Evaluation of e-marketing in aquaculture using an aquachoupal model in the East and West Godavari districts of Andhra Pradesh

P. Mahalakshmi and M. Krishnan

Abstract: *In order to evaluate e-marketing systems in the aquaculture value chain, the authors conducted a study on the aquachoupal model in the East and West Godavari districts of Andhra Pradesh, India. Developmental impact and measurement of information dissemination were evaluated using Sen's capability approach and Brown's information-based approach. Quality of service as a component of the value chain is very important for e-marketing, yet difficult to assess due to its complex and intangible nature. In this study, an analytical hierarchy process was used to examine changes in service quality as a result of e-marketing. The study showed that the aquachoupal had been helpful in improving human resource development through the value chain channels of growth and productivity. It also increased the volume, coverage and diversity of information flows in the study area. There has been significant improvement in service quality in the aquaculture value chain as a result of e-marketing.*

Keywords: *aquaculture; analytical hierarchy process; Sen's capability approach; Brown's information-based approach; India*

P. Mahalakshmi (corresponding author) is with the Central Institute of Brackishwater Aquaculture, (ICAR), 75 Santhome High Road, R.A. Puram, Chennai – 600 028, Tamil Nadu, India. E-mail: maha_ciba@yahoo.com. M. Krishnan is with the Central Institute of Fisheries Education, Seven Bungalows, Versova, Mumbai - 400 061, Maharashtra, India.

E-business is impacting on nearly all company activities, from the procurement of supplies to the delivery of finished products and services. New types of competitors, value-added services and new delivery channels are shifting the boundaries between customers, suppliers, partners and competitors, which are all profoundly altering industry value chains (Economic Intelligence Unit, 2000). In India, the agribusiness division of ITC, an Indian public conglomerate company, conceived the term 'e-choupal' (in Hindi, *choupal* means a traditional village gathering place) to mean a more efficient supply chain aimed at delivering value to its customers in a sustainable way (Dangi and Singh, 2010). ITC's e-choupal resulted in an efficient delivery channel for rural development, and converted villages into potential markets in Chandigarh, Pune and Hyderabad (Matani, 2007). In addition, it developed a Web-supported service offering farmers information, customized knowledge and products and services to enhance farm productivity, resulting in enhanced farm-gate prices for soybean, coffee, wheat, rice, pulses and shrimp (Mahalakshmi *et al*, 2008).

ITC contends that such a market-led business model can enhance the competitiveness of Indian agriculture and trigger a cycle of higher productivity and income, enlarged capacity for farmer risk management, increased investment and better quality produce (Dangi and Singh, 2010). This initiative also creates a direct supply chain to ITC, which buys agricultural produce directly from farmers. ITC ensures a secure supply through this and lowers its procurement costs by eliminating traders and

intermediaries. ITC also uses e-choupal as a medium to advertise its consumer products where farmers can buy them (Bowonder *et al*, 2007; Prahalad, 2006).

In information and communications technology (ICT), recipients and stakeholders should be involved in understanding the operational framework of their project, its successes and failures, and in proposing solutions for overcoming obstacles and utilizing ICT processes in an appropriate context (Department of Information Technology, 2003b). One important way of evaluating ICT projects would be to view the role of ICT in capability enhancement. One such approach could be Sen's capability approach, which adopts a holistic view of the goals of development by looking at the degree of integration that segments of society attain after application of ICT as an e-governance tool (Madon, 2004, 2006). In a similar manner, Brown's information-based approach suggests that the change in the degree of linkage, coverage and direction of information through ICT application should be used as an evaluative tool (Department of Information Technology, 2003b).

Unlike the quality of products, quality of service is an abstract concept with three unique characteristics: intangibility, heterogeneity and inseparability of production and consumption (Parasuraman *et al*, 1985). Measurement of consumer perceptions and expectations of service quality were based on 22-item scale service quality (SERVQUAL) parameters (Parasuraman *et al*, 1988). The scale has been applied in a variety of contexts including information systems (Kang and Bradley, 2002) and websites (Gounaris and Dimitriadis, 2003; Li *et al*, 2002). Most studies assessing the quality of services have focused on two sectors: namely, health and education (Eckerlund *et al*, 2000). However, in terms of coverage of rural services in aquaculture marketing and the method of assessment of changes in service quality, there are significant gaps in the literature. It is therefore appropriate to infer that the assessment of changes in service quality in aquaculture marketing in the light of e-marketing systems requires not only enhancing the coverage of the market services studied, but also exploring the prospect of deploying a different method of service quality assessment in aquaculture.

Here we study the e-choupal in aquaculture known as 'aquachoupal' in the West Godavari and East Godavari districts of Andhra Pradesh, India. The paper presents the aquachoupal model, its services, usage patterns and value chain efficiency, plus an evaluation of the model based on Sen's capability and Brown's information-based approaches, and discusses changes in service quality in aquaculture marketing. Finally, we highlight the usefulness of the methods and suggestions for improvement.

Data and methodology

West and East Godavari districts of Andhra Pradesh were selected because of the presence of important aquachoupals: these are transactions involving brackishwater shrimp and freshwater prawn. A sample of 88 shrimp farmers was selected randomly from West and East Godavari districts. Data were collected from the group by use of structured and pre-tested one-to-one interviews. Usage patterns of services were measured using a four-point continuum and scored accordingly, corresponding to 'frequently' (3), 'occasionally' (2), 'rarely' (1) and 'never' (0).

Table 1. Evaluation framework for the aquachoupal model.

Evaluation methods	Evaluation criteria
Sen's capability approach	Increased productivity Increased growth Human development
Brown's information-based approach	Measures of coverage Measures of linkage Measures of direction

An important way of evaluating the role of ICT projects would be to view their role in capability improvement and enhancement of the value chain. After a study of the literature (Brown, 1991; Department of Information Technology, 2003b; Madon, 2004, 2006), two methods – namely Sen's capability (Madon, 2004, 2006) and Brown's information-based approaches (Brown, 1991) – and their evaluation criteria were selected for evaluating the developmental impact and measurement of information dissemination. Table 1 shows the framework used. Based on model operations, usage patterns of services and farmers' perceptions of the aquachoupal, we analysed the developmental impact and measurement of information dissemination of the aquachoupal model. In order to assess changes in service quality in aquaculture marketing as a result of e-marketing systems, we applied the analytical hierarchy process (AHP) developed by Saaty (1980), which breaks down the decision-making process into a hierarchy of criteria, subcriteria, attributes and alternatives through a set of weights that reflect the relative importance of alternatives.

We break down the decision-making process into three level hierarchies which make up the change in service quality in aquaculture marketing (Figure 1). Assessment of qualitative aspects of the value chain at the first level concerns the final goal, which is to assess the change in service quality brought about by aquachoupal model implementation. The second level represents the nine service quality dimensions of value chain marketing that

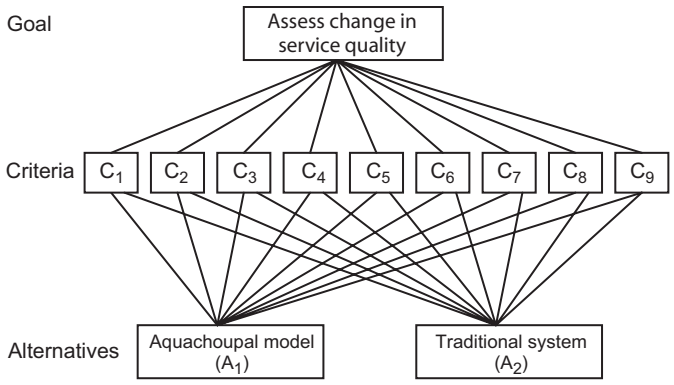

Figure 1. Decision hierarchy to assess change in service quality in aquaculture marketing (modified from Ray and Rao, 2004).

Table 2. Analytical hierarchy process pairwise comparison scale.

Numerical values	Verbal scale	Explanation
1	Equal importance	Two elements contribute equally
3	Moderate importance	Experience and judgment favour one element over another
5	Strong importance	An element is strongly favoured
7	Very strong importance	An element is very strongly dominant
9	Extreme importance	An element is favoured by at least an order of magnitude
2,4,6,8	Intermediate values	Used to compromise between two judgments

Source: Saaty (1980, 2000).

emerged from the interviews with shrimp farmers and users and operators of aquachoupal. They are: time value of market information (C_1); information access and knowledge level of human interface (C_2); quick and clear answer to query (C_3); payment in time (C_4); access to information and knowledge of local/national/international prices (C_5); production cost efficiency (C_6); transportation cost efficiency (C_7); handling cost efficiency (C_8); and accurate systems information (C_9).

In order to assess the value chain gains via e-marketing, two alternatives were assessed: (i) service quality under the aquachoupal model and (ii) service quality under the traditional marketing system. Thus the third level of the hierarchy structure comprises two nodes, namely the aquachoupal model (A_1) and the traditional system (A_2). In order to evaluate e-marketing, we investigated the opinions of 88 shrimp farmers on service quality dimensions by means of a survey questionnaire. Farmers were asked to compare (pairwise) the relative importance of the elements for each level on the basis of the Saaty scale (Table 2). For computing the priorities of the elements, a judgmental matrix (M) (m_{ij} for $i, j = 1$ to n; n is the number of elements to be compared) was used, constructed as follows:

$$M = \begin{pmatrix} m_{11} & m_{12} & m_{13} & \ldots\ldots & m_{1n} \\ m_{21} & m_{22} & m_{23} & \ldots\ldots & m_{2n} \\ \cdot & & & & \\ \cdot & & & & \\ m_{n1} & m_{n2} & m_{n3} & \ldots\ldots & m_{nn} \end{pmatrix} \quad (1)$$

where m_{ij} represents the pairwise comparison rating between the element i and element j of a level with respect to the upper level. The entries m_{ij} are governed by the rules: (1) $m_{ij} = 1 \Leftrightarrow i = j$ and (2) $m_{ij} = 1/m_{ji} \Leftrightarrow i \neq j$. The priorities of the elements can be estimated by finding the principal eigenvector of the matrix M, which is represented by:

$$AW = \lambda_{max} W \quad (2)$$

When the vector W is normalized, it becomes the vector of priorities of elements of one level with respect to the upper level. λmax is the largest eigenvalue of the matrix M. Saaty (1980) has shown that to maintain reasonable consistency when deriving priorities from paired comparisons, the number of factors being considered must be less than or equal to nine. AHP allows inconsistency, but provides a measure of the inconsistency in each set of judgments. The consistency of the judgmental matrix can be determined by a measure called the consistency ratio (CR), defined as:

$$CR = CI/RI \quad (3)$$

where CI (consistency index) = $(\lambda max - n)/(n - 1)$ and RI is the random index, which is the average consistency index of randomly generated reciprocal matrices. Saaty (2000) provided the random indices for matrices of the order of 1 through 10.

In general, a consistency ratio of 0.1 or less is considered acceptable; this threshold is 0.08 for matrices of size four and 0.05 for matrices of size three. If the value is higher, the judgments may not be reliable and should be elicited again. The priorities of elements expressed by respondents have been combined using the geometric mean method (Ramanathan and Ganesh, 1994; Saaty, 2000). Once the local priorities of elements of different levels are available, in order to obtain final priorities of the alternatives *ai*, the priorities are aggregated as follows:

$$P(m_i) = \Sigma_k \, w_k \, P_k(m_i) \quad (4)$$

where w_k is the local priority of the element k and $P_k(mi)$ is the priority of alternative m_i with respect to element k of the upper level. The difference between the priorities of the two nodes in the third level can be interpreted as the change in service quality in aquaculture marketing (Ray and Rao, 2004).

Results and discussion

Aquachoupal model operation

The model is based on a network of aquachoupals – that is, information centres equipped with a computer connected to the Internet in rural farming villages. Aquachoupals serve both as a social gathering place for exchange of information and an e-commerce hub. A local farmer acting as a *sanchalak* [president] or *prithinithi* [operator] runs the village aquachoupal, with the computer located in the *sanchalak*'s home. ITC also appoints a local commission agent, known as the *samyojak* [collaborator] to provide logistical support. They play an important role in the initial stages of setting up the aquachoupals because they normally belong to the village and know the local inhabitants. The *sanchalak*s know the farmers who are educated, the composition of the families and their financial situation.

The previous day's closing price in the market is used to determine the benchmark price at the aquachoupal. The benchmark price is static for a given day. To initiate a sale, the *prithinithi* inspects the produce and, based on his assessment of the quality, makes appropriate deductions (if any) from the benchmark price and gives the farmer a conditional quote. The benchmark price represents the upper limit on the price a *prithinithi* can quote. If the

Table 3. Aquachoupal services and usage patterns.

Services and their interpretations	Usage patterns (%)			
	F	O	R	N
Weather: Localized weather information at the district level.	16	32	36	16
Market pricing: Local and international company's rates. ITC's next-day rates are published every evening. The prices are displayed prominently at the top of the Web page on a scrolling sticker.	64	32	9	6
Customized quality solution: After sale of a crop is completed, ITC performs laboratory testing of the sample collected. Based on the results, farmers are given customized feedback on how they can improve crop quality and yield.	51	24	14	11
Best practices: Scientific practices organized by crop type are available on the website.	18	20	30	32
FAQs: This feature enables two-way communication. Additional questions are answered through FAQs and access to experts who respond to e-mails from the village.	24	25	18	33
Communication: Prithinithi use the Internet to chat extensively among themselves about the status of operations and aquaculture in their villages.	20	11	32	36
Others: In addition to aquaculture-related information, farmers obtain information on government schemes/procedures, plus educational information. They also benefit from health-oriented programmes such as an eye camp, blood testing, blood donation, etc.	18	32	34	16

Note: F = frequently; O = occasionally; R = rarely; N = never.

farmer chooses to sell his or her crop to ITC, the *prithinithi* gives him or her a note including his name, village, particulars of the quality tests the seed and produce have been subjected to, approximate quantity and conditional price. The farmer takes the note and proceeds with the crop to the nearest ITC procurement hub (processing centre) in Andhra Pradesh. At the ITC procurement hub, a sample of the farmer's produce is taken and set aside for laboratory testing. After inspection for quality, the farmer's cart is weighed. The farmer collects his or her payment and is reimbursed for transport to the procurement hub. Every stage of the process is documented.

The non-price services provided through the aquachoupal and utilized by the farmer are highlighted in Table 3. The majority of respondents (64%) used the *prithinithi* pricing facility frequently, since the aquachoupal provides farmers with access to information on prices on a daily basis. About half of the respondents (51%) made use of the customized quality solution facility. The farmers showed a keen interest in learning about ways to detect, control and prevent disease occurrence. More than 15% of the farmers made use of the best practices and FAQ facilities. More than 30% of respondents made use of information pertaining to activities other than aquaculture. Children and youths used the choupals as a source of additional computer information, thus providing value-added services to the aquachoupals. About 36% of respondents made use of the weather report facility, but on an infrequent basis, instead of accessing information on weather via radio and TV.

Evaluation of the aquachoupal model

(a) Sen's capability approach

The aquachoupal provides discounted inputs at the farm gate and reimbursement of transport costs, which substantially increases the share of the consumer's rupee that goes to the farmer. In addition, access to information on best practices, market prices, etc has resulted in greater productivity. Advance information on weather and best practices has enabled farmers to improve production. Moreover, through the aquachoupal, farmers have access to prices and make the critical decision on when and where to sell their crop. After sale, the ITC laboratory tests the sample collected. Based on the results, farmers are given feedback on how they can improve quality and yield. Increased growth is a function not only of real-time extension services rendered at the aquachoupal, but also of supplementary services such as awareness and input–supply linkage programmes in collaboration with public and private sector companies. This connectivity has helped integrate markets and coordinate demand and supply, resulting in improved income. Computer training given to the farmers empowers them to become computer-literate and enables them to use the aquachoupal independently. This has made the farmers more confident and self-reliant. ITC has helped in the development of entrepreneurship by training farmers in basic business skills. The aquachoupal has created a healthy atmosphere of learning and sharing, where farmers can learn computer skills collectively.

(b) Brown's information-based approach

The aquachoupal provides multiple services including information on government schemes/procedures, weather forecasts, market prices and best practices. This increases the sources of information available to farmers. The aquachoupal centres are connected by a wired and wireless network of PCs, telephones and e-mail. This has contributed to the creation of a network of information flows between choupal centres as well as between farmers and input suppliers. It also facilitates the supply of high-quality farm inputs at the lowest prices, as well as purchasing of commodities locally. The aquachoupal provides a 'frequently asked questions' (FAQ) service to the farmers, which enables two-way communication in which farmers can pose queries and receive expert feedback. This has helped to close the gap between farmers and experts.

Table 4. Priorities for each criterion.

Criteria[a]	Priorities vector
Time value of market information (C_1)	0.035
Information access and knowledge level of human interface (C_2)	0.035
Quick and clear answer to query (C_3)	0.024
Payment in time (C_4)	0.084
Access to information and knowledge of local/national/international prices (C_5)	0.070
Production cost efficiency (C_6)	0.236
Transportation cost efficiency (C_7)	0.253
Handling cost efficiency (C_8)	0.229
Accurate systems information (C_9)	0.033

Note: [a] Consistency ratio (CR) value for all the criteria is less than 0.1.

Changes in service quality in aquaculture marketing

The results indicate that the three criteria, production cost efficiency (C_6), transportation cost efficiency (C_7) and handling cost efficiency (C_8), have almost equal priority (about 23%). Cost efficiency reduces costs and improves margins. This provides substantial additions to the gross profit of the farmers and enables them to improve business profitability. This benefit was followed by payment in time (C_4) and access to information and knowledge of local/national/international prices (C_5), which have equal priority (about 7%). Timely payments prevent financial overruns and improve the creditworthiness of the stakeholders, and timely availability of market price information ensures assessment of gross margins and crop planning. The other four criteria have equal priority (about 2%), based on results from the eigenvector of the criteria comparison matrix (Table 4).

The priority of the aquaculture marketing system for each criterion is shown in Table 5. Among the two alternatives used for the study, the aquachoupal model (A_1) has the highest priority for any criteria. Excluding criterion C_9 (accurate systems information), in all other criteria the priority for A_1 is greater than 60%. Thus the aquachoupal model scores over the traditional system of marketing because of its transparency in operations and functions. Moreover, it ensures timely delivery of inputs and payment scheduling, which enables stakeholders to make a proper assessment of their monetary and resource availability and delivery management systems.

The priority of the marketing system for each approach is shown in Table 5. The aquachoupal model receives the highest priority (64%) compared with the traditional system (36%). Significant differences between these priorities were noted. The rationale is that both the shrimp farmers and aquachoupal operators [*prithinithi*] benefit from the aquachoupal model. Prompt payment is made, unlike in other marketing systems, and the aquachoupal model also provides discounted inputs at the farm gate (Singh, 2007). Under the ITC system, farmers no longer bear the cost of transport for crops to storage, but instead are reimbursed for transport to the procurement hub (Mahalakshmi *et al*, 2008; Mahalakshmi, 2010). The *prithinithi* receive a 1% share of the value (Singh, 2007). The aggregation of the demand for farm inputs from individual farmers gives them access to high-quality inputs from established and reputed manufacturers at fair prices (Matani, 2007). Thus there are meaningful economic benefits to farmers and the *prithinithi*. Moreover, there has been a significant improvement in service quality in aquaculture marketing as a result of e-marketing implementation in these districts.

Summary

Aquachoupal is termed a transformational technology. The gains are not only economic but also social, taking into account the exposure to the direct and indirect benefits of Internet accessibility. The aquachoupal model has had a tremendous socioeconomic response in coastal districts of Andhra Pradesh, and has substantially reduced the number of intermediaries in the market. But unlike Dangi and Singh (2010), who view e-choupal as a vehicle of corporate aquaculture, we think that steps need to be taken to ensure that aquachoupals do not represent only corporate interests in aquaculture, but also the interests of primary aquaculture stakeholders.

Acknowledgments

The authors are grateful to Dr A.G. Ponniah, Director of the Central Institute of Brackishwater Aquaculture, Chennai, for his guidance and encouragement. Thanks are also due to those at the Aquachoupal, West and East Godavari districts, Andhra Pradesh, for their cooperation and coordination during our visit.

Table 5. Priorities of the two marketing systems in aquaculture with respect to each criterion and its combinations.

Marketing system	Criteria[a]									Priority for each alternative (%)
	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9	
Aquachoupal model	0.670	0.684	0.671	0.734	0.695	0.626	0.628	0.626	0.598	64
Traditional marketing system	0.330	0.316	0.329	0.266	0.305	0.374	0.372	0.374	0.402	36

Note: [a] Consistency ratio (CR) value for all the criteria is less than 0.1.

References

Bowonder, B., Gupta, V., and Singh, A. (2007), 'Developing a rural market e-hub: the case study of e-Choupal experience of ITC', website: http://planningcommission.nic.in/reports/sereport/ser/stdy_ict/4_e-choupal%20.pdf

Brown, D. (1991), 'Methodological considerations in the evaluation of social development programmes: an alternative approach', *Community Development Journal*, Vol 26, No 4, pp 259–265.

Dangi, N., and Singh, H. (2010), 'e-Choupal: hope or hype?' *American Journal of Economics and Business Administration*, Vol 2, No 2, pp 179–184.

Department of Information Technology (2003a), 'Executive summary I-IV', website: http://mit.gov.in/sites/upload_files/dit/files/downloads/eready2003/EX_SUMM_I-VI.pdf.

Department of Information Technology (2003b), 'Analysis of case studies and hypotheses testing', website: http://mit.gov.in/sites/upload_files/dit/files/downloads/eready2004/CHAP4.pdf, pp 30–64.

Eckerlund, I., Eklof, J.A., and Nathorst-Boos, J. (2000), 'Patient satisfaction and priority setting in ambulatory health care', *Total Quality Management*, Vol 11, No 7, pp 967–978.

Economic Intelligence Unit (2000), 'The e-business value chain: winning strategies in seven global industries', website: http://www.eiu.com.

Gounaris, S., and Dimitriadis, S. (2003), 'Assessing service quality on the Web: evidence from business-to-consumer portals', *Journal of Services Marketing*, Vol 17, No 5, pp 529–548.

Kang, H.K., and Bradley, G. (2002), 'Measuring the performance of IT services: an assessment of SERVQUAL', *International Journal of Accounting Information Systems*, Vol 3, No 3, pp 151–164.

Li, Y.N., Tan, K.C., and Xie, M. (2002), 'Measuring web-based service quality', *Total Quality Management*, Vol 13, No 5, pp 685–700.

Madon. S, (2004), 'Evaluating the development impact of e-governance initiatives: an exploratory framework', *Journal of Information Systems in Developing Countries*, Vol 20, No 5, pp 1–13.

Madon, S. (2006), 'Evaluating the development impact of e-governance initiatives: an exploratory framework', in Ashwani, S., Vijayabaskar, M., and Gayathri, V., eds, *ICTs and Indian Social Change: Diffusion, Governance, Poverty*, Sage India, New Delhi, pp 268–289.

Mahalakshmi, P. (2010), 'Information kiosk', in Prasad, R.M., Hansra, B.S., and Jain, P.K., eds, *Information and Communication Technology in Agriculture: Computer Networking*, RAE 004, School of Agriculture, Indira Gandhi National Open University, New Delhi, pp 28–47.

Mahalakshmi, P., Vimala, D.D., and Krishnan, M. (2008), 'Web kiosks in aquaculture: a study of aquachoupal model in Prakasam district of Andhra Pradesh', in Vasanthakumar, J., Bhaskaran, C., and Philip, H., eds, *Extension Strategies for Fostering Knowledge Centric Agricultural Growth*, Society of Extension Education, Coimbatore, pp 66–72.

Matani, A.G. (2007), 'Information technology improving retail marketing in agriculture', in *Proceedings of International Marketing Conference on Marketing & Society, Indian Institute of Management, Kozhikode*.

Parasuraman, A., Zeithaml, V.A., and Berry L.L. (1985), 'Conceptual model of service quality and its implications for future research', *Journal of Marketing*, Vol 49, No 4, pp 41–50.

Parasuraman, A., Zeithaml, V.A., and Berry L.L. (1988), 'SERVQUAL: a multiple-item scale for measuring consumer perceptions of service quality', *Journal of Retailing*, Vol 64, No 1, pp 12–40.

Prahalad, C.K. (2006), *The Fortune at the Bottom of the Pyramid: Eradicating Poverty through Profits*, 1 ed, Wharton School Publishing, Upper Saddle River, NJ.

Ramanathan, R., and Ganesh, L.S. (1994), 'Group preference aggregation method employed in the AHP: an evaluation and an intrinsic process for deriving member weightages', *European Journal of Operation Research*, Vol 79, pp 249–265.

Ray, S., and Rao, V.V. (2004), 'Evaluating government service: a customers' perspective of e-government', in *Proceedings of 4th European Conference on e-Government, Dublin, Ireland*, pp 627–638.

Saaty, T.L. (1980), *The Analytic Hierarchy Process: Planning, Priority Setting and Resource Allocation*, McGraw-Hill, New York.

Saaty, T.L. (2000), *Fundamentals of Decision Making and Priority Theory with the Analytic Hierarchy Process*, RWS Publications, Pittsburgh, PA.

Singh, S. (2007), 'Agribusiness in South Asia, a fact sheet', Centre for Management in Agriculture, Indian Institute of Management, Ahmedabad.