The Potential for Improved Economic Efficiency in the Fresh Fruit and Vegetable Market Via Computer Technology

by
James E. Epperson
University of Georgia
and
Leonard C. Moon
University of Georgia

The authors describe the potential use of computer technology in marketing fresh fruit and vegetables. They also point out the necessary changes which are needed in the industry before their recommended system would be fully feasible.

Introduction

If perfect competition is used as a model for economic efficiency in a free enterprise market, the necessary conditions[1] for perfect competition can be useful in revealing possible areas for improvement in an actual market (1,3, 13,15). Such an approach brings to light the potential for improved market knowledge in the fresh fruit and vegetable distribution system. With recent advances in computer technology, all information concerning a market can be known by all participants at any point in time (2,9,14).

IMPORTANCE OF FULL MARKET INFORMATION

Without full information in a market, price determination likely will be blurred--it may be impossible to focus on a particular price at any given instance in time. That is to say, there may be several prices in a market at any given moment (15). Holding transportation costs in abeyance and assuming uniform grades and standards, a multitude of prices may exist simply because of the present system of human communication, i.e., telephone. There is a finite number of contracts that are possible by an individual in a given length of time. And, at any given point in time we are normally limited to only one contact. Knowledge of the market, then, is limited to present and past contacts and reports from market information services. Until recently because of time and communication constraints, buyers and sellers as individuals have been limited to only a part of the overall market. For buyers and sellers to break out of normal channels and expand the number of contacts has been to do so at the cost of added risk regarding dependability. The impetus for such action has logically been due to severe market conditions.

What are the costs of limited market awareness? Quite simply in some cases the price may be too high or too low. If prices are too high, buyers may have difficulty in achieving an adequate return for doing business. The consumer will surely share in bearing the brunt of produce which is overpriced. If prices are too low, production resources may be shifted to other activities, perpetuating unnecessarily high produce prices at a later time. Such market inefficiency aggravates cyclical price movements, further distorting the true market picture.

THE POTENTIAL FOR IMPROVED MARKET AWARENESS

At the present time we have the technology to virtually elimate market "ignorance" from the fresh produce scene. The market for an individual participant can be the entire market and not just a part of it.[2] With the advent of the high-speed computer and practically unlimited memory capacity, it is possible to set up a market information network, national and perhaps larger in scope (2,9,11,14). Each market participant could have access to the same up-to-the-moment information.[3]

For example, all buyers and sellers could be tied into a central time-sharing computer by means of a cathode ray tube display (CRT) or touch tone telephone and telephone line. The computer could be programmed to furnish all kinds of information upon request and perform accounting and statistical functions. See Figure 1 for a diagramatic display of such a system (9).

Each morning producers could key into the system their available inventory by product, grade, firm, and location. This capability might also include asking price. Buyers could key-in their requirements also by product, grade, firm, location, and possibly an offering price. Buyers could key-in a request for information regarding offerings of sellers in a variety of ways and vice versa. For instance, a buyer may key-in a request for information regarding the supply of a given product and grade in order of nearness of geographic location. The buyer could key-in an offer to one or more sellers according to some specified pattern. One or more sellers may respond with a confirmation or a counter offer. The buyer might confirm or counter. Upon confirmation of a transaction, the computer would automatically adjust the inventories of the buyers and sellers involved in the transaction.

In addition market participants would have the flexibility to key-in changes in their own inventory as dictated by external conditions such as errors and unexpected inventory fluctuations. Accuracy of information portrayed by the system should remain good as there is an economic incentive on the parts of all involved to present a true picture of their respective situations. Inaccurately low inventory demand and supply in the system would cause a loss of sales and confidence for those responsible. Of course, a loss of confidence now can adversely affect sales in the future. Inaccurately high inventory demands would put affected buyers in the position of having to unload a perishable commodity at a loss. Sellers reporting inaccurately large supplies might be put in the embarrassing position of having to deliver produce which does not exist. Failure to deliver would seriously impair a seller's rapport in the market, resulting in a loss of future sales. The accuracy of the system, then, would seem to be self-perpetuating.

The computer might also be programmed to store all transactions by item, grade, quantity, location, and price. In this way, if a user wished to know the market situation at any point in time, he would merely key-in a request and the information would appear on his CRT.

Of course, there are a myriad of ways the system could be programmed. Likely, most of the market participants can be satisfied as to their desired market capabilities since present

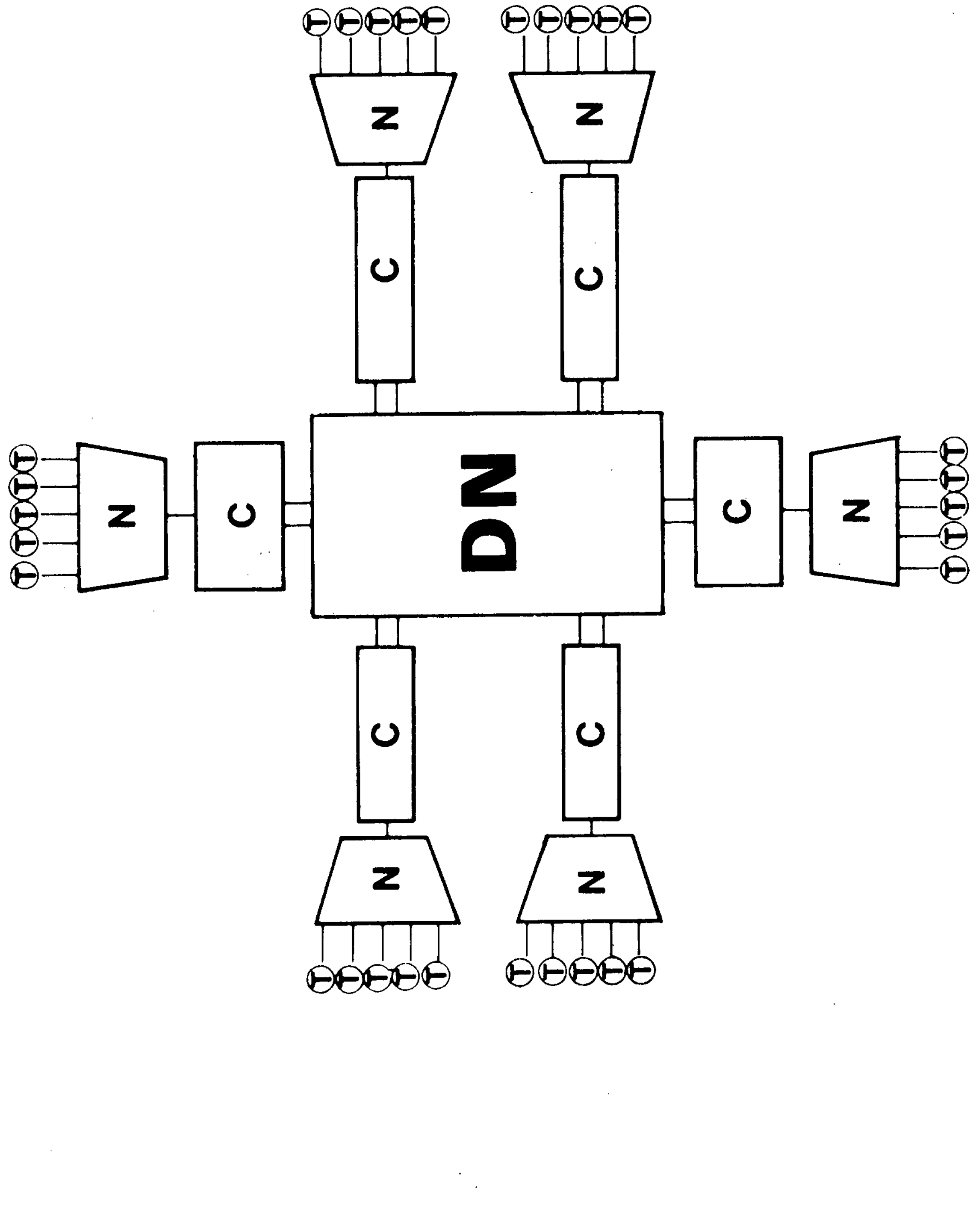

Figure 1. Computer network involving many users. T, remote terminal; N, communications network; C, computer; DN, data network.

computer technology would not be a restraining factor (2,9,14).

The effect of a computerized market network would be likened to an auction with many buyers and sellers present, where bargaining results in a uniform price for a commodity by grade at a given point in time. Now, envision this auction expanding in dimension to encompass all participants throughout the U.S., and possibly the international market where the uniform price differs only by the cost of transporation (12).

Indeed this is an extreme notion. Nonetheless, an improvement in knowledge of the market through a computerized network will likely move the market setting in this direction. The extent of this change will depend on the quality of information flow and the degree to which the other conditions for perfect competition are met.

AN EXAMPLE OF ESTIMATED COSTS

Thus far we have explored the added value in a technical and theoretical sense of more complete information regarding the market. What are the costs of such an increase via a computerized network? The following cost estimates which were obtained from a major computer time-sharing company are provided in an attempt to answer this question.[4] Table 1 shows the estimated monthly cost to a major user per CRT. In other words, for every CRT a user may wish to employ, the monthly cost would be approximately $1,430. The monthly cost to minor users would be considerably less. For instance, a seller may wish to access the market daily over, say, a month. Assuming he already has a touch tone telephone and requires only one hour per day, his monthly charge would be about $458.00, Table 2. A minor user would use a touch tone telephone to key-in his inventory and associated information as dictated by the system design. He could call in at anytime to check on the status of his offerings. The computer would be programmed to use audio communication with the touch-tone-telephone user.

Table 1. Estimated monthly cost per major user for access to a time-sharing computer system.

Item	Comments	Cost
Remote terminal	Rent and maintenance for (1) CRT	$100.00
Phone line		10.00
Connect-time	24 hours per day	300.00
Characters	@ $.20 per 1,000 characters, assume 100,000 characters per day @ 6 days per week	520.00
Usage & Storage	High estimate on computer usage and data storage costs	500.00
Total		$1,430.00

Table 2. Estimated monthly cost per minor user for access to a time-sharing computer system.

Item	Comments	Cost
Connect-time	One hour per day, 6 days per week @ $16 per hour	$416.00
Usage & Storage	Estimate at 10 percent of connect-time	41.60
Total		$457.60

At the present time the prevailing mode of timely information in the fresh fruit and vegetable market is via WATS or some other telephone service. The cost of the full-business-day WATS (one-way) is about $1,670 a month. However, if a user should need only 10 hours of service per month, the measured-time WATS is possible for approximately $245. If more than 10 hours is needed, each additional hour costs about $19.

Assuming that a major user of the computerized system would need the full-business-day WATS, the monthly cost saving with the CRT terminal would be about $240. Thus, on a monthly charge basis, the CRT terminal appears favorable. Savings could become substantial as the number of users increases. For example, given a system with 10,000 users, potential revenues to a time-sharing company would be several million dollars per month based on the figures presented in Table 1.[5] The users through their national organization could barter with several companies for a competitive package deal. In this way monthly costs to the users of the system might be reduced by half or even more. This would mean a monthly charge to a major user of $715 or less.

However, there is another aspect of cost concerning the computerized system which should be considered. This is an initial capital expenditure which must be defrayed in order to cover the cost of designing and establishing the system. The monthly costs depicted in Table 1 are computer hardware charges, that is, the physical costs of using the computer. The capital expenditure involves the software cost of the system. Computer programmers are necessary to convert the desired market capabilities of the users into a language in which the computer can respond. This initial expense also includes debugging or the correction of unforeseen problems and desired user modifications in the system.

Given the framework of a system as described herein, software charges may run as high as $50,000 or as low as $20,000, depending upon the desired complexity of the design. It should be pointed out that since the adoption of such a system may affect thousands of people involved directly in the fresh fruit and vegetable market and perhaps millions of consumers, there is a potential for government support to defray development costs (software charges).

CONCLUSIONS

The potential benefits of economic efficiency through increased market information are evident given a competitive market arena. The fresh produce industry falls well within this arena. However, there are stumbling blocks which might for a time deter acceptance of a computerized market network. Probably the most immediate hurdle is the continuing problem of nonuniform grades and standards which plagues much of the industry. Another obstacle might be agreement on a uniform computer programming system. And, of course, there is the problem of how readily buyers and sellers will accept this new technology as an increase in market awareness will likely diminish chances of large windfall gains through astute marketeering.

FOOTNOTES

[1]The necessary conditions for perfect competition are: (1) a large number of buyers and sellers, (2) a homogeneous product, (3) perfect resource mobility, and (4) full knowledge of the market (15).

[2]As an example of modern inroads in this area, Johnson has contributed extensively regarding improved price and physical efficiency via teletype marketing networks (3-8). Also, such improvements are operational in the Canadian hog market (10).

[3]According to information obtained from a major computer time-sharing company, response time for a request of stored information is approximately five seconds or less 95 percent of the time.

[4]Cost estimates pertain to a national network involving 10,000 users and 50 commodities of various grades.

[5]$171.6 million--$1430 (12)(10,000).

REFERENCES

1. Debreu, G. "Theory of Value, An Axiomatic Analysis of Economic Equilibrium", Cowles Foundation Monograph No. 17, New York: Wiley, 1959.

2. Dwinell, David L. "Advances in Information Systems and Services for the Forestry Community", Journal of Forestry, Volume 76, Number 2, pp. 80-83, February 1978.

3. Johnson, Ralph D. and Richard J. Crom, "Let's Take Another Look at Competitive Marketing", Journal Series, Number 4042, Nebraska Agricultural Experiment Station.

4. Johnson, Ralph D. "An Economic Evaluation of Alternative Marketing Methods for Feed Cattle", Nebraska Agricultural Experiment Station Bulletin 520, June 1972.

5. Johnson, Ralph D. "Physical and Pricing Efficiency Gains From Selling Feed Cattle in the United States by Teletype", Journal Series, Number 3579, Nebraska Agricultural Experiment Station.

6. Johnson, Ralph D. "Teletype Auctioning Would Boost Cattle Feeders' Incomes", Farm, Ranch and Home Quarterly, University of Nebraska, Winter, 1974.

7. Johnson, Ralph D. "The Auction Pricing Alternative for Agricultural Products", Journal Series, Number 3763, Nebraska Agricultural Experiment Station.

8. Johnson, R.D. "The Perfectly Competitive Auction Pricing Alternative for Agricultural Products", Proceedings, Conference on Bidding and Auctioning for Procurement and Allocation, New York: New York University Press, 1976.

9. Kirstein, Peter T. "Distribution Computer Networks", Nature, Volume 257, Number 5527, pp. 549-554, October 16, 1975.

10. Manitoba Department of Agriculture, "Hog Marketing by Teletype", Publication Number 471, 1968.

11. Shannon, Robert E. Systems Simulation: The Art and Science, Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1975.

12. Takayama, T. and G.G. Judge "Spatial Equilibrium and Quadratic Programming", Journal of Farm Economics, Volume 46, Number 1, pp. 67-93, February 1964.

13. Tweeten, Luther. Foundations of Farm Policy, Lincoln: University of Nebraska Press, 1972.

14. Ware, Glenn O., Andrew J. Kasarda, et. al. "A Simulation Study of an Information Dissemination Center Network", Technical Reports UGS/OCA-73-1 and 2, Computer Center, University of Georgia, July, 1973.

15. Watson, Donald S. Price Theory and Its Uses, Boston: Mifflin Company, 1963.