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**Testing the Veracity of Supply Chain Management Technology in a Developing Country  
- Context: A Case Study of Agriculture in Bacolod, The Philippines**

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**Abstract**

**Title:** Testing the veracity of supply chain management technology in a developing country context: a case study of agriculture in Bacolod, The Philippines

**Keywords:** Supply chain management, Developing countries, Agriculture, Enterprise development

**Category of paper:** Conceptual paper

**Purpose of the paper:** This paper describes in the broad terms, the field of supply chain management and then, in particular, its application to agriculture. Modern supply chain management technologies have a lot to offer in the development of agriculture in developing countries.

**Methodology:** Literature review

**Findings:** The paper proposes a rudimentary model for analysing developing country environments and the veracity of supply chain management in its modern form. A test of the model is proposed by way of an case study of a remote farming community in the Philippines.

**Implications for practice:** The design of supply chain management strategies for enterprise development in developing country contexts will be facilitated.

**Value of the paper:** The paper will be on interest to development practitioners and researchers.

Number of pages: 11

Number of figures: 3

Section headings: Abstract; Introduction; Supply chain management and agriculture; Agriculture in developing countries; Agriculture as an enterprise; Developing country realities; The case study: Bacolod, Negros Occidental, The Philippines; Conclusion; References.

## **Introduction**

This paper commences with a brief depiction of the field of supply chain management (SCM) before moving on to consider the special relevance of SCM to agriculture.

Development of agricultural industry is an important component of development in many developing countries, and effective SCM has significant potential in overcoming barriers to its exploitation, in both domestic and international markets. The discussion presented here considers issues in those regards.

The application of modern SCM technology presents real opportunities for agricultural enterprises around the world, but the application of those technologies has a different relevance in developing countries, where, for example, basic logistics infrastructure may be missing.

This paper develops a rudimentary model for analysing the environments for testing the applicability of SCM technologies. The analysis is based on a proposed case study of a remote farming community in the Philippines.

## **Supply chain management and agriculture**

Supply chain management (SCM) is the new management field for establishing competitive advantage and a reliable in not dominant market presence. The philosophy underpinning SCM is that firms must work in partnerships and strategic alliances in order to deliver to 21<sup>st</sup> century customers (Gittell and Weiss 2004).

Part of the story is about expertise. Firms lack the internal resources to carry out all of the functions necessary to meet the demand of customers in modern sophisticated markets, so firms must seek third party provision of range of support products and services. In management parlance, firms concentrate on the core product and utilize partners to augment the product in terms of marketing and promotion, inventory management, transport, billing, indeed, wherever external expertise creates advantage.

Reliance on external parties carries risks of course, not least in terms of management of systems and quality controls. Successful SCM therefore depends upon mutual goals as well as timely and accurate communication capacity between partners, and hence the need for sophisticated information and physical distribution technologies to facilitate communication and co-operation between partners. The relationship between developing new supply chain management strategies and information technology is also one of dependence in the sense that information technology makes new SCM strategies possible, and SCM itself demands new systems, both hardware and software (Brynjolfsson and Hitt 2000).

The veracity of focus on SCM as a key competitive ingredient in profitability and growth has been demonstrated in a variety of contexts. The retailer Wal-mart, the largest firm in the world (depending on how size is measured), bases its success on a capacity to set up relationships with suppliers and feed information from the point-of-sale (POS) back up the supply chain to trigger re-ordering. Another example is Toyota Motor company which is not only the most profitable of the multinational auto-makers, but also carries the largest range of vehicles, a process facilitated by rapid adaptability in its own operations and that of its partner suppliers. Again, Dell, essentially a virtual manufacturer changed the business model by

managing the process of assembly and sales without actually doing much of it in-house (Basu and Siems, 2004).

The point is that thinking about and developing strategies in terms of SCM has important consequences for establishing competitive advantage. The focus can vary depending on the firm and its core competencies and across industry. Wal-mart's SCM focus is up-stream. McDonalds, the fast food retailer is another supply chain master, and illustrates the potential for horizontal integration across the market with its partner franchisees. McDonalds has become a role-model of great significance in terms of successful business modeling.

Very often, the SCM focus in small medium enterprises has been on the cost of running logistics overheads, that is, transport, warehousing and inventory. Although clearly an important dimension, given that cost reductions flow straight to the bottom-line, the results in terms of cost/benefits have often been marginal. One line of reasoning is that a holistic approach to SCM is required to maximize advantages (Aren and Wisner 2005).

The application of SCM thinking has also extended beyond its traditional domain in the physical distribution of manufactured goods to include services, an inevitable consequence of both advancing technology and the general move to services dominated economies worldwide. But perhaps the one field where SCM, at least in terms of the application of SCM jargon, has been relatively limited is in agriculture.

This is despite the fact that one of the most relevant domains for the practice of modern SCM technologies has to be agriculture, because to a greater or lesser extent, agriculture has a limited shelf life. Agriculture is defined broadly to include horticulture, broad acre crops such as cereals and grain legumes, and animal husbandry.

The limits on shelf-life will obviously vary from agricultural product to product. In a generic sense though, this factor has implications that go beyond the need for efficient distribution and handling to get the product to market, to the nature of agricultural markets per se. Traditional agricultural markets are commonly "clearing markets". At the end of the shelf-life, sellers must take whatever price is on offer. Sometimes, the prospective scenario is to dump the excess with zero or negative returns. Such markets most closely represent perfect competition in the sense that resellers, much of the time, and producers, nearly all of the time are price takers, and it is market shortages and surpluses that determine the price. In the standard economic theory, the appropriate approach to farm management is to produce as much as possible at the right time, and "hope for the best".

SCM technologies present two major opportunities in this context. There is first the application to improving access to market information. The internet, mobiles phones, satellite TV, etc., can promote the provision of up date information on market throughput, prices and quantities, which can help the farmer time delivery of produce towards market shortages. Moreover, improvement in transport speed and reliability has improved the capacity to deliver on time.

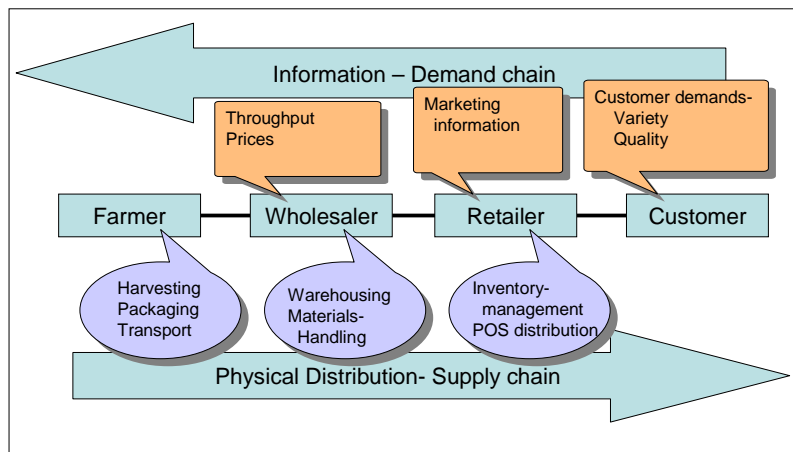
A second application of new technology has to do with quality control. There is not just the capacity to monitor, measure and grade through new mechanical, scanning and other electronic aid; there is the capacity to transmit warnings, employ quarantines and monitor movement of livestock or produce when pests or disease threatens.

A related and also very important dimension to the management of quality has to do with the improved capacity for product differentiation that is offered by new SCM technologies. Packaging, for example, has taken gigantic strides over the last 20 years. For products such as horticulture, packaging of the various forms has enabled more efficient quality lots, while limiting the damage that is done in transport and materials handling, as well as enabling POS promotional opportunities. To summarise, farmers have an increasing capacity by which to differentiate their products and gain some control of prices received and quantities produced by using new SCM technologies. Of course, the consumer also wins because of expanded product variety and better quality, not just in terms on the characteristics such as freshness or colour, but in product presentation and appropriate size lots (labeling, packaging, etc.).

The sophisticated agricultural supply chain is depicted in figure 1. The demand chain sends signals back from the customer at POS in terms of augmented product requirement and prices paid, via the retailer, back to the wholesaler, who “informs” farmers on the required timing and product configurations that will influence both on-farm management practices and returns.

Logistically, the physical movement of product is then initiated with a variety of tasks including harvesting, grading (quality control), packaging and bulk transport to the wholesaler. The wholesaler co-ordinates inbound logistics and manages large inventories for distribution, typically through specialist transporters to retailers, who then manage POS activities. So the demand chain informs the supply chain and vice versa.

**Figure 1: The basic characteristics of the modern supply chain**



Source: Developed for this research

## **Agriculture in Developing Countries**

For developing countries, often the only option for poverty alleviation and economic growth is development of agricultural industries. This is a multifaceted factor as well. Problems with urban poverty often stem from a population drift of people from rural settings into urban centres. Part of the reason is that rural locations often offer negligible opportunities, economic and social. And the drift creates a vicious cycle of ongoing decline in rural society as well as promoting slums and squatting in urban centres as unskilled agricultural workers migrate to *International Technology Management Review*, December 2007, v1, n1.

the cities. Although even the most developed economies have ongoing problems with an urban drift as young rural people move towards the bright lights, developing the agricultural sector to provide some employment opportunities and disposable income is at least a partial mitigation strategy for poverty alleviation. There are also other positive benefits when providing rewards for improved farming activities, through promoting business management skills and a culture of entrepreneurship and the benefits that brings in itself (Howard 2007).

The fact that there are often limited prospects for exploiting agriculture in developing countries is well documented of course. Despite lucrative opportunities in export markets that would propel economic growth and alleviate poverty, barriers to trade prevent exploitation of comparative advantages. For some developing countries, the only platform available for launching on a sustainable growth path is based on agricultural potential. It is also true historically that international agricultural markets are denied to poor countries because of protectionism. The types of protectionism employed are limited only by the capacity of governments and lobbyists to construct the required fallacious arguments. So protectionism takes many forms, ranging from government handouts to farmers (as in Europe) through to specious quarantine requirements (as in Australia), that make it impossible for poor countries to exploit their superior comparative advantages (Carbaugh 2007).

Another problem common in international markets is the nature of the prevailing market structures. Commodity markets can have high elasticity of demand, so increased production in developing countries can result in price falls, and of sufficient magnitude to reduce export revenues overall. Coffee is an example (Carbaugh 2007).

Modern SCM technologies have the potential to resolve some of these issues in international markets. Information about prices and production quantities are more efficiently monitored so the capacity for co-operation and communication between suppliers to avoid the pitfalls in elastic commodity markets can be moderated. Better monitoring and management of production, and better treatment facilities and packaging have basically eliminated many of the claims about quarantine needs. The prohibition of banana imports into Australia is a concrete example of how quarantine barriers are used to protect producers rather than the environment. Internationally, bananas are of far superior quality to the Australian equivalent and about 10% the price when there are shortages in the Australian industry<sup>1</sup>. Even the process of negotiating and implementing the development of quarantine protocols, where trade becomes a political possibility, has been made quicker and easier by information and physical distribution technologies.

### **Agriculture as an enterprise**

Agriculture is no different from other business enterprises. Key factors in success have to do with how well the agricultural enterprise is managed internally (strengths and weaknesses) and how well it responds to the external environment.

Internal to the firm, the two major dimensions that need to be addressed are the technical skills associated with effective and efficient production, and entrepreneurial capacity in terms

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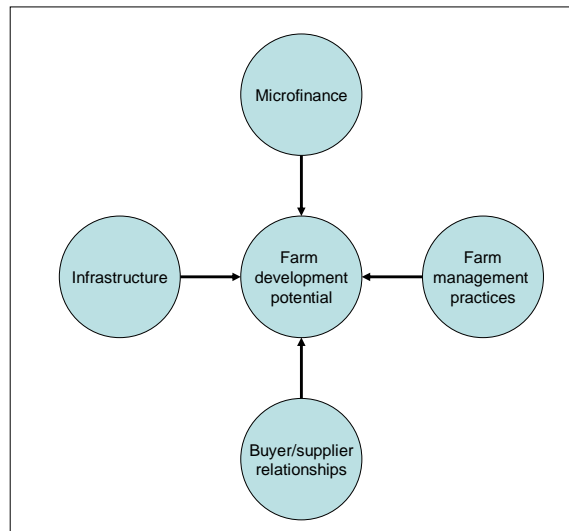
<sup>1</sup> On a fieldtrip by the author to the South Island of New Zealand in December, 2006, bananas in retail outlets were selling at NZD1.89 per kilo. The New Zealand bananas were of superior quality and imported from South America. In Australia, the previous month, domestically produced bananas were selling for up to AUD12 per kilo. A shortage in the Australia market had been caused by crop failure in northern Queensland.

*International Technology Management Review*, December 2007, v1, n1.

of the desire to succeed, pursue profits and take calculated risks (Howard and Hine 2000). In that sense, the requirements for success are no different from developing countries to developed. Where there can be real differences is the actual circumstances. “Levels” of entrepreneurship differ from culture to culture (Hofstede 1984). Technical management skills also vary, not just because of limited access to information and training, but also because business practice can often be constrained by cultural mores and tradition (Howard and Hine 2000).

External environments facing firms are also likely to be very different from developed to developing world. The literature on barriers to development is extensive. At the micro level, access to finance (investment funds) and efficient infrastructure is a common problem. Infrastructure in this sense is a very broad term that includes public hardware such as roads, transport, and telecommunications, as well as institutional arrangements, such as market places and systems, and property rights. A related issue is the conduct of business and the way business relationships are negotiated and partnerships developed. Figure 2 summarises the broad dimensions that influence business success of enterprise and the observation is made that these principles are generic and equally applicable to agricultural enterprises in developing countries (Remo 2007, Aguibo 2007, Howard and Densley, 1988).

**Figure 2: Dimensions in business success in developing countries**



Source: Developed for this research

So in summary, developing agriculture has potential at both the macroeconomic level in improving income distribution and poverty reduction, as well as the micro in terms of better farm management and entrepreneurship development.

### **Developing Country Realities**

The perceived potential of the modern agricultural enterprise is of integrated logistics management supported by an information system capable of operating in real time. Logistical operations are supported by a myriad of outsourced providers of specialist transport, warehousing and marketing services. Access to useful roads and telecommunication systems are assumed. The information system is based on an efficient network that includes basic hard- and software including PCs, mobile phones and maintained databases (including *International Technology Management Review*, December 2007, v1, n1).

broadcasts via television transmission) that monitor prices and product throughput across a wide array of relevant variables.

Apart from the assumptions noted above with regard to enabling infrastructure, the management systems (using a computer or applying appropriate production techniques, eg., the right fertilizers), are either in place or can be obtained. Again, developing effective buyer/supplier relationships is a matter of appropriate use of the appropriate channels of communication, because developed wholesale and retail markets are in place. Indeed, market structures can be manipulated by collective bargaining (co-operatives and single desk marketing for example), where market power of sellers is weak. Finding the funds to invest in the installation of an integrated supply chain is really only a matter of business planning and establishing a reasonable ROI profile, because sophisticated financial systems exist.

In the developing country context however, circumstances and opportunities are likely to be very different. Often, infrastructure is at best rudimentary. Roads are usually inadequate and transport providers, although plentiful, ill equipped for specific needs of different varieties of agricultural produce. Telecommunications may be absent or unreliable. Where mobile phones have proved a valuable resource in enterprise development in urban locations because of access to timely information, in rural settings, the price of acquiring a phone and making phone calls can be prohibitively expensive, even if satellite communication was possible (Anon 2005). Even then, the unfounded assumption is made that electricity is available to recharge the phone battery. In these circumstances, the notion of using PCs and broadcast information to facilitate information flows is, well, absurd.

The barriers to modern SCM technologies do not stop there. If the public infrastructure was in place, there is then the problem of finding the funds for investing in the technology. Perhaps part of the solution lies in the provision of micro-finance<sup>2</sup>. As a development strategy, micro-finance has proved useful in a variety of international development cases since its early adoption by the Grameen Bank (Tendler 1989). The strategy is also one that is being pursued in agriculture in The Philippines, which is the case study target of this research (Remo 2007).

Useful SCM technologies would then be the ones that are appropriate to the specific conditions. The issue goes beyond access to finance and hardware. There is also the question as to whether there is a willingness or even a capacity to modify existent practices. Business management skills including entrepreneurial skills may be so rudimentary in some developing country contexts that basic notions, such as profit seeking or control of inventory, may be non-existent.<sup>3</sup>

Despite the possible differences, there is also a remarkable consistency across developed and developing country contexts on particular issues. Internationally, including in The

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<sup>2</sup> Micro-finance, broadly defined is constituted by small, community based loans to small-holders that target microeconomic behaviour rather than macroeconomic fundamentals.

<sup>3</sup> The author led a Rotary International FAIM (Fourth Avenue in Motion) team to Kar Kar island, off the east coast of Madang in Papua New Guinea in 1998. Apart from the conduct of repairs to the island's hospital and the delivery of educational materials, etc., a part of the project included investigation of business practices for possible future Rotary intervention. Part of the fieldwork included a baseline study of one of the community shops. The shop, owned by the community, carried virtually no stock. Stock if and when it was delivered was mostly either pilfered or taken for community purposes. Stock records were not kept, no re-ordering or costing was conducted on anything other than a reactive basis, and notions of profit-seeking or private property rights were simply absent. Down the road, produce sold in the market, regardless of its shape or size for a 10 coin, the sole currency unit.

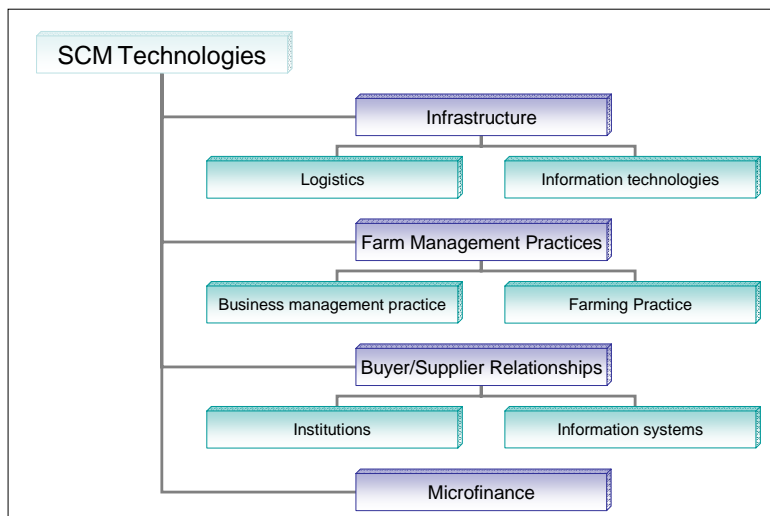
*International Technology Management Review*, December 2007, v1, n1.

Philippines, farmers complain about being taken advantage of by intermediaries (wholesalers), as they notice retail prices far higher than their farm-gate revenues. Almost inevitably, the problem has as much to do with communication and the opportunistic behaviour of farmers, who will take the highest prevailing price rather than developing long-term relationships based on trust and reliability (in delivery and prices) with their buyers (ACIAR 2007A, Howard 1998).

Another common perception is that developing country farmers have limited access to inputs (eg., fertilizers) when the reality is often, like their developed country cousins, the inappropriate application inputs that lowers production. Again, farmers in The Philippines don't necessarily lack information about market prices, it is their incapacity to respond that is the problem. And again, like their richer cousins, co-operative marketing arrangements exist in developing countries, but regularly fail because of poor management, failure to meet quality standards and other communication and technical inadequacies (ACIAR 2007A).

The solution to many of these problems, whether they be the ones specific to the developing country itself, or the ones shared across different levels of development, lie in the correct practice SCM. The task becomes one of determining which part of SCM technology, old or new, is relevant. The variables that will be treated in the fieldwork case study that this paper envisages are as per figure 3.

Figure 3: Variables for case study analysis



Source: Developed for this research

In terms of *infrastructure*, the relevant elements for analysis include the quality of the existent public apparatus for physical conduct of logistics (inbound and outbound) distribution including roads, modes and nodes. Analysis of information technologies is about determining the relevance and availability of hardware and software solutions for improving SCM.

*Farm management practice* is to be analysed from two directions. The first level for analysis considers how well the ideology of SCM fits with extant business management practice. The second aspect in farm management practice is again, the capacity for employing SCM technologies in better production and quality control.



Research into the dimension called *buyer/supplier relationships* seeks to determine the capacity for SCM technologies to facilitate and become part of co-operation and negotiation between partners in the supply chain. It may be that traditional practices in a developing country context mitigate against full integration and the assignment of independent responsibilities that characterise the modern patterns of SCM. Partial application of the available SCM technologies may be appropriate. The same types of circumstances may apply to an integrated information system where the rules of information sharing may proscribe limitations on integration.

The dimension *micro-finance* is treated because it is a very important variable in terms of a capacity to acquire SCM technology.

### **The case study: Bacolod, Negros Occidental, The Philippines.**

Bacolod City is known as the “City of Smiles” and is the capital of Negros Occidental, a province located approximately 400 kilometres south-south-east of Manila. The Bacolod region specialises in the production of sugar cane, but is also a producer of a wide variety of horticulture (Bacolod City Government 2007).

The specific site chosen for case fieldwork is Bariopuey, which is populated by small-holder farmers that produce, in line with the description above, a variety of products including sugar cane, bananas, mangos, various vegetables and corn<sup>4</sup>.

Bariopuey is located one half hour (by jeepney) from Danay, which is then one hour by bus from Bacolod. Farmers in Bariopuey send their horticulture to the Danay market each Saturday. Previously, this was a two hour journey via water buffalo (towing a cart like device). The recent introduction of a Saturday jeepney service has reduced the transit time to one half hour, although the service runs over capacity and so water buffalo can be the only option. Typically, transport will be shared between producers.

Harvested sugar cane is delivered by water buffalo to Danay, where a truck, when its load is full, transports it, on “good” roads to the Central Bato refinery.

The under-developed nature of the transport system is mirrored by other infrastructure inadequacies. For example, mobile phones, although available, need recharging and access to electricity for such purposes is limited to communally shared facilities (the local school). The location therefore presents as a challenging analytical assignment in terms of ascertaining the veracity of SCM strategies and practices given it suggests as an extreme case. The case study should however be useful in exploring the full range of potential barriers to modern SCM technologies, where many of the assumptions about extant conditions can be identified and eliminated.

The research therefore proposes pilot fieldwork that will help in designing an instrument for establishing the veracity of SCM technologies across a broad spectrum of locations, regardless of how extreme.

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<sup>4</sup> This information was obtained by way of personal interview with an experienced farm worker from the location.

*International Technology Management Review*, December 2007, v1, n1.

## Conclusion

This paper started by providing a brief discussion about SCM and its special relevance to agriculture. The point was made that modern SCM technology presents real opportunities for agricultural enterprises around the world, but the application of specific technologies has a different relevance in developing countries depending upon the extant environment.

A model was developed which summarises the four broad dimensions that are likely to effect implementation of SCM technologies. Further development of the model is expected to be achieved by way of fieldwork – a case study of a remote farming community located near Bacolod City in The Philippines.

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