NBSIR 74-515

report of conference on making service industries more productive through computers and automation

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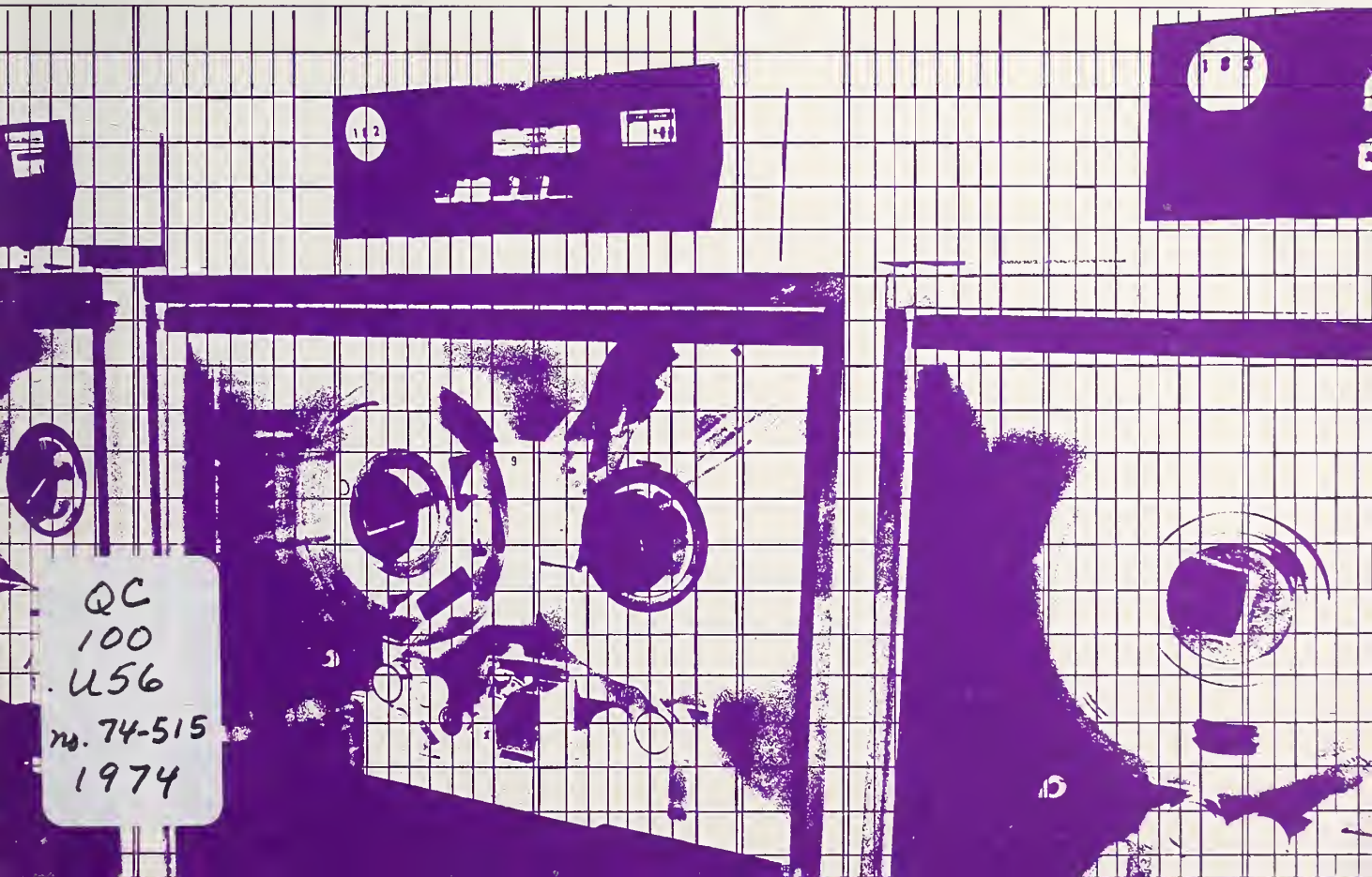

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Sponsored by The Engineering Foundation and the National Bureau of Standards

New England College
Henniker, New Hampshire
August 12-17, 1973

Compiled and Edited by
Alan McAdams and
Madeline M. Henderson

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U.S. DEPARTMENT OF COMMERCE, Frederick B. Dent, *Secretary*
NATIONAL BUREAU OF STANDARDS, Richard W. Roberts, *Director*

FOREWORD

The Engineering Foundation and the Institute for Computer Sciences and Technology, National Bureau of Standards, co-sponsored this conference on the basis of their convictions as to the importance of the subject and the need for a forum to discuss it.

The objectives of the conference were to 1) bring together individuals and representatives of organizations actively concerned with the technology, economics, or institutional arrangements necessary to apply computers to increase productivity and improve quality in the provision of services; 2) identify gaps in knowledge within applicable technological and administrative disciplines; 3) identify business, government and societal needs and opportunities; and 4) identify appropriate governmental goals and programs to respond to these needs.

It was recognized by the co-sponsors that the conference would have a direct bearing and impact upon the country's economic posture since it addressed the identification of specific needs and opportunities for the transfer of innovative applications of computers, automation, and networking for increasing the productivity and quality of services rendered to the public.

The Conference Staff included General Chairman, Alan McAdams of Cornell University; Program Chairman, Edwin J. Istvan; Program Assistant, Madeline M. Henderson; and Conference Coordinator, Roy G. Saltman--all of the National Bureau of Standards, Institute for Computer Sciences and Technology.

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INTRODUCTION

The Conference opened on Monday morning with keynote addresses on definition and measurement of productivity as applied to public services and service industries. These were followed over the next four sessions by theme-setting presentations on technologies for improving productivity in the service areas; automation opportunities in the service areas; a case study of mini-computer applications in the service industries; and education for the design, implementation, and management of service systems.

Conference participants were then assigned to Workshop Panels (five in all) which met to consider their particular topics and to recommend appropriate goals and programs to respond to the needs of these topic areas.

The Workshop Panels met three times and hammered out definitions of issues, problems, and possible solutions. Through special arrangements made by the Engineering Foundation, representatives of Synectics, Inc. of Cambridge, Massachusetts, were available for assistance during Workshop Panel sessions. Synectics, Inc. specializes in facilitating communication and enhancing productivity of conference and seminar groups.

The reports of the five Workshop Panels were presented in summary form to the total conference on Friday morning, for full discussion and comment.

This report includes the principal presentations from the keynote and theme-setting sessions, where available, and also material later referenced in Workshop Panel reports, again, as available. It also includes the texts of the Panel summaries. These are not uniform in approach or content, a reflection of the diversity of the participants and their deliberations. They do however reflect the flavor of those deliberations and their interesting and stimulating results.

CONFERENCE OVERVIEW (REPORT OF GENERAL CHAIRMAN)

The conference at Henniker, New Hampshire, of which this monograph is a report, was itself an activity in the service sector. That is, it presented in microcosm for all the conference participants the problems, fun, and frustrations of this vast area of activity which we have labeled the service sector.

One of our early difficulties in the conference was to define what a "service" was. Indeed, this occurred on two levels: first, on the intellectual level dealing with the concept of service in the abstract, and second, on the concrete level dealing with the real meaning and significance of the activity in which we were all engaged. We can look at these two levels and carry the analysis through the entire working report of the conference.

Let's begin with a formal definition of service.

> A service is defined to be a commodity (broadly defined) which is consumed immediately upon its being produced.

This definition has some profound implications. If a service is a commodity, a process, or an activity which is consumed immediately upon its production, this implies that the producer and consumer must come together physically in space and in time for this transfer to take place. Indeed, this was the case with the Henniker conference. We were all located at Henniker, New Hampshire. We did meet together physically in a conference room or rooms and interchange took place, and it was a dynamic interchange. It will be noted from the table of contents of this report that there was no single producer in this conference and no single consumer. All participants were both producers and consumers. As much of the conference time was spent in spontaneously arranged presentations by conference participants as in the prearranged presentations of thoughts, reports, and materials by scheduled speakers. No speaker emerged without significant challenge to his thinking and ideas. All at least appear to have modified their positions to some degree as a result of the interactions.

By contrast a "product" we define in the following way.

> A product is a commodity which is capable of providing service on a deferred basis.

One of the consequences of the realities of a service is that it is impossible to inventory (while products can be inventoried). By definition, if a service is consumed immediately upon being produced it cannot be stored for later consumption. This in itself has profound implications for the activity which differentiates services from other commodities. The understanding of this definition then provides an avenue to action which can lead us to overcome the apparent lack of storability (and thus transferability through time) of given services.

This report itself is the attempt of the service activity which took place in Henniker, New Hampshire, to create a "product" which can store at least a portion of the service delivered at the New Hampshire conference such that it may be enjoyed at a later date and at other places in space by widely diverse groups even at their leisure. In fact, this is an objective of the printed word in most situations. This is our attempt to inventory the output of the Henniker conference to provide its service to a broader audience in more diverse physical and temporal locations.

The working reports included herein show some of the limitations of a service activity. For example, the output of each conference workshop was being developed simultaneously. There was some feedback among workshops which occurred informally throughout the conference activity, but the timing of report development was so compressed that this was far from sufficient for the thinking that was crystallized in

one workshop to be transferred to others. This is a problem for any service activity. To some extent, each of the workshops had to resolve identical questions early in order to move forward to their assigned tasks. But none had the benefit of the careful in-depth thinking of the others while all could have benefited significantly from that output. The output did not occur until the final day of the conference, Friday morning, when workshop reports were presented orally.

One of the greatest difficulties in dealing with a service is to know, in fact, what has been produced. The measure of our output at Henniker itself is a matter over which much controversy can exist over a long period of time. In the short term, we were clearly able to see that individuals spoke to each other, laughed together, became angry and argued, worked, played and, at the end, applauded. But what is our output in the longer term? It is difficult to know. One thing we do know is that various participants have written letters expressing the worth to them of the conference activities. But do they constitute a true measure of the output of the conference? We do know further that there were flashes of insight, that there were transfers of ideas, that persons could be seen perceptively to change their point of view. This is an exciting phenomenon to observe in any context, the more so in a conference.

It was our perception that this conference was significantly different from the typical conference. As has already been pointed out, this was a conference at which the consumers became producers and in which significant interaction took place both on the formal and informal levels. We do not yet know the long term outputs of the conference, but in raising this point we highlight another important fact. We do expect that this service actually has lead to the creation of products--outputs which are not immediately visible, that will occur at deferred times and places distant from Henniker, New Hampshire. They will occur in the future and they will occur with uncertainty. The participants themselves do not know now what they will actually be. This in itself is an interesting characteristic of service activity and this is an indication of the difficulty of measuring the true value of a service. Frequently this value derives from the impact the service has on people. The product it creates is implemented through people. And here is where measurement becomes complicated: what portion of which future actions occur for which people as a result of the Henniker Conference? A service such as ours produces immediate impact, it produces impact of intermediate term, and it produces impact of long term. The service provided from this conference is now embodied in the minds of the participants and will be implemented through their day-to-day activities, and even perhaps in some major responsibilities which they bear.

Speaking for myself as conference Chairman, I can say that I do look at problems differently today than I did prior to my most challenging assignment at Henniker, New Hampshire. I do look at my own job as an educator significantly differently from the way I did prior to that conference. I do understand better, because I have been forced to conceptualize some of the things which have been at a subconscious level in my day-to-day activities. I do better understand the meaning of the service activity in which I engage professionally--the service of education--which produces a product of intellectual capital.

The conference focuses on productivity in services through automation. Thus the conference itself was dealing with three concepts, all of which are themselves difficult to conceptualize and deal with. We did define the term "productivity." Our definition is:

"Productivity is more bang for the buck."

"More bang for the buck" is another way of saying greater output for a given input or the same output with lesser input.

We also defined automation. Our definition is:

> Automation is a process utilizing machines (devices) with associated control systems in the production of goods or services.

Let us now return to one of the basic difficulties which is suggested by service activity. We could not complete the activity of one workshop and produce its output for use in the next workshop--all workshops proceeded simultaneously. The activity of Workshop 1 in effect was to define the conditions under which it is desirable to undertake innovations which have potential impact on productivity in the service sector. This would be an extremely useful output. The output of Workshop 1 would have been useful to Workshop 2 in its deliberations, and so on cascading through all of the activities of the workshops. Nonetheless, each of these workshops did produce output, and we can, through the commentary of the conference organizers and reporters, show the significance of the output of one workshop for the work product of the others. Necessarily, this is an ex-post-facto operation. Necessarily, it is a delicate operation. The written work is a codification of the service as perceived by individuals. Individuals have egos, their egos become very tightly entwined with the words which they have produced. Any commentary by outside persons on the words which they have used to capture the service activity in which they were participating can appear to be an imposition and thus inappropriate. We, nonetheless, will risk it. In so doing, we hope that we will convey some of the true meaning and excitement of service activities. Back to our definition of the service. If the service involves a high degree of interpersonal interaction, there is the question of ego that will always influence the degree to which that interaction achieves its stated and/or true goals.

In the deliberations of Workshop Panel 1, a lament came forward. It was that we should be able to operate the service area by "taking the egos out" when transferring information that is recognized by serious students of a given area as non-controversial. Yet, this proved to be enormously difficult. Merely the words used to describe the type of information suggest why. Serious students of a particular area are different from others. For others to accept their word implies perhaps a superior/inferior relationship. This is especially affronting to the ego of a person who views himself as an expert in some other activity or area. So it was extremely difficult for us to "take the egos out." Important in any evaluation of a service and underlying all economic theory is the role of ego. The true satisfaction to individuals is the measure of the degree to which economic activity has been successful. If we define productivity as more bang for the buck, the bang really occurs in the ego of the individual served. So we have the very delicate problem of finding ways to "take the egos out" when that is necessary to provide for the delivery of the service and then immediately and effortlessly to "put the egos back in" in order that we may achieve a successful measure of the success of the service delivery itself. These are enormously difficult tasks. We wrestled with them at Henniker throughout the week. We continue to wrestle with them in our report of the conference at Henniker.

At Henniker, we had the services of a productivity-enhancing group known as Synectics. When we first sat down in our workshops, we had a lot of tension. Initially whenever anyone put forward an idea someone else immediately discounted it. But then, as this "stranger" sitting with us kept looking at us, saying nothing, making us increasingly uncomfortable--the Synectics facilitator in our midst--we began rather to be overly polite, and to readily agree with each other. It was only after some considerable period of sparring of this type that we gradually began to use the tools in the complex and interactive Synectics tool kit. But as we did, we began to throw out ideas, to fill the board with them, and to capture them. Then as a second step we had individuals putting themselves in the role of clients taking any one of the ideas he felt had value, to come up with any scheme, no matter how seemingly outlandish, to implement the idea, as well as pinpointing problems along the way. And this dynamic began to disclose potentially feasible operational approaches and mechanisms for overcoming the problems. It was proved to be a dramatically successful dynamic where used.

In compiling and editing the material from this conference, we have tried insofar as possible, to relate the various outputs of the sessions so as to enhance the value of the product we are attempting to codify as an output of the Henniker conference. We hope, too, to have captured some of the excitement, some of the prejudice, some of the insight, and perhaps even some of the fun of that conference. You, the reader, will have to be the judge of the degree to which we are successful in our undertaking.

Report of Workshop Panel 1

on

Economics and Productivity in Service Industries

Panel Participants

* Sanford V. Berg	University of Florida
Frank L. Bernstein	Auerbach Corporation
William Bradley	Puredesal Company
Ritchie B. Coryell	National Science Foundation
* Werner Z. Hirsch	University of California at Los Angeles
David Ironfield	Office of Science and Technology (Canada)
Alan McAdams	Cornell University
Thomas Paterson	MARCOM Applied Systems

Assisted by George Prince, Synectics, Inc.

* Panel Leaders (Dr. Hirsch left the Conference early; Dr. Berg served as Panel Leader and Dr. McAdams assisted in the preparation of the Panel's report.)

Workshop Panel 1 distributed to the conference attendees an outline of the kinds of questions to which its members devoted their attention. A copy of that outline is included here. In addition, the contribution of the Panel was seen to be the output of tutorial discussions of some of the issues facing all the panels. Thus a discussion of the essential differences between services and products was considered to be useful. Also the procedure for determining investment decisions in the service sector was deemed to contribute to the general background information needed for the broad subject.

Outline of Questions

BROAD ISSUES

1. Why is productivity in the Service Industries important, relative to other sectors? Is there a structure among the Service Industries (or within the economy) that makes one subsector more important than another?

   a. Services impinge on national goals:

      aggregate price change
      balance of payment situation (invisibles (services) as well as goods)
      economic growth
      equity, sense of justice and opportunities
      quality of life associated with services
      physical resources required for services may be less than for manufacturing, i.e., human capital

2. Do we have a different perspective from the standpoint of national (social) goals and firm (private) goals?

   a. The social benefits and costs may not equal private benefits and costs. Care must be taken that suboptimization does not occur. The preconditions for private and public optimization must be determined.

   b. A tax and subsidy system that makes the fit needs to be established.

3. What kinds of measurements are needed and can be developed to quantify inputs, outputs, relationships?

   a. Social indicators as proxies

   b. Careful and correct definition of output, e.g., arrest vs. crime prevented

4. How can we facilitate communication among experts and with the affected consumers and producers?

   a. Possible development of an interdisciplinary methodology

   b. Technology assessment, if meaningful

   c. Engineering specifications developed for services, but which could depersonalize the system

5. How can we improve the productivity in service industries through the intelligent participation and contribution of the consumer?

   a. Education and training result in "flexible," knowledgeable consumer

   b. Planned participation is part of the design.

   c. Train the deliverer to recognize that consumers can and should participate actively in the creation of the service.

6. How can we gauge consumer welfare?

   a. Panels of consumers registering satisfaction or dissatisfaction.

   b. Possible role for an "experience firm" (a la Plimpton) to satisfy non-rational, spontaneous, aesthetic elements of life

   c. Use technology to create services to enhance the quality of life

7. How can we devise institutional mechanisms for sharing the benefits (and costs) of automation?

   a. Questions of institutionalizing creativity and of making institutions responsive to change.

PROBLEMS: consumer-producer interface
producer-equipment interface
incentives (monopoly provision)

Why is a "service life-cycle" long?

1. Intangible nature of service:

   a. transitory

   b. incremental effects

   c. producer slow to change

   d. consumer slow to change

2. Can patent product, can't patent organizational change

   a. therefore mix of basic and applied R&D biased away from service innovations

3. Absence of specific focusing mechanisms:

   a. lack of competition

   b. consumer ignorance

   c. producer ignorance of quality of consumer input

   d. complex production interdependencies (compared with assembly line), e.g., education and health

4. Division of labor non-existent

   a. disaggregation is nonlinear

   b. develop modules, benefit from scale economies.

HUMAN DIMENSIONS

1. As an input: design consumer into system,
   educate him to participate,
   educate him to evaluate.
   Therefore provide information

2. Change in consumer as output, measure what didn't happen

3. Responsiveness of consumers to aspects of services

SOLUTIONS

Consumer Studies

a. Current population survey, for example--integrate into several indicators.

b. Government provision of information to consumer on, e.g. schools and hospitals

c. Market-type forces thus brought to bear; this establishes incentives.

Consumer Information Commission

a. Like SEC, with full disclosure by potential investors--

   for consumers, data on doctors, hospitals, educators, schools.

b. Computer can give data on past results, along with tracking of parts or performance of autos.

c. Government has responsibility to ensure that market forces present

Technology Impact Statement--similar to Environmental Impact Statement

Automation

a. Possibility lies in capturing in hardware and software the essence of highly complex services, e.g. management, library services, diagnostic medicine.

b. Inventory services- then transform to goods

c. Information as an input can be inventoried.

In summary: The incentives are messed up; we need to get consumers back into the loop by getting him information; we need to help him realize his role as an input; and to see how he has changed. We also recognize how really complex the services are, and need to get experimenting with more measurement in these areas.

A. Essential Differences Between Services and Products

The crucial difference between "services" and "products" is the timing of their consumption. Services are commodities consumed immediately upon being produced. Products represent "inventoried services" capable of being consumed on one or more deferred occasions.

Commodities have other characteristics that are important to understanding their economic significance and thus improving the efficiency with which they are produced, i.e., their productivity. These other characteristics are sometimes confused with those which distinguish products from services--with disastrous results for productivity.

Let's illustrate this. We will deal with two quite different commodities, national defense and haircuts. Though they are economically quite different on one dimension, they are both services. After this discussion, we will present a brief analysis of the characteristics which distinguish national defense from haircuts; this could lead to a systematic framework within which the reader can keep each of the important characteristics straight.

One a Public Good, The Other a Private Good

National defense falls into a category of commodities which have become identified as "public goods" or "public commodities." They have two distinguishing characteristics: once they are produced they are not appropriable--no individual can appropriate the benefits from them to himself, other persons cannot be excluded also from receiving benefits from the commodity; and they are also not divisible--whatever is provided is provided to all, either all have it, or they don't; it's not possible for one person to have a little and others to have a lot. Let's make this explicit.

National defense provided to one citizen is immediately and automatically available to others. Another way of stating this is that a public good is not diminished by being consumed by one consumer. Then, since it is indivisible, all the costs of producing national defense are incurred in providing it to the first citizen served. Once they have been incurred, no more costs are required for the service to be provided to other citizens. That is, once produced, national defense is available to additional citizens at no additional cost (zero marginal cost).

The situation for haircuts is quite different. A haircut given to one person is available to that one person only. Two haircuts cannot be produced by the same barber simultaneously. To provide the second haircut requires the attention of the barber--and thus, the incurring of costs specifically for that matter. The key characteristic here is that a haircut is appropriable. A second characteristic is that haircuts are divisible. It is possible to cut the hair of your whole family, or only two members, or only the hair of one member, or only part of the hair of one member. These two characteristics of haircuts--appropriability and divisibility--clearly distinguish haircuts from national defense in economic terms (and the reader is aware of the number of other differences that are specific to the commodities discussed). They also imply that the marginal cost of an additional haircut is positive--it is greater than zero. Haircuts fall into the category of commodities which have come to be known to economists as "private goods" or "private commodities." In terms of their public good--private good characteristics, then, national defense and haircuts are exact opposites, but in terms of their product--service characteristics, they are the same. Let us demonstrate this.

Both Are Services--Not Products

The "services" (Army, Navy, Air Force, Marines, and Coast Guard) jointly produce our classic "public commodity" of national defense. (Even our colloquial terminology fits here.) But national defense also fits our economic definition of a service. That is, national defense is consumed immediately upon its being produced. It is related to the fact that it is a "public commodity." The important characteristic which we are

referring to here is that it is being consumed each instant that it is produced. National defense is undiminished by its being consumed by a given consumer, but that is because it is a public good--a public "service."

A haircut is also a service. It is consumed immediately upon being produced, but we have seen that it is a service which has other economic characteristics, those of appropriability and divisibility, which allow it to be characterized as a private good or private commodity as well as a service.

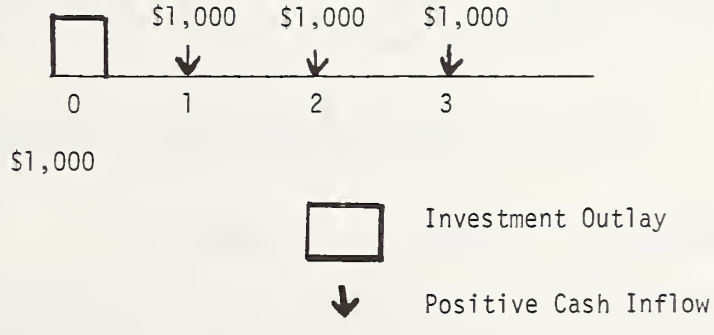
Another distinction needs to be made, and hopefully will be useful. National defense is not a product--though many products are used in providing the service of national defense. All the products could remain in place and the service still fail to be provided. As the old saying goes "Eternal vigilance is the price of . . . ." Similarly, a haircut is not a product, but many products are used in providing the service of cutting hair. The existence of all the products used does not lead to the provision of the service. The products, however, when appropriately used contribute to the providing of that service.

B. Considerations of Investment in the Innovative Process

The normal procedure for an investment is illustrated in Figure 1 in which the square represents an investment outlay of, say $1,000, for the purchase of a product (in our case an automation product). The arrows indicate positive cash inflows from the investment--also assumed to be $1,000--occurring at time periods following the investment. These cash inflows are assumed to be attributable to the investment in the automation equipment.

Figure 1.

Simplified Investment Diagram



In this illustration there are three inflows each of $1,000 which suggests that the investment is clearly worthwhile. In accordance with the principle that "a dollar in hand is worth two promised in the future," each of these later cash flows is worth something less than the full $1,000 amount; they must be "discounted." Our assumption is that the three $1,000 flows occurring annually represent an annuity with an overall value at present of $2,500. The calculation which leads to the present value of these future flows is Equation (1).

(1) $1,000 x 2.500 = $2,500

(annual flow) x (annuity factor) = present value.

The "annuity factor" is the factor corresponding to a particular rate of discount, in this case approximately 10% annually, and a given number of years, in this case three. This logic works both ways, that is, the $2,500 at interest for three years at 10% would earn enough to provide three $1,000 annual payments--an annuity of $1,000 per year for three years. Assuming that additional investments by the organization in question could earn 10% annually, its managers should be indifferent between receiving $2,500 today or $1,000 per year for three years.

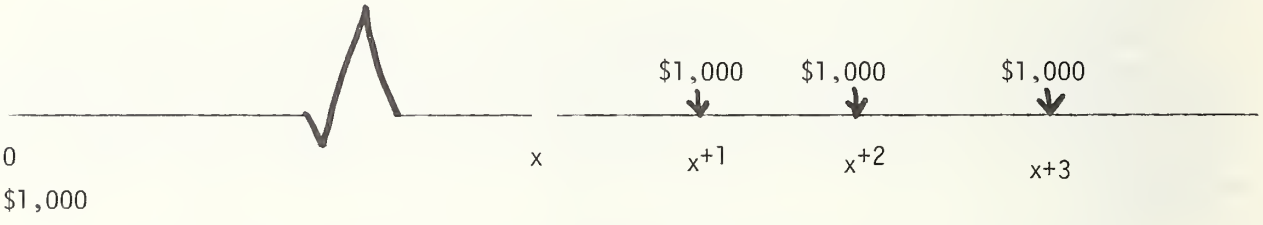
The situation depicted represents a normal, simplified investment analysis. The initial $1,000 investment is worth making; it yields cash flows with a present value of $2,500.

IMPACT OF THE DELAY

The situation depicted in Figure 2 is closer to the actual experience for investors in research, development and innovation. Usually they are required to make investments at time zero which are followed by a significant elapse of time before inflows begin.

Figure 2.

Diagram of Investment with $_x$-Year Lead Time Preceeding Period of Positive Cash Flow



The recovery of the investment indicated occurs again by the three arrows, representing individual $1,000 cash inflows, but this time beginning $_x$-years later. In accordance with the principle that dollars in the future are less valuable than the same number of dollars today, the delay in recovery of the positive cash flows further lessens their present value. The assumption in Equation (2), is that the delay in recovery is two years (x=2) and leads to the outcome expressed:

$$(2) \qquad (\$1{,}000) \times (2.500) \left(\frac{1}{1.10}\right)^2 = \$2{,}000$$

(discount factor) x (annual flow) x (annuity factor) = present value

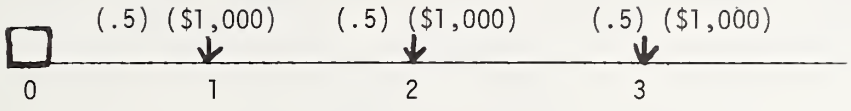
Here, the interposing of an extended lead time (two years) in the example has led in the reduction of the present value of three $1,000 flows by a net amount of $500 ($2,500-2,000). Nonetheless, the investment is worthwhile; $1,000 invested leads to $2,000 in present value of returns.

UNCERTAINTY IN THE PROCESS

A more realistic illustration is that presented in Figure 3 in which the future cash inflows are not certain, but instead have only a (.5) probability of occurring. If they do occur, the positive cash flows will occur in the years immediately following the initial outlay and will amount to $1,000 as before.

Figure 3.

Diagram of Investment With 0.5
Probability of Payoff



$1,000

With the .5 probability of success the expected outcome annually from investments of this type would be approximately $500 per time period. This leads to a result as indicated in Equation (3).

(3) $(.5) \times ($1,000) \times (2.500) = $1,250$

(probability of positive flow) x (annual flow) x (annuity factor) = (expected present value)

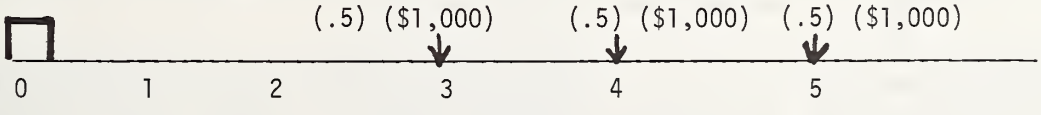
The $1,000 leads to an expected value of future inflow of $1,250 and would probably be undertaken. It may be possible to raise the probability of positive outcome through careful management of this project or the expectation can be made virtually certain through diversification of projects. (Oil companies drill for oil, in several locations, simultaneously to reduce the uncertainty in their operations. They can generally count on a given number of good wells, though they cannot know in advance which locations will be dry holes and which will not.)

TIME DELAY PLUS UNCERTAINTY

If the lead time and the uncertainty both are operative, the investment could be expected to break even and the investor would be indifferent whether to undertake it or not. In situation 4, Figure 4, the delay in payoff reduced the value of the outcome to $\frac{.2000}{.2500}$ = (.8) times the original value; and the uncertainty would reduce it to $1,000 [(.5) (2,000)] as shown in equation 4.

Figure 4.

Diagram of Investment with 0.5
Probability of Inflow After Two Year Lead Time



(4) $\left(\frac{1}{1.10}\right)^2 \times (.5) (1,000) \times (2.500) = \$1000$

(discount factor) x (probability of positive flow) x (annual flow) = (expected value)

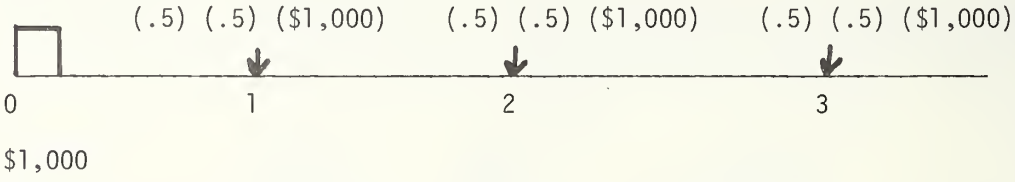
This is an expected outcome, not a certain outcome. Since the investment outlay is certain, a "risk averter" might decide that the outlay outweighs its uncertain return and thus he might not undertake the investment.

CAPTURABILITY OF BENEFITS

Most private firms face an innovation investment situation which is more complex still. Not only is there uncertainty of outcome from an investment outlay for research, development and innovation, but further, there is uncertainty whether the firm making the outlay can capture for its own use the benefits of its outlays. This situation is illustrated in Figure 5.

Figure 5.

Diagram of Investment With 0.5
Probability of Pay-off and 0.5 Probability
of Capture of Payoff



$1,000

Here the assumption is that there is only a fifty percent chance that the positive inflow, should it occur, will accrue to the benefit of the firm making the outlay. This leads to the expected value of each annual cash flow only one half that depicted in Figure 3. That is, the expected outcome for each positive annual cash flow only one half that depicted in Figure 3. That is, the expected outcome for each positive annual cash flow is only $250. The calculation of the net present value this implies is presented in Equation (5).

$$(5) \quad (.5) \times (.5) \times ($1,000) \times (2.500) = $625$$

(probability of return to investing firm) x (probability of positive flow) x (annual cash flow) x (annuity factor) = (expected present value)

Now for the first time the investment outlay has an expected present value of outcome which is less than the outlay. In all previous cases the investment expenditure was worthwhile. In situation 1, the expected net present value was ($2,500-1,000) = $1,500. In situation 2, despite a long lead time, the expected net present value outcome was ($2,000-1000) = $1,000; again, clearly a desirable result. In situation 3, with the introduction of the probability of a failure from the investment, the expected net present value of outcome is $250 greater than the investment amount of $1,000. Again, such an opportunity would probably be undertaken. Even in situation 4, with the time delay plus uncertainty, the investment would break even.

In situation 5, we find that the expected payoff to the firm making the investment is only $625. This clearly would not justify an investment in the amount of $1,000; the net present value of the expected outcome is negative. However, under the assumptions which we have been using, an additional expected annual outcome of $625 is implied to accrue to firms other than the investing firm. That is, there are benefits external to the firm making the initial investment. This expected payoff to firms external to the investing firm is an amount indicated in Equation (6).

$$(6) \quad (.5) \times (.5) \times ($1,000) \times (2.500) = $625$$

(probability of return external to investing firm) x (probability of positive flow) x (annual cash flow) x (annuity factor) = (expected present value)

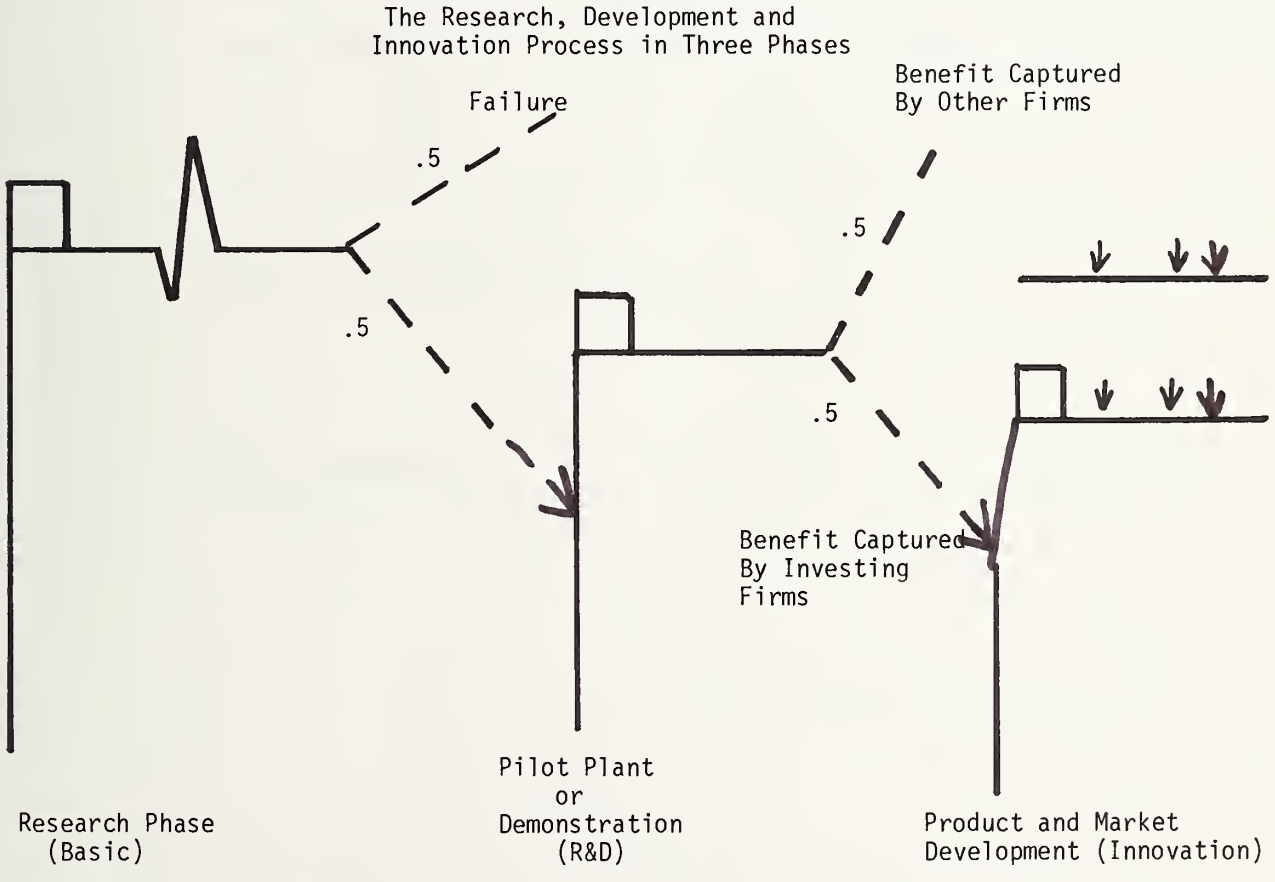
The full payoff to society is expected to be ($625 + 625) = $1,250 (as in situation 3). However, from the point of view of the decision maker the payoff is only $625. Another way of stating this is that, "The payoff is firm, but not to the firm."

In situation 5, the investment is undesirable from the point of view of the private organization, though desirable to the society as a whole. Since the decision to invest or not invest is left to the private organization, the investment would not be made. Some social mechanism is therefore warranted (required) to insure that an investment of this type is made; its economic payoff to the society exceeds its overall economic costs. This is one major justification for the intervention of governmental bodies in the private decision-making process for research, development and innovation.

THE REAL THING

Most realistic of all is a situation which combines the features of all those discussed thus far. This is the situation suggested in Figure 6.

Figure 6.



For innovative projects it may be necessary that all three investment phases suggested in Figure 6 be successfully completed before there are any benefits realized. In such cases three investment outlays have to be made before benefit to the firm can occur at all. As these investments are made, their outcome remains uncertain. Lack of success at any stage in the process can render the overall effort financially unrewarding for the investing firm: If the basic research does not produce a successful outcome, the project would be ended; if it is successful, the pilot plant or demonstration phase may not proceed as desired and the project could be terminated; or the first two stages may be successfully completed, the investment in product development undertaken, but the benefits captured in whole or in part by a competing firm.

The complexity of the innovative process and its uncertainty present an additional basis for governmental involvement. Efforts to perfect the process through creative institutional arrangements, through provision of information or improvement in the flow of information, or through other mechanisms to remove frictions or reduce uncertainty are generally undertaken by governments throughout the world.

Report of Workshop Panel 2

on

Planning and Managing the Introduction of

Computer Technology and Automation in Service Industries

Panel Participants

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* Panel Leaders

"PLANNING AND MANAGING THE INTRODUCTION OF

COMPUTER TECHNOLOGY AND AUTOMATION IN SERVICE INDUSTRIES"

I. MISSION STATEMENT (Chart 1)

Develop and identify the common problems and significant differences in terms of nature of people, management tools, organizational structure, educational needs, and technology requirements that capture the essence of what is required to introduce computer technology and automation so as to increase the productivity of the service industries.

II. ENVIRONMENTAL CHARACTERISTICS

Characteristics of the Service Industries (Chart 2)

The service industries (SI's) are characterized by a diverse group of firms which tend to be geographically distributed in a random way, are labor intensive, and have little capacity for research and development. A majority of SI's operate on low resources to invest in a specialized one-dimensional way, with little incentive for the introduction of automation because the benefits are difficult to capture by the innovator or entrepreneur. The SI's tend toward regulation or licensing of some type with either a high or low level of educational needs to enter the business.

The basic SI structure is perceived to be inefficient in terms of operations, with the output trends difficult to quantify and measure. SI's usually involve a high relative risk factor of business innovation and their structure makes it difficult, in a gross sense, to take advantage of large scale economics.

The small size permits SI's to respond to change of the market place, but can not respond to technological innovations. The businesses tend to have single, rather than a diverse set of objectives.

Both profit and non-profit SI's exist, with the entrepreneur associated with the former and the craftsman with the latter. The profit motivated SI's tend to exploit technology while the non-profit organizations desire a status-quo situation. The non-profit or craftsman perceives that technology is a threat to his way of delivering a service to the consumer.

The size of SI's increases with technology enhancement with an attendant decrease in the ability to have personalized customer feedback.

SI's are people dependent and their structure makes difficult the migration of personnel from industry to industry. This creates a situation where obsolescence in talents may occur.

Motivations of the Service Industry (Chart 3)

SI's serve a basic need for the welfare of society. Service industry business is motivated by a mix of profit and non-profit economics. Some SI's are characterized by a base level of profit motivation beyond which motives tend to be self imposed or of an ego-gratification nature.

Customer Set of the Service Industry (Chart 4)

The customer of SI's tends to be more emotional than logical in his desire for service in an often inelastic supplier market. The customer set imposes a fairly flat demand on the SI's, requiring a constancy of work force, with SI's labor force compensation tending to vary rather than employment force. The customer perceives

TASK GROUP 2 CHARTS

MISSION STATEMENT

DEVELOP AND IDENTIFY:

1. COMMON PROBLEMS AND DIFFERENCES
2. NATURE OF PEOPLE
3. MANAGEMENT TOOLS
4. ORGANIZATIONAL STRUCTURE
5. EDUCATIONAL NEEDS
6. TECHNOLOGY

REQUIRED TO INTRODUCE COMPUTER TECHNOLOGY AND AUTOMATION TO INCREASE PRODUCTIVITY OF THE SERVICE INDUSTRIES

CHART 1.

CHARACTERISTICS OF SERVICE INDUSTRIES

TEND TO BE:

- DIVERSE GROUP
- GEOGRAPHICALLY DISTRIBUTED IN RANDOM WAY
- LABOR INTENSIVE
- LOW CAPITAL
- LOW IN CAPACITY FOR R & D INNOVATION
- SPECIALIZED IN ONE-DIMENSIONAL WAY
- LOW INCENTIVE FOR INTRODUCTION OF AUTOMATION

  (BECAUSE)

- BENEFITS DIFFICULT TO CAPTURE
- SUBJECT TO REGULATION/LICENSING
- PERCEIVED INEFFICIENCY USING STANDARD PRODUCTIVITY MEASURES
- UNABLE TO TAKE ADVANTAGE OF LARGE SCALE ECONOMICS
- POTENTIAL FOR QUICK RESPONSE TO CHANGE (SMALL SIZE)
- SINGLE RATHER THAN DIVERSE OBJECTIVES
- TWO KINDS OF ORIENTATIONS:

  PROFIT (ENTREPRENEURIAL)

  NOT-PROFIT (CRAFTSMAN)

- INCREASED SIZE BRINGS DECREASE IN PERSONALIZED SERVICE

CHART 2.

MOTIVATIONS OF THE SERVICE INDUSTRY TEND TO BE:

1. Serve Society Welfare and Needs

2. Profit and Not Profit Economics

CHART 3.

CUSTOMER SET OF THE SERVICE INDUSTRY TEND TO BE:

1. Emotional Rather Than Logical

2. Non-Central Source of Goods

3. Little Way to Shop or Compare Service Functions

CHART 4.

the SI as a non-central source of goods and subject to social changes which create new markets and demands for new SI's. Current users of SI's also have little way in which they can shop or compare service functions in the market place.

It should be pointed out that the panel report has selectively dealt with planning and management functions in the context of a model which does not include in detail a response to all of the details in its assigned mission.

Of these major characteristics the following were deemed to be of particular importance in planning and managing the introduction of computer technology and automation into the service industries:

1. Low level of availability of Capital for R & D.
2. High degree of inertia in the system.
3. The large non rational component in the decision making process.
4. A wide geographic distribution of providers.
5. Low pay off for entrepreneurs.
6. High degree of individuality and specificity in information systems used.
7. Little opportunity for economics of scale.

The matching characteristics of a plan must then present:

1. External initial risks capital or a new and visible reward for the entrepreneur.
2. Deliberate phasing of start up.
3. High level of intensity in participation by industry and the consumer in both planning and management.
4. A universal language and availability of information within the industry.
5. A specialized service for each industry.
6. An aggregation of interests to induce economy of scale (increased productivity).

Several options for introducing technology were discussed and included:

1. Regional problem solving center.
2. The development of productivity models which illustrates the principle and can sell services.
3. Build a "new town" using the most advanced technology which appears acceptable.
4. Do a model city project with a technology theme.
5. Focus upon the development of a national data base for one or more of the service industries.
6. Develop an educational system which highlights the "do it yourself" potential which exists in the service industries through the use of technologies.
7. Develop information dissemination services for each service industry.

The panel selected the Problem Solving Center as a theme and incorporated with it some of the other concepts. While the panel agreed that a basic function of the government was "to serve the common good," no specific governmental role was described in this model.

A Problem Solving Center might have the following set of functional relationships and responsibilities (Chart 5).

From an organizational and operational point of view it might be set up as follows:

Funding options (Chart 6)

A. Start up funding in these industries will often need federal sponsorship because of the low potential for raising risk capital within the industry. This could be in the form of grants, contracts, interest subsidies or loan guarantees. It could be a combination with probably a different arrangement advisable for each industry.

   It was agreed that any subsidy should have a time limit and be on a phased basis which leads to a free standing, financially stable organization.

B. Operational funding would vary in accord with the potential of the industry, but the options include:

   1. Tax or governmental support.

   2. Subscription services (x 1 year for a service)

      Industry

      Consumer

   3. Fees for specific individual services.

   4. Endowment and contributions.

The control options seemed to be standard (Chart 6):

A. Ownership

   1. For profit with stock holders and a corporate structure.

   2. Not for profit

   3. Non profit.

B. Policy direction

No matter what the supervisory body might be it was agreed that the Board of Directors should be representative of the potential or actual consumers of the services. Within that stipulation the board could be:

   1. Elected representative from selected groups.

   2. Appointed or elected representatives from a planned mix of governmental/private/educational groups.

   3. Selected co-op style.

   4. Appointed by special interest.

   5. Self perpetuating.

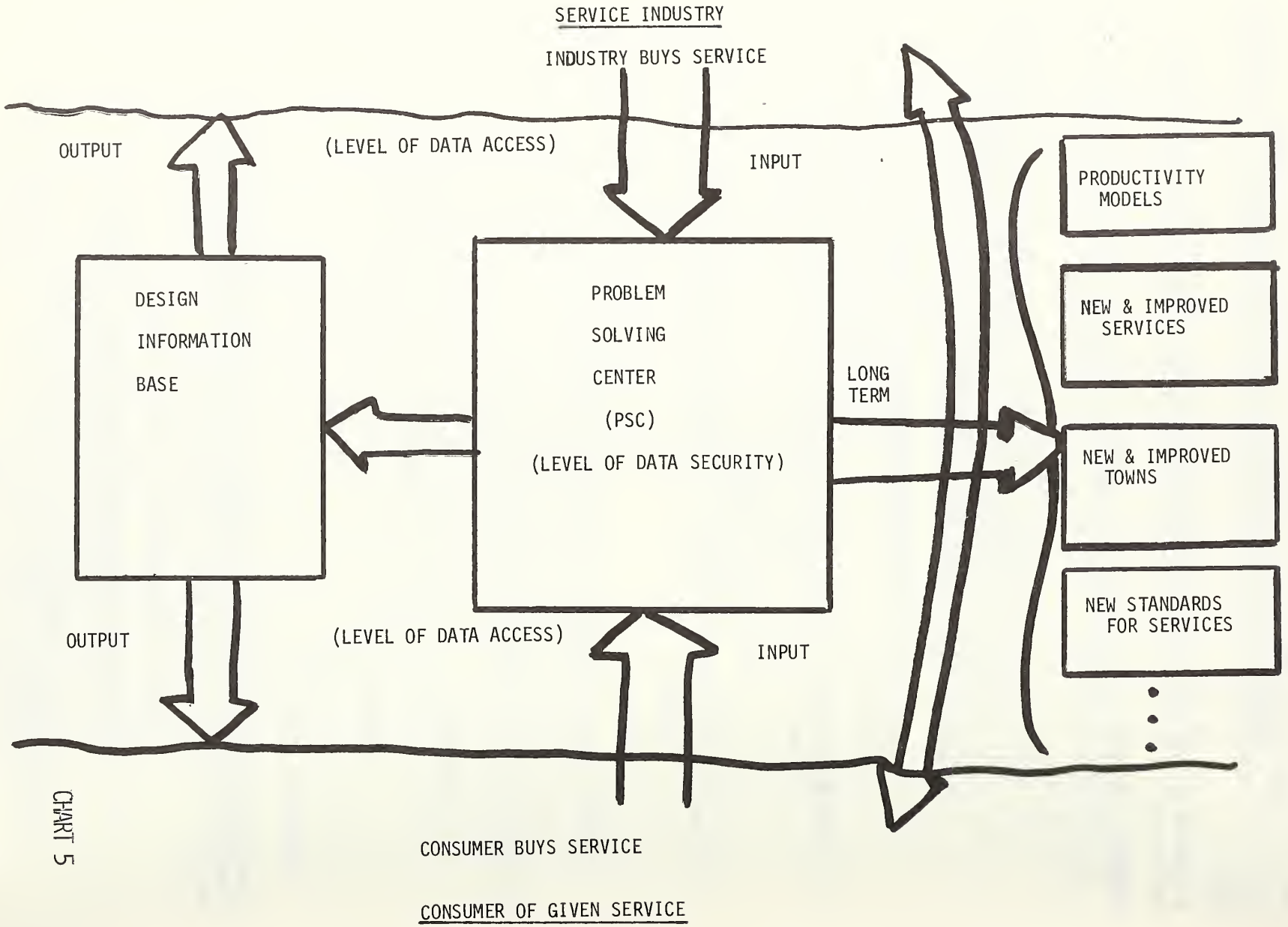

SERVICE INDUSTRY
INDUSTRY BUYS SERVICE
OUTPUT
(LEVEL OF DATA ACCESS)
INPUT
DESIGN
INFORMATION
BASE
PROBLEM
SOLVING
CENTER
(PSC)
(LEVEL OF DATA SECURITY)
LONG
TERM
PRODUCTIVITY
MODELS
NEW & IMPROVED
SERVICES
NEW & IMPROVED
TOWNS
NEW STANDARDS
FOR SERVICES
OUTPUT
(LEVEL OF DATA ACCESS)
INPUT
CONSUMER BUYS SERVICE
CONSUMER OF GIVEN SERVICE

CHART 5

FUNDING OPTIONS

A. Start Up Funding

B. Operational Funding

- Tax or Government Support
- Subscription Service (Industry & Consumer)
- Fees for Service (Industry & Consumer)
- Endowment & Contributions

CONTROL OPTIONS

A. Ownership

- For Profit
- Not for Profit
- Non-Profit

B. Policy Direction

- Elected Representatives
- Planned Mix (Government/Private/Education)
- Selected Co-op Style
- Appointed (Special Interest)
- Self Perpetuating

CHART 6.

From a management point of view the following tactical considerations were endorsed by the panel as worthy of further development (Chart 7):

1. A mission and initial objectives should be tentatively developed and an appropriate corporate structure initiated.

2. The Corporate structure should then undertake the following, somewhat in this sequence:

   a. Refine and codify the mission and objectives.

   b. Develop a funding strategy--Initial Capital, operational funding principles--(Allow at least two years lag time).

   c. Secure staff with a high level of acceptance in the service industry and established expertise in the specific undertakings.

   d. Start the **development** of the long range plan for an information system which can lead to the development of a total data base.

   e. Design a business plan which identifies an applicable package with a high return and a low negative impact upon the industry and its customers.

   f. Identify groups or individuals in the industry with an apparent need for the service who are receptive to the strategy and wish to be identified as innovators.

   g. Stage the introduction of new and parallel packages so that products are in existence at various levels of maturity--Maximize modular approach to allow multiple use of efforts.

   h. Develop supporting plans or strategies to assure resources to industry which will allow or expedite execution of the plan, including:

      --training and education of personnel

      --management tools

      --access to available technology

      --market analysis

Additional considerations must include two thoughts. First the issue of **credibility** is of such crucial importance that considerable effort should be dedicated to meaningful association of the Problem Solving Center with institutions having high visibility and acceptance in the field.

Second, some meta-administrative structure will be necessary to introduce a higher level economy of scale though cooperative effort between service industries. Initially this may take the form of conferences or symposia. Risks might be:

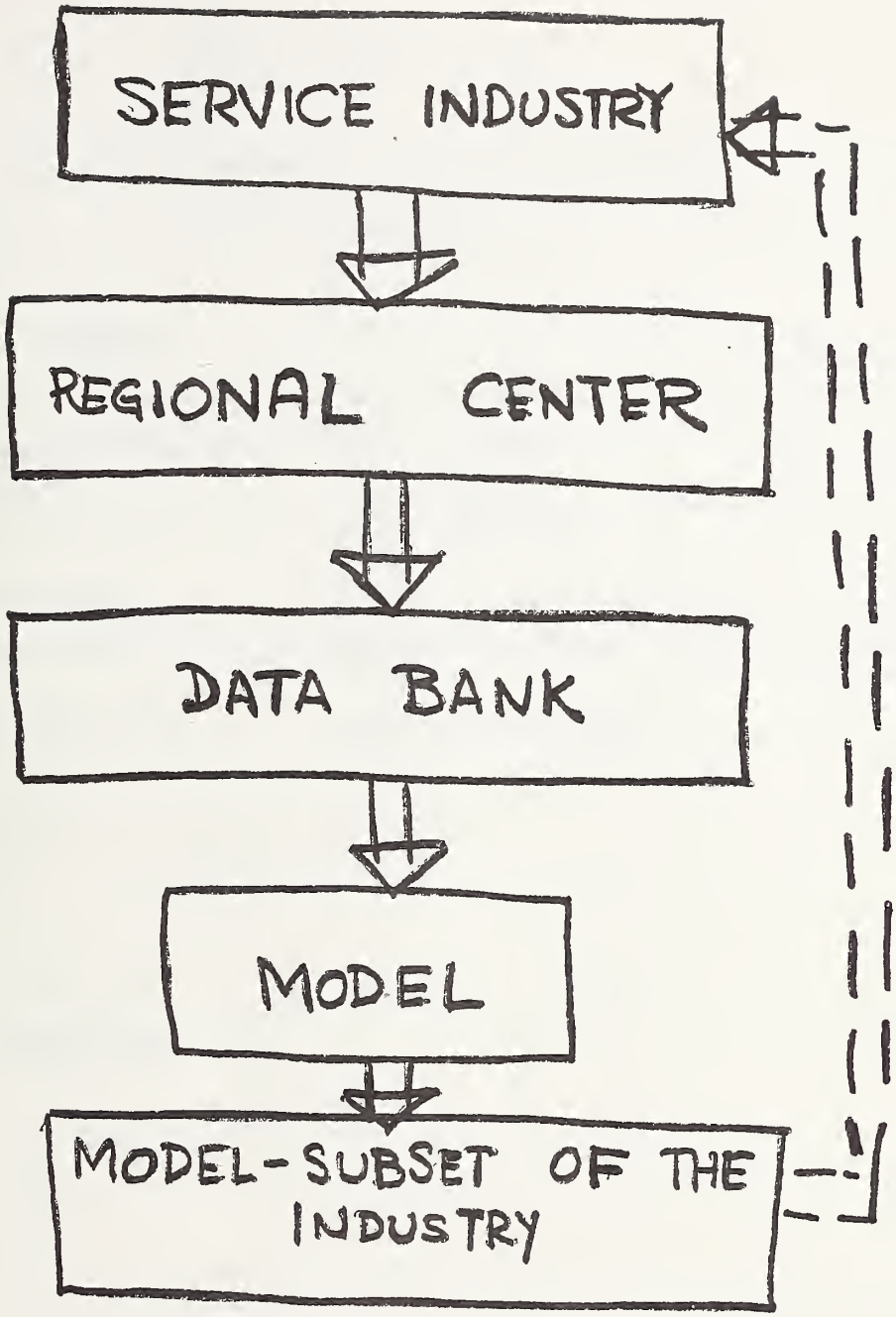
Professional jealousy

A self-serving organization

Possible forced use of a single hardware firm

Compromise, quantity--poor management

Expectation unrealistic--poor communications.



TACTICAL BUSINESS PLAN

CHART 7

Report of Workshop Panel 3

on

Institutional Barriers to Innovation and Diffusion

in the Service Sector

Panel Participants

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Robert A. Davis	IBM Corporation
Robert C. Duvall	MARTA (Metropolitan Atlanta Rapid Transit Authority)
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* Paul Polishuk	Office of Telecommunications, Department of Commerce
Laurence Schmid	MARCOM Applied Systems

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* Panel Leaders

"INSTITUTIONAL BARRIERS TO INNOVATION AND DIFFUSION

IN THE SERVICE SECTOR"

It is impossible to identify and assess the relative importance of institutional barriers unless you first understand barriers in the broadest sense. Similarly, service innovations cannot be treated as a meaningful concept unless they are understood within the context of all innovation. Thus, our panel began its work by identifying barriers of all types, in order to establish a framework for pinpointing institutional barriers and comparing them to other types.

In discussing barriers to innovations, our panel had no trouble listing dozens of different types; some of these barriers will be mentioned in more detail a little later. Our specific barriers and their categories do not represent a comprehensive listing, but they do indicate the wide range and variety of barriers which can be identified even in the short time available to us. We were able, however, to form a significant conclusion: the relative importance of specific barriers can be established. Our panel quickly agreed that the best method for deciding the relative importance of barriers is to quantify and enumerate--in other words, to deal in numbers.

However crude, numerical data permits a higher level of analysis; to demonstrate the point, our panel obtained some preliminary data from an actual study of barriers, being conducted by the Institute of Public Administration and the Denver Research Institute. The data, presented below, are simply a count of barriers (expressed as percentages) encountered by 200 producer's goods innovations. These figures are relevant to our discussion of service innovations, because producer's goods innovations generally are productivity-oriented, and many would be used in the provision of services.

PERCENT OF INNOVATIONS BLOCKED BY TYPES OF BARRIERS

(Sample: 200 producer's goods innovations)

BARRIER	PERCENT
Management (internal)	17.3
Organization and Staffing	6.1
Market (external)	25.4
Capital	16.2
Law and Regulations (excluding anti-trust and patent)	13.1
Patent	4.6
Anti-trust	1.9
Technological	10.8
Other	4.6
	100.0

From the data presented here we can begin to discern significant indicators. No type of barrier appears to be overwhelmingly predominant. Despite the many technological problems which must be solved for any innovation, only 10.8 percent of new innovations ultimately are blocked for technological reasons. Internal management performance and organization and staffing together constitute a major class of obstacle with management performance outweighing organization and staffing competence by almost three to one.

Other findings bear great significance for policymakers; the high frequency of regulatory barriers points out a type of barrier especially amenable to government treatment. Many of these cases concerned innovations which were blocked by uncertain or unpredictable government regulatory policies; other cases centered around standards which could not be met.

At last, we can progress beyond the old arguments arising from lack of hard data; figures like those presented here can tell us a great deal about what is happening to innovations by clarifying the relative importance of different problems. We are able to adopt productive lines of inquiry into specific problem areas, and we can begin talking about looking for solutions to key problems which are being identified.

Every innovation must overcome some barriers, and this is acceptable, because these barriers help protect the innovator against costly mistakes; after all, not every innovative idea is workable and cost-effective. It is true that good ideas also may be blocked, but barriers like the ones we listed may not play the decisive role in killing good ideas. A theme which became stronger as our panel continued its deliberations is that a really good innovation will beat down the barriers to its use.

The history of barriers shows quite clearly that barriers, particularly institutional barriers, disappear for really good innovations. Acceptance of the automobile was overwhelming, despite many early barriers to its success, including absence of paved roads, scarcity of gasoline, lack of repair and service facilities, and indeed, an entire society geared to horse-drawn transportation. This leads us to another point: in addition to comparing the relative importance of barriers to one another, we must try to understand the importance of barriers relative to the innovation itself.

Our panel described the crucial relationship between barriers and the innovation itself by saying that, at the point of decision, the net effect of institutional barriers is inversely proportional to the potential value of the innovation as <u>perceived by the user</u>. This statement is summarized by the formula:

$$B_{pd} \propto \frac{1}{p.v.}, \quad \text{where}$$

B_{pd} represents the effect of barriers at the point of decision; and

p.v. represents the perceived value to the user.

In other words, if a potential user sees an innovation he deems important to have, he will work to eliminate or bypass the barriers which separate him from his goal.

The formula above relates to the user of innovations, but it can be applied easily to the developer as well. A host of decision-makers affect the fate of every innovation, and each one perceives the innovation's value in his own terms. Developers, whether management, sales personnel, or engineers, must perceive value in two ways. They must anticipate the potential value which will be placed on an innovation by the users who might buy it. Equally important, developers must assess the value this innovation represents to their own company by applying criteria including profitability and other familiar factors. As with the user, the developer also perceives a value for an innovation, and the effort he will make to overcome development barriers depends a great deal upon his perception of the innovation's value.

Our panel has succeeded in carrying this analysis a step further, by examining perceived value in relation to degree of innovativeness. We can show that the very nature of a particular innovation can affect a user's ability to perceive its value. Specifically, decision-makers often experience difficulty in perceiving the value of radical innovations where their experience does not extend. These same decision-makers find it easier to see the benefits of innovations adapted from proven processing and products.

A spectrum of innovativeness is depicted below starting at the low end of the scale with diffusion of innovations which are not new to the world, but are new merely to a particular user. An example of this type of innovation is the "Dempster Dumpster" trash collection method currently in use all over the country. To the few people not yet using this system, it represents an innovation; they can see from others' experiences precisely how it would work for them, and what sort of value it offers. This is an innovation at the low end of the innovativeness spectrum, and also at the low end of the scale which measures difficulty in perceiving value.

At the upper end of the spectrum, we find the area of technological discontinuity, where an innovation is really new. An example of an innovation at this end might be the Xerox 914 in predevelopment stages. What is so clearly a valuable innovation now was not so obvious a few years ago; few people now remember that the 914 generally was regarded as an unpromising prospect. Two exhaustive market surveys by different consultants each concluded that the 914 would fail to find acceptance. They cited its size, cost, and a variety of other problems, but they failed to anticipate two key factors which made the 914 a success: first, it was marketed on a lease/hire basis, rather than sold outright; second, it was more than just another means of making copies, because it made those copies faster. The value of this fast speed could not be appreciated until it was tried; when the 914 was demonstrated to users, the value of the innovation finally could be perceived. The high innovativeness produced a high difficulty in perception of value, and this difficulty was overcome only by familiarizing users with the profitable applications of this new technology.

As an example of an item at the middle of the spectrum, the panel looked for an innovation which required moderate innovativeness in the form of adaptation of an item to a new use, new setting, or new environment. The example selected was "slippery water," a polymer process which was adapted to fire-fighting uses. The value of this innovative adaptation was only moderately difficult to perceive because it was easily demonstrated. As soon as officials were shown that a stream of slippery water could be thrown farther than a stream of ordinary water, these decision-makers quickly realized the value of this innovation.

The following chart illustrates the points made above, showing that as one moves up through the spectrum of innovativeness, the trend is towards greater uncertainty, more argument, and greater difficulty in perceiving an innovation's value. At the top of the spectrum, a genius may be required to see the potential value of an innovation.

It becomes evident that the degree of difficulty experienced by decision-makers in perceiving the value of an innovation constitutes a barrier to the success of that innovation. This "perceived-value barrier" is not just another among the dozens of specific barriers identified here and elsewhere. It must be remembered that an attractive innovation seems to beat down barriers before it, while another innovation, of less obvious value, will find barriers to be insurmountable. All other obstacles are a function of the primary perceptual barrier, which acts to diminish or increase the strength of secondary barriers. Furthermore, the effect of the value-perceived barrier acts on the other barriers in a uniform fashion, magnifying or reducing them all. A decision-maker who really wants a particular innovation will minimize all obstacles to it, but a decision-maker confronted by an apparently valueless innovation will amplify any reason for dropping it.

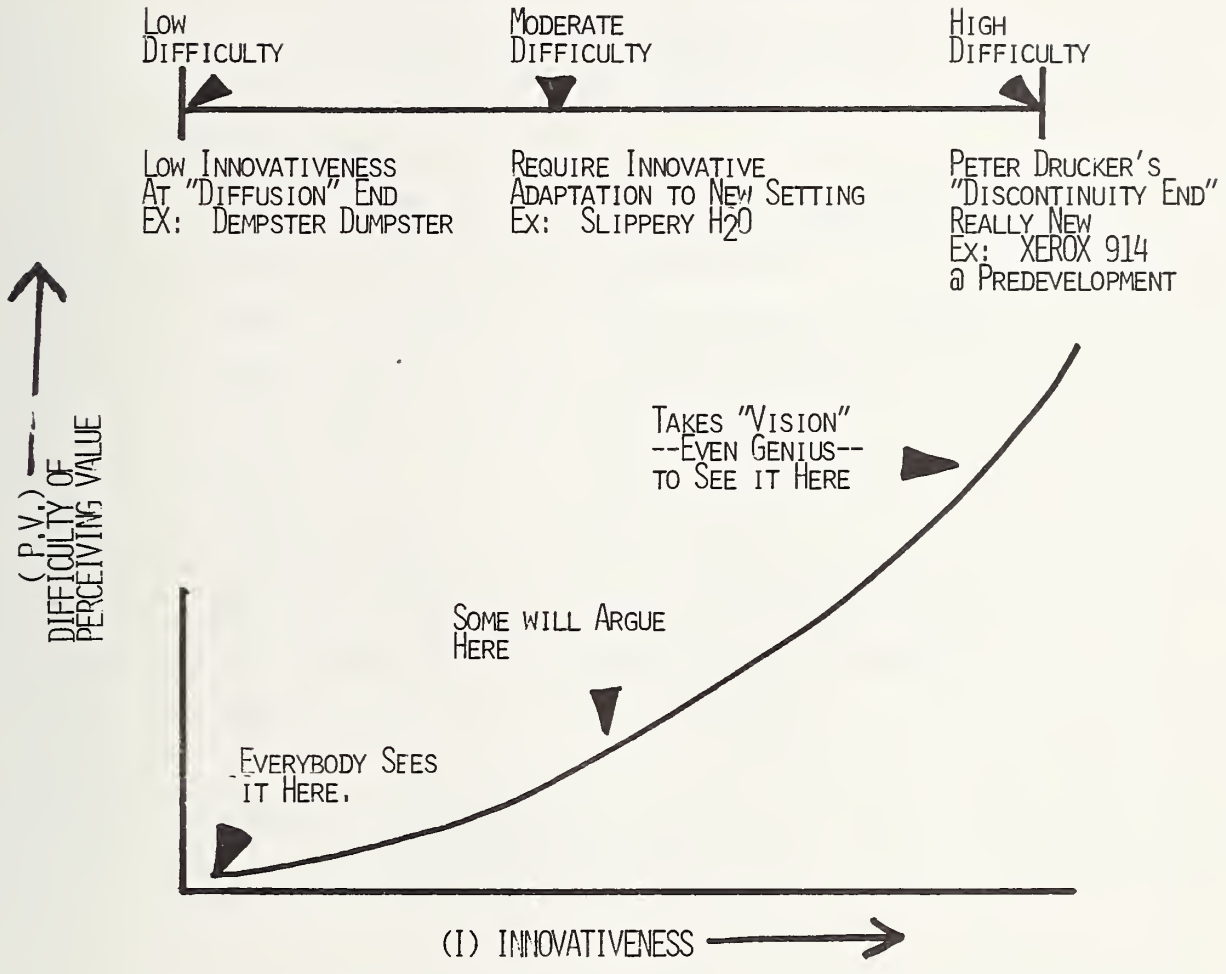
For service innovations, the primary barrier principle is especially relevant, because the abstract nature of services requires more imagination to see the potential value in a new idea or product. The service sector appears to be in particular need of remedies to the perceptual barrier, although this primary barrier operates throughout

the public and private sectors, blocking innovative products and services alike. This barrier is especially critical because it favors low-degree innovativeness while selectively obstructing ideas which are more original and creative.

An understanding of the perceived-value barrier creates a potential for better policymaking whenever we seek to improve the rate of innovation. All our efforts should not be addressed to finding remedies, one at a time, for secondary barriers, if there is a better way of attacking them all simultaneously. This leads us to the recommendation that we should begin thinking of ways to improve the critical decision-maker's perception of an innovation's value.

This recommendation is more than mere rhetoric, and we can see some places where action would be especially fruitful. For instance, an important item for consideration is when and how to use pilot models and demonstrations. The government (and, incidentally, the Ford Foundation) are unsure about this. The venture capital community makes the case that inventors don't know how to develop credible data--but couldn't a project be designed to develop more credible data? The DRI-IPA innovation study uncovered cases where demonstrations failed because the innovations were too unlike old-style ways, and the users were asked to comprehend too much too soon. Other demonstrations did not convince users because they felt they had no stake in the success or failure of the demonstration. Still unsolved is the problem of why seemingly everybody except the potential user can perceive with perfect clarity the value of an innovation; obviously, technological transfer requires conceptual transfer as well. Better design of demonstrations, new techniques of user education and better information flow are just examples of the many priority items for improving the implementation rate of innovations. Many of the effects of barriers to innovation can be bypassed or overcome if more attention is given to jumping the critical perceived-value barrier, by improving the ability of decision-makers to see the potential worth of a new idea. After overcoming this primary obstacle, we should see more innovations beating down those secondary barriers, which will melt away as more decision-makers actively seek out innovations they find attractive.

Difficulty of Perceiving Potential Value
Along the Spectrum of Innovativeness



Report of Workshop Panel 4

on

Improvements in Computer Technology Needed to

Match the Service Industry Marketplace

Panel Participants

	Robert H. Anderson	University of Southern California
	Walter M. Carlson	IBM Corporation
	James A. Dei Rossi	National Bureau of Standards
*	Robert Johnson	Burroughs Corporation
	Brian Mansir	Xerox Corporation
*	James Murphy	Arthur D. Little, Inc.
	Alain Nicolaidis	French Embassy
*	William F. Rhodes	Vienna Technological Services
	Raymond Sangster	National Bureau of Standards
	Joseph M. Wier	Bell Laboratories

Assisted by William Cope, Synectics, Inc.

* Panel Leaders

"IMPROVEMENTS IN COMPUTER TECHNOLOGY NEEDED TO

MATCH THE SERVICE INDUSTRY MARKETPLACE"

SUMMARY

This paper describes a method for relating the needs of the Services Industries to the possible capabilities of the computer and automation sector of the economy. The method would require that informed opinion be solicited and expressed in formal terms. It has several steps.

Step One would relate the Production Functions or driving forces: Technological, Economic, Personal,or Administrative and Regulatory, to each subdivision (SIC Code) within the Services Industry sector. Rational planning for Automation requires an appraisal of the relative importance of these motivating or production functions whose impact varies widely within the Services sector.

Step Two relates the strength or importance of Key Reasons for Automation to each Industry within the Service sector. Reasons include: (1) Jobs undesirable (or dangerous), (2) Scarcity of Talent, (3) Need to augment human capability and (4) Operation is difficult to manage and control. The selection of automation opportunities can be done better if a carefully reasoned appraisal of the importance of each possible reason for automation is made.

In Step Three, we consider four possible Aspects of Jobs. Our breakdown is: (1) Sense (or acquire data and information), (2) Reckon (calculate or decide what to do), (3) Remember (associated with reckon, i.e., looking something up in a file), and (4) Act. We believe that many repetitive jobs can be described in these terms. The method requires that the relative importance of these four work components to each Selected Service Industry be determined by expert opinion.

The Job Aspect categories were specifically selected so that they might be related to kinds of devices that the computer and automation industry could supply. Once the weights described in Steps One, Two and Three are assigned, cross correlation could show how important better Sensing, Reckoning, Remembering or Acting devices might be to specific jobs within Industries. This method should permit the supplier of automation services to rationally plan his product offerings with some clear picture as to where the products would fit and as to the size of the marketplace for them.

The method is straightforward but the development of the expert opinions necessary to quantify the important relationships described will require an organized approach probably with a Delphi-like technique. The workshop members enjoyed the opportunity to discuss these matters and all of us look forward to further steps in this area. We recommend that this method be seriously considered and sincerely believe that we have made a useful step toward furthering the productivity of the Services Industry via automation.

Our title "Improvements in Computer Technology Needed to Match the Service Industry Marketplace" was rephrased into this question:

> "What goods, services, and tools does the Service Industry sector of the economy need from the providers of computers, software and systems in order to enhance their productivity?"

We also considered a companion question with a somewhat different cast:

> "What goods, services, and tools are available from the providers of computers, software, and systems that could, if used, enhance the productivity of the Service Industry?"

It should be noted that the thrust of this report is addressed to the first of these two questions.

In either case, the emphasis starts with needs or requirements as perceived by the Service Industry sector and proceeds to consider the goods and services available from the Technology sector. We also found it useful to incorporate the much-used concept of "systems" into the picture.

In very simplistic terms, we have viewed the problem of matching needs as shown below:

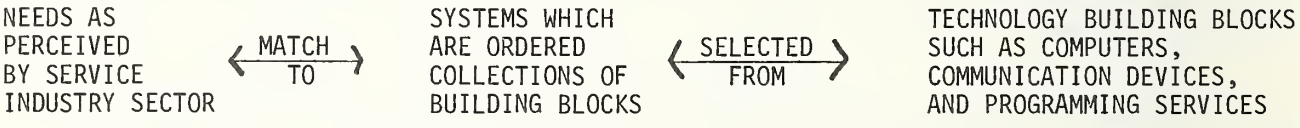


Figure 1. Matching Needs with Available Technology

Recognizing the problems of definition and the need to agree on a philosophical base, we selected the findings of the Federal Council for Science and Technology as expressed by the Committee on Automation Opportunities in the Services areas.* We have reordered these and paraphrased them below.

1. Industrialization will require a division of man/machine roles.
2. A Systems Approach is essential.
3. Users of services are the critical factor, not the suppliers.
4. The "Burden of Effort" should be to find missing links and concentrate on improving them.
5. The "Burden of Proof" requires that price be considered in both human and material terms.
6. There is an illusion of distinction between goods and services. Much is transferable and common between them.
7. Diffusion of automation is not an end in itself.

In our deliberations, we paid particular attention to 1, 2 and 6. As to Item 1, we considered and characterized jobs in a way that we believe will help in the definition of the man/machine roles. As to Item 2, we recognize the place of systems and systems analysis and have portrayed that place in Figure 1. Finally as to Item 6, we drew upon

* Also known as the Davis/Goldmuntz Council.

our experience and the related experience of others to look for analogies whereby manufacturing industrial experience with automation could show the way for progress in the Service Industry sector.

We were further guided by the provocative questions posed to this Conference by John Stewart**. We have paraphrased his questions below:

1. How can the knowledge generated at and exhibited by this Conference be applied to the Service Industries?

2. How can the learning curve in the Service Industries be improved?

3. How can the hard and soft sciences be coordinated?

4. How can the technology be explained to decision makers?

In particular, we addressed ourselves to Question Four. We felt that we could best contribute by designing a process for searching out and assessing automation opportunities. This process is described below in terms that we believe are meaningful to decision makers and we sincerely hope that this process will prove useful to them.

Guided by these findings and questions, we sought to develop a practical method for the identification and assessment of automation opportunities. Our method requires data in detail about jobs and Service Industries. We make no apologies for this because we are all aware of the harm that comes from hasty conclusions and superficial analysis in the sphere of automation. We do believe, however, that the requisite data can be obtained with a reasonable effort. It is our sincere hope that the method herein proposed will be useful to those who must make choices and back the efforts needed to reach our productivity goals.

The essence of our proposed method is shown in various forms and figures. We have suggested a rating scale from 0 to 3 to indicate the strength of the various interrelationships.

In keeping with our general scheme of characterizing needs first, we selected a representative list of the Service Industries for consideration. This list is based on the Standard Industrial Classification (SIC) categories used by the Department of Commerce and corresponds largely to the list used in Mr. Kendrick's work on post-war productivity trends.

We next set up a classification designed to reflect the pacing aspect or "production function" that might pertain to each industry in our group. For this classification, we used E. Blum's four categories. Thus our first tool is shown in Figure 2.

Our recommended use of this table would be to use a scale of 0 through 3 to indicate the importance of each "production function" to each industry. The selection of values should be done by those with expert knowledge in each industry.

This table when properly completed will have a value of its own. If, for instance, a particular industry is strongly driven by Administrative and Regulatory forces, then planning for automation within that industry will probably require a careful assessment of regulatory trends.

As the next step in our method, we consider the job-related reasons for automation. We found four circumstances where automation might be justified (Figure 3).

1. The job is undesirable (boring, dangerous) to the performer.

** Executive Director, National Commission on Productivity.

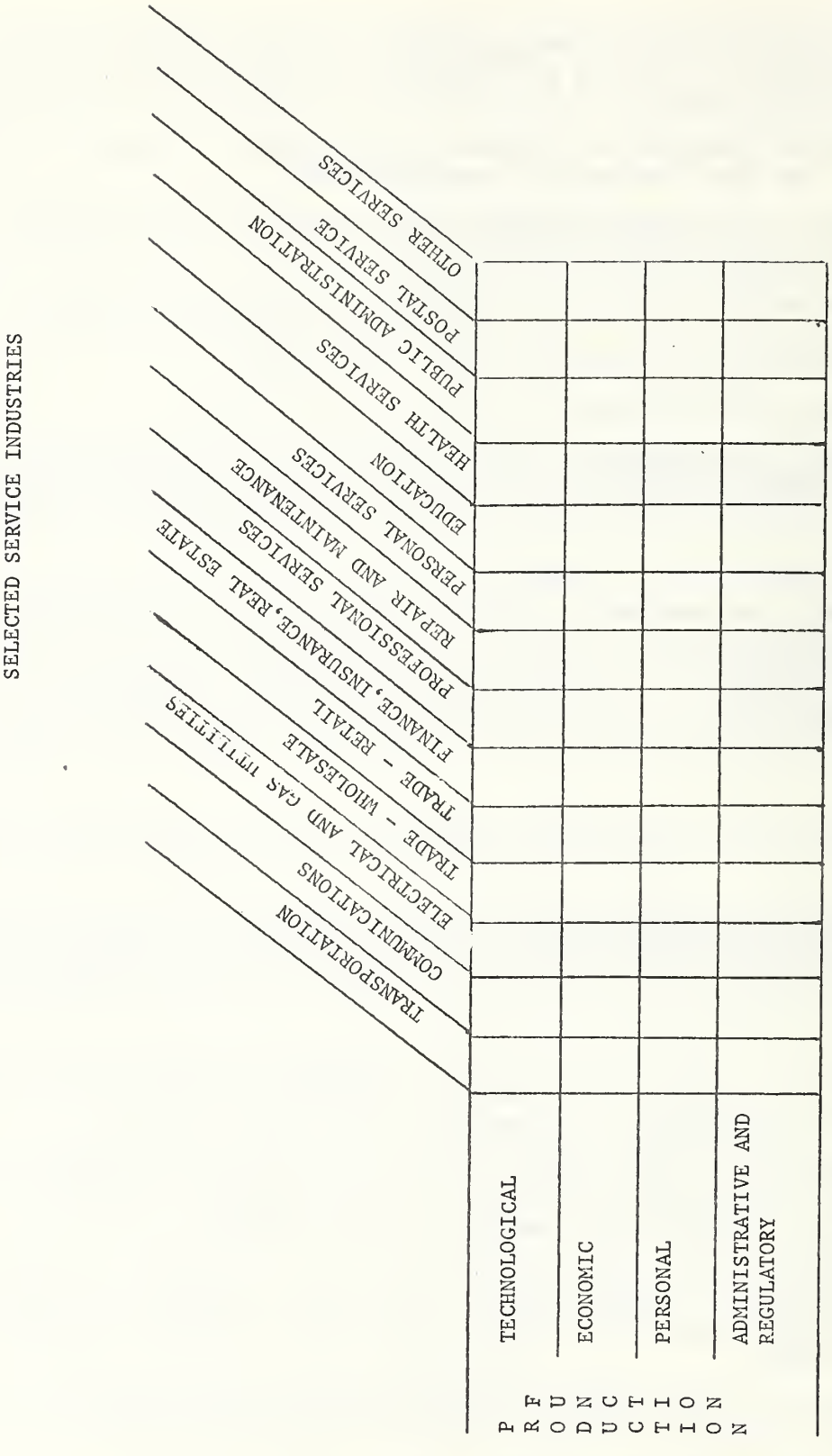


Figure 2. The Importance of Certain Production Functions to Various Industries Within the Service Sector

SELECTED SERVICE INDUSTRIES

REASONS FOR AUTOMATION	TRANSPORTATION	COMMUNICATIONS	ELECTRICAL AND GAS UTILITIES	TRADE - WHOLESALE	TRADE - RETAIL	FINANCE, INSURANCE, REAL ESTATE	PROFESSIONAL SERVICES	REPAIR AND MAINTENANCE	PERSONAL SERVICES	EDUCATION	HEALTH SERVICES	PUBLIC ADMINISTRATION	POSTAL SERVICE	OTHER SERVICES
JOBS UNDESIRABLE TO PERFORMER														
TALENT SCARCE														
HUMAN CAPABILITIES INADEQUATE														
MANAGEMENT OR CONTROL DIFFICULTY														

Figure 3. Reasons for Automation Within Each Service Industry

2. The job can be done by a properly trained person but these are scarce (talent scarce).

3. The job can be done better with a better tool (augment human capability).

4. The whole activity or collection of jobs is hard to control or manage.

As a first approximation, a scale of 0 to 3 could be used to reflect the importance of each reason to each industry. More refined scales based on actual job analyses might be weighted by the proportions of jobs in each industry relating to each reason.

Our next cut at this characterization of need looks at the functional aspects of jobs. We selected four such aspects which we believe can usefully characterize many ordinary jobs.

These are:

1. Sense. Includes the acquisition of data and information.

2. Reckon. All processing of this information by human mind or machine.

3. Remember. Includes the filing and retrieval of information in pertinent forms.

4. Act. May include sending a message "information" to others.

We chose this characterization for two reasons:

1. We believe that it can describe many of the jobs whose content would be altered by automation.

2. We believe that these terms have analogs with various systems and devices that Technology can provide.

We propose that a matrix of these four functional aspects versus the Selected Service Industries should be constructed. Its form is shown in Figure 4.

We suggest that values from 0 to 3 be assigned by expert opinion for each of the blocks in Figure 4. Here, however, we recognize a real difficulty; namely, each industry has several kinds of jobs and each job may have a different sense-reckon-remember-act profile. Thus for some or all of these selected industries, it may be useful to examine the activities or jobs that they require. To this end, we have selected certain categories of activity as shown below.

Critical distinctions in Service Industries

1) Distribution (i.e., direct delivery to consumers)

2) Payment (i.e., completion of transactions, including third parties)

3) Marketing

4) Production (i.e., creation of capability for service delivery)

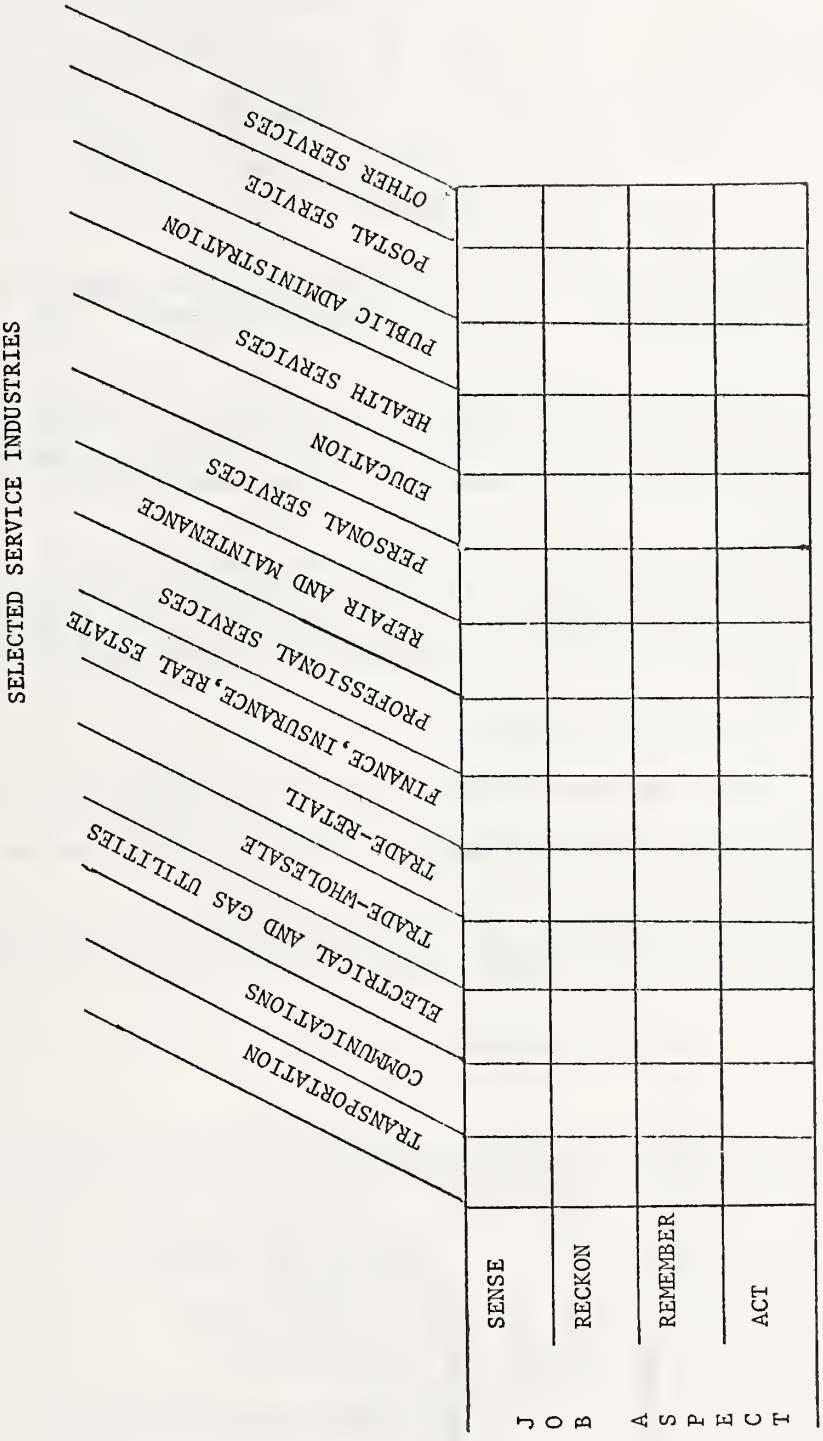


Figure 4. The Importance of Certain Aspects of Jobs Within Selected Service Industries

Non-specific to Service Industries	5) Production Planning and Scheduling
	6) Finance, Administration, & Control
	7) Personnel
	8) Capital Facilities
The place where the crucial action programs get started	9) Research, Development, and System Design

Although each of these activities probably can be found in each Selected Service Industry, there will be some activities that will be important to all and some that will specialize to certain industries. To determine this, we propose the use of the form displayed in Figure 5.

Here again we suggest a 0 to 3 scale. The values selected for each box should reflect the cost impact of the activity within each particular industry. We expect that all of the activities are probably present in each industry to a greater or lesser degree but we are trying to focus on the costly activities where we hope to find opportunities for gain.

This table will serve two purposes:

1. It will permit the user to build up the tables described earlier.

2. It will show the extent of common elements or activities within the totality of Service Industries.

We suggest that a cross table may be useful, namely one to show how these activities are related to our sense-reckon-remember-act categories. Its form is shown in Figure 6.

Again our 0 to 3 scale may be used.

EXPECTED RESULTS

When the tables are properly filled in, one should examine the results to determine the cross correlations. Basically we could examine these correlations:

Job Aspect		Reason for Automation
Sense	Versus	Job Undesirable
Reckon		Talent Scarce
Remember		Augment Human Capability
Act		Difficulty of Control

SELECTED SERVICE INDUSTRIES

ACTIVITY	TRANSPORTATION	COMMUNICATIONS	ELECTRICAL AND GAS UTILITIES	TRADE-WHOLESALE	TRADE-RETAIL	FINANCE, INSURANCE, REAL ESTATE	PROFESSIONAL SERVICES	REPAIR AND MAINTENANCE	PERSONAL SERVICES	EDUCATION	HEALTH SERVICES	PUBLIC ADMINISTRATION	POSTAL SERVICE	OTHER SERVICES
DISTRIBUTION														
PAYMENT														
MARKETING														
PRODUCTION														
PRODUCTION PLANNING AND SCHEDULING														
FINANCE, ADMINISTRATION, & CONTROL														
PERSONNEL														
CAPITAL FACILITIES														
RESEARCH, DEVELOPMENT AND SYSTEM DESIGN														

Figure 5. Importance of Certain Activities to Selected Service Industries

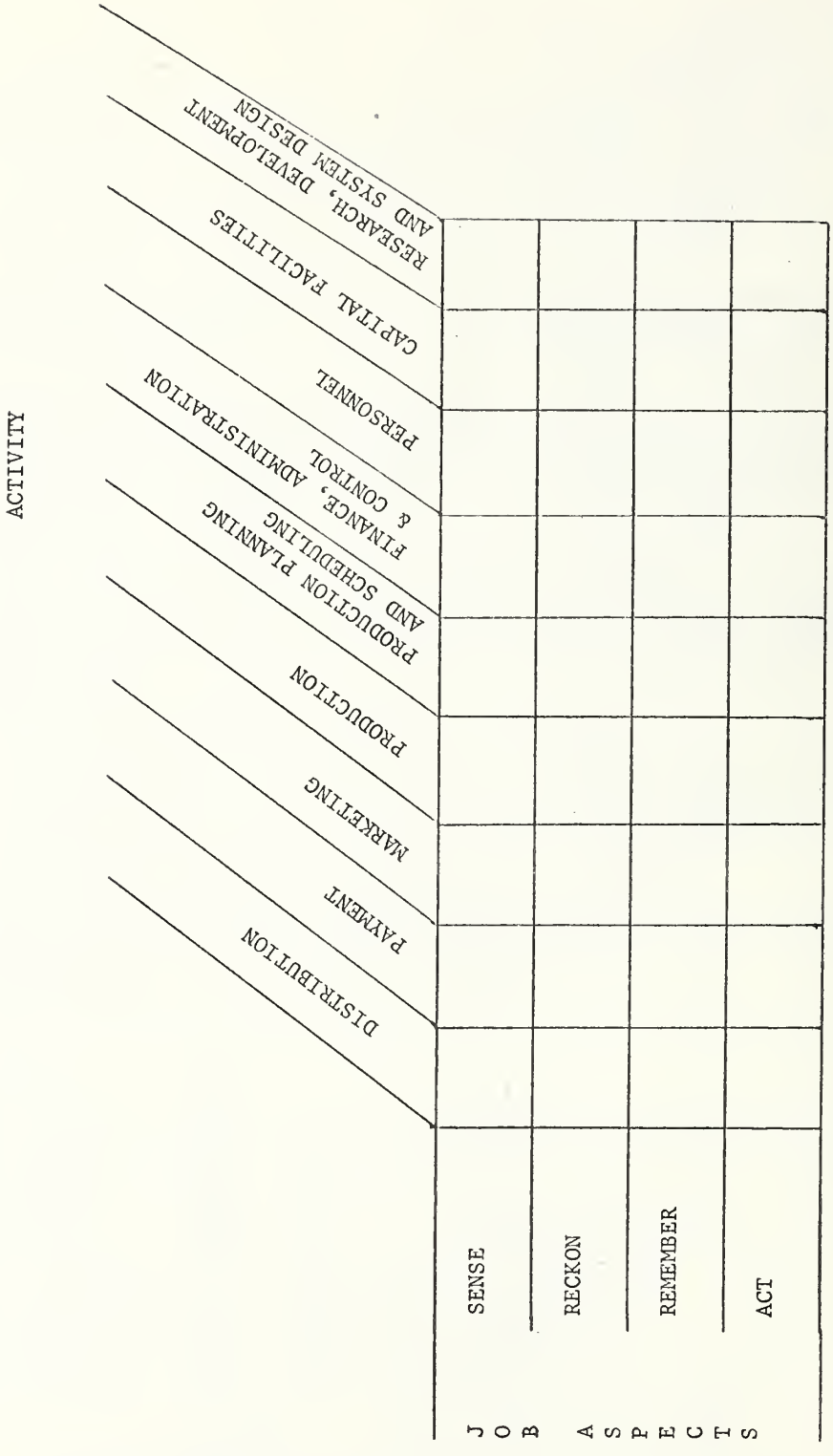


Figure 6. Profile of Job Aspects Versus Certain Activities

Reasons for Automation		Activity
Job Undesirable	Versus	Distribution
Talent Scarce		Payment
Augment Human Capability		Marketing
Difficulty of Control		Production
		Production Planning and Scheduling
		Finance, Administration, & Control
		Personnel
		Capital Facilities
		Research, Development and System Design

Reasons for Automation		Production Function
Job Undesirable	Versus	Technological
Talent Scarce		Economic
Augment Human Capability		Personal
Difficulty of Control		Administrative and Regulatory

Job Aspect		Activity
Sense	Versus	Distribution
Reckon		Payment
Remember		Marketing
Act		Production
		Production Planning and Scheduling
		Finance, Administration, & Control
		Personnel
		Capital Facilities
		Research, Development, and System Design

There are others that may be useful. The end product of this work should show the importance of the job aspects (sense, reckon, etc.) to the Service Industry sector. This information will be of great value to those who are to provide the systems work and technological building blocks that the Service Industry needs.

As of today, all of us seem to feel that the greatest shortcomings are in sensing and remembering, i.e., in the ready capture of data and in its easy retrieval. While this may well be true, we lack the quantitative base for efficient product planning that the Technology sector should have to guide its own developments.

RELATIONSHIP TO TECHNOLOGY

Since we do not have the results that our method will provide, we had to surmise as to the developments that are needed by the Service Industry sector. Nonetheless, the panel did examine certain areas and made the following provisional catalog of probable needs as set out in Figure 7 and Figure 8.

RECOMMENDATION

That the methodology described herein be applied to determine in a more reliable fashion where the needs are so that the necessary goods, services, and tools can be developed by the private sector. The data collection and correlation tasks described herein should be started as soon as practicable. We would recommend that a suitable government activity sponsor this work and that it be done by a joint Federal-University task force with suitable representation from the Service Industry sector. We believe the Technology sector is anxious and able to provide products once a reasonable need and hence a market is shown to exist and described in reasonable detail.

Mental Function Category	Technology	Needs Satisfied
Sense	Terminals: $100 sale price level Improve reliability of printing terminals Interactive displays with communications Standard electrical interfaces	Improve people-to-people communication Mass interconnection availability necessary
Sense	Sensors: Family of sensors to measure physical effects: temperature position pressure electrical counts etc. especially needed with this is a set of standard interfaces for this family.	Medical/clinical Meter reading Product maintenance (built-in fault indicators) Burglar alarms, fire alarms Product people locators (geographical)
Reckoning	Computer Improvements Needed: Methods of handling faults Major reduction in cost of maintenance Methods to write bug-free programs	"Too hard to communicate with computers"
Remember	Displays: Resolution, contrast, quality and quantity and equivalent to a type-written page.	This is the measure of what people need and want if we are to achieve mass usage.
Act	Actuators: Family of standard interface actuators to control meters, valves, solenoids.	Same service industries as "Sensors"

Figure 7. Needed Improvements in Product Technology

Improvements Needed	Needs Satisfied
Information System Technology Improvements Needed: Means to represent information structure Means to provide secure, private information systems Social System Technology Improvements Needed: Means to measure the decision-making activities of people Means to measure the effectiveness of pedagogical processes Means to measure the effectiveness of government Means to measure the "job" satisfaction of people	Information retrieval People-to-people communications International Library Elimination of "reinventing the wheel"

OTHER SYSTEM CONSIDERATIONS

A theory for "national-dynamics-stability" anticipating the day when the information feedback loop is closed by providing instantaneous nationwide vote taking. (The technology to achieve nationwide opinion collection is here today--and it's inexpensive.)

Those inventions required to better utilize the existing huge national installations to serve the newer social needs:

i.e. { Telephone network for nationwide voting
Server system for unified waste disposal
Cable TV for interactive communication

Means to bridge the "NIH" gap between research-output and business acceptance.

Need satisfied: To get industry to use the research technology available.

Figure 8. Needed Improvements in System Technology

Report of Workshop Panel 5

on

Government Roles, Policies and Programs for Productivity Enhancement Through Computers and Automation

Panel Participants

* Bruno Augenstein	RAND Corporation
Bernard Chern	National Science Foundation
William W. Cooper	Carnegie-Mellon University
Frederick R. Cross, Jr.	General Accounting Office
* Frank Hersman	National Science Foundation
Herbert S. Kleiman	Battelle Memorial Institute
Gerald G. Smith	Control Data Corporation
Robert A. Vitro	Office of Telecommunications, Department of Commerce

Assisted by Peter Bergson, Synectics, Inc.

* Panel Leaders

"GOVERNMENT ROLES, POLICIES AND PROGRAMS

FOR PRODUCTIVITY ENHANCEMENT THROUGH

COMPUTERS AND AUTOMATION"

The Workshop Panel 5 report took the form of an outline of general principles and motivations of government, followed by three examples of possible government action as suggested by the Panel participants.

GENERAL PRINCIPLES

We sought to outline these in the following categories:

I. What are some central goals and functions of government?

II. What are some rationales for government action?

III. In what areas do important government roles lie?

IV. What are some actions government can take?

V. What are some first steps for specific government actions, as exemplified by three cases?

I. Goals and functions

Questions:

1. How can we leave the major action burden in the private sector?

2. How can government work effectively as sponsor and partner?

3. How do we identify areas where government should play a major or joint partner role (with the private sector) to increase productivity?

   Suggestion: Government should play such a role in any area wherein we can increase productivity and wherein also government already has a legal and/or regulating responsibility.

   E.g.: a) Where productivity increases involve or impact issues of public health or safety;

   b) Where productivity increases involve or impact issues of institutional, market, or organizational defects;

   c) Where productivity increases involve or impact issues of conservation of material, energy or environment;

   d) Where productivity increases involve or impact issues of work obsolescence, manpower retraining, new kinds of personnel skills, etc., requiring new legislation or policy decisions.

4. How do we exclude government intervention (of a non-benign type) in areas in which the private sector can achieve the objectives?

5. How can the government communicate its willingness and intent to motivate the private sector?

6. How do we single out "leverage points" in government wherein it is a major buyer or supplier of services--hence where impact is largest?

7. How do we use government's regulatory/legal power and role to assure the private sector of action in a beneficial way?

8. How do we ensure government action in a positive, benign, non-hostile role towards private sector efforts to increase productivity?

9. How, by government action, do we break a log jam or create momentum in productivity increases?

10. How can government be involved early (i.e., government must be pro-active)?

11. What are the means by which government can improve productivity in service areas by providing pressure to change?

12. How can modern technology be employed in Federal services to establish a demonstration of productivity-increase possibilities?

13. How can government be anticipatory rather than ex-post-facto regulatory?

14. How can government identify and act on major trends - i.e., how are needed changes identified, anticipated, and channeled towards positive ends, and managed by functional objectives?

II. Some rationales for government action

1. Support development of national competence level in some technological areas

2. Intervene when there is a disaggregated market or where industry cannot provide R&D

3. Open the present governmental monopoly of some services, where competitive industry can be more effective

III. Areas where important government roles lie

Focus where there are obvious productivity increases needed (e.g., health, education, transportation, urban/local government).

IV. Some actions government can take

1. Use economic mechanisms, such as tax incentives; tax credits for productivity gains; regulation of rates in transportation; manipulating/utilizing government purchasing power; direct aid or grants; application of import/export restrictions; restrictions via patents, copyrights, licensing--these uses should be pro-active as well as reactive.

2. Use institutional mechanisms, e.g., regulation/licensing of service professionals such as garage mechanics; setting of national standards, like NBS; anti-trust mechanisms or the converse, joint ventures currently prohibited by anti-trust; information and technological services, technology transfer on the national level as with agriculture research stations; recasting of or modifying existing legislation pertaining to labor and work training.

3. Utilize tax credits, etc., to stimulate industry toward innovativeness in consumer services sector.

In the backdrop of these fairly general statements, we wanted to get into a number of specific areas in order to identify existing problems and propose some initial recommendations or solutions. These are selected areas, and don't pretend, obviously, to cover all possible desirable routes or options. There was a panel consensus, however, that these are particularly important for a number of reasons which will be clearer when we get into them.

An Example of Specific Government Action - No. 1

STATEMENT OF GOALS

Productivity of local government is an important national issue, and one which should receive particular study and action in the light of revenue sharing, other New Federalism policies, and a growing national consensus that public problems are best handled at the level of government closest to the people. It must be a main concern of the Federal Government and industry for reasons not only of "self interest," but because of their pronounced effect on the quality of life of the bulk of the country's citizens.

There is a marked need for productivity improvement (by any of the definitions used in this conference) at the local level and state levels if the taxpayer is to receive his "money's worth," and if the other sectors are to contribute services in such a way as to improve the quality of our national product and wealth. From an "industry" point of view, local and state governments together constitute one of the largest (12×10^6 employees) and one of the fastest growing industries in the U.S.

Improving productivity of existing services is valuable but there are also whole new functions and whole new approaches that also ought to be considered along with possible new institutional arrangements if the full benefits from productivity increases are to be realized.

To provide a hospitable climate for local government productivity experiments and operation, the local jurisdiction will need to improve communication between the citizen and his government. This implies a need both for improved data and for diligent efforts to inform citizens of alternatives and the consequences of innovative productivity-inspired programs. New institutional arrangements will also have to be developed to establish the framework for innovation between existing institutions not only of a government-to-government variety but also of a government-to-industry and government-to-university variety. The land-grant college and county agent system established many years ago for a rural economy offers one example of the kinds of institutional arrangements necessary to bring about increased productivity. Efforts will also be necessary to upgrade the personnel systems of local government and the technical competence of local officials so that they can effectively participate in planning, monitoring, and implementing the new technologies that will be necessary to bring about greater productivity in local governments. Thus there is a need for better education and extension programs; the design of model experiments, including their evaluation and their dissemination; the development of new institutions (such as Public Technology, Inc.); and the upgrading of old institutions.

The Nation has seen, and will have increasing experience in, improving productivity at a level of state and local Government. Some highly imaginative research sponsorship in, especially, the area of management and technological innovation and use could have a very large payoff.

The workshop believes therefore that the following recommendations should receive priority attention at this time:

(1) Since neither adequate performance nor productivity measures or standards for local government service operations exist at this time, efforts should be made to develop these by a suitable body at the earliest possible time. As accepted measures

become available, these should be routinely collected by an appropriate national body and given widespread public dissemination so that the citizens of the United States have good means for measuring the quality of their government.

(2) Experiments in upgrading the productivity of local governments should be planned and implemented on a national scale by suitable government bodies, evaluated and the results actively disseminated and publicized. The carrying out of such experiments will require the development of new funding programs, which should involve participation by all levels of government.

(3) In many cases the upgrading of local government services involves a complex technical undertaking beyond the resident skills of some local governments. Where this is true, suitable technical assistance, manpower sharing, training and educational programs should be developed so that all U.S. citizens may share equally in the benefits of productivity increases.

(4) Local governments should be encouraged through the development of new institutional arrangements, such as the proposed "Big City Consortium," to identify their common problems, develop specifications of their requirements, and aggregate their purchasing power. Such arrangements then will create the markets that will unleash the best efforts of U.S. industry to assist local governments in enhancing productivity.

(5) If the Nation does make a true commitment to raising productivity, new national planning mechanisms will be needed to plan, monitor, and evaluate the results of productivity experiments and experience, and to constantly review the development of new indicators and statistical measures of progress in enhancing productivity of local government. The National Commission on Productivity might effectively perform this function if given an appropriate mandate and funding.

An Example of Specific Government Action - No. 2

OBJECTIVE - Support private industry in efforts to increase productivity.

ISSUE - What kinds of problems does private industry face in increasing productivity--particularly in service sectors?

a. Often market is fragmented, disaggregated

b. There can be substantial obstacles in risk, time scale, or technical competence, leading to inadequate R&D to provide innovations.

c. There is often a failure of market accessibility to assure reasonable protection to provide a return from a risk investment.

d. There is inadequate maintenance of overall technical competence.

e. There is a general failure to be competitive in a world-wide technology--hence an impact on the ability to maintain trade in the international arena.

IDENTIFICATION OF AREAS - How do we identify initial high priority areas for governmental action?

Criteria - Industry is important.

- Government has a role and presence in it now.

- Government has plans and programs already in these areas

- Therefore build on and amplify such programs for early effects

- Hence, choose critical areas where government is already purchasing services which need to be improved.

SOME EXAMPLES OF SUCH AREAS

Health Services - e.g., administration and management of health care facilities; development of automated test and diagnostic instrumentation, to reduce costs; correction of maldistribution of services and better utilization of available medical personnel, via information and communication networks; etc.

Transportation - e.g., development of automated personal rapid transit, to reduce inner city congestion and pollution; development of improved intercity freight and people movement, by controlled high speed automated vehicles; etc.

Education - e.g., development of improved CAI equipment; interactive access to information sources at any grade level; etc.

Manufacturing Automation - e.g., improve and innovate automation of discrete parts manufacturing--which provides tools and equipment spanning the entire range of services and provision of services--resulting in better or lower cost products, of more uniform high quality.

HOW TO RESPOND TO NEEDS - How can we respond to such identified needs which are perceived by both government and the private sector?

- Assemble ad hoc groups spanning the supply and demand spectrum.
- Include in these groups:
  - Government representatives who can generate a specified market demand;
  - Industry or technically qualified suppliers who can guarantee developments if an assured demand can be created;
  - Private sector demand representatives (consumers) who will be in a position to build up market areas once an initial demonstration of needs satisfaction can be shown.
- Government sponsorship can range from simply guaranteeing a specified market demand, to government sponsorship at several levels of intensity: study; R&D; applications engineering; diffusion of relevant technology (via cooperative joint ventures); and assurance, by market trial, that the technology meets true needs; against the assured purchase of end items.

An Example of Specific Government Action - No. 3

THE UPGRADING OF SERVICE SECTOR SKILLS AND CAPABILITIES

Since the beginnings of the Industrial Revolution we have been seeking techniques and methods for increasing the productivity of industry. The development of these techniques and methodologies has resulted in those productivity gains we've experienced during the ensuing years.

No comparable work has been done in the service area. The services spectrum has not been the subject of equally effective effort. Consequently, the productivity growth of our services segments has not paralleled that of manufactured goods.

The understandings we have come to realize in product manufacturing have been accumulated over an extensive time. Left to itself, and with special note of scalar relationships of services relative to manufacturing, it is doubtful that unique productivity techniques for services will come into being on a time frame commensurate with the nature of the need.

Therefore it is resolved by this panel that:

(1) Research and Productivity Technique and Methodology Development should be supported by Federal grants. This research should be fundamental problem oriented as required for utilization. This research should culminate in curricula in our educational institutions and be disseminated to potential users.

Further, it can be established that the processes of generating services have counterparts to certain well understood manufacturing processes: Market and financial analysis, system design, preventative quality control, management information, cost accounting, reliability analysis, distribution, selling and billing functions are much the same as those pertinent to manufacturing enterprise. More importantly, the application of computer techniques for such functions as scheduling, capacity optimization, support service requirements, resource optimization and industrial engineering and/or economic analysis are pertinent and may be directly transformable. Applying the principles of these techniques to the services should yield productivity increases.

Therefore, it is resolved by this panel that:

(2) Federal grants should support research and/or analysis seeking to establish the applicability of current techniques and methodologies to the services industries.

(3) The Federal Government is encouraged to aid in the development of criteria by which performance standards for services can be quantified. This effort should include services offered to and consumed by the private sector, and also those provided by local, state, and Federal Government and to the degree appropriate to ultimate citizen consumer concern.

"SUMMARY AND CLOSING STATEMENTS BY CHAIRMAN"

This conference is a service industry. It is a microcosm. We have multiple goals; we've had them throughout. It has been impossible totally to satisfy multiple goals, and we've had to make trade offs. As we've made trade offs, each individual has perceived that he has not been totally satisfied. We've had a "dynamic"; it is a process, and it has come to some sort of a result.

The next step, under the rubric that we're operating in, is to take what is a service activity and a service process and to translate it from a "service" into a "good." We have to be able to inventory that which we have captured. At the coffee break, I was asked "Do the panel reports meet your expectations?" My response was "No, they're better." They are better by a very considerable degree than I had expected and hoped.

My initial thought was that I would do something which the Synectics group did with our group. We had a lot of tension in our panel when we first sat down. I think that's very unusual for a panel, but I wanted to report that fact to you. We did get a lot done the first night. Initially, anytime somebody opened his mouth, somebody else jumped down his throat. Then, since this guy was sitting there saying nothing and looking at us and making us uncomfortable--that was the Synectics person--we decided that maybe we ought to try to bow to each other. So one person would say something and another person would say "Hey, yeah, boy--that's terrific!" Then someone would tell a story and someone else would tell a longer story. The net outcome of our panel's first evening together just wasn't good. However, I called it very productive on my questionnaire because the contrast with what we were able to do the next day was absolutely fascinating. The way we got out of our initial problem was to play the "I wish" [redacted] game.

Now, I'd like to make a brief statement. It's my perception that not all panels went through all the tools in the tool kit of Synectics. That tool kit is very complex and interactive. The first step is to throw out [redacted] ideas, fill the board with them, capture them, because it's the ability to get your idea up there that is the first step. There's a second step. The second step is to have a "client" person take one of those ideas that he thinks has some value or some potential value, and come up with the most outlandish possible scheme for implementing that idea; be vivid, for when something comes up in a vivid way it begins to crystallize thinking. So in our approach we did, and we had a good one. Tom Paterson was talking about fatigue in the skin of an aircraft. We also had something up there on the wall which said "Signal the consumer that he has a problem." And it wasn't hard to think of a nice vivid way of giving a consumer in the aircraft the signal--Zap!--Right out the window! Now that sounded absolutely crazy but we worked on that a while and I think we came up with something that was operational, had problems, but had mechanisms for overcoming those problems. What I saw was a dynamic in operation, and I'd like to share the dynamic with you.

My mechanism of operating, as you may have noticed, is to try to raise the potential of the group in a voltage way. Frequently it succeeds. Ritchie Coryell said something the first night and I immediately leaped to my feet and said "I am horrified by that statement." Well, the first night Ritchie and I lived with the fact that I had jumped on his ego. Then there's a fellow named Smith here who jumped on my ego last night and I got a much better idea of how this feels. We've all got egos and that's a problem. Yet that's the very dynamic at work throughout this whole process.

I was trying to figure ways that I could communicate with you, and I thought, "Well, why don't I stand up here and say what I would wish we had been able to do with this conference." At the coffee break time I ran down the fantasies which had been going through my cranium, along with some other important ideas, and absolutely frankly, I decided that most of my wishes have been met. Among the things that I wished for was that we could get egos out of the way when information is available, so that we have the ability to transfer that information without affronting the self esteem of individuals. I perceive that my method of delivering information creates vivid images in people's minds. That may be good, but it also involves their egos very directly. When I looked at our

output, my conclusion was that this is alright. Because I did that, we skirted on the verge of disaster, but maybe one has to go that far to energize a complex system. There's more than just the Synectics approach--there's the dynamic that we have to achieve. We have to establish the potential, the interest, and the willingness to know.

As I say, I thought our Wednesday night meeting was very productive. We didn't get a thing done, yet that was productive. We didn't define what a service was, but you know that was productive. We didn't find what productivity was, yet that was productive. So I feel good that way. Right now, however, I have some less than good feelings, too, and I'm back in the soup—because how do I communicate these to you without running into the problem of my ego and yours.

Let me go on with "I wish":

- I wish that economists had the ability to provide what little they know in a form that would communicate to people who have grown up in an experiential system.

- I wish that we had a way which would allow people to see that we live in complexity with multiple goals.

- I wish people would see that we don't have a necessary antagonism between the roles of government and private business.

- I wish that people could see that at no time in the history of organized society has there been such a thing as a private enterprise system alone.

- I wish people could see that businesses and other institutions have the power to transform themselves when faced with real adversity or crises and that sometimes it takes a crisis because changes can be extremely painful.

- I wish that people could see that there are things which cannot be sold in markets because they just don't have the characteristics that allow them to be sold in markets.

- I wish that people could stop fantasizing that the market is some form that it is not, and recognize that if you try to deliver goods and services through a mechanism which requires particular kinds of goods to work, the first step in understanding is to know what the market really is.

There are things called public goods. You can't sell a public good in a market. It is not appropriable to an individual. **Nobody can** get his hands around it, no individual can get all the benefits of it, you can't fence it in. If you can't fence it in, you can't sell it in the market, and the market won't work. If you try the market, it's going to fail, and you're not going to deliver the goods. I'm not saying that all services are public goods but there's a high number of services which are public goods.

- I wish that people could see that although Government on occasion and with great frequency has mucked things up left and right in the past, just saying that Government mucked up in the past doesn't solve the problem, and that some problems can only be dealt with by Government.

- I wish people could see that railing against something which does not necessarily have to exist in its current form is not productive, and that they could more usefully ask how we can innovate in the use of our existing imperfect institutions, some of which match and map in their characteristics the problems and realities that are out there, in order to bring about this productivity that we're talking about.

- I wish people could perceive the level of managerial technology that comes through the interaction of management studies, economic analysis, technology, the ability to simulate, the ability to create market-like incentives where markets previously have never been able to work before.

- I wish that people could see that we can create incentive mechanisms and that the technology that is available today to us may be the mechanism for allowing that to happen.

- I wish people could see that we have the opportunity to utilize Government to create freedom for managers to follow dispassionate incentives that they can perceive and which tell them go left, go right, go fast, go slow, and if they follow those incentives they are moving not just themselves but the society as a whole towards its goal.

That's my vision. That's my biggest wish; I think that we here were on track.

My perception is that within the bounds of this conference, many of my "wish" statements have essentially been fulfilled. The level of difference between what I have perceived as the output of earlier conferences on essentially this subject and the output which I perceive here is enormous. There is a certain thrill that comes when you see that there's something new coming out. I feel that way about our output, even if we can only communicate some 10 or 20 percent of it to others. I'm sure you feel the same way. I think that we are almost at the point of delivering not just the service of this conference, but a good that can be codified and broadly distributed. I do expect that we will have a printed output, that it will be edited and distributed to every member here and to the sponsoring agencies for their use to the degree that they need.

The fact that we could get this close to fulfilling my wishes reinforces my optimism. I am an optimist. And it's the occasional thrilling experience such as this conference that keeps me that way.

We stand adjourned.

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"PRODUCTIVITY TRENDS IN THE U.S.

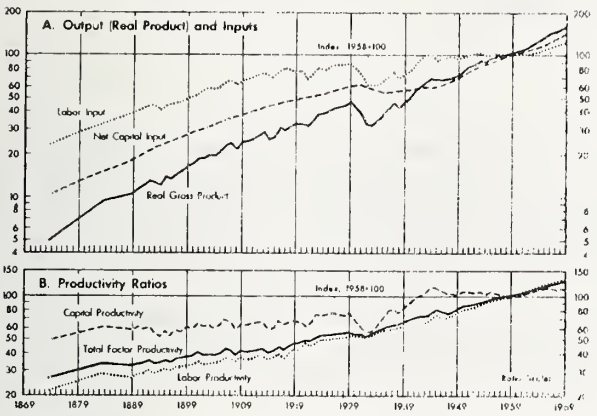
PRIVATE DOMESTIC ECONOMY"

John Kendrick

John Kendrick is Vice President and Director of Economic Research at the Conference Board in New York. He is best known for his work in economic accounts and productivity. Drawing upon this expertise, Mr. Kendrick presented in a series of tables the rate of change of productivity in the U.S., by major industry divisions such as agriculture, mining, manufacturing, transportation, etc. He also protrayed the economic growth of the U.S. private domestic economy in terms of output (real products), inputs, and productivity ratios.

A Century of Economic Growth— U.S. Private Domestic Economy

Output, Inputs, and Productivity Ratio, 1869-1969*
Index Numbers, 1958 = 100



*The pre-1889 period is based on decade averages 1869-78 and 1879-88

Source: John W. Kendrick, *Postwar Productivity Trends in the United States, 1948-1969* (New York, National Bureau of Economic Research, 1973)

Productivity Trends In the U. S. Private Domestic Economy

Table 1.

By Major Industry Divisions
Average Annual Percentage Ratios of Change, 1889-1969, by Period

	1889-1919	*1919-1948*	*1948-1969*
Private domestic economy			
Real product	3.9	2.8	3.9
Total factor productivity	1.3	1.8	2.3
Real product per unit of capital	0.5	1.6	0.2
Real product per man-hour	2.0	2.2	3.1
Industry divisions (Real product per man-hour)			
Agriculture	0.5	2.1	5.7
Mining	2.0	2.9	3.8
Contract construction	0.9	0.4	1.3
Manufacturing	1.3	3.0	3.0
Durable goods	1.4[e]	2.8	2.8
Nondurable goods	1.3[e]	3.4	3.3
Transportation	2.6	4.0	3.2
Communications	2.8	2.4	5.4
Electric and gas utilities	6.7[e]	4.7	5.9
Trade	1.0	1.7	2.6
Finance and services	2.7	1.1	1.6

[a] 1899-1919

Source: John W. Kendrick, *Productivity Trends in the United States* (Princeton, N.J., Princeton University Press, 1961); and *Postwar Productivity Trends in the United States* (New York, National Bureau of Economic Research, 1973).

Productivity Trends in the U.S. Private Domestic Economy

Table 2.

By Major Industry Divisions
Average Annual Percentage Rates of Change, 1948-1972, by Sub-periods

	Period	*Sub-periods*[a]					
	1948-1969	*1948-1953*	*1953-1957*	*1957-1960*	*1960-1966*	*1966-1969*	*1969-1972*[p]
Private domestic economy							
Real product	3.9	4.6	2.5	2.7	5.2	3.4	3.0
Total factor productivity	2.3	2.7	1.9	2.2	2.8	1.1	1.9
Real product per unit of capital	0.2	0.2	−1.1	0.2	1.7	−0.9	−0.5
Real product per man-hour	3.1	4.1	2.7	2.6	3.6	1.7	2.8
Industry divisions (Real product per man-hour)							
Agriculture	5.7	6.4	4.1	5.9	5.8	6.7	1.9
Mining	3.8	5.2	3.3	4.7	3.7	1.8	0.6
Contract construction	1.3	4.4	3.2	1.5	−0.5	−3.0	0.6
Manufacturing	3.0	3.7	2.2	2.2	3.6	2.7	2.4
Durable goods	2.8	3.6	1.4	1.8	3.8	2.2	1.4
Nondurable goods	3.3	3.5	3.4	2.9	3.4	3.4	3.8
Transportation	3.2	2.2	3.1	3.0	4.8	2.2	3.7
Communications	5.4	5.4	3.6	7.6	5.7	4.6	5.7
Electric and gas utilities	5.9	7.6	6.3	5.4	5.1	4.4	2.8
Trade	2.6	2.5	2.7	1.9	3.9	2.1	2.4
Wholesale	3.1	2.2	3.3	2.9	3.7	3.0	3.2
Retail	2.5	2.6	2.2	1.2	3.8	1.0	2.2
Finance, insurance & real estate	1.9	1.5	2.7	1.5	2.6	−0.4	0
Services	1.1	0.5	1.2	1.1	1.7	0.4	0

a = Sub-periods are measured between successive business cycle peaks, 1948-1969. The final sub-period 1969-1972 ends with the last year for which data are available as of May 1973. Given the strong expansion thus far in 1973, it seems clear that 1972 was not a peak year.

p = preliminary

Source: John W. Kendrick, *Postwar Productivity Trends in the United States* (New York, National Bureau of Economic Research, 1973); estimates extended from 1969 through 1972 by the author.

"PRODUCTIVITY DEVELOPMENTS IN THE SERVICE INDUSTRIES,

PUBLIC AND PRIVATE"

John M. Stewart

John M. Stewart was (at the time of the conference) Executive Director of the National Commission on Productivity. Mr. Stewart specialized in the management problems of technically-intensive businesses. His focus has been productivity improvement, production analysis, international marketing and long-range planning. Mr. Stewart spoke of the viewpoint on productivity as seen by the Commission and some of the difficulties and problems. He recounted the results of a poll on productivity among managers and employees, wherein many of the popular misconceptions were repeated, e.g., jobs are harder and unemployment higher when productivity goes up. A study has been made trying to put measures on productivity in the Federal government which, Mr. Stewart believes, can be improved.

"PRODUCTIVITY DEVELOPMENTS IN THE SERVICE INDUSTRIES,

PUBLIC AND PRIVATE"

John M. Stewart

I would like to add to your discussions by conveying the viewpoint on productivity as seen by the Commission and some of the difficulties and problems. We don't have very many answers to the problems--we are searching for some and I will try to describe some of the paradoxes about productivity that Alan (McAdams) mentioned earlier this morning. One of the first things we could do is start by examining industries. Probably a number of you have seen these figures before. Defining what the service industry is and what it is not is an enormous problem, but essentially there is a very pronounced shift from manufacturing employment to service employment. The farm industry is down to about 5 percent of the working population and is getting smaller (Figure 1).

Manufacturing is about 22 percent or so of total employment. Generally speaking, we regard the red shaded area (on the slide) as representing services in the private economy and they constitute about 63 percent of employment (Figure 2).

I will talk about government, which is an enormous service sector.

I would like to describe how we spent our productivity gains over the last few centuries and how we are spending them now. If we look at the U.S. in comparison to some of the other trading nations (and John Kendrick mentioned this), we spend our productivity gains in two ways. One is leisure--either in terms of shorter work weeks or a smaller percentage of the population working--and the second is goods and services. If we look at the U.S. vs. other countries we see that the U.S. has a higher GNP per capita than Germany, France, Japan, and the U.K. (Figure 3). The U.S. also has the shortest work week and the labor force in the U.S. is a smaller percentage of the total population than in any other country. So in absolute terms, we are in pretty good shape. Part of the reasons for the Commission's existence is the slowdown in our productivity growth rate and the greater awareness by the public of the disparity between the Japanese rates of growth and our own. While we have been growing at about 3 percent, Japan has been growing at about 14 or 15 percent for the past several years and the members of the European economic community have been growing in the range of 5 to 8 percent. That has created some concern that the relative differential will mean a lower relative standing for the U.S.

There are some common misconceptions about productivity. If you are going to talk technology and hardware, it is very important to also understand software and the sociology of the subject. In the studies that we have done, motivations and incentives are critical to the application of technology, and I would hope that this week you would spend some time on these subjects. Three common misconceptions are: higher productivity is the American way; labor is against and management is for productivity; and productivity in services is hopeless. These are statements that have been made fairly frequently to us over the last year.

In a Harris poll concerning productivity, we examined how managers and employees view the subject.

The question was "Does increased productivity mean that people have to work harder?" 60 percent of the people believe affirmatively; 30 percent don't believe it is so; and 10 percent aren't sure. If you follow that question with "Is your job harder?" You get exactly the opposite reaction: "No, my job is easier than my grandfather's." For building streets, driving a Caterpillar tractor is easier than digging a ditch and shoveling. As you interview individuals about what has happened to their jobs, they would point out that their jobs have gotten easier, but they are absolutely convinced that by and large higher productivity means that one works harder--thanks to Charlie Chaplin and "Modern Times."

The Shift in United States Employment From Goods to Services Will Continue

	1970	1980
Manufacturing	28%	23%
Contract Construction	5	6
Mining	1	1
Agriculture	5	3
Subtotal	39%	33%
Wholesale & Retail Trade	20%	21%
Government	16	17
Services	14	19
Finance, Insurance, Real Estate	5	5
Transportation	6	5
Subtotal	61%	67%
TOTAL	100%	100%

U.S. Employment by Sector 1970-1980

Figure 1

1971 Employment Within Sectors (thousands)

MEASUREMENT OF PRODUCTIVITY BY SECTOR

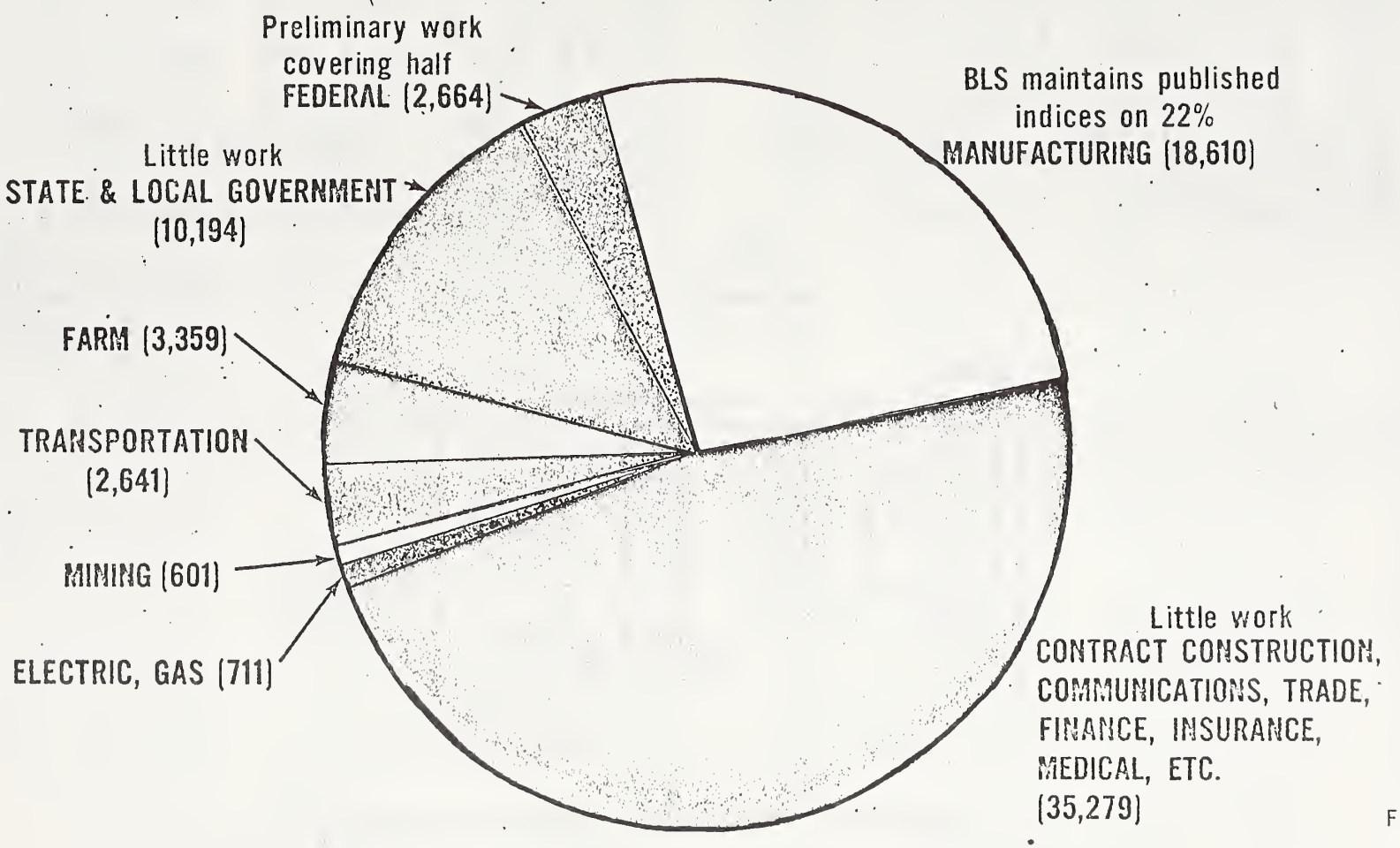
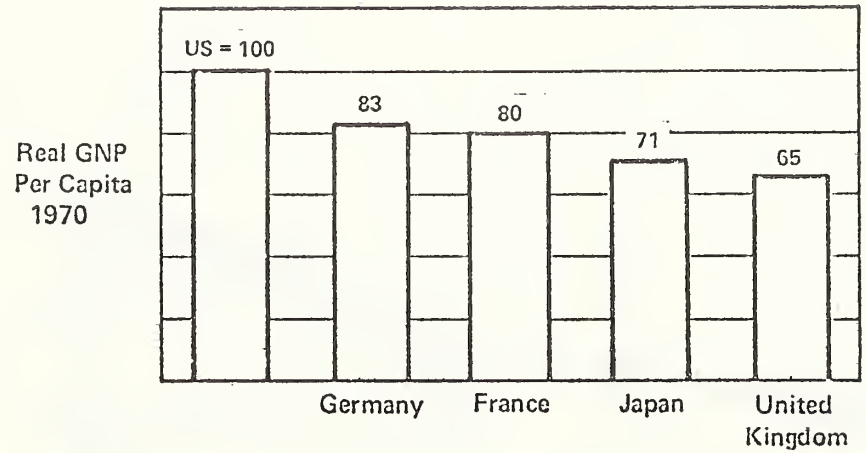
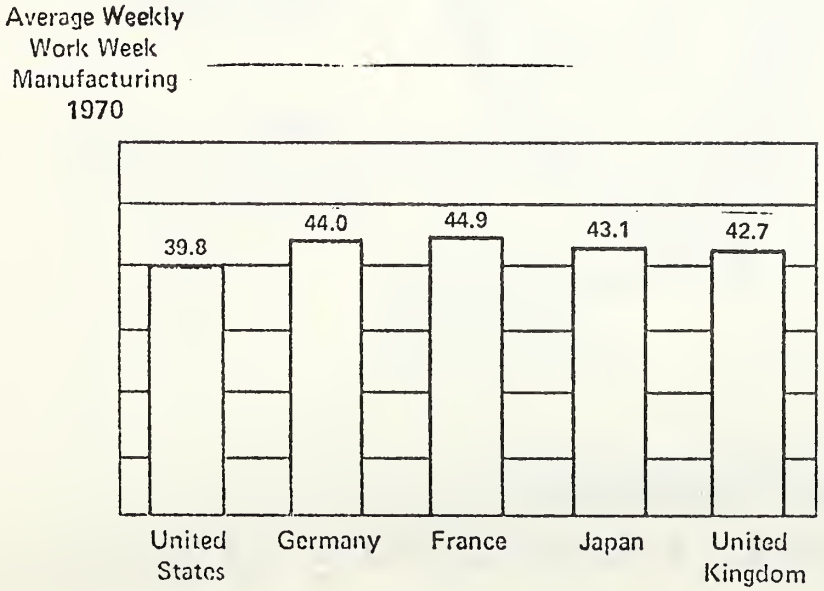


FIGURE 2

Higher Productivity in U.S. Allows Higher Living Standards With Shorter Work Week and Smaller Percent of Population in Work-Force





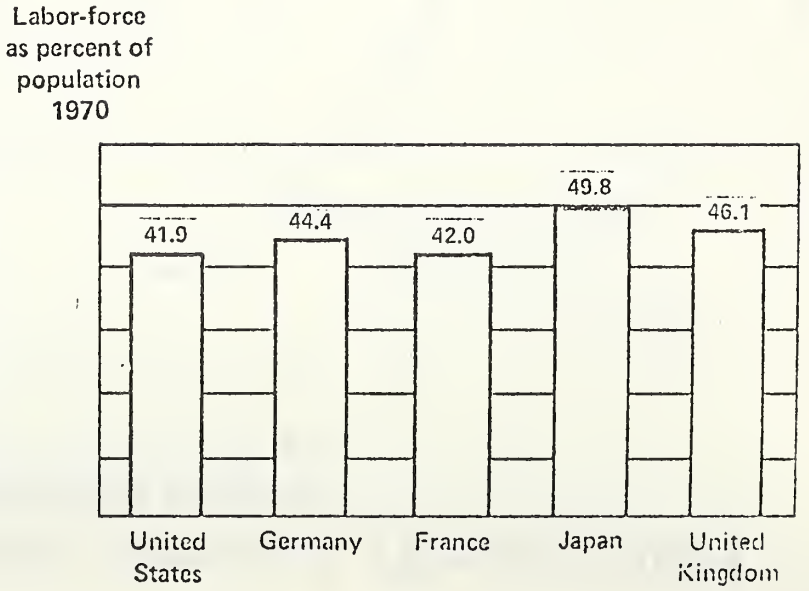


FIGURE 3

Does an increase in productivity mean higher unemployment? About 50 percent of the people believe that, in fact, higher productivity does mean higher unemployment (Figure 4). In an industry with no additional demand, and an increase in productivity, employment does go down; but, some of the industries with high rates of productivity still grow in employment because of rapidly increasing demand.

Who benefits a lot from productivity? This, perhaps, gets to some of the difficulty that many of us have in incorporating new techniques. Seventy percent of the people agree uniformly that stockholders benefit quite nicely as productivity goes up (Figure 5). There is less certainty that the country, as a whole, benefits--and roughly 80 percent of the people, be they manager or union member, believe that employees do not benefit as productivity grows, even though the growth in real wages has paralleled productivity growth for many years, and even though increased productivity has resulted in the shorter work week, a lower percentage of the population working, and a higher real GNP.

We asked also who has above average productivity and who has below average productivity. As you can see (Figure 6), foreign manufacturers, particularly Japanese manufacturers, are perceived to have very high productivity, as do doctors and nurses. Company management and TV repairmen are seen to have approximately the same level of productivity. I'm never sure which conclusion to draw from that! I'm sad to report that government workers are seen to have the lowest productivity of all. We will talk a little bit about that in a minute.

In management there is a strong feeling that labor is <u>against</u> and management is <u>for</u> productivity. In fact, as one looks at the scatter diagram, one sees that there is very little pattern among union and non-union industries.

Many people believe that improving productivity in services is hopeless. But during the past two years an OMB/GAO/CSC study started by Senator Proxmire, as Head of the JEC (Joint Economic Committee) has been trying to put measures on productivity in the Federal government. There are obvious problems in doing this. For example, should one give credit to the Defense Department for getting us into wars or out of wars; should one give credit to the Federal Reserve for expanding or contracting the money supply? At the present time, there are some 600 measures--some crude, some refined--on more than 100 operating units of the Federal government. These measures over the past 5 years show roughly a 2 percent gain. Productivity in government can be improved!

Incentives and motivations are important. Productivity within the Federal government has a relatively low priority. It is more important for a Secretary (whose average tenure is 22 months) to work on policy issues. This means that time after time the internal efficiency of the department takes low priority. There seems also to be relatively little interest in identifying the effect of the government productivity in the private sector.

Ten months ago, four elected officials and four labor officials came to our office. They explained that additional revenues would not be forthcoming from the real estate base in this country. The tax rate was as high as it could be and therefore revenues would probably only grow at 1 percent per year. This is an impossible situation for an elected official because the expectations by the taxpayer were running at higher than 1 percent per year. At the same time, the unions could not settle for a 1 percent pay raise per year. Both had concluded that some form of productivity bargaining made sense and are so engaged. They are working to move people around to give them opportunities through retraining.

Question- "INCREASED PRODUCTIVITY" MEANS HIGHER UNEMPLOYMENT ?

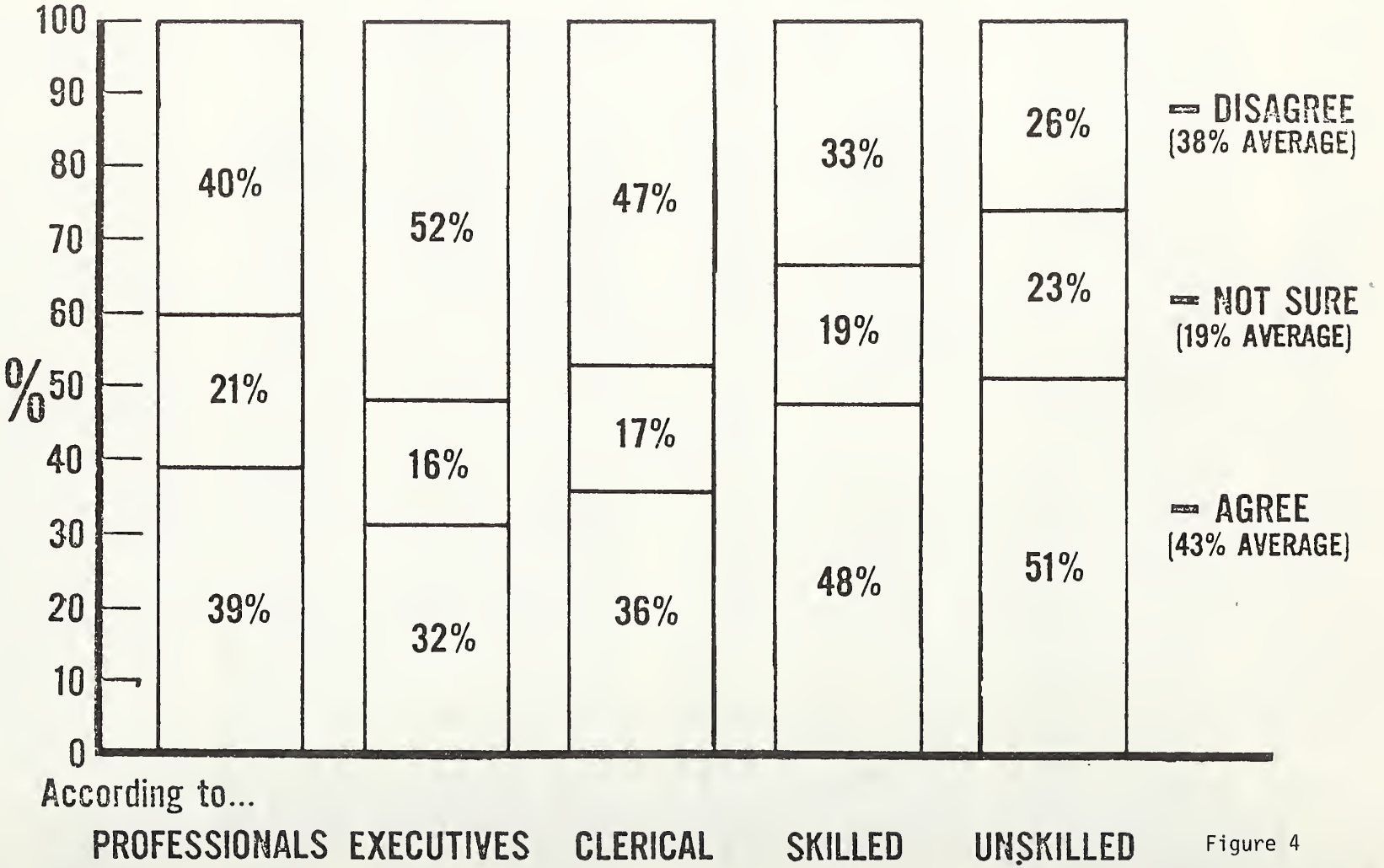


Figure 4

Source: Harris Poll

Question - WHO BENEFITS "A LOT" FROM PRODUCTIVITY?

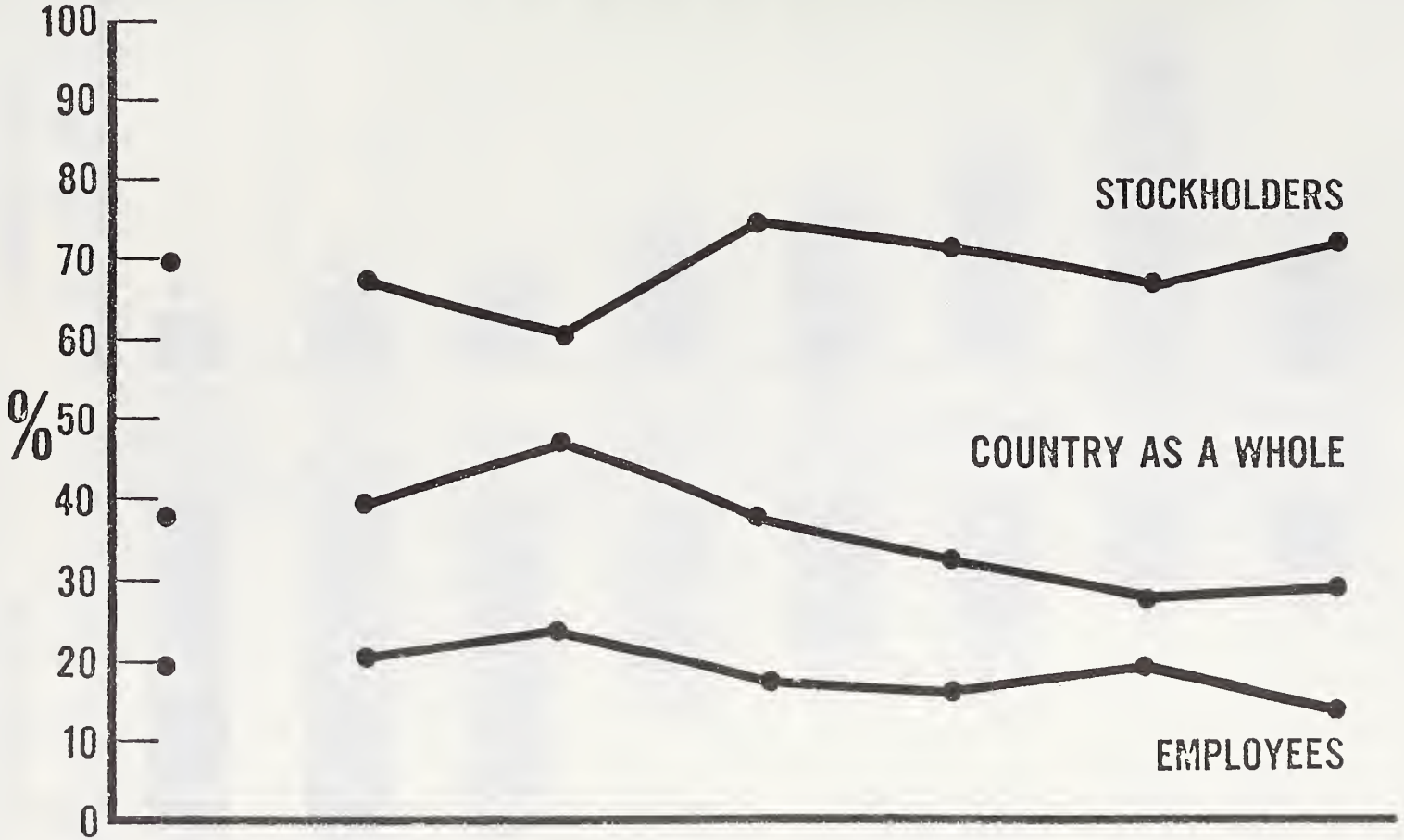


FIGURE 5

Source: Harris Poll

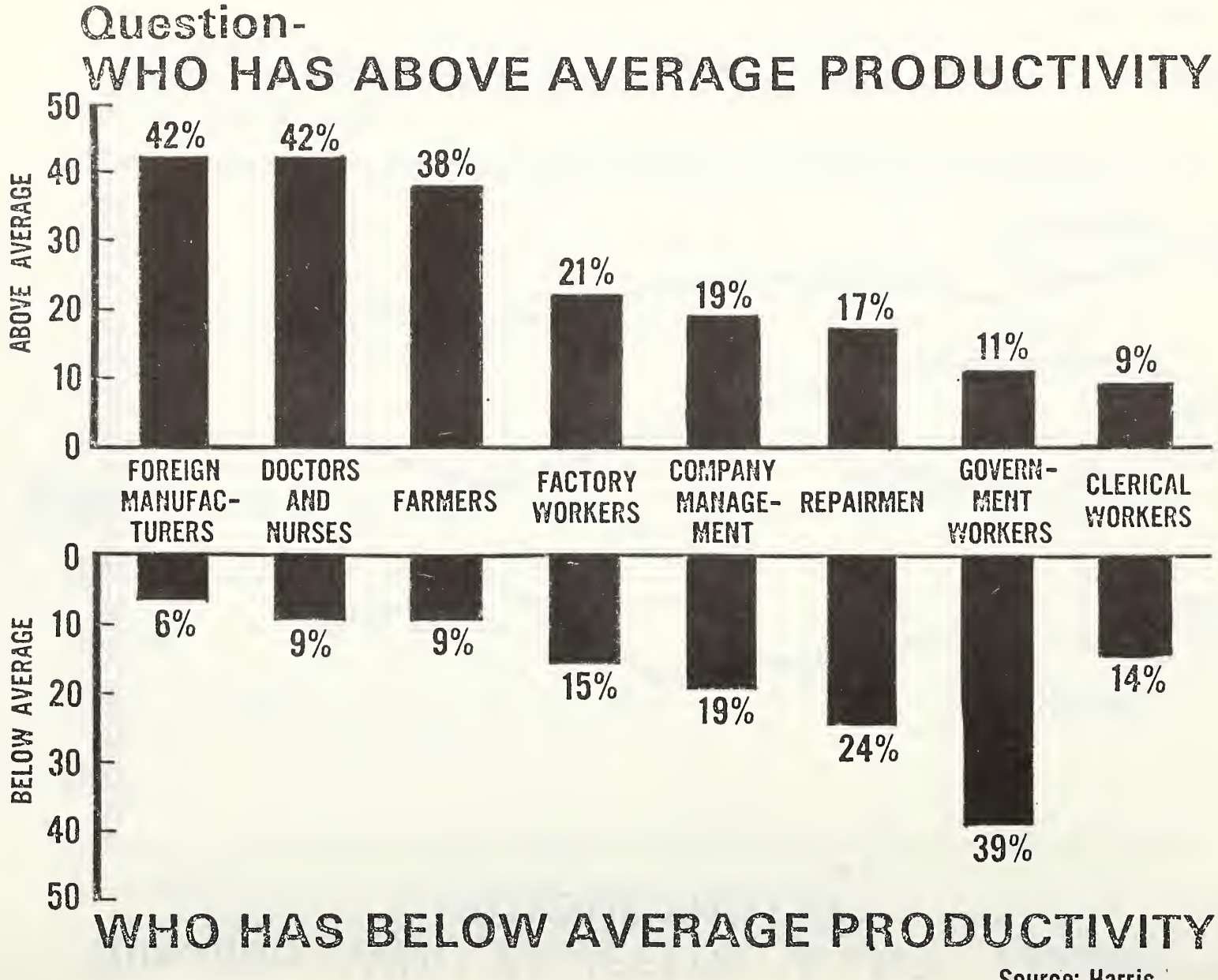


FIGURE 6

Source: Harris

Although there is not precise information on the variation of productivity among cities, there are wide variations in garbage collection. As you notice, there is almost a five-fold difference in the twice-a-week collection on a per man basis (Figure 7). The two-city variation, 30 miles apart, shows a 3-to-1 difference. The lower city has not developed labor and management relations to the point where introduction of new techniques and new equipment is easy. One can see also that once- and twice-a-week collection make quite a difference. But, these data are not routinely available in public works departments.

There is also a variation among police departments. The Urban Institute has summarized for us the general quality of the data and the problems that exist in gathering better data.

Health costs have risen about 13 percent per year. Last year a survey indicated that only half the hospitals had budgets, and there is evidence that in hospitals 2 miles apart the cost of doing simple tests, such as blood tests, varies by 100%.

We have been looking at transportation for the food industry. The problem, as many of you know, is that for the past 20 years transit time across the country has nearly doubled. Rates have gone up by 50 percent and spoilage has gone up sharply. This means that food is of lower quality as it reaches the East coast. We are encouraged by a joint project among labor unions, railroads, growers and food chains to try establishing a unit train coast-to-coast to improve transport service. It appears to us from our work with farmers, food processors, railroads and food chains that much of the gain will come from the inter-sector differences rather than the intra-sector differences as they have in the past.

I will commend to you the restaurant industry if you are interested in service. This is an industry with $2\frac{1}{2}$ million people. In New York a survey indicates a turnover rate of 300 percent. There is a wide disparity of technology applied--from Marriott, which has a very well organized effort, down to local diners which do not. Restaurants are a good example of a disaggregated industry with low technology. Very low skill levels are a problem that this group could face. What technology can be applied economically to this industry?

Let me summarize by saying that (1) the environment is neutral-to-unfriendly concerning productivity, (2) there is a considerable misconception about who wins and who loses, (3) there is a clear shift towards services where we are much less certain about how to keep productivity improving and (4) there is a poor development of productivity measures and poor coordination among hard sciences and soft sciences. Something that would be quite useful would be the answers to the following questions:

1. How can the knowledge we have concerning service productivity be applied more widely now?

2. How can we avoid the slow learning process in disaggregated industries in the future?

3. How can the process be speeded by combining the hard sciences and the soft sciences in the large and growing service sector of the economy?

And finally, technically, one of the questions I hope you address this week is "How can those of you who understand technology, better inform the decision makers in corporations, the government and unions to use technology in improving productivity?"

CITY TO CITY VARIATIONS IN GARBAGE COLLECTION PRODUCTIVITY

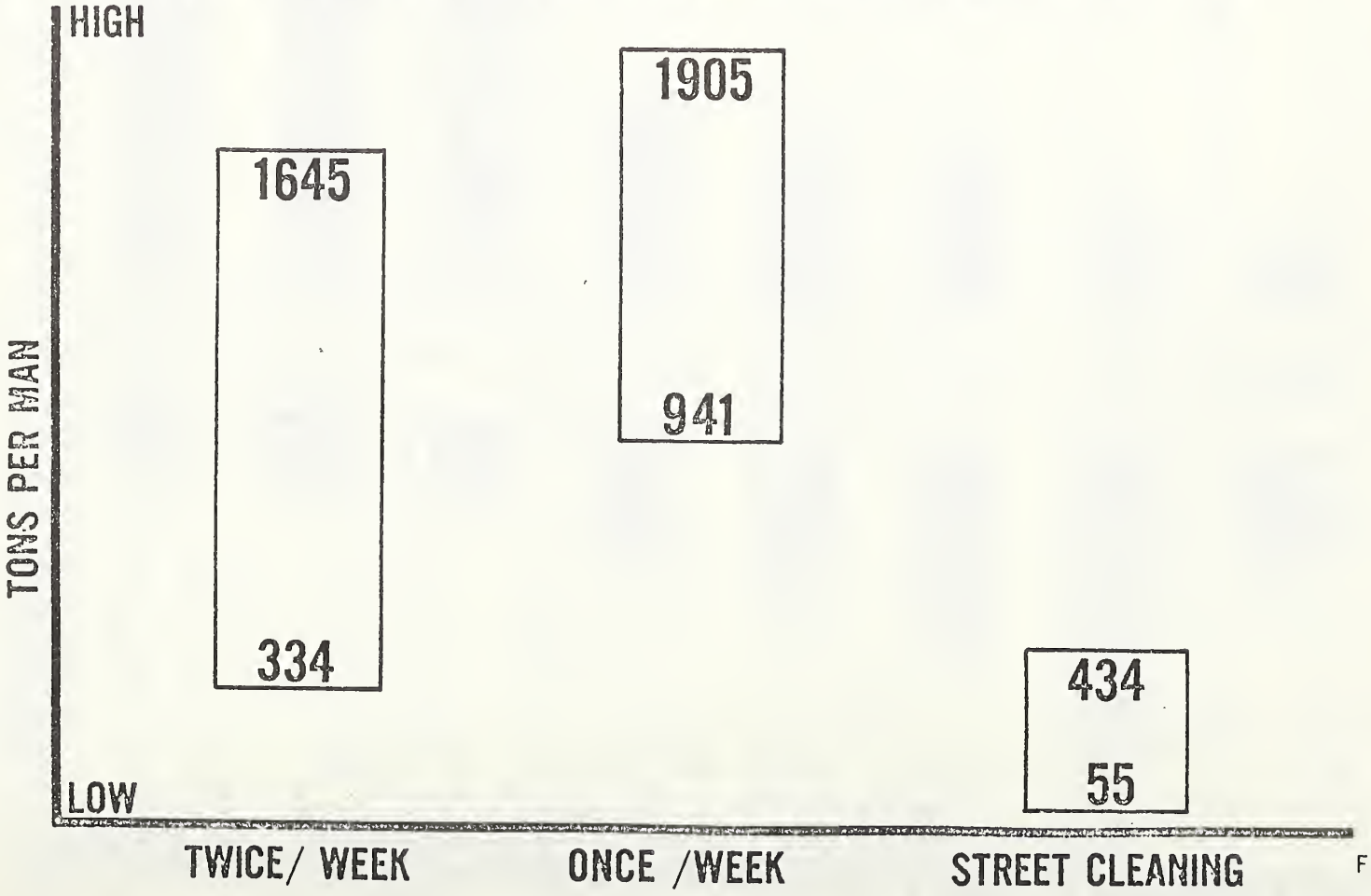


FIGURE 7

NATIONAL COMMISSION ON PRODUCTIVITY MEMBERS

BUSINESS

Stephen D. Bechtel, Jr.
President
Bechtel Corp.

Berkeley Burrell
President
National Business League

Edward W. Carter
Chairman of the Board
Broadway-Hale Stores

Archie K. Davis
President
Chamber of Commerce of U.S.

M. Peter Venema
Chairman of the Board
Universal Oil Products Co.

R. Heath Larry
Vice Chairman of the Board
United States Steel Corp.

James M. Roche
Member of the Board
General Motors Corp.

Walter B. Wriston
Chairman
First National City Bank

LABOR

I.W. Abel
President
United Steelworkers of America

C. L. Dennis
President
Railway, Airline and Steamship
Clerks, Freight Handlers, Express
Station Employees

Frank Fitzsimmons
President
International Brotherhood of
Teamsters

Paul Hall
President
Seafarers' International
Union of North America

LABOR (CONT'D)

Lane Kirkland
Secretary-Treasurer
American Federation of Labor and
Congress of Industrial
Organizations

John H. Lyons
President
International Association of Bridge,
Structural and Ornamental Iron
Workers

George Meany
President
American Federation of Labor and
Congress of Industrial
Organizations

Leonard Woodcock
President
International Union, United
Automobile, Aerospace and
Agricultural Implement Workers
of America

PUBLIC

Honorable Beverly Briley
Mayor of Nashville/Davidson County

William T. Coleman, Jr.
Dilworth, Paxson, Kalish, Levy
and Coleman

William Kuhfuss
President
American Farm Bureau

Edward H. Levi
President
University of Chicago

Arjay Miller
Dean
Graduate School of Business
Stanford University

Honorable Arch Moore
Governor of West Virginia

John Scott
Master of the National Grange

PUBLIC (CONT'D)

W. Allen Wallis
Chancellor
University of Rochester

GOVERNMENT

Roy Ash
Director
Office of Management and Budget

Peter J. Brennan
Secretary of Labor

Frederick Dent
Secretary of Commerce

John T. Dunlop
Director of Cost of Living Council
and Chairman of the National Commission
on Productivity

Virginia Knauer
Special Assistant to the President for
Consumer Affairs

George P. Schultz
Secretary of the Treasury

Herbert Stein
Chairman
Council of Economic Advisors

John M. Stewart
Executive Director
National Commission on Productivity

August 13, 1973

"SUMMARY OF FCST FINDINGS"

Lawrence Goldmuntz

Dr. Goldmuntz is Director of OPTEL Corporation in Princeton, New Jersey. He was formerly on the staff of the Office of Science and Technology, Executive Office of the President, and while there served as Executive Director of the Federal Council on Science and Technology's Task Force on Automation in the Service Sector. Representing that capacity, he summarized the results of the work of the Task Force, and its panels on Health Care, State and Local Governments, Education, Postal Service, and Transportation. The common factors among their conclusions, as described by Dr. Goldmuntz, fell under general findings, opportunities for automation, factors which inhibit the diffusion of automation in service areas, and recommendations.

"SUMMARY OF FCST STUDY FINDINGS"

Lawrence Goldmuntz

Panels of the Task Force on Automation in the Service Sector investigated Health Care, Government, Education, the Postal Service, and Transportation. Each panel arrived at its conclusions independently, considering only factors pertinent to its own area of responsibility. Nevertheless, these independent efforts resulted in a remarkable degree of commonality among the conclusions. A meaningful pattern of common factors follows:

I. GENERAL FINDINGS

Automation and Productivity: The diffusion of automation throughout the service sector is not an end in itself. Rather it is only desirable insofar as it contributes to the net basket of goods and services enjoyed by Americans. The preponderance of evidence indicates that automation can and does make such a contribution through increasing the productivity of goods-producing or service-rendering organizations.

II. OPPORTUNITIES FOR AUTOMATION

The speed, efficiency, and accuracy inherent in automation devices make possible a wide range of potential improvements in the delivery of service. The opportunities for automation to contribute can be found in most stable and routine aspects of each service sector.

1. Automated Record Storage: The need for storage of large volumes of information is a common feature of each service sector examined.

2. Automated Processing of Information: In addition to record keeping, opportunities exist for automation to improve the handling of information within a service organization.

3. Automation as a Tool of Management: Automation can also provide service managers with powerful analytical tools for running their organizations.

4. Automated Real-Time Services: The effectiveness of real-time emergency services such as police and fire protection or ambulance service can be enhanced through automated control systems. Opportunities for automation also can be found in routine real-time services.

III. FACTORS WHICH INHIBIT THE DIFFUSION OF AUTOMATION IN SERVICE AREAS

The factors which enable or discourage the application of automation technology are best described as patterns of conditions rather than in terms of single important variables. These patterns of conditions include:

1. Productivity Measurement. The ability to measure productivity is the sine qua non for improving it. Yet no entirely adequate means of measuring productivity exist in three of the five areas examined: health care, government and education.

2. Clarity of Goals. Clear and unambiguous objectives of the service organization are critical to the improvement of productivity whether by automation or by any other means. Where goals remain diffuse or contradictory, automation can do little to assist in bettering the quality or efficiency of the service.

IV. RECOMMENDATIONS

Recommendations concerning the introduction and diffusion of automation in the service sector must be made within the context of productivity improvement throughout the total economy. Two factors demand this more universal approach. First, automation is best employed in consonance with other means of productivity enhancement rather than in isolation. Automation should be viewed as a means to an end, greater productivity, and not as a goal in its own right. Second, the distinction between service and manufacturing activities tends to be rather arbitrary.

"DO WE KNOW WHAT TO EXPECT FROM RELAXATION

OF REGULATION OF SURFACE TRANSPORTATION"

Alan K. McAdams

Dr. McAdams is an Associate Professor of Managerial Economics and Finance at the Graduate School of Business and Public Administration, Cornell University. He reviewed the reasons why the question is posed, why the regulation of surface freight transportation might be relaxed. According to Dr. McAdams, regulation prohibits competition and thus prevents efficiency. He recommends learning from tests of relaxed regulation of surface freight transport in environments similar to those in the U.S., e.g., Great Britain, Canada, Australia, and small scale experience in the U.S. itself. According to Dr. McAdams, the evidence supports the theory that an improvement in the allocation of resources should result from the relaxation of regulation.

"DO WE KNOW WHAT TO EXPECT FROM RELAXATION OF REGULATION OF SURFACE TRANSPORTATION"

Alan K. McAdams

This talk is directed at the question "Do we require further study in order to determine the probable impact of possible relaxation of regulation of surface freight transportation?" Before addressing that question directly, though, it may be helpful to review reasons why that question is at issue. Why might we want to relax the regulation of surface freight transportation by the Interstate Commerce Commission (ICC)?

WHY RELAX REGULATION?

Research in the recent past has documented the degree of waste that has resulted in surface freight transportation, and its proximate causes. Today's bill for the pure economic waste in surface freight transportation is estimated at $4-9 billion annually. The main cause of this waste is (un-) economic regulation of the industry which prohibits competition and thus prevents efficiency. How has this come about when the stated objective of regulation is the protection of consumers, small towns, and small businesses from the power of monopolists to exploit them and discriminate against them?

The answer is that if monopoly power ever existed in freight transportation (and there are disputes on this issue), it was a phenomenon of the railroads in the second half of the 1800's and early 1900's, but is nonexistent in freight transportation today--except as a direct result of ICC regulation. Surface freight transportation is inherently competitive today. Instead of allowing competition, the ICC has enforced price fixing--price fixing has been based on the "value of the service" provided (and thus is highly discriminatory) rather than on the cost of providing the service (which many railroads haven't bothered to try to even find out)--plus a host of other practices that have prevented each mode of transport from competing with the others.

Railroads move over fixed roadbeds from particular terminals in one location to terminals in another. Efficiency comes with long-haul shipment of reasonably large quantities. Terminals, interchanges, and switching raise rail costs. Costs soar at sidings and in yards when individual boxcars are picked up, delivered or assembled into extra-long trains. That's rail technology.

Rail rates which might allow the roads to take advantage of their natural efficiencies are refused by the ICC. "They would have negative impacts on truckers serving those routes," i.e., rates are based on the costs of the high-cost producers.

Truck technology is an entirely different matter. There are few if any economies of scale. The truck is the ideal vehicle for short distance shipment. Highways are ubiquitous. The internal combustion engine could assure small, out-of-the-way localities of low-cost service at reasonable rates--if trucks were free to serve them competitively.

Trucks were brought under regulation in the 1930's not to control monopoly--there are no economies of scale or other bases for monopoly inherent in trucking--but to control the competition they were providing to the railroads. To put trucks on an "equal footing" with railroads, the ICC required them also to operate only over fixed routes, between specified, fixed termini, through particular "gateways" (e.g., in moving from North Carolina to Boston you must proceed only through the "Pittsburgh gateway"), frequently only to carry particular commodities (". . . only tacos, and tacos only between your termini."). A "grandfather clause" allowed truckers in operation on particular routes in the 1930's to serve those routes, but only those routes. All other potential competitors (or potential competitors for other routes) must petition for a certificate of "public convenience and necessity," grantable only by the ICC and only after much expense and delay and with high probability of refusal. They are not allowed to change their routings, to pick up and deliver at other than the specified points or otherwise

respond to changes that have occurred since the 1930's. Entry restrictions are combined with legalized price fixing, prescribed accounting and costing procedures to reinforce the other absurdities of truck regulation.

In short, the ICC has forced the disadvantages that accrue inherently to railroads on to regulated trucks. To these it has added all those disadvantages it had been able to devise in four decades of regulation of railroads. Trucks are required to traverse inefficient routes with diversions of up to 30%, to proceed partially unloaded and in many cases to return empty. Trucks carry long-haul loads which are more economically carried by train, while trains are required to continue to service uneconomic short-haul routes.

To avoid the high costs of regulated trucking many large shippers have gone to unregulated private trucking, although private trucking almost necessarily involves empty backhauls. The flow is from factory to warehouse, warehouse to store, and the ICC prohibits private trucks to carry cargoes for anyone but the single firm. This virtually assures excess capacity and inefficient use of private trucks. Small operators, on the other hand, are stuck with the higher cost of regulated common carrier transport--which become higher-cost-still since its most lucrative traffic has been forced into private haulage.

All this has been thoroughly documented, most recently by Professor Thomas Moore of Michigan State University in a summary analysis of the earlier studies. These same studies were tested last year by the research department of the American Trucking Association which challenged many of the findings. The record of the challenge and the responses to it is found in the Hearings of the House and Senate Committees on Regulatory Reform in the Spring of 1972 (especially the House Committee). These Hearings show that the major conclusions remain intact.

Perhaps the most insidious result of regulation has been the stifling of initiative, innovation and action through delay and bureaucratic entanglement. The manager's ability and desire to manage has been destroyed, especially in railroads. The phenomenon is called by Wilson the "Dead Hand of Regulation" and by Meyer the "Regulatory Syndrome." Managers abandon the substance of what should be their jobs to become ensnarled in legalistic wranglings and procedural minutia. Top positions in management go by default to those who by temperament and training are best suited to such trivia--generally accountants and lawyers rather than operating managers.

The lack of innovation can be seen in particular instances: The braking system in railroading is essentially the same today as when it was introduced in the 1800's (the Westinghouse air brake). It causes damage to cars and cargo each time a mainline train is brought to a stop (it could better be termed a "breaking" system). The coupling mechanism is of similar vintage and even in its "automatic" form is very labor intensive today, particularly to hook up the air hoses for the "breaking" system. The technology of the boxcar is antiquated.

By contrast containerization for shipment of general cargo is well advanced in Canada and in ocean shipping even in the U.S. But containerized shipments were forbidden by the ICC for U.S. railroads in the 1930's.

The effects of regulation have been documented, but do we know what the impact of relaxing regulation would be?

What Can Be Expected?

Let's review the information available on the impact of relaxation of regulation and especially the significance of the experience with relaxation of regulation in other economies such as those in Australia, Canada and the UK.

One way to go at this problem is to set out an idealized approach to the development of information on the topic. The next step would be to compare the amount of information

currently available with that which could be gathered through the ideal information-gathering approach. This is done below. My conclusion is that the information in hand is close to what one could expect from an ideal data-gathering and testing effort. At each step the evidence points consistently in one direction.

An Ideal Process

The first step in the process of analysis is to state what it is we want to test.

We want to test the following proposition:

> Relaxation of regulation of surface freight transportation in the U.S. would lead to profitable, stable carriers capable of meeting growing demands for service; efficient operations (with each carrier handling traffic in accord with its own comparative advantage); prices related to the costs of providing service; good service to all shippers and to consumers; and competitive wage rates for workers in the industry.

The proposition is based on theory and analysis: economic analysts today conclude that transportation is not (or is no longer) a monopoly activity; there are few, if any, economies of scale. We have just documented the hypothesis that competition is currently inhibited by regulation which results in cartel-like inefficiencies. The implication is that through relaxation of regulation, competitive results might be achieved. The conditions required for competition appear to be met: there are a great number of existing and potential competitors, especially in trucking. Railroads compete with other forms of transportation in most parts of the country. Most railroads appear to have achieved whatever scale economies are required for efficient operation (though coast-to-coast rail lines could prove to be very desirable). In the absence of regulation, there appear to be few, if any, natural barriers to entry into the transportation industry (except for new railroads). One might expect highly competitive, efficient results from relaxation of regulation.

In summary, if the current market has been rendered inefficient through regulation, then one would expect an improvement in the allocation of resources through the removal of regulation.

The next step is to test it.

How?

The only fully valid test of this proposition would be to try it and see. That may not be too practical as a first step.

A next best approach would be to make a series of small scale tests in other environments as closely similar to ours as possible and then run a full scale test in the environment most similar to our own. If results are encouraging, they might justify small scale tests in the U.S. If these are all encouraging, then the full scale U.S. test could be justified.

Each of these steps has been taken.

What's a Good Test?

It's important to note that a good test only requires relaxation of regulation of surface freight transport in physical and economic circumstances similar to those in the U.S. (a large, diverse, advanced, Western, private enterprise economy). Conditions prior to deregulation do not have to be identical to those in the U.S., if enough time has elapsed to allow adjustment to relaxation of regulation to have taken place.

What Data Do We Want?

If possible, tests should be carried out with two kinds of data. First, data should be gathered from a situation in which a change is made from the existing conditions to the test conditions and then observations made in succeeding time periods to see what results occur (time series data). In other words: Relax regulations and see what happens.

This was done in Australia.

Second, data should be gathered and compared from different sectors (of the same economy, for example), some in which test conditions hold, and some in which nontest conditions hold (cross-sectional data). In other words: Relax regulation in some states (or provinces) and don't in others.

This was done in Canada.

Might Other Factors Be Important?

The speed with which change is imposed may be significant. Information from different situations and different rates of change-over could be useful.

> Australia deregulated trucking fully and quickly; Great Britain relaxed regulation of trucking partially and slowly.

Perhaps the Best Test of All

If the conditions stated in our proposition represent significant change from the situation as it currently exists, another opportunity for a real-world test of the proposition is provided. Groups that would be advantaged from a change to the test conditions should support the change. Groups that would be disadvantaged from the change should oppose it. The degree of support and opposition should be proportional to the degree of change that would be expected under the new conditions.

We are experiencing this test.

The final step is to evaluate the test data to see the degree to which they support going ahead with the full scale test.

Substance of Information in Hand:

Our proposition states what we should expect from a deregulated transportation industry under today's conditions. What has been the result of the various tests made so far and what data are available?

Great Britain. Great Britain has gradually relaxed the regulation of its trucking industry. Each change has been small, but most important, each has been followed by additional relaxation of restrictions. These additional steps would not have been taken if earlier steps produced undesirable results. Full deregulation has now been achieved. Lower costs, lower rates and better service have resulted from each small step taken. There has been no attempt to reimpose regulation. No "chaos" has resulted at any stage. It should be noted that as economic regulation (costs, rates, routes, entry, etc.) has been relaxed safety regulation has been strictly enforced. This makes good sense, but the two should not be confused.

Canada. Canada supplies the best cross-sectional data. Regulation has been on a provincial basis. The outcome has been directly in accord with our proposition. Provinces in which regulation has been most strict have had higher rates for trucking and less efficient operations. Essentially unregulated provinces have experienced lower rates, greater efficiency and at least as good service. Especially important to note is that

"chaos" has not resulted in the unregulated provinces.

Australia. Australia represents a full scale test of deregulation of trucking. It is important also because of the impact that deregulated trucking has had on the railroads which have remained under the ownership of the individual provinces. (The high degree of rail regulation which led to early negative results in Australia is a further substantiation of the converse of our proposition.) Full deregulation of trucking occurred suddenly as a result of a court ruling. The impact has been dramatic.

The trucking industry of Australia has improved enormously since deregulation. Today, and for the last two decades, the industry has been stable with several major truck lines providing regular scheduled service between provincial capitals at something of a premium in rates. Medium-sized lines compete with these larger lines, provide service among medium-sized cities, and provide private trucking services to groups of particular shippers at rates below those of their larger brethren. As potential entrants into the scheduled portion of the market, they provide a constant check on the rates chargeable by the larger firms. Small truckers, mainly owner-operators, provide the competitive cutting edge of the Australian industry. They provide capacity to particular markets at demand peaks, move around the country from excess to deficit service areas, and perhaps most important, contract themselves to the large truckers. This latter point is perhaps the most convincing on the economies of scale question. The large truck lines own only a nucleus of trucks. The bulk of their capacity is provided through subcontracts to small truckers and owner-operators--both of whom may use the name and colors of the parent line. If there were real economies of scale, the large lines would not subcontract. The lack of a well developed highway network and the continuation of tight regulation of railroads did mean that a period of some turmoil resulted immediately after the court ruling, but the situation stabilized after a year or two.

Three levels of service have grown up, each consistent with the characteristics of demand in their respective markets. These levels, and the freight rates on trucking, have been quite stable. The large truck lines provide scheduled service at a premium in rates as common carriers. Medium-sized lines provide the equivalent of private carriage, peak service over the major routes and some service over particular routes among noncapital cities. The small truckers may, by special knowledge of particular areas or routes, be able to achieve some limited geographic monopoly for a given rural area. However, even here entry is free, so there is the constant threat of potential competition which keeps rates reasonably low. Students of the impact of deregulation state that cost reductions have been substantial. Trucking is a stable and profitable industry. Wages are competitive. Entry and exit are free. Service is good. Shippers have a choice between fixed schedules (with higher rates) and less regular service (with lower rates).

Chaos has not resulted. Our proposition has.

And Here's the Clincher!

In Australia, competition in trucking has had substantial and beneficial impact on the regulated railroads. Before deregulation of trucking the gauges of the railroads owned by different provinces did not match! After deregulation of trucking they did. "Value of shipment" pricing was abandoned by Australian railroads; competitive pricing and efficient service were introduced. This suggests the power of competition in surface freight. Perhaps it also suggests the likely direction of competitive impact. Freedom in trucking can force the hand of even strongly cartel-minded railroads. It appears likely that full deregulation of the Australian railroads could make their performance better still.

Canada has relaxed regulation of its railroads with dramatic results. Freedom of the railroad managers to manage, plus full intermodal operation by a single carrier, has led to "wholesale" carriage by rail, "retail" by truck and substantial containerization of general cargo to facilitate the interchange. Improved planning, coordination and efficiency have resulted in Canadian railroads.

U.S.A. U.S. experience with deregulation has not been widespread, but as further pieces to the jigsaw, helps build the case. If foreign experience were not appropriate to the U.S. we might expect those instances in which deregulation has been tried in the U.S. to produce results different from other countries.

Trucking of unprocessed agricultural commodities in the U.S. is exempt from regulation. Borderline areas have been regulated, exempted, re-regulated and re-exempted. When frozen chickens and frozen fruits and vegetables were deregulated, rates fell and service improved. When they were "re-regulated," rates rose and service declined. Shortly after being exempted, truckers in these segments of the market found themselves able to drop their rates from 10 to 30 percent--and provide better service than they had under regulation. Stable patterns of business resulted.

In exempt trucking as a whole, entry is free and exit is free. Efficient operators are profitable. This has been true despite the actions of regulators which prevent such truckers from finding backhauls of nonagricultural products.

Cross-sectional data in the U.S. is supplied also by PSA (though for air passengers, not freight) and other California airlines; lower rates with better service results from unregulated air fares. Again not conclusive in themselves, these results tend to support our proposition, and do not negate it.

Nothing in the data presented thus far contradicts the proposition stated at the outset. Thus the stage is set for planning a full scale U.S. test.

We are all familiar with the provisions of the Transportation Regulatory Modernization Act proposed by the administration in 1971 and 1972. They represented a moderate approach to relaxation of regulation. If regulation does what analysts say it does, and if relaxation of regulation would move toward our proposition, we could expect:

1. Opposition, especially from the regulated truckers. Their monopoly power comes from the cartel created by the ICC. Particular truck lines operate very profitably and without the nuisance of price competition or threats of entry. Removal of cartel regulations and permitting entry can threaten their monopoly position.

   And we got it.

2. Opposition from the Teamsters, who share (sometimes up to 100 percent) the monopoly power of the truckers.

   The Teamsters were also opposed.

3. Mixed feelings from railroads. They are not doing well now, recognize the need for change, but have lived under a regulatory umbrella for decades. They would have to take much greater responsibility for their own actions--while they could become profitable and plan a very effective role in the future. On balance you could expect their reaction to be mixed.

   Railroad reactions were mixed, but privately at least some railroads were favorable.

4. Negative reactions from some classes of shippers who are currently benefited by railroad service which comes at a loss to the railroads. Some agricultural groups and shippers located on little-used branch lines are in this category.

   These groups did oppose the bill.

5. Other shippers, in general, should support the bill.

   They did.

After looking the situation over, I've been impressed with the evidence which (for this case, at least) supports the theory. It strikes me that it should almost be saleable even to the Congress, and certainly to the public.

"MINI-COMPUTER APPLICATIONS IN THE SERVICE INDUSTRIES"

Earl Sasser

Earl Sasser is an Associate Professor at the Harvard Business School. He specializes and consults in the Management of Service Operations. His presentation on mini-computer applications was designed around a case study of AVCON, Inc. (an acronym for Automatic Vehicle Control). The two applications were an automated newspaper delivery truck system and a hotel front and back office operations system. The experiences of AVCON in trying to develop and market these systems were studied by the conference participants and discussed for definition of the problems and recommendations for further actions.

MEMORANDUM

To: Participants of the Conference on "Making Service Industries More Productive through Computers and Automation"

From: W. Earl Sasser

Subject: Session IV, Tuesday Evening, August 14

This session, which explores mini-computer applications in two service industries, is designed around the case study, "AVCON, Inc." The session will be split into two parts. During the first part, small groups will meet to discuss the case; during the second part, the entire conference will meet as a group for a discussion of the case. For some, the "case method" may be a new experience. Let me make some suggestions to help you get started.

1. Go through the case almost as fast as you can turn the pages, asking yourself, "What broadly is the case about and what types of information am I being given to analyze?"

2. Read the case very carefully underlining key facts as you go. Then ask yourself: "What are the basic problems this manager has to resolve?" Try hard to put yourself in the position of the manager in the case. Develop a sense of involvement in his problems.

3. Note the key problems on scratch paper. Then go through the case again, sorting out the relevant considerations for each problem area.

4. Develop a set of recommendations supported by analysis of case data.

Up until now, your best results will come if you have worked by yourself. The next step is to meet with your discussion group, present your arguments to the members of this group and hear theirs. The purpose of the discussion group is not to develop a consensus or a "group" position. It is to help each member to refine, adjust and fill out his own thinking. It is not necessary, or even desirable that you agree. It is an important preparatory step for class discussion.

This case was developed by two of my students in the second-year MBA course, Management of Service Operations at Harvard Business School. The case was made possible through the splendid cooperation of Mr. Halden Conner, President of AVCON, Inc. while he was attending the Program for Management Development (PMD) at Harvard. A great deal of credit must be given to the other employees of AVCON in Fort Worth who supplied the student casewriters with additional information and exhibits, and also to the Fort Worth Star-Telegram who worked closely with the casewriters. Mr. Conner will be a participant of this conference and will serve as a resource during our discussion and as a critic at the end of the session.

Harvard Business School

AVCON, INC.

Currently, the major goal in my life is to build a profitable, respected, and well-managed company. AVCON will be that company. I am prepared to devote my time and resources to that goal. My attendance at PMD this spring signals the transition from my concern for our survival to my preparation for our success.

W. H. Conner, President
AVCON, Inc.

After stating his ambition, Mr. Conner described the short history of AVCON. The story begins with Command Systems Corp., a small firm in Fort Worth, Texas, founded in 1969 to develop hardware and software applications on mini computers. In the beginning, the firm consisted of five technical people who worked for the company on a part-time basis doing contract development work. By 1971, Command Systems had two major contracts. One was for $150,000 with the Fort Worth Star-Telegram newspaper to develop an automated paper delivery truck. The second was a cost plus fixed fee contract with Hotel Computers, Inc. (HCI), a small Fort Worth company which hoped to develop and market a standard mini computer system for doing front and back office operations for hotels and motels. HCI had a single contract with the Green Oaks Inn, a luxury motel in Fort Worth.

In 1971 management of Command Systems decided that in order to realize the potential inherent in the vehicle which they developed for the Star Telegram, that they would need considerable marketing and management expertise as well as an inflow of capital. They approached Mr. Conner for help on all fronts. In January, 1972 AVCON, INC. was formed and absorbed Command Systems. (AVCON is an acronym for Automatic Vehicle Control.) Mr. Conner arranged for a $500,000 line of credit for AVCON. In return he received 51% of the AVCON stock; 20% of AVCON was held by the Star-Telegram and 29% by the principals of Command Systems. Bob French, President of Command Systems, became the research director and vice-president of AVCON.

The first three months of 1972 were spent in acquiring new personnel and developing a strategy for AVCON. Bob Rapp, an HBS graduate and former director of marketing for a division of a pharmaceutical company, was hired as director of marketing and vice-president of AVCON. The decision was made that AVCON was in the business to manufacture and sell automatic vehicle control systems.

At this same time development work continued on the HCI hotel system for the Green Oaks Inn. Even though AVCON had decided that the HCI project was outside of AVCON's primary area of interest, Bob French

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This case was prepared as a basis for class discussion rather than to illustrate either effective or ineffective handling of an administrative situation.

felt that the contract was a commitment Command Systems had made and one which should be honored by AVCON. Mr. Conner agreed to complete the work outlined in the contract, which was to install an operational system in the Green Oaks Inn.

However, Mr. Conner was not pleased with the HCI project because (1) it took resources in terms of personnel away from the automatic vehicle development, thus detracting from AVCON's primary focus, and (2) when developed the hotel system would not belong to AVCON, but to HCI. "We're much less interested in a new venture unless we have the means of obtaining 51% of the firm" was Mr. Conner's philosophy. He felt "the company which controls the market dominates the one which controls the productive facilities or R&D. Marketeers make the real money from an innovation, not R&D and production firms. As a result we want AVCON to be able to gain the majority interest of a firm before we get too involved."

In addition, the hotel project schedule had slipped because of software development difficulties. Mr. Conner felt that this was due in part to the development responsibility being split between HCI and AVCON. Therefore, Mr. Conner was anxious to "get the project completed as soon as possible" in order to fulfill the contract and devote the full resources of AVCON to the sales and development of the automated vehicle.

The Automatic Route Control System

The automatic route control system evolved from an idea originally conceived by R.V. Holsinger, Fort Worth Star-Telegram Controller, for correlating subscriber data with the position of a vehicle along a route in order to produce signals to throw newspapers at proper positions. Command Systems Corporation formulated techniques and equipment configurations to implement Holsinger's idea, and added the concept of controlling the actual driving of the route.

A simple method was invented which, in addition to maintaining an accurate measure of position along a route, provided a means of automatically correcting position errors and of detecting deviations from the specified route.

A development contract with The Star-Telegram was made through Command Systems for producing a prototype system for the delivery of newspapers.

A special vehicle equipped with a paper folding machine was provided with the system. This unit was delivered to The Star-Telegram in March, 1971 and Command cooperated with The Star-Telegram in designing comprehensive operational tests. AVCON has a patent pending on the automatic route control system. The patent application was filed for the means developed for automatically maintaining a highly accurate measure of vehicle location. Foreign patent possibilities will be evaluated and, if feasible, filed.

Physically, the system consisted of a standard truck, a position sensing device patented by AVCON, a mini computer with its I/O devices, and miscellaneous control equipment. There was capacity in the truck for several thousand newspapers (the exact number depending on the size of the edition). Large windows were installed on either side of the truck to enable two people to throw newspapers on both sides. Exhibit 1 is a picture of the vehicle.

A self-contained on-board computer directed the operation of the vehicle over predetermined routes, and controlled activities (such as the delivery or pickup of items) performed along the route. In effect, the system continuously determined the location coordinates of the vehicle, compared these with the route coordinates, and then issued audio, visual and/or printed instructions appropriate to the location. All commands were issued within approximately ten feet of the proper location. The system also detected route errors made by the driver and prescribed corrective action. The routes to be followed and the actions to be taken were recorded on interchangeable magnetic tape cartridges which may be updated daily, or as required, from a computerized central file. This system enabled a driver to operate efficiently over a complicated route without reference to maps or lists and without prior knowledge of the route.

It was felt that the automatic route control system was applicable to other industries which have operations carried out over predetermined routes. Examples include home delivery of consumer products, distribution to retail outlets, laundry and dry cleaning pickup and delivery, armored car service, parcel delivery service, refuse collection, city bus systems, security patrol, and several postal service and military functions.

Several advantages of the system were outlined by Bob French:

> In some applications, automatic route control may effect large savings by reducing the number of vehicles and drivers required to cover a given territory. Another advantage is that drivers are fully interchangeable, because they can easily drive a new route with virtually the same efficiency as an experienced driver. Time-consuming manual reporting can be eliminated, since the system provides computer-ready data for accurate and complete route accounting. Finally, automatic route control can help assure accurate and highly personalized customer service .

Newspaper Distribution

Bob Rapp described in detail the system of newspaper distribution in the United States:

> In the United States, urban newspapers have developed a unique distribution system. Everyone is familiar with the figure of the paperboy as the final distributor of newspapers. He is also the primary seller of newspapers. In Fort Worth, the Star Telegram sells only 20% of its copies through single sales in newsstands. The newspaper delivery boy acts as an independent retailer, buying his papers below the newsstand price from a distributor who in turn either is employed by the newspaper company or is an independent contractor who is a wholesale supplier to the newsboys.
>
> Because of this system, newspapers do not maintain control over the distribution of their product. If one regards newspaper publishing as a service and its product as timely delivery of the news, this control becomes critical as no one is interested in buying an old newspaper. The system served well enough in the past partially because there was a large supply of young boys who were willing to deliver newspapers. Changing social and economic circumstances have seriously eroded this supply and delivery is frequently done by adults. With this change, several limitations of the system became apparent:
>
> 1) Young boys were willing to work for lower wages than adults. This pressure for higher wages can and has resulted in increased unionization amongst distribution and delivery labor.
>
> 2) Delivery and, in some cases, distributor personnel are not newspaper employees and therefore the newspaper has very little control over them with regard to quality of service. In some cases distributors even want to charge different prices for different delivery situations.
>
> 3) In general, newspaper publishers do not know who their subscribers are. Some subscription additions and changes are handled centrally, but these are passed on to distributors and newsboys. Newsboy-solicited subscriptions are not necessarily known by the newspaper company at all.
>
> 4) Because of the above, and the perishable nature of the product, the distributor/delivery system literally has a death grip on the newspaper. A strike is extremely expensive, and unlike a strike in the print plant, producing a newspaper is of no avail since there is no knowledge available on how management could distribute it.

The factors outlined by Rapp existed in 1968 in Ft. Worth. They and the impending unionization of the Star Telegram distributors motivated R.V. Holsinger to pursue his idea of developing an automated delivery vehicle (ADV). The initial tests of the delivery vehicle developed by Command Systems were encouraging to the Star Telegraph and full scale tests on several sample routes were conducted between October, 1971 and May, 1972. The tests were stopped one month prior to the renewal of the union contract in June, 1972.

During the course of their tests several problems were identified and solved. Changes in mapping techniques and subscriber lists were made. The central support, provided by an IBM computer, presented some difficulties, but these were overcome. At an operational level, it was found that by rotating the throwers in the truck, that a rate of 600 papers per hour per thrower could be maintained. Fatigue was not a problem if the throwers switched sides periodically. Further results were: a larger opening in the truck was required; a backhand throwing motion with the hand corresponding with the side of the truck was most effective; a 175-pound thrower was more effective than a 135-pound thrower.

The tests revealed the basic operating characteristics of the system. In a newspaper delivery district with 2,491 individual family dwellings and 250 apartment units at a density of 120 feet along the route per dwelling, the truck was able to average 13.7 mph, passing 19 dwellings per minute and having a house appear to the thrower on each side of the truck every 6.2 seconds. The truck completed the 28.5 mile route in two hours and nine minutes.

Based on this and data from other tests, AVCON was able to estimate that 53 trucks were necessary to service The Star Telegram circulation area. Exhibit 2 shows how this estimate was obtained and a schedule for truck departures on the evening routes. AVCON felt that the tests and their development of a delivery schedule proved technical feasibility of automatic delivery vehicles.

The system could also be justified on a cost basis. Exhibit 3 shows the components of current distribution costs for The Star Telegram. Exhibit 4 shows the annual operating cost for one ADV, including allocated central system costs. The purchase price of the truck was established at $45,000 ($5,000 for the truck, $40,000 for the electronics). Using the above data, Exhibit 5 demonstrates that The Star-Telegram could reduce its circulation costs per thousand from $49.00 to $38.53 the first year the system is installed, and to $35.00 in the second year.

AVCON prepared a sales contract and presented it to The Star-Telegram on June 2, 1972. AVCON proposed to sell The Star-Telegram ADV's at the rate of five per month as long as the trucks could perform the deliveries at the rate of thirteen newspapers per minute. The routes were to be chosen jointly by the parties. The Central Subscriber Data System (CSDS) was priced at $120,000, but the payment schedule was tied

to the delivery of ADV's at the rate of $6,000 per ADV. That is, the CSDS would be fully paid when twenty ADV's were bought by The Star-Telegram. AVCON agreed to map each route for $1,500. AVCON reserved all rights to improvement in equipment and/or procedure which might be developed. Maintenance was to be provided by AVCON for six months. All components of the system were to be covered by a one-year warranty. The contract was conditional upon acceptance by the union (formed in June, 1971) representing the circulation department.

The Star-Telegram turned down AVCON's proposal just prior to the renewal of the contract with the union representing the circulation department. An official of The Star-Telegram explained the decision.

> We were reluctant to jeopardize our negotiations with the union. Our labor lawyer advised us not to allow AVCON to talk with union officials. The union had learned of our development efforts and had expressed their disapproval.
>
> We might have been willing to take a chance with the union, but we were not convinced by the tests conducted by AVCON. The economics and the performance measures presented by AVCON appeared optimistic to us. For example, we were not convinced that we could match their delivery schedule. What happens if we were a little late getting to press? What about maintenance? What happens if something goes wrong with the central processor? This is a new technology. You can never tell what might happen.

The Star-Telegram decision came as a surprise to AVCON management. Mr. Connor described his reaction at that time:

> The decision caught me a little off-guard because it was the first time that we had received any negative feedback on our product. We felt that they had been quite pleased with our tests to date. If only I had had a chance to talk with the union, things might have been different.
>
> This decision forced (AVCON management) to sit down and discuss our next step. We decided that we would look on AVCON as a start-up and decide whether we would continue or not. We re-examined the market and decided to stick with the strategy of selling ADV's to newspapers.

As a result of the re-evaluation of the firm's strategy, an extensive marketing campaign was launched. In late October, 1972, Bob Rapp described the marketing efforts to date:

Efforts to get before publishers, presidents, and/or general managers were not actively initiated until late August 1972. In discussing our approach to the newspaper market with several newspaper personnel, we were told to go to the upper management level initially, if at all possible before approaching the circulation department heads. It is easier to work "down" from the publisher or general manager level than to even get to that level after obtaining initial exposure at the circulation level. We also learned that AVCON, in the opinion of many circulation people from coast-to-coast, presents a "threat" to their job security. Most of these people have their publishers convinced that papers would never get delivered without the circulation director or manager. If AVCON places all this vital circulation data on computer and then automates the home delivery of the final product, how important is the circulation director in terms of handling emergency situations and other day-to-day problems?

Since late June, 1972, we have had four accounts we have considered "hot"--to the point of a "go," "no go" decision. These are the Atlanta Constitution, Donrey Media Group, Miami Herald, and the Sacramento Union. The Oakland Tribune was very interested and planned to come to Fort Worth until they experienced a major "shake-up" in circulation (CD and 14 staff members were abruptly dismissed). Two of these four (Atlanta and Sacramento) accepted the economic and operational feasibility of our proposal for implementation of AVCON's distribution system, but declined any commitment to order until after January 1, 1973 due to major changes being made within their plants which necessitates their full attention at this time. Exhibit 6 is the proposal submitted to the Atlanta newspaper in August.

For a product with worldwide marketing applications, our total number of sales calls actually made to the newspapers to date totals twenty-seven. (See Exhibit 7.) This might indicate that we have only "scratched" the surface of the newspaper distribution market. All of our initial contacts with prospective customers were at the circulation department level with very few exceptions. For the first two months of marketing effort, we made only three calls with noncirculation people. Our first direct contact to the upper management level of the industry came in August, 1972 with the mailing of a general letter with literature to publishers of papers ranging in circulation size from 50,000 to 250,000 daily.

> One of our earliest assumptions concerning the newspaper market for AVCON was to not concentrate our marketing activities in the northeast quadrant of the country, primarily due to constant objections relative to the inclimate weather, ghettos, high density of "high rise" complexes, etc. In doing so, we may have excluded our prime market for a part of the newspaper distribution system--the Central Subscriber Data System, exclusive of ADV's. This approach, the marketing of segments of the system as well as the total system, was not actively employed for several months following the ICMA convention.

In October there was growing realization on AVCON's part that, while the long-run potential of the system still looked favorable, the ADV system was not going to be a revenue generator in the near future. In assessing their efforts to date, AVCON management felt there were several reasons why the automated vehicle was not an immediate success.

First, the concept of controlling and routing vehicles by on-board computers was a brand new one. ADV was at the leading edge of technology. People really needed to be shown that the concept and the product were viable. Second, an automatic delivery system for newspapers implied a large and fundamental structural change for the newspapers. Management and labor problems, while not insurmountable, in the long run could not be solved overnight. Third, much of the initial development money had been provided by The Star-Telegram, yet it had not implemented the system. The first question other newspapers asked was, "Why should we bet on a system that has been refused by the company that helped to develop it?" Because of this, AVCON began looking in other areas to see what potential there was for their product in other industries.

In October, 1972 the management of AVCON realized that even if other distribution markets were tapped, the length of time necessary to "learn the business" in the industry and to make contacts was going to be longer than AVCON could survive without having some positive cash flow from operations or some additional outside financing. The management of AVCON felt that a three-year "gestation" period would be needed for the development of the ADV market. Mr. Connor and the rest of management of AVCON still strongly believed in the viability of the product and felt that the potential market for it was very large.

Hotel Computers, Inc. (HCI)

HCI was formed in early 1971 by Tony Green, son of the owner of the Green Oaks Inn, a luxury 300-room motel in Ft. Worth. He had spent his summers working in the motel and had a thorough knowledge of the operations. While attending Texas Christian University he had met Alex Hoffman, head of the computer sciences department. In discussions with Professor Hoffman, he became convinced that reservation management and back office operations could be done on a mini-computer, replacing

the current IBM card system with a resulting improvement in cost effectiveness and efficiency.

Hotel Industry Attitude

In early 1973 there was considerable interest in hotel computer systems as evidenced by a series of feature articles in Hotel and Motel Management, a major trade publication in the industry.

According to industry sources both Hilton and Holiday Inn are planning comprehensive computer systems for their properties. In addition a number of electronics firms offer computer/programming systems for hotels. Some of the larger companies such as Motorola and IBM plan to introduce systems in 1973. Many of the smaller corporations such as Teltron, Total Systems, Hotel Reservations, Varian/Talix, EECO, and Statacom offer off the shelf systems similar to the one produced by HCI.

However, Tony Green felt that while most of the above companies had the computer-engineering competence to deliver a hotel system, only HCI had developed their system by talking to hotel people.

> Our system is built from specifications directly given to us by people at the Green Oak Inn. Most of the other companies making this type of system have designed around the way a hotel should operate ideally. Ours is designed to operate in the way a hotel actually operates. I really think that most of the systems were designed by people who have never even been behind the desk in a hotel.

Current users of various computer systems gave the following answers to the question "How do you cost justify the expense of a computer in your operation?"

> The cost is less than the salary and overhead of one person in the Reservation Department - and it provides a lot more data.

> Our system is a time saver, not a people/payroll saver. The whole advantage of the system is that it shows the property's room status at that moment. Housekeeping can be managed much more easily.

> Although the system is fairly expensive, with the excellent guest service provided plus better desk/housekeeping communications, it more than pays for itself.

> From not knowing true status at any given moment, too much money can be lost; it's just that simple. We have to use an automated system.

> Our system doesn't eliminate people - it eliminates wasted time and delay.

The users also commented on the operational characteristics of their systems:

> The key to making the system work is extensive training of personnel. Just getting used to the basic procedures overwhelms some the first time around.
>
> The company selling the product must be reliable. Anyone who has ever used and relied on electronic equipment knows that in order to be effective it must work 100% of the time. Otherwise it's just not doing its job. No hotel can afford a communications breakdown.
>
> There is a natural resistance to the system from hotel employees. People are afraid that they will lose their jobs or that the computer will show how inefficiently they have been doing them. However, the system requires people for its information. Good employee relations and training are essential.

Hotel Operations and the HCI Concept

Hotel accounting operations can be divided into two groups: front office and back office.

Front office operations are divided into three systems: reservations, registration, and night audit.

The purpose of a reservation system in a hotel/motel is to 1) provide the service of guaranteeing a room to a customer for a specific date and number of days and 2) provide planning information to management on the utilization of facilities. This second function is quite important in planning for tours and conventions. Since most hotels will accept reservations up to one year in the future, one could think of a reservation system (automated or not) as a set of 365 files, named for each day of the year, each file consisting of the names of those who have made reservations for particular types of rooms for that day. A further requirement would be an indication of whether of not a deposit was paid, therefore confirming the reservation for such things as late arrival of a guest. The hotel uses these series of files in the following ways:

1) add or delete names for a particular date.
2) look at the number of names and types of accommodations for a particular date.
3) On a given date, use the reservation information at registration time.

The reservation system can be characterized as handling all information about a guest before he arrives at the hotel. The registration system deals with all information and transactions while he is staying at the hotel. The registration system should accomplish the following:

1) using the reservation system decide whether or not the guest can be registered.
2) check on room status (made up or not) for assignment purposes.
3) open an account for a guest.
4) accumulate charges on this account.

5) keep a current guest list by room in order to provide message/phone service.
6) close the guest's account and provide him with a bill at checkout time.
7) maintain information on the guest and his transactions for the accounting systems.

Running concurrently with the registration system is the night audit system. This system takes information from the registration system, and other hotel operations (restaurant, etc.) and provides summaries of the daily operations for management as well as posting information to be used by the accounting system.

Back office functions include the normal accounting record keeping, city ledger (accounts receivable), payroll, general ledger, and inventory.

The HCI system was designed to perform all of the above applications. The front office system was to be real time, that is, the files of reservations, registrations, guest charges, and rooms in the hotel were to be kept current and immediately accessible by the system. Desk clerks would utilize a CRT terminal at the front desk to check someone in or out, make reservations and check on room status quickly and easily. All point-of-purchase sites in the hotel such as restaurants and gift shops could post charges immediately to a guest account over a telephone-connected terminal.

Automation of both the front and the back office is something new for hotels/motels. In the past, accounting functions were sometimes done by machine, but very few hotels have any kind of real time handling of guest billing. Large chains have reservation systems, but these are not in general tied in to the accounting system. HCI felt that computers capable of doing this kind of work were available at a low enough cost to justify automating and merging the front and back office operations and that the time was ripe for this development. Tony Green sold the Green Oaks Inn on this idea and raised $90,000 in capital by selling stock in HCI to local businessmen. Green Oaks Inn contracted to buy the first system developed by HCI. In October, 1971, HCI contracted with Command Systems for development of the Green Oaks system. Command Systems was chosen because of their general commitment to mini-applications and the fact that Alex Hoffman and Bob French, the president of Command, were friends. The initial contract called for the development of the system by Command at cost in return for 20% of the stock of HCI. The anticipated costs for hardware and software were $90,000. Work on the hardware components started and preliminary specifications were made. In November a full-time programmer was hired to supervise the programming. The original shcedule called for a completion of the front and back office applications by June, 1972.

Several problems arose which delayed the development. First, the full-time programmer left in February, taking all of the work done by him to that point and leaving no documentation of what he had done. This was a real blow and set the whole project back several months. Second, even when more programming personnel were hired, it was found that the design specifications were not as complete and as accurate as was necessary to program the application correctly.

This resulted in having to redo some of the initial systems analysis work and considerable reprogramming. Because of the above and the fact that no one person was totally responsible for the whole development (HCI being responsible for the specs, Command /now AVCON/ being responsible for hardware and programming), morale deteriorated among those working on the project and there were several personal conflicts between the people in AVCON and HCI. Even with these problems, the front office system was up and running by September 1972. There were still major problems with the back office system.

At this point HCI was beginning to run out of resources. The initial capital was close to being exhausted, even though in August the Green Oaks Inn had accepted the system and had prepaid a year's maintenance on it despite the fact that the system was not complete. Tony Green had hoped that he could be marketing the system to other hotels while it was under development. He found that much of his time was devoted to working on systems specifications with Green Oaks employees, a job he did not feel qualified to do. As a result the marketing was not as far along as was originally envisioned. In October HCI was in need of additional resources and turned to AVCON.

HCI's Arrangement with AVCON

The HCI decision came at a time when AVCON was looking for a new product. The automation of the front/back office system did not require a fundamentally different way of doing business in a hotel. The product was one with which AVCON was already familiar, and could provide revenues relatively quickly. Also, it fit into the general policy of applications on mini computers originally adopted by Command Systems. However, one problem was that AVCON did not own 51% of HCI.

On October 20, 1972 HCI signed a six months' agreement with AVCON for undertaking the company's management and marketing responsibilities. If AVCON sold three HCI systems within the six-month period, it acquired the right to purchase enough stock at par value to have control of HCI (approximately $50,000). All of the HCI stockholders were in favor of the agreement. Tony Green joined the marketing staff of AVCON.

Development work continued on the Green Oaks system and by January 1973 the system was ready for testing. Exhibit 8 gives an accounting of the development costs up to November 1972.

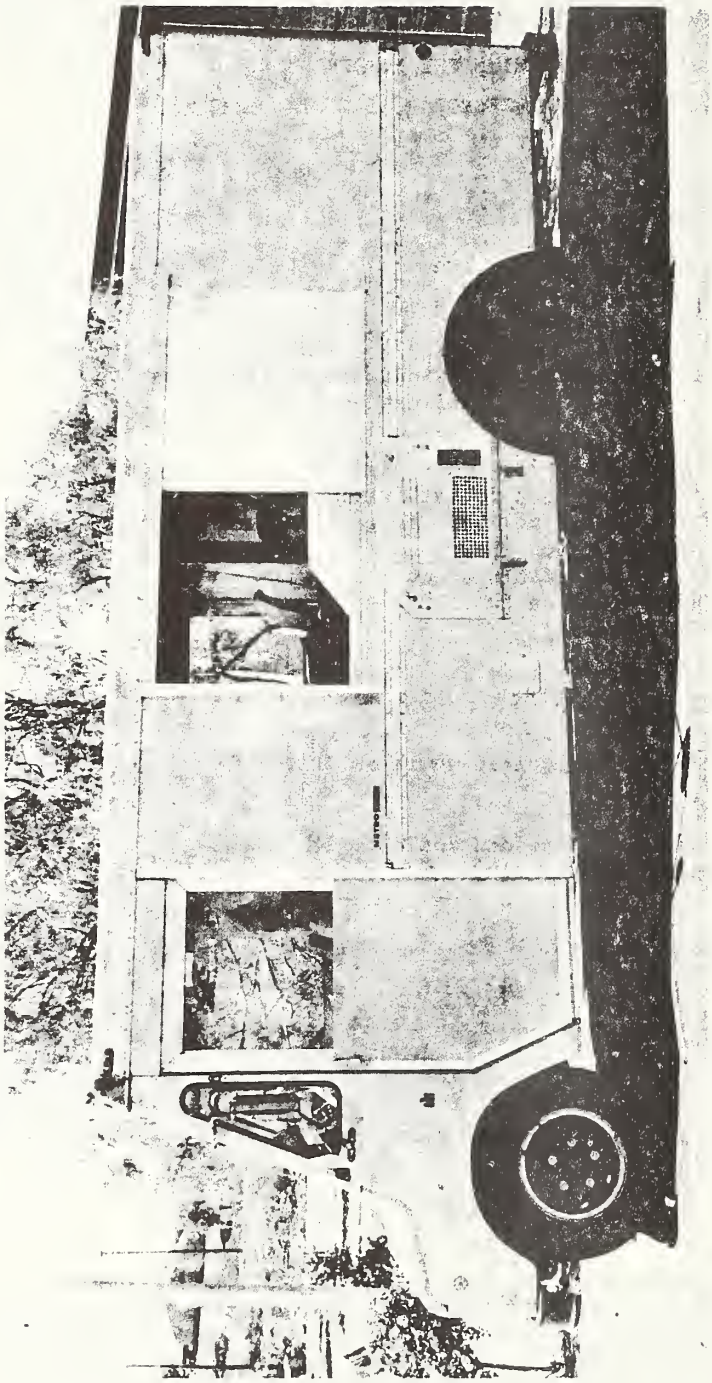
Meanwhile, Bob Rapp began the preliminary marketing analysis. He identified the market as hotels and motels with 200 to 800 rooms and 50% or better occupancy. The total system price is between $100,000 and $200,000 depending on hardware configuration. This is roughly in line with current standard cost allocations of hotel accounting and control functions of about $5-$10/room per month.

The Future

In early 1973 AVCON was once again evaluating its strategy for the newspaper truck. One of their best prospects had just notified them (Exhibit 9) that they would not be able to consent to a test with AVCON. However, the hotel system was being successfully tested at Green Oaks Inn. Several industry publications had noted the development and several letters of inquiry had been received about the system.

Exhibit 1

AVCON, INC.



Vehicle for Delivering Newspapers Under Automatic Route Control

Exhibit 2
AVCON, INC.

AN APPROACH TO DETERMINE THE NUMBER
OF A.V.D.s NECESSARY TO SERVE THE STAR-TELEGRAM CITY CIRCULATION AREA

Assumptions:

1. There are 212,453 dwellings in the area.
2. Tests on Districts 15 and 12 indicate the truck can pass an average of 1418 dwellings per hour.
3. With first truck starting at 1:15 PM and last at 3:45 PM. (average press run) and 11 minutes allowed for each truck to reach its starting point, the amount of throwing time would range from four hours and four minutes to one hour and thirty four minutes assuming each truck finishes at 5:30 PM. An average of all trucks would be two hours and forty nine minutes (2.82 hours.)

Therefore:

Number of truck hours required would be 212,453 ÷ 1418 = 149.83

Number of actual trucks needed would be 149.83 ÷ 2.83 = 53.13 trucks.

AVCON, INC.

A.V.D. LOADING SCHEDULE TO OBTAIN MAXIMUM PERFORMANCE

This table is based on following facts and assumptions:

1. There are 212,000 dwellings in area to be covered.
2. There are 97,000 evening copies in the area to be covered.
3. This is one paper to 2.186 dwellings.
4. Tests indicate approximately 100 dwellings per mile.
5. Vehicle speed is 14 MPH by test and 15 MPH by assumption.
6. Therefore, one vehicle can cover 15 x 100 dwellings per hour. (1500)
7. This would mean it can deliver 686 copies per hour. (1500 ÷ 2.186 = 686) (Also equal to 11.435 copies per minute.)
8. Press production averages 37,560 copies per hour or 626 copier per minute.
9. Average departure time for first truck would be 1:15 PM. Other trucks follow at press production rate. (Times listed to nearest quarter of a minute.)
10. Each truck is loaded with maximum number of copies it can deliver at rate of 11.435 per minute to 5:30 PM stopping time.
11. An average of 11 minutes is assumed for truck to reach starting point from dock on roll shop.
12. Five thousand car route copies are loaded on private vehicles after 7th truck departs. Another 5,000 apartment copies are loaded after 19th truck departs.

Exhibit 2 (continued)
AVCON, INC.

SCHEDULE

Truck No.	Departure Time	Delivery Time - Minutes	Number of Papers
1.	1:15	244	2,790
2.	1:19.50	239.50	2,739
3.	1:23.75	235.25	2,690
4.	1:28	231	2,641
5.	1:32.25	226.75	2,593
6.	1:36.50	222.50	2,544
7.	1:40.50	218.50	2,499
8.	1:44.50	214.50	5,000 (car routes)
9.	1:52.50	206.50	2,361
10.	1:56.25	202.75	2,318
11.	2:00	199	2,276
12.	2:03.75	195.25	2,233
13.	2:04.25	191.75	2,193
14.	2:07.75	188.25	2,153
15.	2:11.25	184.75	2,113
16.	2:14.50	181.50	2,075
17.	2:17.75	178.25	2,038
18.	2:21	175	2,001
19.	2:24.25	171.75	1,964
20.	2:27.50	168.50	5,000 (Car route Apts.)
21.	2:35.50	160.50	1,835
22.	2:38.50	157.50	1,801
23.	2:41.25	154.75	1,770
24.	2:44	152	1,738
25.	2:46.75	149.25	1,707
26.	2:49.50	146.50	1,675
27.	2:52.25	143.75	1,644
28.	2:55	141	1,612
29.	2:57.50	138.50	1,584

Exhibit 2 (continued)
AVCON, INC.
SCHEDULE - page 2

Truck No.	Departure Time	Delivery Time - Minutes	Number of Papers
30.	3:00	136	1,555
31.	3:02.50	133.50	1,527
32.	3:05	131	1,498
33.	3:07.50	128.50	1,469
34.	3:09.75	126.25	1,444
35.	3:12	124	1,418
36.	3:14.25	121.75	1,392
37.	3:16.50	119.50	1,366
38.	3:18.75	117.25	1,341
39.	3:21	115	1,315
40.	3:23	113	1,292
41.	3:25	111	1,269
42.	3:27	109	1,248
43.	3:29	107	1,224
44.	3:31	105	1,201
45.	3:33	103	1,178
46.	3:35	101	1,155
47.	3:36.75	99.25	1,135
48.	3:38.50	97.50	1,115
49.	3:40.25	95.75	1,095
50.	3:42	94	1,075
51.	3:43.75	92.25	1,055
52.	3:45.50	90.50	1,035
			96,989

Exhibit 3
AVCON, INC.

STAR-TELEGRAM ECONOMIC FACTS
CURRENT

	%	MONTH	YEAR	CUMULATIVE
Customers Pay	100%	$354,300	$4,251,600	
Newsboys Receive	38%	133,800	1,605,600	
Star-Telegram Gross	62%			$2,646,000
District Mgrs. Compen.	19%		824,000	1,822,000
Kickcatcher	1.5%		64,000	1,758,000
Supplemental Trucking	1.3%		55,000	1,703,000
Fringe Benefits	1.2%		52,000	1,651,000
Rack Sales Cost			(282,000)	
TOTAL DISTRIBUTION COSTS	61.2%		$2,600,600	
COST PER THOUSAND	$49.00			

CIRCULATION FIGURES

Morning	55,000 x 313 =	17,215,000
Evening	96,000 x 313 =	30,048,000
Sunday	121,000 x 52 =	6,292,000
TOTAL		53,555,000

Exhibit 4
AVCON, INC.

ANNUAL COST OF ONE ADV

ADV				
Truck	$ 5,000 ÷ 3	$1,667		
Electronics	40,000 ÷ 7	5,714		
				$ 7,381
LABOR				
1.4 Driver-Supervisors @$12,000 (5 days, 2 days)			$16,800	
Crew Men				
4.5 men x 3.5 avg. hrs. x 365 days x $1.60			9,200	
3.5 men x 3.5 avg. hrs. x 313 days x $1.60			6,134	
Total Labor				32,134
Operating Expense (38,600 miles x 6.5¢)				2,504
Other Allocatable Expenses:				12,900
Central System	$1,000			
Collections	7,600			
Fringe Benefits	3,300			
Other	1,000			
TOTAL COST OF ONE ADV				$54,919*

*NOTE: Add $1,915 for $1.80 per hour.

Exhibit 5

AVCON, INC.

TOTAL COST ESTIMATES

ASSUMPTIONS

1. 35 ADV's (87,500 Papers)
2. 1 CSDS
3. 10 Car Routes (5,000 Papers)
4. Foot Routes (5,000 Papers)
5. 58 Driver-Supervisors
6. 141 Weekday Throwers
7. 120 Sunday Throwers
8. 1 Supervisor for Car Routes
9. 2 Supervisors for Foot Routes

	MONTH	YEAR
1. ADV & CSDS	$50,000	$ 600,000
2. LABOR		
Delivery		
(a) ADV - Driver - Supervisors (58)	58,000	696,000
(b) Throwers		
141 Weekday ($100/month)	14,100	169,200
120 Sunday ($20/month)	2,400	28,800
TOTAL TRUCK LABOR	74,500	894,000
(c) Foot Routes 37% x $15,000	5,500	66,000
(d) Car Routes 45% x $16,250	7,312	87,744
(e) 3 Supervisors (Car routes & foot routes)	3,000	36,000
TOTAL DELIVERY LABOR	$90,312	$1,083,744
OTHER LABOR		
CSDS Operator	1,250	15,000
3. OPERATING EXPENSES		
ADV - (gas, maintenance) 5.5¢/mile x 1,356,000 miles =		$ 74,580
313 days x 4,000 1,252,000		
52 days x 2,000 104,000		
1,356,000 miles		

Exhibit 5 (continued)
AVCON, INC.

INSURANCE		$ 10,500
4. FRINGE BENEFITS		75,000
5. SUPPLEMENTAL TRUCKING		20,000
		$1,878,824
NORMAL ANNUAL OPERATING EXPENSES		$1,878,824

ONE-TIME CHARGES

Mapping	$45,000	
Rolling Machines (12 x $7,500)	90,000	
Building Modification	30,000	
Public Relations	5,000	
Legal Help with Union	15,000	
Total First Year Cost		$2,063,824

ITEMS NOT INCLUDED ABOVE

1. Sales Force
2. Mail Expense of Bills
3. Maintenance of Folding Machines
4. Storage of ADV's

COST PER THOUSAND

First Year	$ 38.53
Second Year	35.00

Exhibit 5 (continued)
AVCON, INC.

STAR-TELEGRAM

FINANCING OPTIONS

			TOTAL
1. PURCHASE			
35 ADV's	($45,000 each)	$1,575,000	
CSDS		135,000	
TOTAL			$1,710,000

	MONTH	TOTAL
2. LEASE PLAN		
ADV $1,390 per month each ADV		
Total 35 ADV's	$48,650	$ 583,800
CSDS	4,166	50,000
TOTAL	$52,816	$ 633,800

(a) This plan assumes a 12-month commitment from the Star-Telegram.
(b) Longer commitment times would indicate re-evaluation of lease costs.

Exhibit 6

AVCON, INC.

August 24, 1972

Mr. Ferguson E. Rood
Research & Marketing Director
Atlanta Journal-Constitution
Post Office Box 4689
Atlanta, Georgia 30302

Dear Ferguson:

As we discussed over the phone, I have enclosed some economic facts for your review and analysis. These figures are intended to be ballpark figures and should give you a good idea of the economic feasibility of our distribution system. There is absolutely no doubt in my mind that with carrier monthly profit of $1.30 for morning and Sunday, and $.98 for evening and Sunday, your paper should realize annual savings from $500,000.00 to $1,000,000.00 depending on the final number of our vehicles which you can economically and operationally justify. I stress again that it is our desire to suggest only enough vehicles which meet the criteria of economic and operational feasibility.

We have continually approached an economic analysis from the standpoint of comparing current distribution costs with costs of our new distribution system and from seeking a breakeven point in numbers of customers above which it is more economical to utilize our system. I have followed that same pattern on the attached sheets.

Ferguson, at this stage I have not provided information on our central computer system because I believe your people are primarily concerned about the economics of the throwing vehicles. However, I do want to stress that our central, on-line circulation information system would also have significant benefits for your organization. Huey was quite helpful in showing me your current set-up and while everything does seem to flow in an orderly manner, our system would provide the extra benefits you and I discussed, i.e., immediate starts and stops, blanket market coverage capability, reduction of paper work, central computer billing, etc. Some of these features can be obtained with just the vehicle portion of our system, but all of the benefits can accrue only with total implementation.

I hope you will see the economic outlook as brightly as I do and will want to pursue a more detailed meeting between us to discuss and "dig-into" the economic picture. The economics just look too good to let the project drop without more careful analysis. Our offer still stands to have you or any of your people visit us in Fort Worth to see the system in action.

Please call me after you have had an opportunity to review my figures.

Best regards,

Bob

Robert T. Rapp
Vice President-Marketing

RTR:dc
Enclosures

ATLANTA NEWSPAPERS, INCORPORATED
ECONOMIC ANALYSIS
AVCON, INC.

A. GIVEN

1. Home delivered circulation:
   a. Morning 110,000
   b. Evening 155,000

2. Carrier Profit per Montn per Subscriber*
   a. M & S (40% x $3.25) = $1.30
   b. E & S (30% x $3.25) = $ .98
   *(Non-Motor Routes)

3. Papers are trucked at ANI's expense to carriers.

4. District managers are utilized to recruit, train, and supervise carriers.

B. ASSUMPTIONS

1. Automated vehicles will be used in morning, afternoon, and Sunday deliveries.

2. Vehicles can average throwing 2,500 papers in the morning; 3,000 papers in the evening; and an appropriate number of Sunday papers.

3. Collections will be made principally by mail with personal efforts utilized to collect the small remaining balance.

C. ESTIMATED MONTHLY COST OF ONE AUTOMATED VEHICLE THROWING MORNING, EVENING, AND SUNDAY EDITIONS

1.	Vehicle Cost		
	a. Lease (60 months)		$ 1,200
	b. Outright Purchase and Amortization	$ 650	
2.	Operating Expense - Maintenance, Oil, Gas, Etc. (6-1/2¢ per mile x 3,500 miles)		$ 250
3.	Driving and Throwing Labor		$ 2,500
4.	Collections		$ 550
5.	Maintenance - Electronics		$ 25
	TOTAL ESTIMATED MONTHLY COST		$ 4,525

Exhibit 6 (continued)

AVCON, INC.

D. BREAKEVEN POINTS

M & S	$2,262 - $1.30 = 1,740 customers
E & S	$2,262 - $ .98 = 2,308 customers
Combined	$4,525 - $2.28 = 1,984 customers

NOTE: Breakeven points are lowered if current costs of trucking papers to carriers are included. Also, if current District Manager expenses are included, breakeven points are reduced substantially. Straight depreciation of the vehicles rather than leasing would also reduce the breakeven point.

E. ESTIMATED SAVINGS TO ANI

Assumption: 2,500 Morning
3,000 Evening
Appropriate Number Sundays

Current ANI System Monthly Cost

2,500 M & S x $1.30	=	$3,250	
3,000 E & S x $ .98	=	2,940	
Trucking (Est.)	=	200	
TOTAL COST			$ 6,390

New System Monthly Cost

2,500 M & S	=	$2,262	
3,000 E & S	=	2,262	
TOTAL COST			$ 4,524

MONTHLY SAVINGS PER VEHICLE	$ 1,866
ANNUAL SAVINGS PER VEHICLE	$ 22,392

ANNUAL SAVINGS IF:

30 Vehicles are justified	$ 671,760
40 Vehicles are justified	$ 895,680
50 Vehicles are justified	$1,119,600

Exhibit 6 (continued)
AVCON, INC.

F. CONCLUSION

1. The economic analysis, even allowing wide margins for inaccurate assumptions, shows substantial economic gains.

2. More detailed discussions and analyses are justified as a prerequisite to a full-scale proposal.

3. The entire system will benefit both the circulation and the advertising sales efforts.

Exhibit 6 (continued)
AVCON, INC.

COST COMPARISON
CURRENT SYSTEM vs ADV
[2,500 (E); 1,425 (M); 3,150 (S)]

CURRENT SYSTEM

2,500 x 313 x 4.8¢	$37,560	
1,425 x 313 x 4.8¢	21,409	
3,150 x 52 x 4.8¢	7,862	
		$66,831

ADV SYSTEM 55,000

Savings $11,831

Breakeven Point: About 2,060 Evening Circulation

Total Possible Savings:

$11,831 x 39(97,000 ÷ 2,500) = $461,409

Cost Per Thousand:

Old System - $49.00

New System - $40.00

Exhibit 7
AVCON, INC.

NEWSPAPER MARKETING ACTIVITIES

June 5-6	GK called on Austin and San Antonio (2) papers
Early June	Literature mailed to Circulation Managers (50,000-250,000)
June 12-13	RTR & GK attended ANPA Production Conference in Atlantic City, New Jersey
June 24-29	RTR/WHC/GK/BF took booth to ICMA convention in Los Angeles, California
July 11-12	RTR/GK called on San Antonio (2) papers and Harte Hanks
July 14	GK called on Dallas (2) papers
July 24-26	RTR/GK called on Ottaway (Corp.), Hackensack, Philadelphia, Baltimore, and Chicago papers.
July 31-Aug. 2	RTR/JW/GK called on Sacramento (2), Oakland, and San Mateo papers.
Aug. 3	GK called on Dallas Times Herald
*Aug. 4	Literature mailed to publishers (50,000-250,000)
Aug. 15	GK called on Ft. Worth Press
Aug. 21-25	GK called on Shreveport, Alexandria, Baton Rouge, New Orleans, Lake Charles, Beaumont, Galveston, and Houston (2) papers
Late August	RTR/WHC called on Atlanta and Miami papers
Sept. 6	Miami Herald (GR) in Fort Worth for demo (ADV)
Sept. 8	RTR/JW/GK exhibited mock-up at SNPA Labor Symposium in Dallas
Sept. 9	RTR/JW/GK breakfasted with Claude Capers and Bob Ballow
Sept. 14	RTR/BF/GK called on Donrey Media Group in Las Vegas
Sept. 17-19	RTR/GK exhibited at SCMA in Birmingham
Sept. 18	RTR/WHC demo of ADV to Atlanta Constitution in Birmingham
Oct. 1-3	GK presented slide presentation and distributed literature at Inter-State CMA convention in Wheeling, West Virginia
Oct. 2	GK phoned Bill Rinehart (ANPA) for references
Oct. 3	GK had dinner in Nashville with Bob Ballow
Oct. 4	RTR wrote Presidents of major newspaper groups
Oct. 11-15	RTR/GK exhibited at Cal-Western CMA in Scottsdale
Oct. 26	GK made sales presentation to Oakland Tribune

*First direct contact with newspaper management

FUTURE APPOINTMENTS

Nov. 4-7	GK/JW to exhibit at Texas CMA at El Paso
Nov. 10	GK to make sales presentation at Nashville Tennessean
Nov. 10	Harte Hanks (Corp.) to come to Fort Worth for system demo

Nov. 13 Appointment with Les Journaux Trans-Canada, Le Journal de Quebec, London (Ont.) Free Press early part of the week of Nov. 13-17, 1972

Nov. 17 Copley Newspapers in La Jolla, California

NEWSPAPER GROUPS (CORPORATE) CONTACTED

Name	Exposure
Ottaway Newspapers, Inc.	ICMA and personal visit
Harte Hanks	Personal visit
Donrey Media Group	Personal visit/proposal
Gannett	Letter
Lee Enterprises, Inc.	Letter
Copley Newspapers	Personal visit with Systems Consultants
RTR's letter to presidents of various groups.	No response to date.

NEWSPAPERS CONTACTED

City	Person(s) Contacted	Type of Contact
Austin (A-S)	CD and CM	Personal Visit
San Antonio (E-N)	CD, Asst. CD, Pur. Agent	"
San Antonio (L)	CD and CM	"
Dallas (T-H)	CD and CM	"
Dallas (MN)	CM	"
Hackensack (R)	VP-Marketing	"
Philadelphia (B)	CD and assistants	"
Baltimore (S)	CD, Data Processing Dir.	"
Chicago (T)	CD	"
Sacramento (B)	Publisher and CM	"
Sacramento (U)	CD, CM, Asst. VP-Dir. of Operations	"
Oakland (T)	CD, Data Processing Dir.	"
San Mateo (T)	CD	"
Ft. Worth (P)	CD and CM	"
Ft. Worth (S-T)	Gen. Mgr., Controller, CD	"
Atlanta (C)	CD, Sec'y-Treas., Mkt. Mgr.	"
Miami (H)	CD, Data Processing Mgr., President	"
Shreveport (J)	CD, Director of Advertising	"
Alexandria (TT)	Publisher and CM	"

CD - Circulation Director
CM - Circulation Manager
VP - Vice President

City	Person(s) Contacted	Type of Contact
Baton Rouge (A)	CM	Personal Visit
New Orleans (T-P)	Gen. Mgr., Bus. Mgr.,	"
	CD	"
Lafayette (A)	CM	"
Lake Charles (AP)	CM	"
Beaumont (E-J)	CM	"
Galveston (DN)	CM	"
	Publisher	Phone call
Houston (C)	CD	Personal Visit
	Data Processing Dir. and Controller	Mail
Houston (P)	CM	Personal Visit

NEWSPAPERS EXPRESSING INTEREST AFTER JANUARY 1, 1973*

Name	Marketing Activity	Their Indication to Avcon
Sacramento (U)	Proposal	Act on proposal
Atlanta (C)	Proposal	Act on proposal
San Juan, P.R. (EI)	Letter with literature	Pursue investigation
Lee Enterprises, Inc.	Letter with literature	Pursue investigation

*All four prospects indicated they are in the midst of major revisions of various departmental procedures and/or systems and, therefore, will not undertake the implementation of any other major system changes until after January 1, 1973.

C O P Y

673-109

Exhibit 8
AVCON, INC.

December 27, 1972

Mr. H. J. Jung
6901 W. Freeway
Fort Worth, Texas 76116

Dear Mr. Jung:

As promised at the December 20, 1972 HCI Board of Directors meeting, the cost of the Green Oaks Inn system through November, 1972 is provided below:

	Cost	% of Total
Avcon, Inc. Hardware Labor Services	$25,172.86	18.5
Tony Green's " " "	3,180.85	2.3
Sub Contract " " "	3,619.22	2.6
Sub-Total Hardware Labor Services	$31,972.93	23.4
Avcon, Inc. Software Labor Services	$36,410.40	26.6
Tony Green's " " "	3,180.85	2.3
Sub Contract " " "	16,606.47	12.1
Sub-Total Software Labor Services	$56,197.72	41.0
Hardware Costs	48,204.36	35.2
Other Cost	595.02	.4
Total Costs	$136,970.03	100%

Bob French's direct labor services are distributed on an equal basis between the "Avcon, Inc. Hardware Labor Services" and "Avcon, Inc. Software Labor Services" line items. Consultants fees paid to Dr. Hoffman in the amount of $5,000 are distributed on an equal basis between the "Sub Contract Hardware Labor Services" and "Sub Contract Software Labor Services" line items. Tony Green's net salary costs have also been equally distributed between Hardware Labor Services and Software Labor Services line items.

If you should have any questions regarding the above cost figures, please call me.

Sincerely yours,

James P. Wright, Jr.
Secretary/Treasurer

JPW:pb

Exhibit 9
AVCON, INC.

February 6, 1973

Mr. Robert T. Rapp
Vice President - Marketing
AVCON, Inc.
1330 Summit Avenue
Fort Worth, Texas 76102

Dear Bob:

As we discussed over the phone the other day, Newspapers will not be able to commit to a test with AVCON at this time. This decision was made at our board of directors meeting at the end of January.

Our decision was based on the limited availability of management time in due to the commitment to supervise the installation of a major capital investment. As we have discussed, was the only property in which I would want to make such a test based upon its labor climate, geographic location and excellent management.

This decision in no way reflects a lack of interest in your concept or in the total commitment of AVCON to the successful completion of a test. We at . are very interested in evaluating the potential of your system and hope you are successful in testing your system at another newspaper.

Bob, I would like to personally thank you for the professional, straightforward manner in which you have presented your company and product. I wish you all the best of luck and, as potential customers, please keep us informed of your progress.

Sincerely,

Bob

Robert
Corporate Director
Special Projects

"CENTAUR"

John J. Alexander, Jr.

Mr. Alexander is a member of the staff of the Securities Industry Automation Corporation, which began operations in July 1972 in New York. SIAC has consolidated and simplified the communications, trading, market reporting, and clearance and settlement functions for the New York and American Stock Exchanges. SIAC's Central Exchange Network Trading and Unified Reporting System (CENTAUR) is a major program for automation services that consolidates various communications needs of the exchanges into an effective single system. Mr. Alexander briefed the conference participants on the status and future plans of CENTAUR.

CENTAUR

PRESENTATION TO THE

ENGINEERING FOUNDATION CONFERENCES

MAKING SERVICE INDUSTRIES MORE PRODUCTIVE THROUGH COMPUTERS AND AUTOMATION

NEW ENGLAND COLLEGE – HENNIKER, N. H.

AUGUST 16, 1973

John J. Alexander, Jr.

CENTAUR

CENTRAL

EXCHANGE

NETWORK,

TRADING,

AND

UNIFIED

REPORTING

CENTAUR

- Objectives of CENTAUR
- Present Trading System
- Proposed System
- Costs and Benefits
- CENTAUR and a Central Market

CENTAUR OBJECTIVES

- Reduce Operating Cost to Firms and Exchanges
- Improve Availability and Timeliness of Information for Investors
- Strengthen Market Mechanism and Self-Regulatory Capability

CENTAUR SCOPE

COMMUNICATIONS

- Network Plan in Process

TRADE

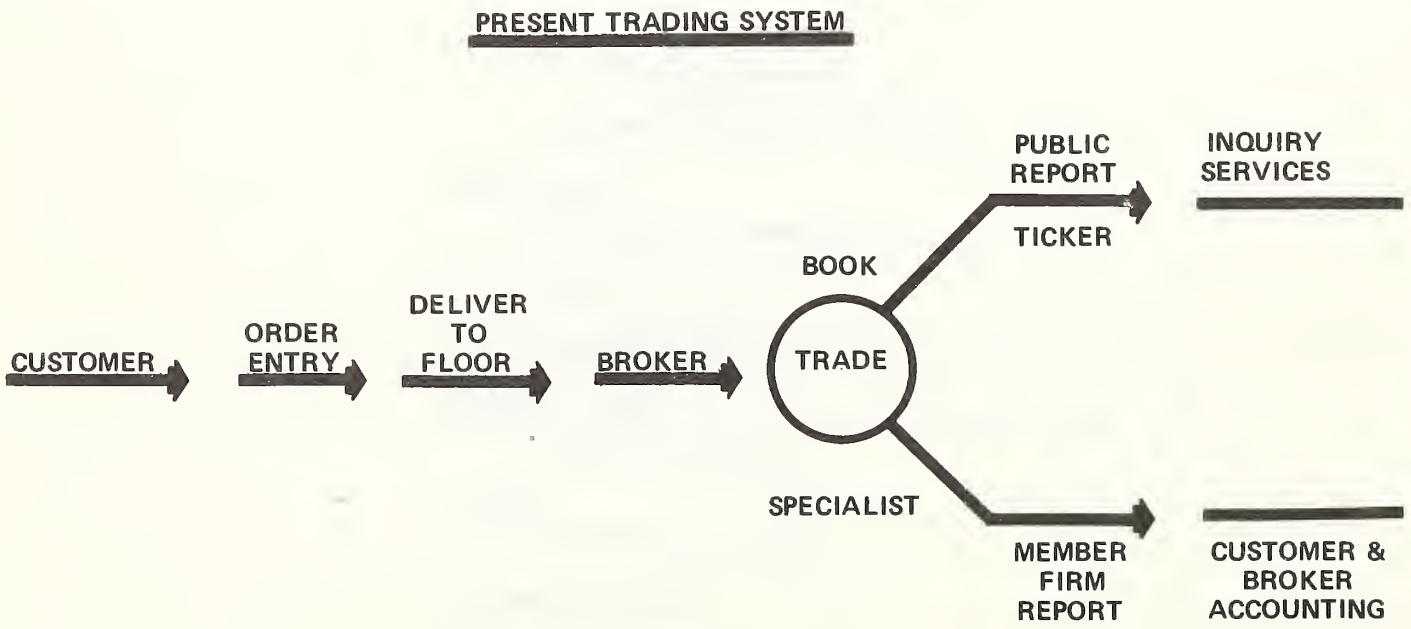
- Three Phase Proposal

MARKET DATA

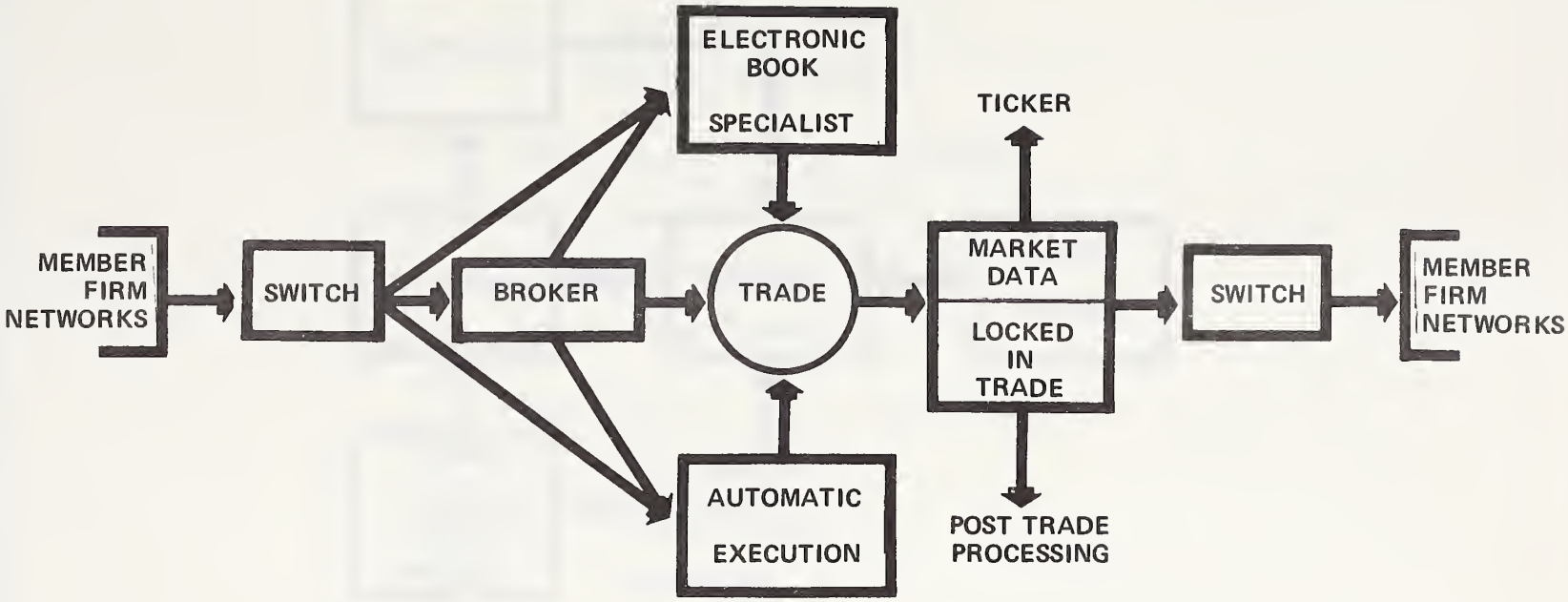
- New System Installed
- Expanding for Amex
- Developing Consolidated Tape

POST TRADE

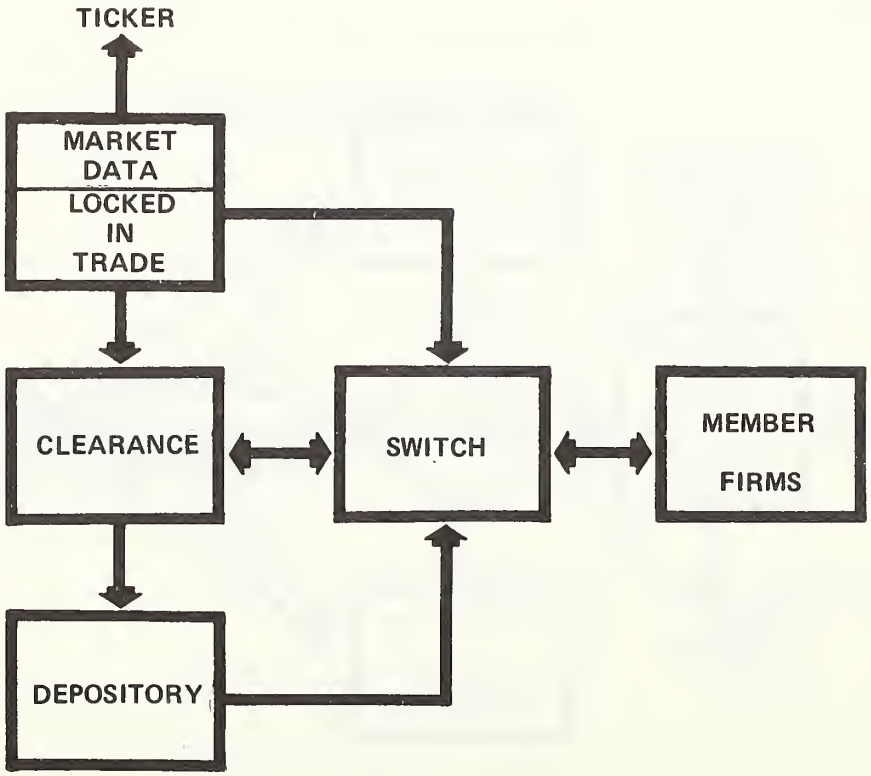
- Clearance and Settlement Combined
- Planning National System


PRESENT TRADING SYSTEM
CUSTOMER
ORDER ENTRY
DELIVER TO FLOOR
BROKER
BOOK
TRADE
SPECIALIST
PUBLIC REPORT
TICKER
INQUIRY SERVICES
MEMBER FIRM REPORT
CUSTOMER & BROKER ACCOUNTING

CENTAUR TRADE SYSTEM



LOCKED IN TRADE



CENTAUR TRADE SYSTEM SCHEDULE

1973 – 1974 **IMPLEMENT NOW**

- Consolidate Existing Programs and Services
- Install Floor Terminal System
- Develop Full Order Switch

1975 – 1976 **PLAN NOW**

- Establish an Open Order File
- Install an Electronic Book
- Lock in All Trades

1977 – 1978 **STUDY NOW**

- Broker Terminals
- Automatic Execution
- Central Market

CENTAUR

AND A

CENTRAL MARKET

- Central Market System Is Not Well Defined
- Automation Elements Needed to Support a National System Are Known
- CENTAUR Compared to a Central Market System

CENTRAL MARKET	CENTAUR
Switch	Expand
Open Order File (Book)	Expand
Terminals • Specialists • Brokers	Expand
Inter--Market Displays	Add
Market Data System	Available
Locked in Trade	Available

CENTAUR CONCLUSIONS

1. Long Range Plan for Trade System Automation Has Been Completed.

2. Plans for Communications, Market Data and Post Trade Will Be Completed This Year.

3. Current Projects Are Conformed to the Plan.

4. Studies Are Defined to Resolve Technical Issues Raised by the Plan.

5. Trade Program Does Not Require Significant Increase in Current Expenditure Level over Next Five Years and Cost Savings Start Accruing in 1975.

6. CENTAUR Can Evolve into the Central Market System.

"NEEDS, OBLIGATIONS AND OPPORTUNITIES FOR PRODUCTIVITY AND QUALITY IN THE SERVICE SECTOR"

Gerald G. Smith

Mr. Smith is a Services Executive in the Systems and Services Co. subsidiary of Control Data Corporation, Minneapolis. His message to the conference participants concerned the problem of productivity and quality in services: quality must be designed into a product; computers can aid in services productivity. Management is a service and will benefit from computer technology. As Mr. Smith points out, the computer holds great promise not only in the dissemination of knowledge but also the application of that knowledge which brings about the productivity we enjoy. Computers save time, and services are time critical. Mr. Smith urges the conferees to assist in the application of technology to societal needs.

"NEEDS, OBLIGATIONS AND OPPORTUNITIES FOR PRODUCTIVITY AND QUALITY IN THE SERVICE SECTOR"

Gerald G. Smith

This evening I would like to point my remarks directly toward the conference title, "Making Service Industries More Productive Through Computers and Automation," with particular emphasis on "identifying relevant business, government and societal needs and opportunities" as referenced in the second paragraph in the "Foreword" section of the conference brochure. There are needs, there are obligations and there are opportunities for productivity and quality in much of our services sector. Business can serve these needs and these obligations in ways not only beneficial to our society but also commercially viable for them as entities within our system. This is particularly true in the computer business.

I remember years ago witnessing a seminar leader perform an amazing feat. Turning his back to a blackboard, he asked a member of the audience to quickly write the numbers 1-20. Just as quickly, he called for words from the audience, which were written on the blackboard opposite the numbers. The entire process was rapid-fire, taking no more than a minute or so. He then proceeded in random order to identify each word and its numerical counterpart, or vice versa in random order as requested to do so by those present.

What seemed quite amazing at the outset became much simpler as he explained his approach to this particular task. By associating the words called out with twenty things he performed during the course of each day, he in effect was actually living an experience, and was able to recall it just as sharply as you and I would recall the happenings of this day--via the associative mental process. His message was a simple and self-apparent one. What on the surface would seem to be a significant task, if not one of overwhelming complexity viewed from one's traditional perspective, can become drastically simplified by a designed approach appropriate to that particular problem. The problem of productivity and quality in services does appear and is in fact a very significant and complex problem; still, it is possible to devise a "construct" that suggests ways in which we might gainfully address that problem in the services industry.

Earlier in the course of this conference, we identified some of the characteristics of a service product. We said in part that:

1. A service was consumed at the point and at the time of creation, and

2. It therefore could not be inventoried.

It would follow then, since the above is characteristic, that the service cannot be subjected to inspection or traditional quality controls at the time of or subsequent to its delivery. If it hasn't the substance of a product, such as we conventionally define a product, with tires you can kick, or a taste, or an aroma or a box you can examine, then perhaps we could better define service as a process.

Again, attempting to fashion a "construct" that better enables us to perceive ways in which we can attack the central problem of productivity and quality in services, let's walk around the elephant a bit, examining what begins to occur if we perceive of service as being a process involving a paying customer, or a consumer.

Over the years, manufacturing of goods has been subjected to much basic work--work which has resulted in techniques and tools for productivity and quality. In manufacturing what is known as Work-in-Process is always a negative attribute as it concerns the quest for productivity. The longer Work-in-Process exists and the higher the monetary value of that Work-in-Process, the greater the adverse impact on the economics of the situation.

Assuming that in any given Service we have a process that does not consume itself (which is the hoped-for state), material drops out of the equation and the output of the process in a general sense can be symbolized as R x T = Output, (i.e., Resource x Time utilized = Output of the Process).

Another analogy might be a chemical process, wherin by combining two or more unique ingredients a process occurs whereby a separate and distinct substance results. In this type of example, the quality of the chemical substance produced has more to do with the quality of the ingredients utilized than of the process itself. At least the dependency for quality at the input end is primary.

We've talked about service as something we consume at the moment it is created; we have also discussed the absence of objective units of utility, and the fact that they are not specified with necessary rigor. Even if we could so specify and measure the "inches" of a service or its "pounds" such that they could be measured and inspected, we all personally understand and have experienced the fact that quality cannot be inspected into a unit; it must be designed into the product. The same can be said relative to a service. Even though quality can be defined, even though product can be measured at the output end, the more important measures and quality controls are at the input end. Using a common computer phrase, "Garbage in, garbage out."

Many of us have a bit of a problem talking about producing units we can't measure with a quality that can't be verified after the unit is produced; hence, in our mental approach to Services productivity and quality problems we continue to thrash about, looking for those measures or units which would allow us a frame of reference within the traditional "construct" experienced in the manufacturer of more tangible goods. But this is a mental orientation problem and can be improved, just as the seminar leader improved the result of the task addressed via his mental orientation in the 1-20 illustration I referenced earlier.

We have another mental or attitudinal problem, at least I believe most of us do. We really don't want an engineered or designed utility, we want what we have or what we consume to be crafted. I notice a great many antique stores here in Henniker. You among us who are fortunate enough to have your wives with you, while antique shopping you no doubt have heard various descriptions relative to the merits of craftmanship. We feel better if the chairs we sit on, the shirts we wear, the table at which we eat, the house in which we live, are crafted products.

This urge or desire is a part of our tradition and has woven itself into the fabric of our character, and even more importantly, into our mental orientation. We long for those days of yesteryear when craftmanship was still a part of those goods we buy and utilize. We regret that "service," whether it be in the hotel or the restaurant or wherever, seems to be a thing of the past. There seems to be a psychology that causes the word "Service" to become a synonym to "Servitude."

No one need or should be embarrassed about their desire for fine, crafted products. Neither should they apologize for expecting high quality of service, when you consider today's restaurant prices. But to the degree these mental outlooks become barriers in achieving a higher productivity and a higher quality in our Services spectrum, we need to be aware.

The french fries at McDonalds are not crafted, they are engineered. The way those french fries are placed in the sack we carry out is engineered. Despite variations in temperament or even training on the part of the operator, the sack filled with french fries comes out looking and being the same. Do you miss it being crafted? In San Francisco the other day I watched a Japanese chef dice onions. Fantastic!!! His hands were a blurr and the product of his rapidly flashing knife consistent to a fraction of a millimeter, a real pleasure to watch, a work of art, a craft. But also, expensive! I doubt that the world could afford hamburger onions produced by this prescribed process alone.

Let's pursue the process "construct" and follow this line of thinking:

Service is a Process
Processes can be designed
Designed Processes can be made to produce consistent results
Consistency is the forebearer of quality
Process costs are proportional to the resource confined, and the time for which these resources are confined in creating the outcome of the process.

A successful Services process can be symbolized as:

$$\frac{R \times T}{Q} \longrightarrow CU \rangle C\$$

Given a certain level of quality, if the product of the resource confined and the time for which it is confined yields a consumer utility greater than the value placed by the consumer on his dollar, we in effect have a services system in place.

From that "equation" (it really isn't an equation but it is sufficiently descriptive for our "Construct") if we pick out and place specific emphasis on "time," we begin to see ways in which computer technology can aid in Services productivity.

The computer is the most significant "time shrinker" the world has ever known. The horse-to-car transition was about one order of magnitude. It enabled man to travel 30 miles per hour more or less as opposed to walking 3 miles per hour previously. From the car to the airplane, we went from 30 miles per hour to 300 miles per hour; as a result of these two technologies we moved something approximating 2 orders of magnitude from walking. Cars go a bit faster today and so do airplanes, but in approximate terms we are still 2 orders of magnitude away from walking.

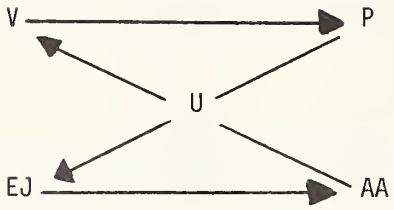
In the last 18 years arithmetic--mathematics--has proceeded to a point such that today in 1973 we can accomplish this function 100,000 times as quickly as we did 18 years ago. From 3 or 6 miles an hour to 300 or 600 miles per hour is a factor of only 100.

It is also pertinent to point out that these arithmetical tasks (the computer has reduced the science of mathematics to the equivalent of arithmetic for most users and for most needs) are now performed 10,000 times more economically than 18 years ago as well as 100,000 times faster. Arithmetic is really the computer's bag.

One definition that might be given a clerical function would be "a function whose logic is predetermined." What can be more logical than a computer? Clerical work is really the computer's bag.

I don't know who this should be attributed to, I am sure to some old long-since deceased philosopher, but I recall a statement that went something like this, "Civilization progresses in direct proportion to what man can accomplish without thinking about it." Somewhere back in time the man that was lucky and had more than one day's food supply in his cave thought about how to make the process easier, and came up with a spear or a bow and arrow or an ax. Later as he learned to preserve his food, he created still additional tools for the benefit of his society and ultimately ours.

There is a similar theorem as it concerns the production processes or the manufacturing processes. "Progress comes about in the main by exposing pacing problems, items or variances to levels of ability or authority commensurate with the nature of the need."



Following the arrows of the above diagram, Visibility (V) yields Perception (P). This in turn permits the application of Experience (E) and/or Judgment (J); this in turn permits Applied Action (AA). If we have visibility of the result of those applied actions, then through Understanding (U) we have the "closed servo system" from which productivity and progress and quality are born.

Again, I'll not belabor the point but we are really describing a communication or information process, and the computer is perhaps the most fantastic of all information collators and structured information output devices we yet know. It is the appropriate structuring of such information that does give true visibility, which allows us to perceive or to "see" and it is this ability to "see" that permits us to utilize the experience and the judgment at our command in fashioning the appropriate action commensurate with the nature of the need.

Given the computer's arithmetical capability, its ability to perform predetermined logic (clerical) functions and its immense capacity for information and information arrangement, we can easily and conveniently extrapolate to deductive decision making. Whenever conclusions are reached based on arithmetic or comparative data, these conclusions can be regarded as computer-based decision making. Today, many of our manufacturing plants procure, receive, assemble and ship material independent of human calculation and decision making, based simply and straightforwardly on deductive decision rules, a part of the computer program.

A final step becomes the more complex task of literally capturing human skills. Here again this is a matter of fact accomplishment in the manufacturing sector involving everything from automated design to computer-based manufacturing, engineering or processing, to management method. We in our company have experienced setting up complete facilities in underdeveloped countries: within a few months, manufacturing a state-of-the-art product with a workforce that literally is illiterate. These endeavors achieve results every bit the equal of their U.S. counterparts simply because the necessary skills for such accomplishment have been subscribed to computer-based processes and actions.

The horizons revealed by looking at management as a process make these steps possible within the manufacturing industry. Management is a Service. Even though the problem is complex it can be partitioned and addressed with meaningful results attained.

In summary:

... Look upon Services as a process
... Design a good process
... Partition and computerize

.. Arithmetic
.. Clerical
.. Information gathering, arrangement and distribution
.. Deductive decision making
.. Capture the skill

... Expect and foster evolution (It takes more than one day).

The total set of tools and techniques for productivity in manufacture of goods, and quality in that manufacturing process, did not come into being overnight. Neither will those associated with Services, but still a major tool for that evolutionary process is at hand today, the computer.

I would like once again to reference the statement in the foreword section of the conference brochure:

"Identify relevant business, government, and societal needs and opportunities;"

We talked about services productivity and the nature or characteristics of Services. We mentioned that management is a service, fitting the definition or the characteristics we have utilized in describing a Services product. There are many examples other than of the type I have described, whereby the computer has in fact captured the skills of an individual manager or a management team. That has been done, not universally, but in part--with an adequate abundance of examples. What is a "management" that is "captured?" What is it that those managers were doing? They were engaged in the organization and utilization of human knowledge and skills.

When I was younger I wanted a competence and experience in many functional areas--Marketing, Engineering, Operations, etc. The president of the company I worked in at the time was quick to point out that most presidents don't accede to their lofty heights through being better at anything or everything than any other one individual, but rather in being able to recognize and utilize the knowledge and skills of many.

Any multi-function manager recognizes his task as being primarily the organization and utilization of human knowledge and skills. The manager of this human resource must perceive the nature of the problem or objective and then bring to bear the knowledge and/or skills pertinent to further definition and solution.

Earlier we said that progress comes about in the main by exposing pacing problems, items or variances to levels or ability or authority commensurate with the nature of the need. We also referenced the cliche, "Civilization progresses in direct proportion to what man can accomplish without thinking about it." What we are talking about in both instances are techniques and tools. Tools have always been the backbone of productivity.

The brochure, this seminar folder, writes of needs of services people for computers. Really the need is for people to utilize the tool we have at hand, the computer. Let's be specific and talk about the process of Education.

What if, while not interrupting or threatening the current structure of the educational process that developes or creates our Ph.D.-type of creative individual, within that qualification we could alter our aims to encompass these objectives:

- "Bank" Knowledge and mental skills in computer storage/networks
- "Train" an intermediate level for managing (using) that larger inventory of knowledge rather than only what they themselves can assimilate, retain and refresh.

Earlier I referenced the brilliant dissertation by John Diebold concerned with "The Social Responsibilities of Business" and how U.S. business can and does address its social responsibilities. In this paper he laid out some very interesting facts. One such fact dealt with knowledge. Mr. Diebold said, (and I paraphrase) "Knowledge is increasing such that between today, and the death of today's baby, 97% of the knowledge then existing in the world will be knowledge discovered during his lifetime."

Can you imagine a world where literally knowledge is being discovered at the same rate as our lifetime is ebbing? To the degree that 97% approximates 100%, such is the case today. Despite the fact, that we can for example, make mathematical calculations 100,000 times faster and with 10,000 times more economic efficiency today than barely 18 years ago, we have not yet begun to realize the revolutionary powers of both induction and deduction that this increase in human knowledge is putting into our hands and minds.

The computer truly is the first tool applicable to the productivity of man's intellect. It is the fulcrum point from which we can lever our entire society--even our civilization--upward, and then with the next thrust still ever higher again, understanding that once computer-captured, the knowledge and skill afforded by that knowledge is retained and can be built upon again and again. Knowledge raised to the power of Understanding yields Education. That in itself is vital. Much more important, however, is the potential of knowledge raised to the power of direct application, yielding a productivity of man's intellect never before deemed feasible.

The problem of course is the approaching limitation imposed by dissemination and distribution of knowledge as opposed to its discovery. Why can't we use a combination of knowledge and skills we ourselves don't understand? Management does, especially top management. These days a lot of engineers do just that, whether they are designing aircraft or nuclear reactors. It is not my intent to be unduly critical, but perhaps I can be stimulating. Just as the ultimate purpose of a company must include profit, so must the ultimate purpose of knowledge include its application. Where is the research for applying, through computer-based knowledge, what someone else already knows. All of us use "tools" we don't fully understand. Sometimes we are fearful of it but yet we do it all the same. The computer, properly utilized, holds great promise not only in the dissemination or distribution of knowledge, but the actual application of that knowledge as a tool of human intellect. It is the application of tools that have brought about the productivity we enjoy. Education is still treated as an attribute, an element of personal domain. With the rate of discovery of new knowledge, consider the added time any young individual must begin to devote to just "keeping up." What a waste of time. Computers save time.

Services are time critical in that the longer they confine any given resource, the more costly or less productive that resource, hence that service. Educational services are time critical. Computers are here today and are available for utilization by universities, medical centers and government as well as by industry. All the while we perpetuate the syndrome of knowledge for education, and education for knowledge, to the expense and detriment of the application of knowledge for productivity. Is it possible that educators might broaden their perspectives so as to perceive of themselves not only as obliged to convert knowledge to education, but to assume a leadership role, a role of responsibility in the dissemination, the distribution, and the application of such knowledge to the benefit of mankind?

The preponderance of this conference is made up of academic and governmental professionals. There are very few of us here from industry. My perception is that those people responsible for creating and bringing an availability of computers to a need, of creating and bringing automation to the needs of society, are far more aggressive than those who could utilize those tools for societal benefits.

As I said, I don't mean to be unduly critical, but I would like to in part return some of the benefits I have enjoyed from this conference through perhaps influencing or stimulating the behavior of each of us relative to productivity needs in the service sectors. I am mindful of the vital needs for the application of computer-based technology to the needs of the service industry--and most significantly, educational services. After all, it is precisely that service that has been and still remains as the backbone of a technically-based standard of living as yet unequalled in any other land. And after all, isn't it fitting that the benefactor of technical achievement, education, in turn finally itself benefits by its parentage? There is a way to increase the productivity of the educational process and of knowledge through more direct application to societal needs. We, everyone of us, should be a part of the satisfaction of that need and we could be, if we just make up our minds to do so. The technology exists--now the will must be applied.

"HUMANE QUALITY

Frank Bernstein

Mr. Bernstein is a member of the staff of Auerbach's Washington Office. He spoke to the conference participants of the essential ingredient of services, humane quality. The "delivery encounter" of service should be well mannered and pleasant--the goal, according to Mr. Bernstein, should be to serve more customers better.

"HUMANE QUALITY"

Frank Bernstein

Quality is an essential factor, universally necessary in any endeavor, but of perhaps greater significance in services because of the higher incidence of people interplay. As quality control is mandatory in manufacturing hard products, and system effectiveness must be determined in the development of complex systems, HUMANE QUALITY is an essential additional ingredient of services. Success in their delivery is synonomous with its application.

Quality, as defined and described here, is considered in the old-fashioned sense of just good manners. You may question the pertinence of discussing the need for good manners in the context of the conference's stated purpose.

Ed Blum, in discussing productivity in services dwelled on

and added EQUITY

which he did not include as part of PRODUCTIVITY, but rather as a POLITICAL factor, or a FAIRNESS factor, "who gets what." I would add DELIVERY. If one accepts the definition of Jordan Baruch, that a service is a good which is consumed at the moment of delivery, then the "delivery encounter" should be well mannered and pleasant.

And computerized methods can be cold and impersonal--they lack soul, and on occasion can be unfeeling and even cruel.

In automation design and in automation/manual combinations heed must be paid to the DELIVERY INTERFACES COLLECTION, DELIVERY OF INPUTS, DELIVERY OF OUTPUTS.

This then is the ascribed nature of HUMANE QUALITY as applied here.

Is it quantifiable? Is it necessarily linear in its characterization and application?

We would all agree that in preparing and delivering services, customer satisfaction is a key objective, whether in government or in the private sector. The goal should be to serve more customers BETTER. But what are the bases for BETTER?

Perhaps there is a mixture of factors varying in tangibility:

IMAGE
GOODWILL
ATTITUDE
DEMEANOR
COURTESY

CONSIDERATE
RESPONSE

INDIVIDUAL
PRIVATE
INTEREST

PUBLIC
INTEREST

As Bill Cooper reflected: QUALITY OF LIFE is how people feel!
- it affects their responses
- it has a real value in the market place

We should DESIGN SYSTEMS AND DELIVERY INTERFACES ACCORDINGLY!

"PARTICIPATORY GOAL SETTING PLANNING SYSTEM"

Shimon Awerbuch

Mr. Awerbuch is Research Director of the Planning and Development Agency of Cohoes, New York. His presentation to the conference participants discussed a planning system for community development, which included a model presenting decision-making information to the community and its officials. Such information is necessary for rational decision-making. By holding certain components of the community system constant one can begin to study the complex system. For Cohoes, five simplified situations were selected and information on demography, fiscal and socio-economic considerations, and utilization of land were presented. Such presentations do not attempt to recommend one possible situation over another, but rather give the officials enough information to make a decision.

"PARTICIPATORY GOAL SETTING PLANNING SYSTEM"

Shimon Awerbuch

Past planning has tended to be physical in nature (2)*. Thus, the "Comprehensive Plans" of the last decade failed to consider fiscal and socio-economic impacts of development. The planning system discussed here considers these impacts.

Work began with an attempt to define a "balanced community" in terms of economic, social and fiscal considerations (3). It soon became apparent that in order to formulate such a "balance," many subjective decisions were required which could not be made by the professional planners working in isolation from the community. For example, a municipality's tax base is usually improved by development of commercial and industrial land uses. Since such land use is often considered a nuisance, only the community itself can decide how much industrial and commercial activity it is willing to "tolerate" in return for lower taxes. Rather than subjectively attempting to define this "balance," work proceeded towards a model which would present decision making information to the community and to its officials (4). Based on such information, the planning process can proceed with sound basis for rational decision making. In other words, if one can show what the demographic, fiscal, and socio-economic impacts of various forms of development are, then the community and its administrators have proper basis for deciding what growth form the city should pursue.

It is important that the planning tool that is developed be practical and workable with limited data. It must also be easy to implement, have a short "turn-around time" to be of value to nontechnical individuals (4). This is easier said than done since the urban system is, in reality, quite complex and involves numerous interactions and "spin-offs" (6). But, by selectively holding certain components of the urban system "constant," one can begin to study the complex system. This leads us to the definition of the "extreme" scenario (8). For Cohoes, five initial simplified (extreme) scenarios were selected (9): maximum residential development, maximum industrial development, maximum commercial development, historic tourism, and the baseline against which the merits and costs of these can be measured--the zero action or "do-nothing" scenario. For each scenario, decision making information consisting of demographic characteristics, fiscal indicators, socio-economic indicators and utilization of land are presented (10).

The first scenario presented is the zero action (12). As it implies, no effort is made by municipal government to attempt to affect change, and present trends continue.

Analysis of demographic characteristics under "do-nothing" reveals that by 1980 the city's population will drop from a present 18,600 to 16,600 (13). More interesting than the overall decline, however, is the fact that the proportion of elderly residents increases considerably and that the population is moving towards older and smaller household units (14). Examination of municipal fiscal structure reveals that increases in the municipal appropriation coupled with a relatively stable tax base will result in higher property taxes under "do-nothing" by 1980 (18-19).

The next scenario examined is maximum residential development, or "bedroom community" (20). After making necessary assumptions, analysis reveals that such a growth strategy would increase the city's assessed valuation by $10.4 million from a present value of $18.6 million (21). The demographic analysis reveals under maximum residential development the population will increase to some 22,000 people, and the age distribution will become "younger" (22).

Since the initial scenarios are well constrained and well defined, certain spin-offs, such as increased commercial activity, can be calculated since the new families and family income and propensity to consume locally are known (24).

*(Note: Numbers in parentheses refer to visual aids used in the conference presentation; not all were reproduced here.)

DEFICIENCIES OF THE MASTER PLAN CONCEPT

- STATIC, NOT A REAL-TIME PROCESS
- NOT A USEFUL DECISION-MAKING TOOL
- PREPARED BY PROFESSIONALS IN RELATIVE ISOLATION
- DISREGARDS INTERACTIONS AND EXTERNALITIES

CHART 2

"BALANCED" COMMUNITY

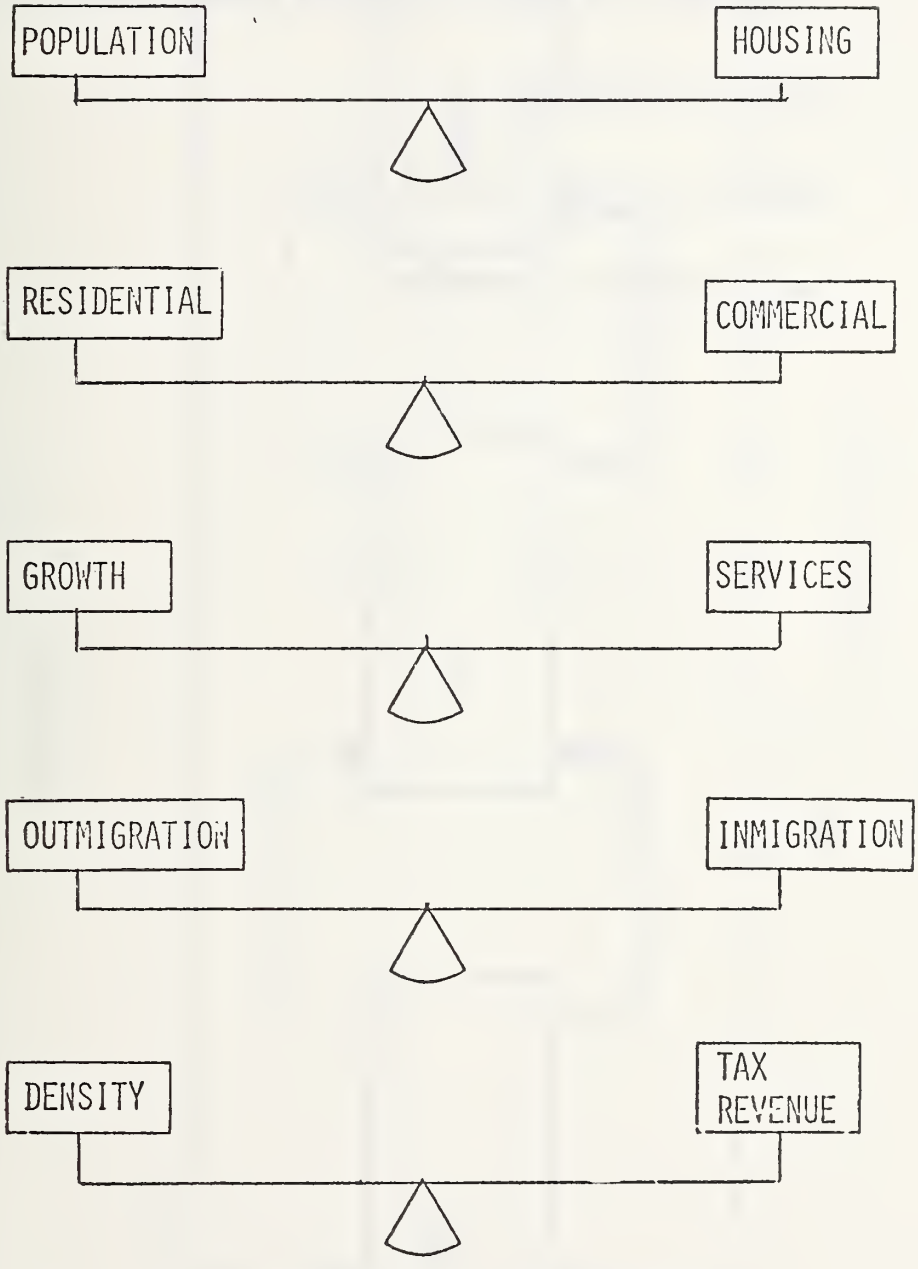


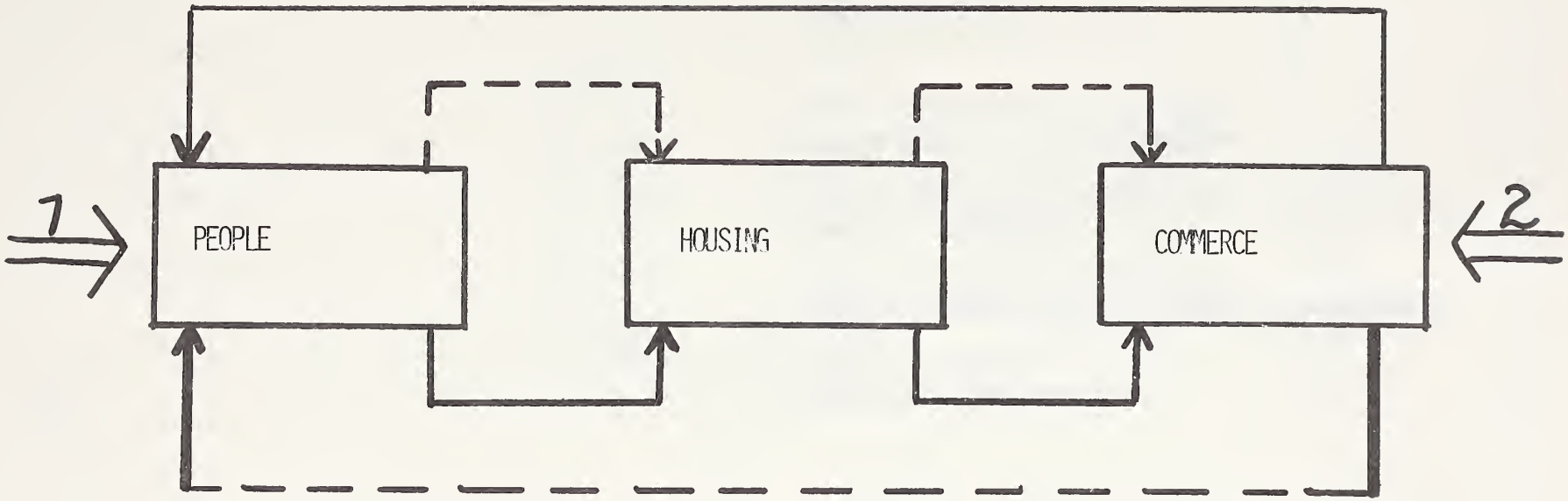
CHART 3

DEVELOP AN ANALYTICAL PLANNING TOOL

- Demonstrate the Impact of Various Growth Strategies
- Simple to Implement
- Workable with Limited Data
- Decision Making Information

CHART 4

INTERACTION



SPIN OFF

CHART 6

"EXTREME" SCENARIO

- Hypothetical Situation
- Describe Extreme Feasible Limits of Development
- Simplifies Analysis
- Aids in Study of Complex Systems

CHART 8

INITIAL (EXTREME) SCENARIOS

- Zero Action (Base Case)
- Maximum Residential Development
- Maximum Industrial Development
- Maximum Commercial Development
- Historic Tourism

CHART 9

SCENARIO ANALYSIS

DEMOGRAPHIC:

POPULATION SIZE
AGE DISTRIBUTION
NUMBER OF SCHOOL CHILDREN

FISCAL:

MUNICIPAL APPROPRIATION
SCHOOL EXPENDITURE
TAX BASE
ASSESSED VALUATION
FIXED REVENUES
CITY TAX RATE
SCHOOL TAX RATE

SOCIO-ECONOMIC:

COMMERCIAL SALES VOLUME
JOB OPPORTUNITY
MEAN FAMILY INCOME

LAND UTILIZATION:

TOTAL ACRES DEVELOPED
COMMERCIAL FLOOR SPACE
INDUSTRIAL FLOOR SPACE
RESIDENTIAL ACREAGE
HOUSING UNITS BY TYPE

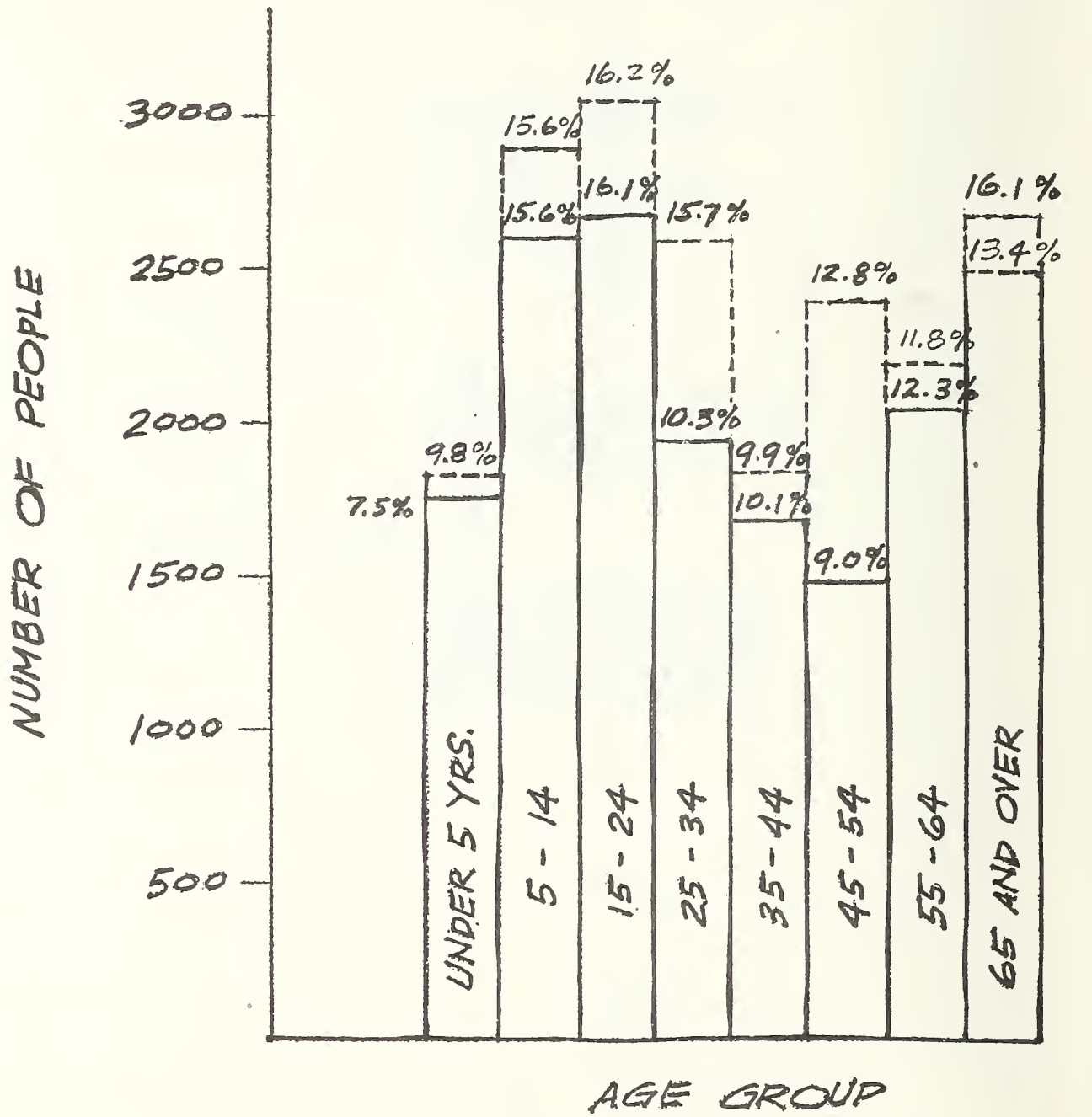
CHART 10

ZERO ACTION SCENARIO

- No Effort on the Part of Municipal Government to Effect Change
- Present Trends Continue

CHART 12

FIGURE 1. POPULATION ANALYSES BY AGE CITY OF COHOES 1970-1980



SOURCE: HOUSING REPORT (RPI)

CHART 13

FIGURE 2. HOUSEHOLD PROFILE (AGE OF HEAD) 1970 - 1980

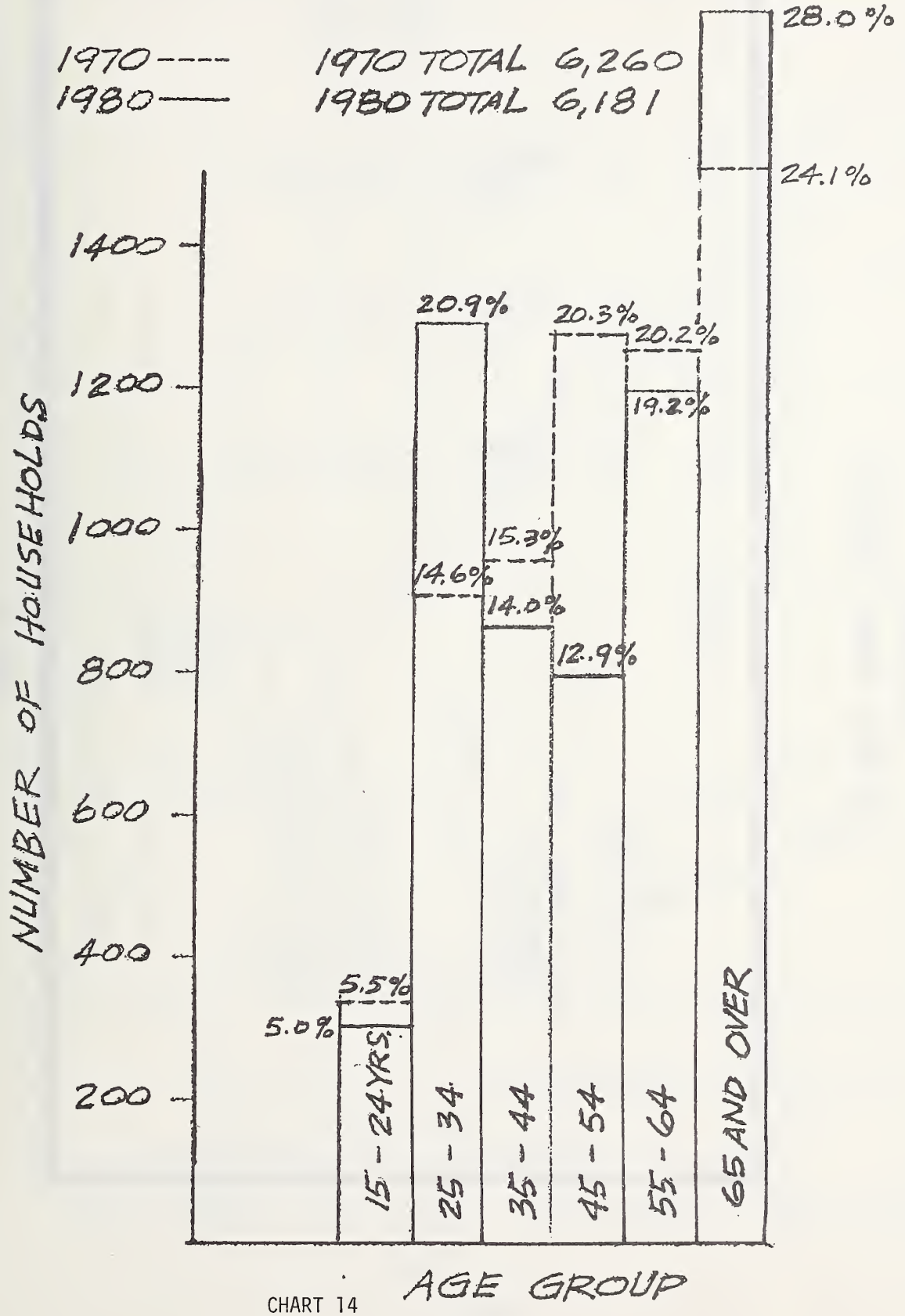


CHART 14

ZERO ACTION

1980 BUDGET SUMMARY ($ MILLIONS)

BUDGET ---	6%	8%	10%
APPROPRIATIONS	4.50	5.00	5.50
NON-PROPERTY TAX	.70	.70	.70
WATER SALES	.55	.55	.55
STATE AID	2.00	2.00	2.00
FIXED REVENUES	3.25	3.25	3.25
PROPERTY TAX	1.25	1.80	2.25
CITY TAX RATE/$1000*	$65	$94	$117
SCHOOL EXPENDITURES	1.76	1.76	1.76
SCHOOL TAX RATE/$1000**	$92	$92	$92

* Based on $19.2 million in assessed valuation

** Based on 2400 pupils

CHART 18

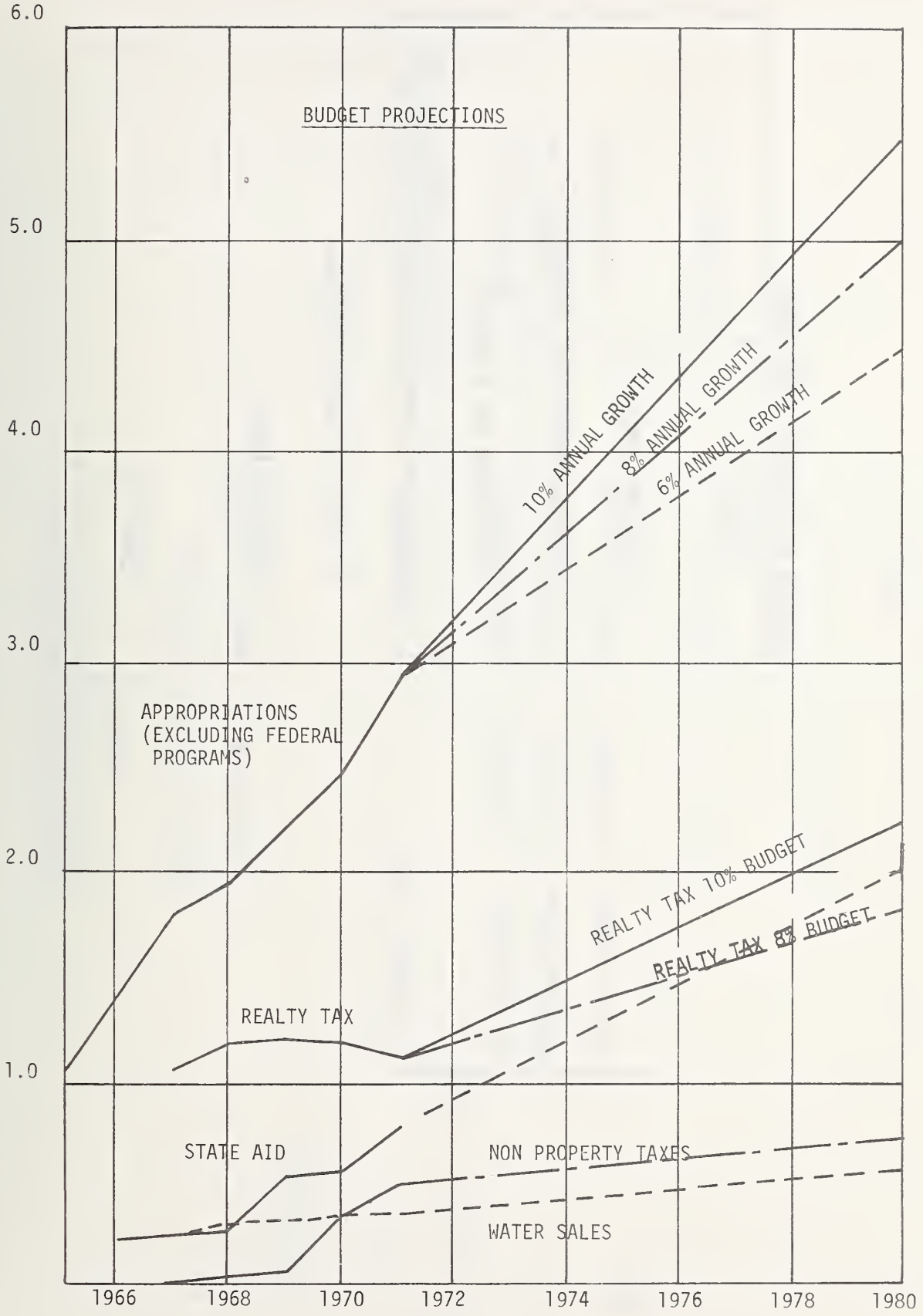

BUDGET PROJECTIONS
6.0
5.0
4.0
3.0
2.0
1.0
10% ANNUAL GROWTH
8% ANNUAL GROWTH
6% ANNUAL GROWTH
APPROPRIATIONS
(EXCLUDING FEDERAL
PROGRAMS)
REALTY TAX 10% BUDGET
REALTY TAX 8% BUDGET
REALTY TAX
STATE AID
NON PROPERTY TAXES
WATER SALES
1966
1968
1970
1972
1974
1976
1978
1980

CHART 19

MAXIMUM RESIDENTIAL DEVELOPMENT: SCENARIO

- "Bedroom Community"
- 416 Acres Vacant and Suitable
- In-Migrants are Attracted
- In-Migrant Characteristics
- New Housing Characteristics
- 1980 Time Frame

CHART 20

MAXIMUM RESIDENTIAL DEVELOPMENT:

ANALYSIS

DEVELOP SUITABLE VACANT LAND

--ASSESSED VALUE OF NEW DEVELOPMENT

DESCRIPTION, UNITS		TOTAL VALUE	ASSESSED VALUATION (30.4% EQUALIZATION)
416 Apartments	@ $25,000	$10.4 Million	$3.85 Million
670 Single Fam.	@ $27,000	$18.4 Million	$6.82 Million
270 Replacement	@ $20,000	$ 5.4 Million	$2.00 Million
		$34.2 Million	%10.40 Million

CHART 21

MAXIMUM RESIDENTIAL DEVELOPMENT:
ANALYSIS (CONTINUED)

DEMOGRAPHIC ANALYSIS

1980 POPULATION PROFILE

	UNDER 5	5-14	15-24	25-44	45- 54	55-64	65+	TOTAL
TOTALS	1927	4265	3235	6035	2004	2362	2905	22,733
PERCENT DISTRIBUTION	8.5	18.8	14.2	26.5	8.8	10.4	12.7	100%
ZERO ACTION DISTRIBUTION	7.5	15.6	13.1	25.8	9.0	12.3	16.1	100%

CHART 22

MAXIMUM RESIDENTIAL DEVELOPMENT: ANALYSIS (CONTINUED)

COMMERCIAL SPIN-OFF

(RETAIL)

--Number New Families

--Family Income

--Propensity to Consume Locally

--Average Retail Sales per Square Foot of Retail Space

$$\left\{\begin{matrix}\text{Family}\\ \text{Income}\end{matrix}\right\} \times \left\{\begin{matrix}\text{No. New}\\ \text{Families}\end{matrix}\right\} \times \left\{\begin{matrix}\text{Local}\\ \text{Propensity}\end{matrix}\right\} = \text{NEW SALES GENERATED}$$

$$\left\{\begin{matrix}\text{New Retail Floor}\\ \text{Space (Sq. Ft.)}\end{matrix}\right\} = \left\{\frac{\text{New Sales Dollars}}{\text{Avg. Sales Per Sq. Ft.}}\right\}$$

$$\text{Number of New Jobs} = \left\{\frac{\text{Avg. No. Jobs}}{\text{Sq. Ft. Retail}}\right\} \times \left\{\begin{matrix}\text{New Retail}\\ \text{Space}\end{matrix}\right\}$$

CHART 24

The analysis continues with an examination of municipal expenditures under maximum residential development (25). This examination is facilitated because many of the municipal expenses can be fairly well projected, given the constraints and assumptions that have been built into the scenario. Likewise, increases in the school expenditure can be calculated since the number of new students and the cost of education per student are known.

Next, the new sources of revenue are computed (26). This is done on the basis of the increased real value of property previously calculated, increases in state aid which are based on a precise formula, increases in county sales tax revenue which are apportioned on a per capita basis, and new water sales.

A summary presentation of the fiscal structure under maximum residential development (27) shows that although appropriations are higher than under "do-nothing" the tax rate is considerably lower due to the increase in total assessed valuation.

Discussion continues with analysis of a maximum industrial development scenario under which the tax rates are still lower (28, 29, 30).

Finally, a summary of all preliminary results is presented showing the various demographic, fiscal and socio-economic indicators for each scenario (31). It should be noted that by no means does this presentation attempt to recommend one particular growth form over another. Such a decision can only be made by the community and municipal officials after careful consideration of the indicators in concert with their own priorities and desires. For example, although the tax rate is lowest under industrial development, the community may not desire such a land use. Likewise, though the population is highest under maximum residential development, the community may feel that it does not want the city to grow in size.

Eventually, it will be possible to mix these initial simplified scenarios so that more realistic development options may be examined and evaluated in a participatory setting (32).

MAXIMUM RESIDENTIAL DEVELOPMENT ANALYSIS (CONTINUED)

INCREASE IN PUBLIC EXPENDITURE DUE TO DEVELOPMENT

1. Municipal

   --Capital

   - Parks
   - Streets
   - Utilities
   - Etc.

   --Operating

   - Public Safety
   - Snow Removal
   - Sanitation
   - Staff
   - Water & Sewer

2. Schools

   --Fixed Costs

   --Variable Costs

CHART 25

MAXIMUM RESIDENTIAL DEVELOPMENT: ANALYSIS (CONTINUED)

PROJECTED REVENUE SOURCES

-- Tax Base

-- State Aid

-- County Sales Tax

-- Water Sales

CHART 26

MAXIMUM RESIDENTIAL DEVELOPMENT

1980 BUDGET SUMMARY ($ MILLIONS)

BUDGET ---	6%	8%	10%
APPROPRIATIONS	5.26	5.85	6.43
NON-PROPERTY TAX	.96	.96	.96
WATER SALES	.55	.55	.55
STATE AID	2.33	2.33	2.33
FIXED REVENUES	3.84	3.84	3.84
PROPERTY TAX	1.42	2.01	2.59
CITY TAX RATE/$1000*	$47	$67	$86
SCHOOL EXPENDITURES	2.80	2.80	2.80
SCHOOL TAX RATE/$1000**	$93	$93	$93

* Based on $30.04 million in assessed valuation

** Based on 3890 pupils

CHART 27

MAXIMUM INDUSTRIAL DEVELOPMENT SCENARIO

- 193 Vacant and Suitable Acres
- Light Industry

  Electronics
  Warehousing
  Pharmaceuticals
  Pringing

- Sited in Industrial Parks

  One Story Structures
  35% -- 40% Lot Coverage
  25% Gross Acreage For Streets, Utilities, etc.

CHART 28

MAXIMUM INDUSTRIAL DEVELOPMENT ANALYSIS

DEVELOP SUITABLE VACANT LAND
  ASSESSED VALUATION

JOB OPPORTUNITY

DEMOGRAPHIC
  NUMBER OF FAMILIES
  CAPTURE RATE

RESIDENTIAL SPIN-OFF

COMMERCIAL SPIN-OFF

MUNICIPAL EXPENDITURES

MUNICIPAL REVENUES

CHART 29

MAXIMUM INDUSTRIAL DEVELOPMENT
1980 BUDGET SUMMARY ($ MILLIONS)

	BUDGET --- 6%	8%	10%
APPROPRIATIONS	4.92	5.48	6.04
NON-PROPERTY TAX	.80	.80	.80
WATER SALES	.55	.55	.55
STATE AID	2.10	2.10	2.10
FIXED REVENUES	3.45	3.45	3.45
PROPERTY TAX	1.47	2.03	2.59
CITY TAX RATE/$1000*	$42	$59	$75
SCHOOL EXPENDITURES	2.00	2.00	2.00
SCHOOL TAX RATE/$1000**	$58	$58	$58

* Based on $34.6 million in assessed valuation

** Based on 3300 pupils

CHART 30

SUMMARY OF PRELIMINARY RESULTS

EXTREME SCENARIOS 1980

CATEGORY	ZERO ACTION	MAXIMUM RESIDENTIAL	MAXIMUM INDUSTRIAL
DEMOGRAPHIC			
POPULATION SIZE	16,600	22,600	18,600
AGE DISTRIBUTION			
NUMBER OF SCHOOL CHILDREN	2,400	3,890	3,300
FISCAL ($ MILLIONS)			
MUNICIPAL APPROPRIATION (8% GROWTH)	5.0	5.8	5.5
SCHOOL EXPENDITURES	1.8	2.8	2.0
TAX BASE	50.5	85.5	96.5
ASSESSED VALUATION	19.2	30.0	34.6
"FIXED" REVENUES	3.25	3.7	3.45
CITY TAX RATE/$1000	$ 94	$ 67	$ 59
SCHOOL TAX RATE/$1000	$ 92	$ 93	$ 58
SOCIO ECONOMIC			
SALES VOLUME	$59 MILLION	+ 5%	+ 5%
JOB OPPORTUNITY	--	+ 75	+ 2600
MEAN FAMILY INCOME (1970 DOLLARS)	$ 9000	+15%	+ 15%
TOTAL VACANT LAND DEVELOPED	--	280 ACRES	129 ACRES

CHART 31

PARTICIPATORY PLANNING SYSTEM

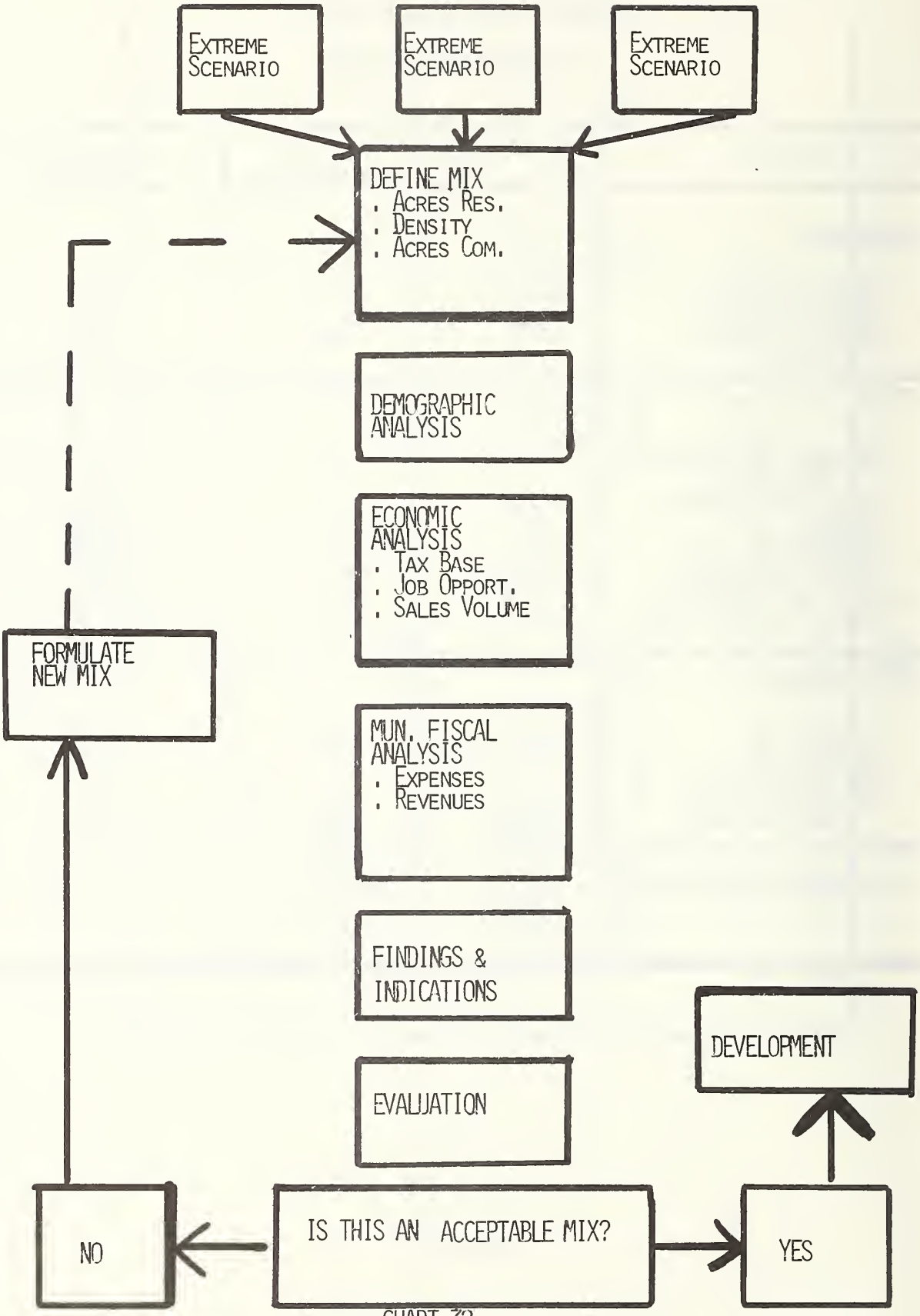


CHART 32

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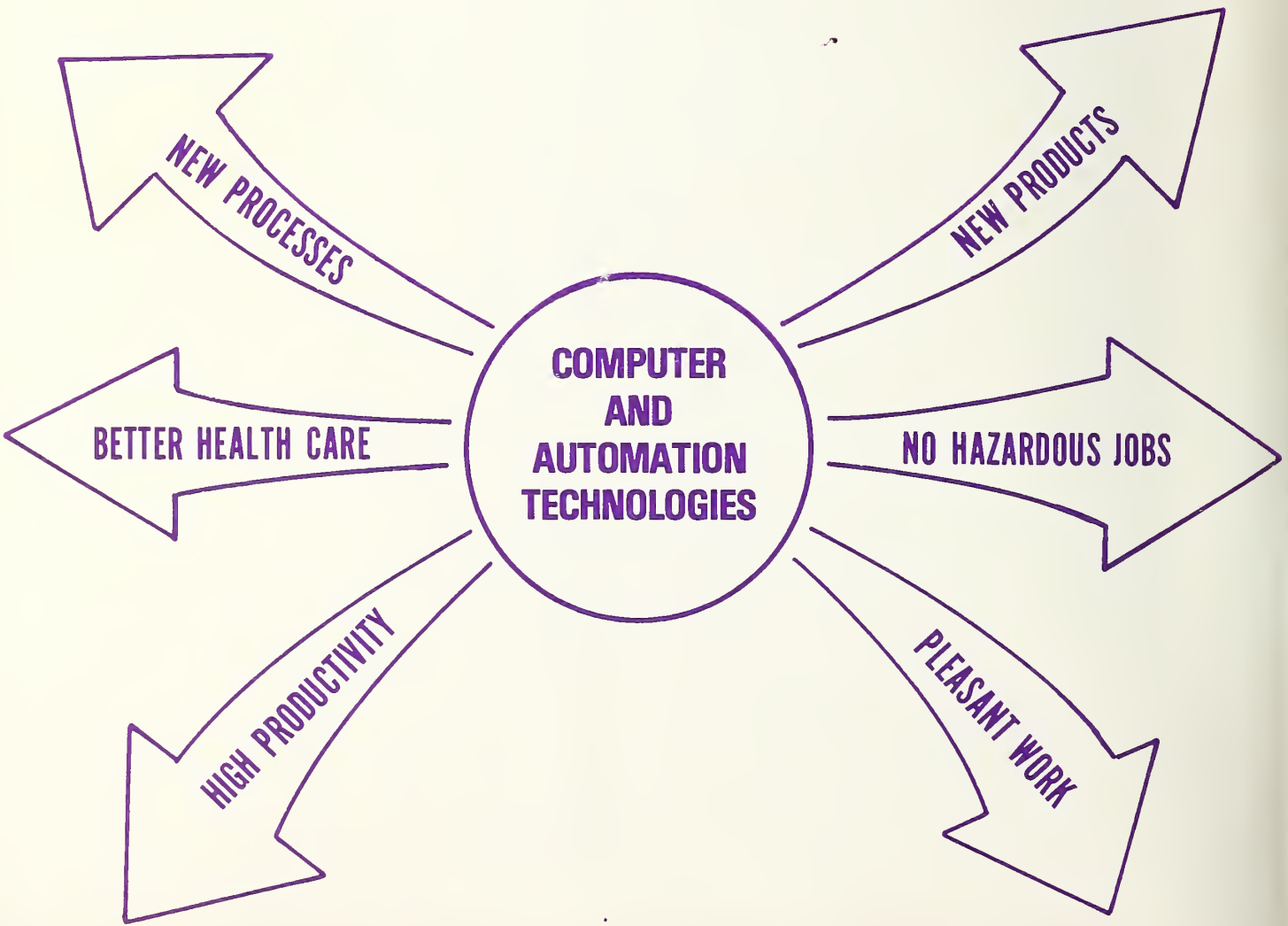
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