RESEARCH NEEDS

The following is a list of potential research projects for immediate consideration by NACS membership. All are directly related to this project. No attempt has been made to establish priorities nor suggest that this list could not be expanded.

1. A statistical analysis of the interrelationships among key indicators defined in this study. How much of the variability in net profits do they explain? Which indicators are most important?

2. Development of a detailed accounting procedures manual which is consistent with these results.

3. Identification of needed analysis flows to aid in the development of computer software that will satisfy the largest majority of NACS members. Sales, financial, and market analysis programs may be possible to standardize, for example.

4. Developing a computer simulation of a convenience store company as a training tool.

5. Determine the methods and needed measurements associated with expanding the operational MIS model into other areas such as store development or personnel.

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CRITICAL ISSUES IN FOOD DISTRIBUTION

by

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Almost any assessment of critical problems for the food industry ends up in the area of productivity of the nation and the food business seems to have been a leading indicator and the first industry to begin to fail. Most of the nations problems such as inflation, cost of living, exports or imports seem directly linked to food prices or agricultural exports.

While we have been examining food industry productivity at these FDRS meetings for sometime this year, the subject has escalated in importance with the whole American economy following the food business in the decline. Output in U.S. private business dropped at an annual rate of 2.8 percent in the first quarter of 1979 and at a rate of 3.8 percent in the second. Only farming saved the nation from recording a decline of 5.7 percent in the second quarter.[1] There is an implied conclusion this decline is bad, perhaps this has yet to be proven but that is not the purpose of this paper.

Productivity in the food industry has tended to be highest in certain food manufacturing categories and lowest in the service areas, with the service areas seeming most vulnerable to heavy declines in productivity (Table No. 1).

Table 1. Average Annual Rate of Change in Output Per Employee Hour

Selected Food and Agriculture[1]

Sic Code	Industry	Employment (000)	Output per Employee Hour All Employees 1972-77	1947-77
2082	Malt Beverage	51	6.8	5.5
2046	Wet Corn Milling	13	6.2*	4.9**
2086	Bottled & Canned Soft Drinks	137	5.5	2.4
2047,48	Prepared Feeds for Fowl & Animals	74	4.5*	3.9**
204	Grain Mill Products	147	3.2*	3.4*
203	Canning & Freezing	289	2.8*	2.9***
2111,21,31	Tobacco Products	57	2.0	2.9
2061,62,63	Sugar	30	1.2	3.7
2045	Blended Prepared Flour	10	1.0*	2.0*
205	Bakery Products	240	.3	2.3
2041	Flour & Other Grain Mill Products	28	.2	3.6
58	Eating & Drinking Places	4205	.2	1.0****
2044	Rice Milling	5	.1	2.4**
2043	Cereal Breakfast Foods	17	-0.3*	1.5**
7011	Hotels, Motels, Tourist Courts	969	-0.8	1.9****
54	Retail Food Stores	2379	-1.0	2.0****
2065	Candy, Confectionery Products	56	-2.8	3.5
401-Class 1	Railroads (revenue traffic)	520	.5	4.7
4213 Part	Inter-City Trucking	652	3.2	2.7*****

[1]Productivity Indexes for Selected Industries, 1978 Ed., U.S. Dept. of Labor, Bureau of Labor Statistics Bulletin No. 2002.

*1972-1976

**1963-1976

***1947-1976

****1958-1977

*****1954-1977

The productivity declines in food retailing and food service more than offset the food processing increases because of the size of the service industries and large number employed. Food industry sectors having 1.0 percent or better growth since 1972 represent less than 10 percent of total food industry employment. A slight increase of .8 percent in food retail productivity in 1977 was more than offset by a -1.0 percent decline in food service.

Also, recent slight increases in productivity for railroads have largely been at the expense of perishable agricultural cargo which has shifted to trucks, a much less efficient transportation mode. This mode shift in agricultural cargo reflects negatively on overall agricultural marketing productivity.

The overall decline in U.S. National Productivity of all industries seems to be following that of food marketing. In the U.S. non-farm business sector productivity per hour of labor for all employees increased an average of 2.5 percent per year from 1947 to 1972, and 1.0 percent per year from 1972 to 1977. In 1976 the average growth was 3.6 percent, but in 1977 it had slipped to 1.5 percent. This year productivity has taken an even sharper turn for the worst, showing almost no increase at all.

What makes the situation even more critical is that while productivity has been falling in the U.S., it has been rising in Europe and Japan. Since 1967 the productivity rate has surged ahead 105 percent in Japan, 54 percent in Italy and France, and 39 percent in Canada. Even Great Britain topped America with a 25 percent growth in productivity to a 24 percent growth for the U.S.

One question we could ask is, what happened to those segments of the food industry that have reported good productivity at a time when most sectors were in difficulty?

Recently one of the highest productive industries in food and agricultural marketing has been SIC code 2046, wet corn milling. The industry has been examined by several authors and provides information as to how this section became productive at a time when most of the food industry languished.

The wet corn milling is a concentrated oligopoly that consists for the most part of firms that have been in the business for several decades. One firm dominates the business and there has been a good deal of stability over time in the relative market positions of the established leading firms.[2]

In 1840 a U.S. patent was granted for the use of alkali to speed recovery of starch granules. This process was the standard processing method for many years. More than half of the starch derived from corn is converted to syrups and sugars. Of this, 3/4 is in glucose and 1/4 in crystalline dextrose.[3] In the late 1930's, the use of saccharifying enzymes to produce a sweeter corn syrup was developed by A. E. Staley researchers in which starch was partially hydrolyzed by acid and saccharified, (converted to maltose and glucose), with an enzyme of fungal origin. This development widened the corn sweetener market.[4]

During the 1950's, high amylose starch research at NRRC Peoria, developed basic principles which led to expanded use of corn starch in sizings, coatings and films.

The enzymatic process for developing high fructose corn syrup was first identified by Marshall and Kooi in 1957 and patented by Marshall in 1960. However, the center of glucose isomerases research shifted to Japan and Japanese scientists developed this field to the stage of processing of commercial quantities in the 1960's. Takasaki and Tanabe were granted U.S. patents on the commercial processes in 1971.

From the time the potential for aldose-Ketose isomerases was demonstrated, 1952-53, it took 7 years of basic research and 7 years on technology advancement, all in public institutions rather than industrial laboratories. Industry required 2 years to commercialize the results.[5]

U.S. firms were licensed to produce the product and several large plants began production in the early 1970's.[6] The overall process which involved continuous, semicontinuous and batch operation has been tied together by on-line process control. The product competes directly with invert sugar (hydrolyzed sucrose) and can be used in food products except where sweeteners are required in dry form. Other uses are bottled soft drinks, fountain syrup, flavors, pickles, catsup, salad dressing, and in baking. Producing sugar syrups from corn starch requires less energy than from either sugar beets or cane; furthermore corn provides an almost unlimited source of raw materials.[7] The adoption of processes to produce high fructose sweeteners for corn products became economic with the substantial rise in prices of cane and beet sugars. Rapid construction of new large plants resulted in very high productivity rate increases for the U.S. wet corn milling industry, 8.8 percent for 1970-75.

At the same time the sugar industry, utilizing a much more stable and established technological process, began to close old plants and concentrate production in newer ones. Over 120,000 acres, formerly planted with sugar beets were converted to other crops and several beet sugar plants were closed. As a result of these changes, the sugar industry (sic 2061, 2, 3) also increased its rate of productivity growth.

Why was the U.S. research establishment slow to respond to this area of research? "Lack of attention by industrial technologists cannot be assigned to insufficient research expenditures. The wet corn milling industry supported a high level of enzyme research in their own laboratories and as grants to university laboratories. However, the enzymes studied were mostly hydrolases, or degradative types and the vision was lacking to see the possibilities of a different class of enzymes."[8]

Peckham finds that in this particular invention market, 1) the sources have been primarily organizations of large size, government agencies or large firms, 2) inventors have been highly trained scientists with access to corporate or government laboratories, 3) the primary recent source of inventions was a group of Japanese biochemists, 4) the dominant firm failed to provide technological leadership and failed to dominate the new product market, and 5) that relatively high levels of research effort do not guarantee technological leadership.[9] When high fructose corn syrup was conceived and developed, there was yet no economic justification--that came later.

Peckham indicates that one relatively small firm received the most U.S. patents on high fructose corn syrup, and that the dominant firm (half of total industry R&D) had about 20 percent of the patents. He concludes that concentrated oligopoly must receive technological stimulus from outside, but can be capable of strenuous technological competition and that competition in the invention market has resulted in a steady increase in the productivity of capital goods in this industry.

Casey concludes 1) basic research is important to commercial innovation, 2) the technology base for high fructose corn syrup came from outside the industry, 3) that mature basic industries are likely to experience long intervals between major innovations, 4) socio-economic and technology opportunity are not enough--the innovative spirit and entrepreneurial instinct must also be present and 5) companies who wish to establish dominant technology must do their own basic research in-house otherwise it becomes available to everyone. However, new market opportunities and new technologies offer special rewards to companies who maintain advanced technological and marketing positions, and pioneering marketing of new technology pays off.[10]

Conclusions can be drawn that U.S. research organizations were slow to identify the correct scientific approach needed. Casey's point of the key initial technology base coming from outside the industry, in this case medical research, indicates the need for cross discipline communications. Federal, as well as industry research is needed, but even more important is how to select the right mixture of disciplines and organize and manage research so that creativity and initiative are achieved. Perhaps even more important will be methods to train economists to work with the scientists to identify early key scientific breakthroughs and potential markets.

An MIT assessment of federal involvement in Research and Development concluded that direct federal actions were effective, especially actions that help start new firms and ventures.[11]

Despite a rather clear link between productivity and economic well being, many current prognostocators on productivity foresee a period of no growth, or of productivity stagnation, for the U.S. and they see little that industry or government can do to change this situation.

In the food and fiber sector, there are a number of public concerns such as the increased use of pesticides, environmental contamination from chemicals that are used in industrial development and that enter our food supply, and the increased use of drugs and chemicals as additives to feed for livestock. Restrictions on use of such chemicals tends to impact negatively on productivity. In the marketing sector there is concern about the increased use of "fabricated" foods, food additives, the impact of new packaging technologies, the impact of the electronic checkout and electronic funds transfer, central meat cutting and similar technologies that could increase productivity. If these concerns are translated into legislative or regulatory action or threat of actions, the result will be a further reduction of innovation, technology adoption and productivity.

The food industry had its inning in the productivity arena in Houston, Texas when the U.S. Department of Commerce task force held its conference on the potential for a productivity center for food distribution industry, June 12 and 13. Roy Beasley, of the former Productivity Commission, ran the conference with staff assistance from several FDRS members. About 40 industry representatives were present for the evaluation. A significant list of issues and concerns was prepared by polling the attendees and this list is included in this paper. However, the highest ranked issues were (1) Improved transport action, (2) Modularization, (3) Development of a warehouse scanning symbol. A subsequent conference with food industry, labor heads and a follow-up conference with twelve food industry trade associations recognized the need for actions and cooperative effort to improve food industry productivity but the trade associations responded by recommending against requesting public funds at this time of expanding federal budgets.

At this point it is uncertain what future actions can or will be taken or would be necessary or desirable.

A possible meeting with the White House Office of Science and Technology Policy or with with Alfred Kahn's inflation fighting office has been proposed.

Agricultural Economists seem to be deeply involved in "structure" studies, but as Jarvis Cain indicates, mostly at farm level. The Science and Education Administration seems to be headed totally toward basic agricultural science.

Our most critical issue is the segmentation of the industry into power groups both in the private sector and government and universities. We are "balkanized" into small interest areas and may not even be able to identify our problems. As Bert Hamilton says, "Do we have a problem?" With current productivity records, you better bet we do. We need a framework to look at our total industry, to get reasonable diagnosis before treatment to assure that the treatment is not worse than the disease. The Food Distribution Research Society is the one place we have the broad base of industry, scientists and public agency personnel working together. We just need to get our act together.

Futurist type research is needed to direct public policy, guide scientific endeavor and coordinate efforts to achieve balanced growth and development without undesirable social or environment side effects. Increasing concerns with the total impact of research have led to broader-scope studies such as technology assessment and these need to be expanded.

It would appear that a successful turn around of productivity in the food industry may require a level of public and private cooperation much greater than presently contemplated.

I would like to conclude by thanking our President, Jerry Peck, for his Yoeman effort in trying to get this industry together on the productivity issue.

Identification of Key Productivity Issues in Food Distribution

This listing is a grouping of the approximately 80 productivity issues in food distribution that were identified by participants in the Cooperative Technology Workshop in Houston on June 13, 1979. The grouping is arbitrary and many of the issues could have been cross-listed, but were not. Similarly, no order of priorities has been given to this listing.

Scanning

1. Expansion of the use of UPC (Universal Product Code) information--this includes the provision of more useable information for the consumer.

2. Computer to computer ordering.

3. Development of an unmanned checkstand.

4. Warehouse scanning, including the development and adoption of shipping container symbols.

5. Evâluate radio frequency scanning vs. visual.

6. Develop industry identification codes.

7. Electronic shopping.

Warehousing

1. Warehouse and store layout match.

2. Cooperative central distribution centers.

3. Utilize slipsheets across the industry.

4. Automation of materials handling.

5. Pallet less - pallet pool.

6. Improved handling of low-volume items.

7. Modularization.

Retailing

1. Palletized displays.

2. Move the product closer to the customer.

3. Develop consumer mailboxes - facilities where consumers may obtain previously ordered merchandise in neighborhoods.

4. Re-evaluate convenience and warehouse stores in terms of energy savings.

5. Develop effective retail reordering procedures.

6. Develop mechanized bagging.

7. Improve litter and sanitation control.

8. Develop returnable container systems (includes bottles and cans).

9. Improve shrink control (shoplifting).

Reduce Losses

1. Encourage central packaging of perishables including re-evaluating frozen meat.

2. Improve shelf life.

3. Improve bulk handling of partially processed perishables.

4. Reduce food waste and losses.

Packaging

1. Develop a centralized file of packaging data.

2. Optimize container design.

3. Improve warehouse packaging.

4. Evaluate the potential impact of the retortable pouch.

5. Metrification.

Handling and Transportation

1. Evaluate truck loading incentives for unit handling.

2. Maximize use of unit load - farm to retail.

3. Improve food industry transportation--truck, rail, air.

4. Consolidate vendor delivery to retail.

5. Evaluate loading dock robots.

6. Cost justified backhaul.

7. Automatic truck loading.

8. Computerized trucking information.

9. Eliminate tire weights.

10. Ease the million-pound rule.

11. Develop uniform state and ICC regulations.

Processing

1. Encourage more source-level processing.

2. Lower energy food processing.

3. Individualized food portions.

Management and Miscellaneous

1. Standardized documentation of invoices.

2. Improve white-collar productivity.

3. Improve support of ROI (return on investment) by government.

4. Develop a productivity data and techniques exchange.

5. Motivational techniques, government, management, labor.

6. Interorganization cooperation.

7. Incentive programs.

8. Dissemination of food distribution research.

9. Food system coordinating mechanism.

10. Evaluate new technology shifts.

11. Evaluate energy savings potential.

12. Share productivity technology.

13. Improve management systems.

14. Paperless office.

15. Improve communication with government and labor.

16. Improved profitability analyses.

17. Industry funds transfer system.

18. Quality control circles.

19. Redefinition of the business we're in.

20. State of mind needed to improve productivity, not gadgets.

21. Work ethics.

22. Standardization and reduction of government regulations.

23. Increase health and safety.

24. Shorter research and development cycle.

25. Improve public perception of productivity.

26. Identify anti-productivity regulations.

27. Document productivity vs. cost ratios.

28. Improve productivity measurements.

29. Data-base structure incentive.

FOOTNOTES

*From a book chapter by Dale Anderson, Dr. Harold Ricker, AMS, USDA, and Milk Phillips, Office of Technology Policy, U.S. Congress, "The Economics of Technology Adoption in Major Segments of the Agricultural Marketing System."

[1]TIME, August 27, 1979.

[2]Peckham, Brian W. "Markets for Invention in the U.S. Corn Refining Industry: A Preliminary Report," Food Systems Res. Group, Dept. of Agricultural Economics, Univ. Wisconsin.

[3]Commeford, John D. Corn Sweetener Industry Symposium: Sweeteners, edited by George Inglett, AVI Publishing Co., 1974.

[4]Newton, J. M. and E. K. Wardrip. "High Fructose Corn Syrup," Chapter 8, Symposium: Sweeteners, edited by George Inglett, AVI Publishing Co., 1974.

[5]Cassey, J. P. "High Fructose Corn Syrup," Die Starke 29. Jahrg. 1977 Nr. 6, S. 196-204.

[6]Peckham, Brian W. "Markets for Invention in the U.S. Corn Refining Industry: A Preliminary Report," Food Systems Res. Group, Dept. of Agricultural Economics, Univ. Wisconsin.

[7]Ibid.

[8] Cassey, J. P. "High Fructose Corn Syrup," Die Starke 29. Jahrg. 1977 Nr. 6, S. 196-204.

[9] Peckham, Brian W. "Markets for Invention in the U.S. Corn Refining Industry: A Preliminary Report," Food Systems Res. Group, Dept. of Agricultural Economics, Univ. Wisconsin.

[10] Cassey, J. P. "High Fructose Corn Syrup," Die Starke 29. Jahrg. 1977 Nr. 6, S. 196-204.

[11] U.S. Congress, Office of Technology Assessment, "Government Involvement in the Innovation Process," A Contractor's Report by the Center for Policy Alternatives, MIT, LCC 78-600102.

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