk-averse users will tend to demand less than the socially optimum amount of information, affecting its demand and consequently its production. Willingness to pay for information is a function of the perceived *ex ante* value and search cost of information. Analogously, the inherently uncertain nature of information affects who will supply it. Due to uncertain demand and nonappropriability of returns, information production is a risky business, and organizations that exhibit scale economies are better able to internalize the risks.

For the provision of market information services, greater assurances of reliability, objectivity and accessibility can often come from the public sector. Although not exempt from disseminating distorted or untimely information, it is generally believed, relative to the private sector, that the public sector has less to gain by generating misinformation, therefore reducing some of the *ex ante* uncertainty as well as search costs of information.

C. Timeliness

Information is "news" when it reduces uncertainty in decision making. To be of value to potential users, "news" must be accessible and available in a timely manner, as information loses its value with time. For example, last month's market price is not considered "news" for the trader making a purchase decision today. However, the importance of timeliness varies with the needs of market participants and information products. For instance, policy makers tend to demand both historical and current data. On the one hand, historical data are used to analyze market trends and do forecasting, and thus frequent diffusion is not as critical. On the other

hand, decisions to release security stocks require current information. In general, farmers, traders and consumers require current price and quantity information to make daily sale and purchase decisions.

Accessibility to market information is directly related to timeliness. Market information could very well be produced by several institutions but restricted to certain categories of users. Improved accessibility is central to the public-versus-private debate. It is widely believed that the public sector has a greater incentive to disseminate accessible and relevant market information. Within the policy sector, various organizations may differ in their capacity and willingness to collect, process, analyze and diffuse information publicly in a timely way.

D. Uneven Ability to Use Information

Equal access to strategic market information for all market participants can influence the conduct of the participants and, therefore, market performance. Demand for information is determined by the users' ability to employ the information in a decision-making context. Analytical capability is bounded by the unequal distribution of resources to respond to market information, asymmetric access to additional complementary information, educational levels and risk aversion. Market participants who have limited capacity to respond to market information are subject to opportunistic behavior by more capable participants. To increase the social returns to market information systems, and reduce opportunistic conduct, information must be collected, processed, analyzed and widely disseminated by a reliable and trustworthy source.

Large traders with extensive contacts and better communication facilities have considerable information advantages. Farmers who depend on information from their buyers (traders) are unable to cross-check the veracity of the information. Publicly disseminated information serves to cross-check information stemming from the informal information circuits

or networks, thus effectively reducing the differential in the level and quality of information among market participants.

Complementary services, such as local agricultural extension programs, could assist farmers in utilizing and interpreting market information. In the U.S., the Cooperative Extension Service carries out marketing extension programs to help farmers and traders use market information to make better business decisions. A similar program could be set in motion in countries like Mali⁶. Overlooking users' abilities to take advantage of the market information system can seriously reduce the effectiveness of an MIS in improving food-system performance.

E. Empirical Evidence

In addition to the economic characteristics of information, empirical evidence suggests other critical factors that facilitate or constrain the capacity of the MIS to meet its objectives while sustaining itself.

Eele (1987) queries whether the problems associated with agricultural statistics in Africa are a failure of supply or demand. Most statistical systems in developing countries exist, and are sustained by external financing, not local demand. As a result, these systems are essentially supply-driven. MIS designers must first focus on why statistical information is not more widely demanded before examining how to increase or improve its supply. If indigenous demand has not been created, then there is little incentive for national governments to support or budget scarce resources for the MIS. This is evidenced by the several MISs throughout the developing world that have collapsed once external support and funding were withdrawn. MISs often face a vicious cycle: in the absence of demand, the local administrations find little need to appropriate already scarce resources for the development and sustainability of information systems. At the

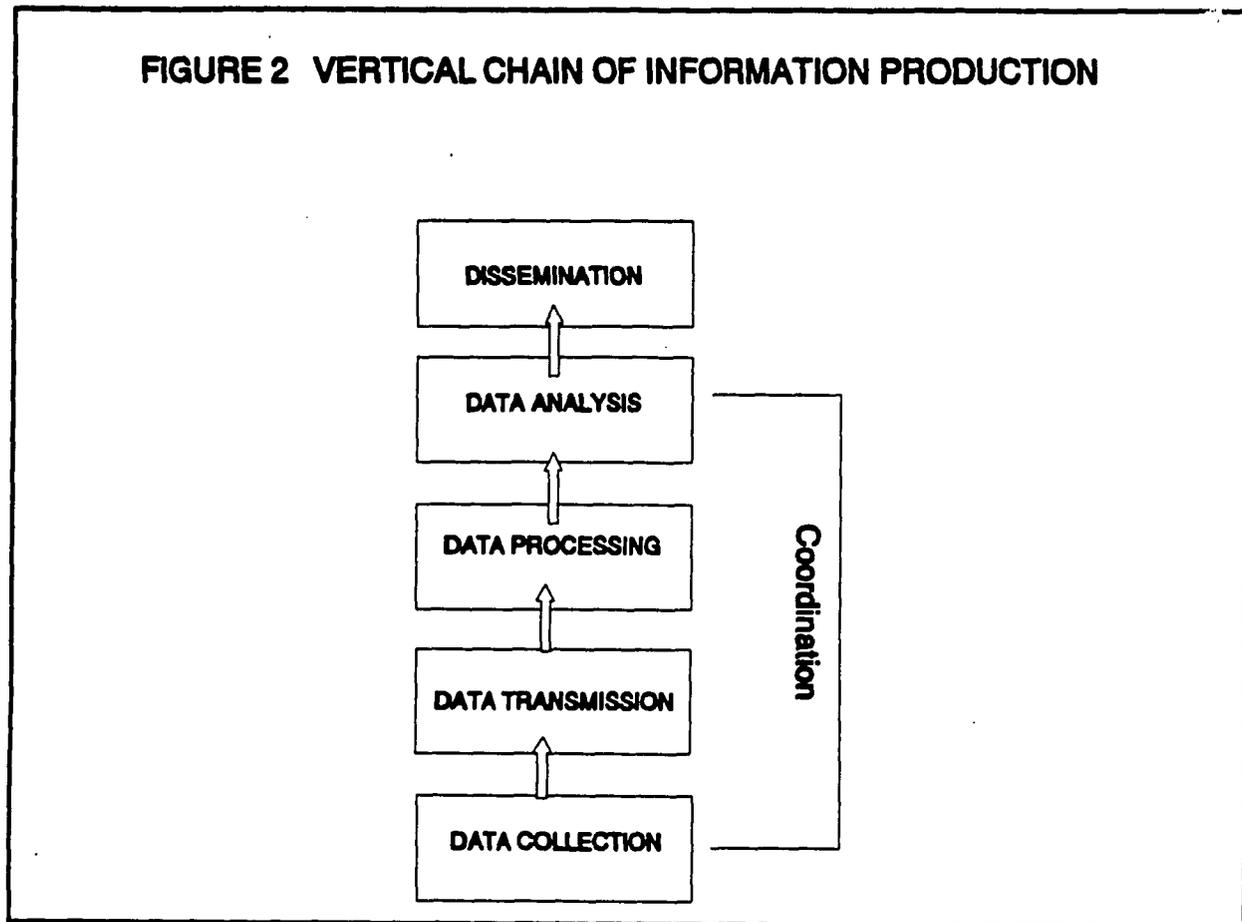
⁶ Historically, this has been one of the objectives of CEFADOC, a training center affiliated with OPAM.

same time, without adequate resources, the MIS is unable to invest in producing reliable and relevant information products that could induce demand (Holtzman *et al.*, 1993).

A related concern is information overload. Too often statistical services and MISs diffuse information that is irrelevant to the decision-making processes of users, or is relevant but not presented in an easily understandable way, or is jumbled with information beyond the scope of the decision maker's needs. The MIS must diffuse relevant information frequently enough to be useful, but avoid overloading the user. The rate of dissemination should be a function of user needs which can be articulated through an MIS customer service department which serves as a feedback mechanism. Additionally, the format (type and level of analysis and presentation) of the information product must be understandable for the target audience. Linking data analysis with data production is key to ensuring a digestible product for users. Therefore, open dialogue and frequent consultation between users of market information and the MIS staff plays a critical role in balancing supply and demand of information.

In order for an MIS to generate and disseminate reliable, credible, understandable and timely information, an adequate training and incentive structure for enumerators, analysts and managers is essential. Market information systems that have been successfully implemented usually begin as pilot projects, with training components, that cover limited numbers of relevant commodities and markets. After investigating the existing supply and demand for market information, systematically implementing the MIS allows the designers to, in effect, "de-bug" the system.

V. Alternative Ways of Structuring an MIS



Section III identified the necessary components of an MIS, while section IV examined some of the economic factors that help to explain who should or can provide market information services. A remaining concern is how the components or stages of information production should be coordinated or synchronized. The stages in the vertical chain of information production include assessment of user needs (policy analysis component); conceptualization and definition of variables; observation on variables (data collection component); data transmission; processing and analysis; and dissemination. At each stage, the designer of an MIS must decide how to coordinate the activities in one stage with those of the adjacent and subsequent stages. See figure 2. For instance, how should data collection be

coordinated with data transmission, and in turn how should data processing be coordinated with data analysis?

The analysis of how vertical stages in the production of a product are coordinated has been a major interest of many economists. One of the tools frequently used to analyze this question is the subsector (or *filière*) approach. The approach recognizes that the efficiency with which a good or service is produced depends on: (a) the efficiency of the production process at each stage in vertical chain and (b) how well the various stages are coordinated with each other (Staatz, 1993).

In recent years, economists have analyzed how the level and type of transaction costs present in a subsector affect the way in which the subsector is organized.⁷ Transaction costs are defined as the costs of carrying out exchange between firms or organizations. Coase has shown that if there were no transaction costs, each stage of production would be handled by a separate entrepreneur, with all exchanges between stages handled by markets. But as the costs of exchange increase, firms and organizations arise, and it may be more economical to integrate several stages of production under one firm or organization. Recent work by Williamson and North has looked at how the structure and level of transaction costs influence the type of organization (e.g., private firm, cooperative, government agency) that can most effectively mediate a transaction.

One can view an MIS, broadly defined, as an "information subsector." Here, we apply some of the concepts from the transaction-cost approach to analyze the costs and benefits of organizing the information subsector in different ways. In particular, we examine the pros and cons of maintaining the Malian SIM as an integrated structure, in which all data collection,

⁷The transaction-cost approach was pioneered by two recent Nobel Prize winners, Ronald Coase and Douglass North. Coase's work has been extended by Williamson.

transmission, analysis, and dissemination take place within a single organization, as opposed to carrying out some or all of these roles in separate organizations that would exchange data and information among themselves.

For an information subsector, the major concern is how the organization of transactions between the various stages of the subsector affect the reliability, accessibility, and timeliness of the various information products. Because the different types of information products (market news, analytical products, and credit reports) differ in their characteristics and clienteles, decisions to organize the MIS by vertical integration or through contracting may depend on the type of information product(s) being demanded.

One of the critical questions in MIS design is how many commodities should be covered by a given MIS? What are the advantages and disadvantages of organizing the market information system horizontally, by function, versus vertically, by commodity group, versus an integrated combination of the two? In a horizontally organized system one organization collects data for all commodities, another organization processes the data, and another one analyzes them. Coordinating the information subsector in this way involves contracting with specialized structures (see below). Vertical organization refers to having one organization perform all the functions of an MIS for one commodity group such as cereals while another vertical system is in charge of collecting and diffusing market information for another commodity group, such as vegetables or livestock. Given the financial and technical capacities of the MIS, are there synergies to the integrated approach when dealing with rapidly changing conditions in marketing systems and policy environments?

Another key issue is the institutional placement of the MIS. Should the market information system be an autonomous, self-contained unit, or should it be integrated with other

institutions within or external to government? The trade-offs in timeliness, impartiality and analytical capacity associated with each decision affect the MIS's ability to adapt over time.

A. Independent Organizations

One way of organizing an MIS would be for each stage in the system (data collection, transmission, entry, etc.) to be handled by a separate organization, which would then transfer its output to the next organization in the chain. This would be analogous to organizing a commodity subsector through independent firms that traded across spot markets.

The advantage of this way of organizing the subsector is that at each stage, organizations could specialize in a particular activity, presumably becoming more adept at it. But the disadvantages are many. Economic theory argues that for such a system to be efficient and well-coordinated, there must be many buyers and sellers at each stage in the subsector. But given the scale economies and other public good characteristics of information outlined above, it is more likely that there will be only one organization at each stage. With only one organization at each stage, market or quasi-market mechanisms may not be sufficient to assure on-going coordination of the whole system.

For example, consider an organization that collects grain prices in the field. Once the grain prices have been collected, they need to be transmitted to a central processing office. However, if the organization collecting the prices has not arranged internally or through contract for the data to be transmitted, it will have to go to the open (spot) market and purchase "transmission services." Organizing for transmission services in this way subjects the "buyer" of the data (the down-stream organization) to potential quality uncertainty. Can the "seller" supply timely transmission services, and is the transmission service reliable?

B. *A Vertically Integrated System*

The opposite extreme from the independent-organization approach is for all stages in the MIS, from data collection to policy analysis, to be handled by one organization. An organization is vertically integrated when two or more adjacent stages such as data collection and data transmission are controlled by a single organization. Such an arrangement offers producers of information products greater control over product quality, accessibility and timeliness. For example, if quality variability is inherent in the data collection process, particularly when cross-checking of enumerators is not regular, verification of data quality is likely to be more costly across organizational boundaries than within a single organization.

The gains from vertical integration of the MIS may be greatest for market news, such as the weekly dissemination of grain prices in key markets. For market news services to work well, reliable data collection and timely transmission are absolutely critical to producing and diffusing a credible and timely product. A vertically integrated system in which all the components of an MIS are controlled by a single institution offers the greatest control over these aspects, thus, minimizing transaction costs.

There are, however, limits to the gains from integrating all functions of an MIS in a single organization. The first is the cost of trying to manage an organization large and varied enough to handle all the tasks involved in the entire information subsector. The second is the danger that in trying to cover all the tasks from data collection to policy analysis and marketing extension, the staff within the single organization spread themselves too thinly. In trying to cover all the tasks, they may perform none of them well, thereby compromising the quality of their products.

C *Contracting Among Organizations*

A third mode of organizing the information subsector is through long-term agreements between specialized structures that concentrate their efforts on one or more stages in the vertical chain. For example, one organization might concentrate on data collection and processing, a second on policy analyses, and a third on developing extension services to help the different clienteles of the MIS interpret and use the various information products. This mode of organization is analogous to organizing a commodity subsector through long-term contracts between specialized firms.

The main advantage of such contracting is that it permits specialized structures to develop particular strengths in specific tasks in the information system, while allowing better coordination among the various tasks than would be the case with entirely independent organizations. For example, the Malian SIM could concentrate its efforts on basic data collection, processing, preliminary data analysis, and market news services. It could then arrange with other organizations to do the more in-depth policy analyses and/or market extension work.

Various modes of contracting are possible. The SIM could simply agree to make its data available on demand to any or all users. This arrangement would have the disadvantage that the data the SIM collected might not correspond to the theoretical or conceptual variables envisioned by researchers. An alternative arrangement that could overcome this problem would be for the SIM to enter into cooperative agreements with analytic units, such as the Institut d'Economie Rurale (IER), the Institut Polytechnique Rural (IPR) of Katibougou, or the faculty of economics at the Ecole Nationale d'Administration (ENA). These cooperative agreements could take several forms. The transaction costs involved in coordinating the system would vary according to the particular contracting modality chosen:

- (a) The SIM could subcontract with these organizations or with specific individuals from these organizations for analytic reports conceived and financed by the SIM, and which would be published under the SIM's name.
- (b) These organizations could subcontract with the SIM for data collection and processing services to provide the basic data for analyses conceived, financed and published by these organizations.
- (c) The SIM and the cooperating organization could undertake various types of jointly conceived and financed research efforts, which would be published with the imprimatur of both the SIM and the cooperating agency.

Regardless of the modality of cooperation, several key conceptual and implementation issues would arise:

1. **How to assure conceptual coordination between data collection and analysis?** As stressed earlier, for an MIS to be socially useful, the data collected must be those required to help answer important practical questions of market participants. In other words, there has to be close coordination between those providing information products for specific users' needs (e.g., policy analyses for government officials and donors; market extension radio broadcasts for farmers) and those in charge of collecting and processing the underlying data. If there is not close coordination between the production of the final information products and the collection of the basic data, there is a strong risk that the wrong data will be collected.

In a poor country, the failure to specify clearly what data need to be collected to answer critical policy questions can substantially increase the cost of an MIS. Not only is the correct information not produced, but much extraneous data may be collected. The result is that the MIS incurs the costs of collecting and processing data that nobody

needs, while important decisions remain uniformed because of a lack of relevant information.

This issue is particularly important during periods of rapidly evolving market structures and changing policy environments. The changes in market structure may result in new policy questions and new ways of organizing production and trade. For example, certain markets may become more important in the commodity subsector, while others wane. If data collection methods don't evolve to take account of these changes, the basic data may be increasingly irrelevant to policy needs.

Recent experience from Mali illustrates the advantages of coordinating the design of data collection with analyses of market evolution. With the liberalization of paddy marketing in the Office du Niger, small private rice mills (*petites decorticeuses*) have become an increasingly important source of rice to semi-wholesalers in Bamako. A data collection agency that was working in isolation might have continued to collect only wholesale prices at the level of the Office sales bureau, ignoring the increasingly important alternative source of rice from the small mills. The SIM, however, was carrying out studies of the evolving market structure at the same time that it was conducting its routine price monitoring. The studies of the changing market structure allowed SIM researchers to perceive the growing importance of the small mills and modify the SIM's price collection accordingly. If data collection and analyses/extension are separated between different organizations, strong coordination between the activities are needed to assure a relevant information product.

2. **Who would do the work?** No matter where the policy analyses would take place, there is the fundamental question of who would carry them out. There is a dearth of experienced Malian market policy analysts. Simply saying that the SIM currently lacks

the capacity to carry out such analyses does not guarantee that such capacity exists elsewhere. It is true that there are some well-trained economists at IER, IPR, and ENA. Yet these economists have very full work loads. If they were to take on additional policy analyses with or for the SIM, they would have to give up or transfer part of their current responsibilities to others.

3. **Contracting mechanisms.** Would any contract be strictly between organizations (e.g., between the SIM and ENA), or between an organization and a specific individual (e.g., between the SIM and a particular professor at ENA)? If the contract was between organizations, what mechanisms could be put in place to assure that the researcher charged with carrying out the work actually got the resources passed on to his or her organization?
4. **Quality control.** What mechanisms would be put in place to guarantee the quality of work produced under contract or through some sort of cooperative arrangement? The reputation of the organization(s) under whose name the information products are diffused can be seriously damaged if the cooperating party does poor work. For example, if the SIM and IER published a joint document on marketing margin analysis in which there were fundamental errors in data entry, the reputation of IER could be compromised. Similarly, if the basic analyses involved fundamental conceptual errors by IER researchers, the SIM's reputation could be besmirched.

Equally serious would be the failure of one party to carry out its promised work in a timely manner. (This is a particularly germane given the heavy and often unpredictable work loads of key researchers in Malian research organizations like IER.) The other organization would be left either to do the work itself or simply not deliver a promised product in a timely manner. Thus, there are strong reasons why those

information products like market news, where timeliness is essential to their value, should probably be produced within a vertically integrated system.

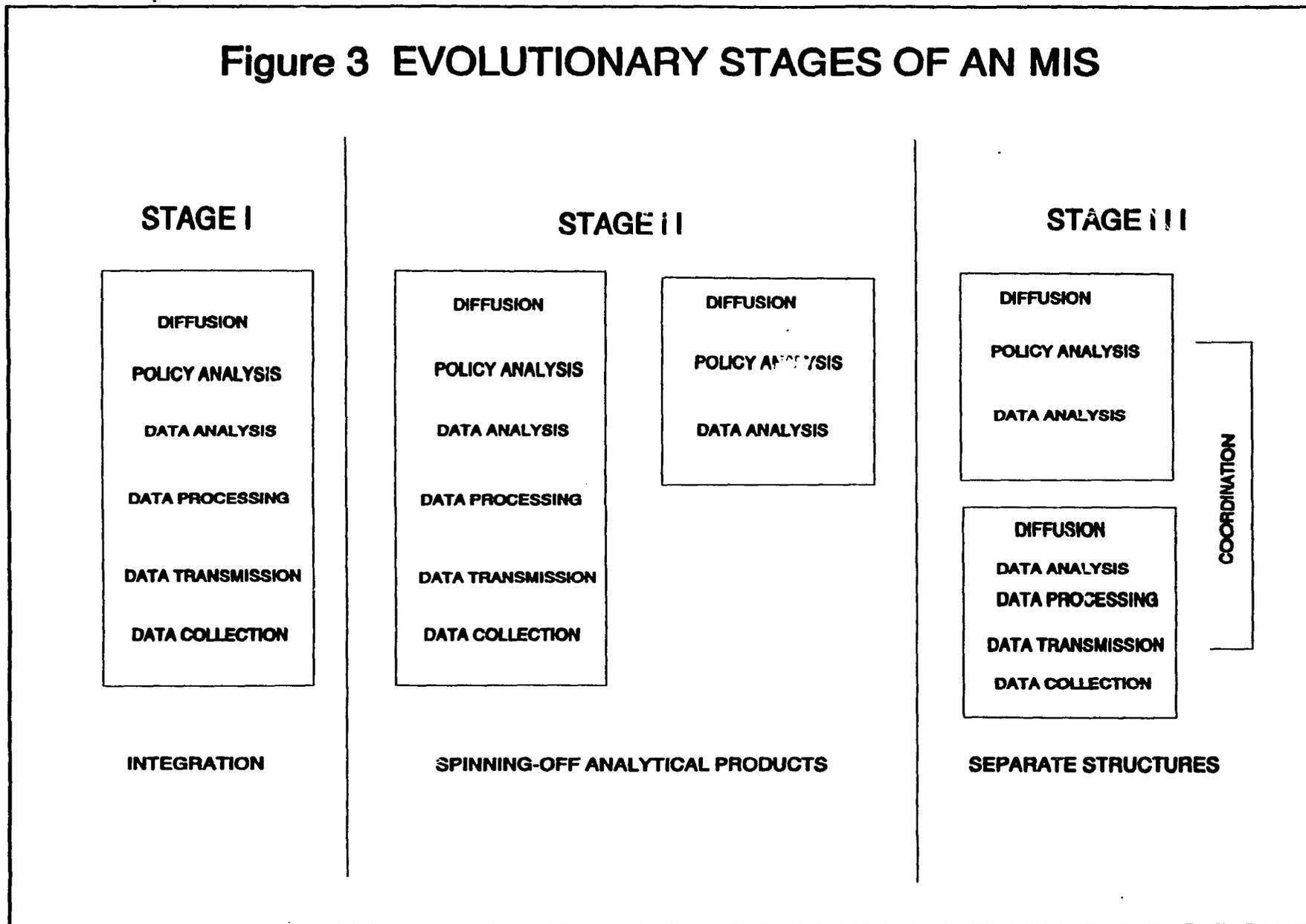
As discussed above, one of the advantages of a vertically integrated system is that it is often easier to use sanctions within an organization to ensure quality control than across organizational boundaries. Therefore, any move toward an MIS based on contracting across organizations must seriously address the issue of quality control.

VI. Summary and Implications for the Evolution of MISs

Experience suggests that the initial design of an MIS should be an integrated structure where all the MIS functions (collection, transmission, processing, diffusion, etc.,) are performed or controlled by one institution. This is particularly important for countries with limited financial and technical resources, implying that the skills and resources required to run a smooth-functioning MIS are less likely to be available in several institutions. Moreover, in the early stages of an MIS, it is critical that the system build a strong reputation for reliability and timeliness. Management in a vertically integrated structure has greater control over product reliability and timeliness. Technical assistance and staff training (technical and managerial) play critical roles in the early stages of the development of an MIS, and substantial scale economies can be realized when training resources are organizationally concentrated. It is also often easier to iron out problems in a single institution. (This obviously depends on the choice of the institution.)

The MIS can be integrated vertically or contractually. However, in the early stages, due to the greater control realized in a vertically integrated structure, all the functions that can feasibly (cost effectively) be performed by one organization should be, as this allows the staff to build sufficient experience and skill in all functional areas of the MIS.

Figure 3 EVOLUTIONARY STAGES OF AN MIS



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It is easy to recognize the benefits of vertically integrated arrangement in the early stages of an MIS. However, when do the costs of this initial design exceed the benefits? As MISs mature, when should (assuming it should) the organizational form evolve from a vertically integrated structure towards greater specialization or horizontal integration. The Malian economy is rapidly changing, and as Hayek (1945) wisely observed, the organization of institutions that govern economic activity must also change. With many of the staff in training, the SIM is still in the developmental and "de-bugging" phase; however, the demand for additional market news, extension and analytical products is increasing. Should the SIM move towards more contracting or horizontal integration? Stage two in the evolutionary process involves occasionally spinning-off certain activities such as the production of specific analytical products to other organizations, while the primary responsibility rests with the SIM. (See figure 3. This model allows the SIM to refine its current activities such as data collection methods and data transmission while simultaneously meeting the needs of its clients for analytical products. However, a critical question is the paucity of trained personnel to do analysis both within the SIM and outside the SIM. Due to the importance of reliability, accessibility and timeliness of the "market news" product, emphasis should be put on the SIM retaining activities related to data collection, transmission and diffusion and some basic data analysis necessary for maintaining data quality. This is to avoid losing the reputation that the SIM has worked hard to establish.

Stage three involves separating the collection and diffusion of fundamental market news variables in one institution and the production and diffusion of analytical products in another. Economies from this stage are realized when the demand for analytical products reaches a level where the SIM and its occasional partners can no longer feasibly meet the demand. Or analogously, it occurs when the demand for market statistics reaches a level that requires that all

of SIM's resources be devoted to the production and diffusion of market statistics (to avoid compromising the reliability of the product). Lessons learned from the U.S. model suggests that a feedback mechanism between the data collectors and the analysts needs to be institutionalized so that the statisticians and analysts avoid working in isolation. Otherwise, the information product may become irrelevant to user needs. Thus, even in stage three SIM has to do some data analyses to ensure that its data are relevant and reasonable.

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