

# TOWARDS A RATIONAL CONCEPTUAL FRAMEWORK FOR FEDERAL EFFORTS TO IMPROVE PRIVATE SECTOR PRODUCTIVITY

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## Preface

The following discussion has two parts: the first part (Section A) briefly sketches what might be called the traditional Federal productivity agenda; whereas the second part (all subsequent sections) lays out a complementary set of alternative concerns. Since the traditional issues are well known, their treatment is terse, if not peremptory. Accordingly, the reader's patience is requested in advance for Section A's numerous oversimplifications; for our interest, hence the bulk of our discussion lies in the alternatives presented in the remainder of the paper; hopefully the reader will judge them to be a significant contribution towards the improvement of current Federal policies.

## A. Economic Goals and Productivity

Since productivity is a means, not an end in itself, judgments as to whether productivity is or is not high enough must relate to success or failure in achieving economic goals. For the purpose of this discussion, the productivity-related goals of corporate management and the federal government will be characterized as follows:

\*Management - satisfactory profits, return on assets, share of market, etc.

\*Government - the economy's efficient use of scarce resources such as energy, capital and water (in Western states); and satisfactory output of goods and services at reasonable prices.

If the economy is regarded as a system of industries, an industry as a system of firms, and a firm as a system of workplaces, one infers that, with respect to any particular industry, the productivity interests of government and management may overlap but are not identical:

\*Management - primarily concerned with corporate productivity. Where a firm's performance is unsatisfactory, its management will modify relationship between workplaces (closing some, opening new ones) or modify relationship within workplaces (e.g., installing new technology).

\*Government - primarily concerned with the aggregate performance of all firms in an industry or within some regional subsystem of an industry. Where national or regional measures indicate unsatisfactory productivity, federal attentions will be directed to changing undesirable factors in the industry's environment, the systemic relationships among the industry's component

firms, or factors inhibiting the productivity of individual firms as systems in their own right.

The crucial implication of these differences is the potential conflict between the priorities of an industry's management and the public interest:

- Example: Management has little market incentive to use scarce resources more efficiently where increases in input costs can be readily passed on to customers. Without some kind of government intervention, such as rationing or tax penalties, wasteful industries would tend to outbid their competitors, thereby producing irrational resource allocations.
- Example: Even where resources aren't scarce, if customers have sufficient need for an industry's output (e.g., medical care), its prices and hence its profits will tend to rise. This achievement of corporate goals may lead managers to regard their productivity as being "high enough"; on the other hand, government analysts may denounce the industry's combination of "low" performance and rising prices as inflationary, which diagnosis may lead them to recommend corrective government actions such as price controls.
- Example: Where customer demand tends to fluctuate, it may be rational for suppliers to restrict their productive capacity to average demand levels, accumulating backlogs of customer orders and thereby creating a more predictable and hence a more profitable working environment for themselves. If profits are high enough, there won't be much incentive for them to develop more productive, i.e., more flexible, production facilities; and, of course, government analysts might

criticize such "bottlenecks" as posing serious impediments to their customers' productivity.

These three examples are all instances of the following:

\*Market Imperfection #1: Market incentives may not induce management to act in the interest of the whole society; in particular, high profits may cause management to regard as satisfactory, levels of productivity which aren't high enough to sustain the goals of the larger economic system.

Although we characterized industries as systems of component firms, thus far we have treated them as monoliths; however, in subsequent sections we will describe other market imperfections derived from the strategic interactions of the separate managements of an industry's separate firms. Taken together, the full set of these imperfections will define a rational agenda for federal efforts to enhance productivity in the private sector.

(Note: Our omission of labor's goals, their potential conflict with the goals of management and the public interest, and the strategic interactions among unions implies that our present analysis will, at best, be only partially complete; hopefully, a subsequent expanded version of this discussion will remedy this deficiency.)

(Note: Throughout this discussion the term "technology" should be interpreted in the broadest sense so as to include both hardware (equipment) and software (operating procedures, incentive systems, organizational structures, etc.).

B. Characteristics of Productivity Innovations

(1) Innovation Costs - Innovations are first invented, then communicated, and finally adopted; hence there are development, communication, and implementation costs. Note that innovations are seldom fully compatible with all elements of an existing system: usually some personnel have to be retrained, some existing equipment modified, some organizational relationships restructured, and some adjustments made to the innovation itself before it can become operational. Therefore implementation costs not only include an innovation's purchase price, but also the costs of whatever local preparations are required for its installation.

(2) Independent vs. Systemic vs. Environmental Innovations -

(a) We define independent innovations as inventions developed and implemented by individual firms on their own initiative; hence any firm anticipating that projected benefits will sufficiently exceed estimated costs can proceed with development and implementation regardless of the actions of other firms.

(b) On the other hand, systemic innovations require the coordinated support of more than one firm, i.e., of a sufficiently large segment of an industry's membership. (Some common examples of systemic innovations include standardization of parts, product identification codes, package sizes, and accounting procedures). All other things being equal, the more firms involved, the larger the coordination costs and hence the larger the total costs of development; in fact, coordination costs increase with startling rapidity as the number of participating firms increase. Consider that two firms have only one relationship to coordinate; three firms (A, B, C) have three interrelationships

(AB, AC, and BC); four firms (A, B, C, D) have six interrelationships (AB, AC, AD, BC, BD, CD); five firms have 10 interrelationships;...10 firms have 45;...100 firms have 4,950;...and so on, in accordance with the well known combinatorial formula:

$$\frac{n!}{2! n-2!}$$

where n = the number of firms.

(c) Lastly, we define environmental innovations as changes in an industry's systemic environment; in a sense such changes are implemented "on" the firms rather than "by" the firms. For our purposes, the most important environmental factors affecting any industry are federal regulations and federal tax codes; hence we focus our attentions on this regulatory subset.

(3) Private Goods, Public Goods, and Free Riders - In this section we derive strategic implications from differences between what are called private and public goods; in the next section these insights will suggest that productivity innovations which can be classified as public goods will tend to be developed and implemented to a considerably lesser degree than their net benefits would seem to merit.

(a) Economists define public goods (or services) as goods which must be made available to all members of a group if they are available to any particular member of the group; by contrast, the distribution of private goods can be restricted. (For instance, see Paul Samuelson, Economics, 10th ed., McGraw-Hill, 1976).

Examples of public goods available to all U.S. citizens include national defense, the federal judicial system, our national parks, and our relatively stable currency; on the other hand, retail stores abound in private goods available only to those

who can afford to pay their purchase price.

(b) How much of a good (or service) will a rational person buy? Well, if it is a private good, he will keep buying until he feels that the cost of one more unit of the good was greater than the marginal increase in the satisfaction he anticipates receiving from that extra unit. Which is not to say that he would not like to have more than he felt he could afford to pay for; on the contrary, where additional units are free of charge, he will take as many as he can get.

(c) But suppose a public good is being purchased by a group. Question: How much would the group buy? Answer: As much as could be purchased by the sum of the individual members' contributions, of course. But this merely begs the question, so we now ask: How much would each member voluntarily contribute towards the collective purchasing effort? In answering this second question, we employ an artifice derived from the so-called "tatonnement process" invoked by economists when explaining how free markets determine the sale of private goods. (For instance, see E. Malinvaud, Lectures on Microeconomic Theory, North Holland/American Elsevier, 1972.)

(d) Scenario: "Fair Share" - Imagine that the group has hired an outside agent, called a "Fund Raiser", to conduct a "campaign" to solicit contributions from the group's membership towards the purchase of a public good. Now suppose the Fund Raiser makes his collections in a series of "rounds", asking everyone to contribute the same amount per round; further suppose that at the beginning of each round he lets everyone know the names of the members still participating in the "campaign" and how much has been collected thus far. To simplify our discussion, let us assume that there are ten members in the group

and that the Fund Raiser is asking each member for \$10 per round. At the start of the first round, each member decides whether his anticipated satisfaction from, perhaps, \$100 worth of the good is worth a \$10 contribution. If so, he contributes; if not, he drops out. An obvious but nonetheless important point to note is that by acting collectively, each member buys far more of the good than this individual contribution would secure, i.e., \$100 vs \$10, which is, of course, the Fund Raiser's basic argument for collective purchasing. At the start of the second round, the Fund Raiser informs the group how much was actually collected, e.g., only \$90 because someone dropped out. Now each of the nine remaining members decides whether his marginal increase in satisfaction from the purchase of, perhaps, an additional \$90 in the second round is worth a second \$10 contribution; and again some contribute and some decide they cannot afford to. The process continues in this manner round after round until, eventually, everyone drops out; at which point the "campaign" is over. All other things being equal, we should expect the poorest members to contribute the least, i.e., to drop out first, and the wealthiest members to contribute the most, i.e., to drop out last.

(d) Scenario (Continued): "Free Riders" Unfortunately, there is a troublesome conundrum lurking in our little fable: members who drop out still enjoy the benefits of additional units paid for by contributions from later "rounds"; hence to the drop-outs, these additional units are free. For example, if poor Mr. Jones contributes \$10 to his local public television station, while rich Mr. Smith contributes \$1,000, Mr. Jones enjoys the benefits of \$1,010 worth of programming. In fact, if Jones knew for sure that Smith would contribute \$1,000, it would be more reasonable for Jones

to calculate his marginal increase in satisfaction as applied to a \$1,000 base rather than to zero base. If so, he might decide that his \$10 was better spent on other things; and by so doing, he would become a consumer of a public good to which he had contributed nothing, i.e., he would become a "free rider". The potential flaw in Jones' reasoning, of course, is that he cannot really foresee what Smith will contribute. Nevertheless, other things being equal, it is reasonable for poor members to anticipate larger contributions from wealthy members; hence it is reasonable for poor members to contribute less than their "fair share".

As groups get larger, the logic of free riding becomes stronger and more pervasive; indeed, in very large groups even the wealthiest might compare their individual contributions to the considerably larger projected "campaign" totals from the entire group and conclude that their donations were also marginally insignificant. We summarize this tendency as follows:

Strategic Insights - Where public goods are financed by voluntary contributions, the larger the group the greater the proportion of "free riders" in the group; hence the farther the members' actual contributions will fall short of their optimal "fair shares".

(For a detailed elaboration of this point see Mancur Olson, Jr., The Logic of Collective Action, Schocken Books, Revised ed. 1971.)

In other words, the larger the group, the greater the difference between the amount of public goods actually purchased and the amount which the potential net benefits of the goods would appear to merit; hence we conclude that while individuals will tend to

purchase optimal levels of private goods, groups' purchases of public goods will tend to be suboptimal. (Note: Our scenario should not be taken literally; nevertheless, its present formulation suggests an important topic not discussed here, namely, "Fund Raisers" counter-strategies for minimizing "free riding".)

### C. Productivity Innovations as Public Goods

Recall that earlier we distinguished between three types of innovations: independent, systemic, and regulatory (i.e., environmental). It will now be argued that regulatory and systemic innovations are public goods; and, moreover, that unpatentable independent innovations also fall into this category.

(1) Regulatory Innovations - To the extent that federal regulations and tax codes are not formulated for the exclusive benefit (or disbenefit) of specific firms, they are public goods (or "bads") for all members of each affected industry. Hence our strategic insight would suggest that the greater the number of firms in a given industry, i.e., the more fragmented the industry, the greater will be the tendency for less profitable firms to avoid contributing to the costs of promoting favorable regulations, i.e., favorable in terms of management's priorities. Consumer groups and other public interest advocates may be skeptical of this conclusion; but it is not likely to be disputed by trade associations and other industrial "Fund Raisers" whose efforts to mobilize constituent firms' support for Washington lobbying efforts are repeatedly frustrated by what might appear to be their irrational unwillingness to contribute to their own self-interest, but which, from our perspective, represents a highly rational tendency to "free ride"

on the contributions of their wealthier competitors. Therefore:

\*Market Imperfection #2: There will be substantial "free riding" in fragmented industries resulting in lower than optimal efforts to promote more favorable federal regulations.

Naturally, where an industry is proposing regulatory changes not in the public interest, this second imperfection is actually a kind of public good for the larger society; for example, lack of sufficient effort may cause auto industry lobbyists to fail in their efforts to persuade Congress to lower auto emission standards. On the other hand, where public and private interests coincide, an industry's failure to exert sufficient effort to effect a desirable regulatory reform will also be a public "bad"; for example, cumbersome transportation regulations which have outlived their original usefulness may remain in effect to the detriment of railroads' productivity and their consequent capacity to serve the public.

(2) Systemic Innovations - After they have been developed and after the earliest adopters have shown everyone else how they should be installed, systemic innovations become public goods; consequently our strategic insight again suggests that trade associations, privately sponsored productivity centers, and other "Fund Raisers" in fragmented industries will experience considerable difficulty in their efforts to induce their members to contribute money, manpower, or other resources towards the development of such useful systemic inventions as standardized parts, standardized packages, and standardized product identification numbers; indeed, the rational tendency to "free ride" will be substantially reinforced by the rapid escalation of coordination costs, noted earlier, as the number of firms in the industry increases.

Accordingly, we have:

\*Market Imperfection #3: There will be a great deal of "free riding" in fragmented industries with respect to systemic innovations; systemic innovation will therefore be considerably less than optimal.

(3) Unpatentable Independent Innovations - Lastly, we observe that an independent innovation whose adoption cannot be restricted by patents is a public good; hence our strategic insight again suggests that there will be lower than optimal development of such inventions. Unfortunately, this inhibition is likely to be strongest in low technology industries whose productivity is usually most in need of improvement. For as technology becomes more sophisticated, the local preparations required for installing the simplest unpatentable inventions take on a rapidly increasing complexity; adopters must not only calculate how each of the existing elements of their firms must be adjusted to accommodate the innovation; they must also consider how such adjustments will affect the  $\frac{n!}{2! n-2!}$  interrelationships among these elements. Consequently, as technology increases, it becomes increasingly difficult for competitors to copy one another's local installation procedures; hence "free riding" on unpatentable innovations will be more effective in less advanced industries:

\*Market Imperfection #4: "Free riding" in fragmented industries will result in lower than optimal development of unpatentable independent innovations, especially where the industry's technology is low.

Figure 1  
SUMMARY OF PUBLIC/PRIVATE STATUS OF  
INNOVATIONS

<u>Innovation Type</u>	<u>Public</u>	<u>Private</u>
Independent	Unpatentable	Patentable
Systemic	All	None
Environmental (Regulatory)	All	None

D. Target Industries

(1) Traditional Focus - Federal concern has traditionally centered on the first type of "market imperfection", i.e., upon situations wherein substantial conflict exists between the productivity goals of a particular industry and the needs of the larger economy. Recall that such conflicts involved inefficient use of scarce resources, insufficient levels of output, or inflationary pricing of output. Federal policy-makers have usually attempted to compel target industries' behavior to become more consonant with the public interest via controversial aversive mechanisms such as rationing, tax penalties, and price controls; or they have attempted to induce voluntary behavioral changes through positive inducements such as tax breaks and temporary relaxations of regulations designed to achieve social goals other than productivity, but which have productivity-inhibiting side effects (e.g., emission controls on cars). Both strategies are perilous for their supporters: policy-makers advocating controversial controls may encounter formidable resistance from the industry's political allies; on the other hand, policy-makers advocating positive inducements may find themselves accused of promoting tax and other regulatory "loopholes" for the benefit of special interests at the public's expense.

(2) Alternative Focus - Without denying the necessity for continuing federal concern for these issues, we suggest that greater attention needs to be directed towards supporting the development, communication, and implementation of systemic, regulatory, and unpatentable independent innovations consistent with the public interest but which an industry will fail to support at optimal levels due to members' tendencies to "free-ride". Our previous discussion suggests that the most appropriate federal targets in this regard are fragmented industries, especially those having comparatively low technologies (e.g., construction, food distribution, and apparel).

(3) Additional Criteria - No matter what target, conflict or "free rider", the impact of federal productivity efforts should be maximized; hence two additional criteria are proposed:

(a) Target industries should be important--either the size of their output or required inputs should be relatively large compared to the total economy; or they should be suppliers, i.e., potential "bottlenecks" for large segments of the economy.

(b) Target industries should have low productivity as measured by national and/or regional productivity indices, there being essentially three standards of comparison: the industry's own historical performance, the performance of other comparable industries (foreign or domestic), and performance norms derived from theoretical industrial models.

E. Federal Strategies

(1) Strategies for Traditional Targets - Many traditional federal interventions have already been mentioned, are well understood, and hence require no further elaboration here.

(2) Strategies for Alternative Targets - Federal resources should close the gap between a fragmented industry's "fair share" optimal investments in productivity enhancements and the lower levels of actual investments reflective of its members' "free riding". In particular, federal agencies should observe the following agenda:

\*Systemic Innovations

- (a) Sponsor R&D.
- (b) Sponsor trade associations and other "Fund Raiser's" efforts to coordinate the communication and adoption of such innovations.

\*Regulatory Innovations

- (a) Sponsor on-going analysis of productivity impacts of federal regulations designed to achieve social goals other than increased productivity, advocating reforms where appropriate.

\*Unpatentable Independent Innovations

- (a) Sponsor R&D.
- (b) Sponsor demonstration programs (a la Agriculture Extension Service).
- (c) Sponsor the communication of such innovations.

Considerable caution should be exercised by agencies contemplating the support of independent innovations; for an invention which might be intrinsically patentable might become legally unpatentable by the simple fact of its having been developed through federal dollars. The problem is not so much the artificial transformation of what should have been a private good into a public good, as the limited likelihood that successful products will result from such transformations. Private firms attempting

to develop independent innovations do so subject to penalties of market failure; whereas federally sponsored research entails no such risks; hence it is unlikely that the protected judgments of a federal R&D administrator will be as sound as the market-disciplined assessments of his private sector counterparts. It is worth noting that vendors can be expected to "absorb" the costs of communicating (advertising) patentable independent innovations, passing these charges back to their customers in the form of higher sale or lease prices; furthermore, vendors will similarly "absorb" the local preparation costs of such inventions, i.e., they will engage in substantial "hand holding" with their customers in order to insure their product's greater saleability. Finally, it must be conceded that patents offer less than ideal protection against unauthorized utilization of an invention; or put more bluntly, competitors often infringe upon patents rights; hence the proportion of independent innovations falling in the category of public goods is considerably larger than our discussion would indicate.

We conclude by calling attention to a particularly important kind of independent innovation meriting special federal concern: productivity measurement. Sound methodology for productivity measurement at all levels--national, regional, corporate, workplace, and job--is a non-trivial hence costly development, but also an intrinsically unpatentable one: we therefore anticipate its receiving less than optimal support from individual firms in fragmented industries. Yet for lack of reliable indices, management may be misled into believing that productivity problems do not exist when in fact they do, and vice versa.