

# Information Systems in Management Science

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It is the policy of this column (*Interfaces*, Vol. 3, No. 3, May 1973, p. 31) to publish pertinent comments and contributions from all sources. Material is either incorporated into columns or is published as a guest column.

The central issue to all these columns is why and how the management scientist can contribute to the field of information systems. This and the next column describe the personalized insights, experiences and recommendations of a management scientist turned into an information systems executive. The material is being published in its original form with some minor editing.

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## EXPERIENCES OF A MANAGEMENT SCIENTIST IN THE MIS WONDERLAND. PART I

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Writing about information systems in a publication of TIMS and ORSA is certainly an appropriate thing to do. In the late fifties and early sixties I classified myself as an O/R professional. My first major management job in 1959 was to create and run an O/R department. I still have friends who remember my involvement with TIMS publications and TIMS business operations. Then, in 1962 I decided to switch out of O/R as a career and to move into Information Systems Management. This message is a report to my O/R friends about what I have learned in the intervening years. It is also a report on how a quantitatively oriented person looks at the evolution of the information systems industry which, depending on definition, can be described as follows:

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1973 USA \$'s (Billions)

Electronic data processing (people, machines, supplies)	\$ 26
Above, plus all information processing (telephone, filing cabinets, typewriters, etc.)	\$ 68
Above, plus the cost of clerical and administrative labor	\$268
Above, plus the cost of managers, professional and technical labor	\$768

**The early days of EDP**

When I began dealing with information systems in the 1960's, the focus was entirely technology oriented. Hardware accounted for about 65% of the total budget of the function I managed and the budget grew at the astounding rate of 50% compound per annum. Of course, we were starting from a small base and even a high growth rate did not amount to much in the overall expense pattern so that management relaxed its purse with an unbelievable profligacy. Consequently, the exhilaration of growth, expansion, adventure and dreams of directly influencing the running of the organization were a welcome change from the painstakingly slow, constrained experiences of the O/R group I left.

In those days, the premium skill was technological decision making regarding hardware, software and telecommunications trade-offs. The primary issues were people development: How to acquire the cadre of personnel that could feed and manage the explosive manpower growth under conditions of great technological instability. Formal O/R and M/S were irrelevant to managing this problem except that O/R and M/S Conventions became the best hunting grounds for adaptable management talent.

By the end of the decade the technical era of EDP started fizzling out imperceptibly. As budgets started amounting to 1%—2% of corporate sales, or, 15%—30% of corporate profits, or, about 20% of the company's R&D budgets, EDP emerged from the closet of the Finance and Accounting function and started to be viewed as a corporate resource.

Propelling this change was an acceleration in the shift of manpower from productive sectors of the organization into overhead categories, and especially into large scale industrial and government bureaucracies. One way of illustrating this shift dramatically is by using an interpretation of the work force distribution trends as seen by the Stanford University Research Program on the impact of information systems on the American society (Chart 1). I consider this interpretation as perhaps a bit biased in favor of a liberal interpretation what constitutes "information". Nevertheless, a completely separate source of data—the Bureau of Labor Statistics, U.S. Department of Labor—throws a very sharp focus on the 1954—1974 era. It is clear that dramatic

## U. S. LABOR FORCE

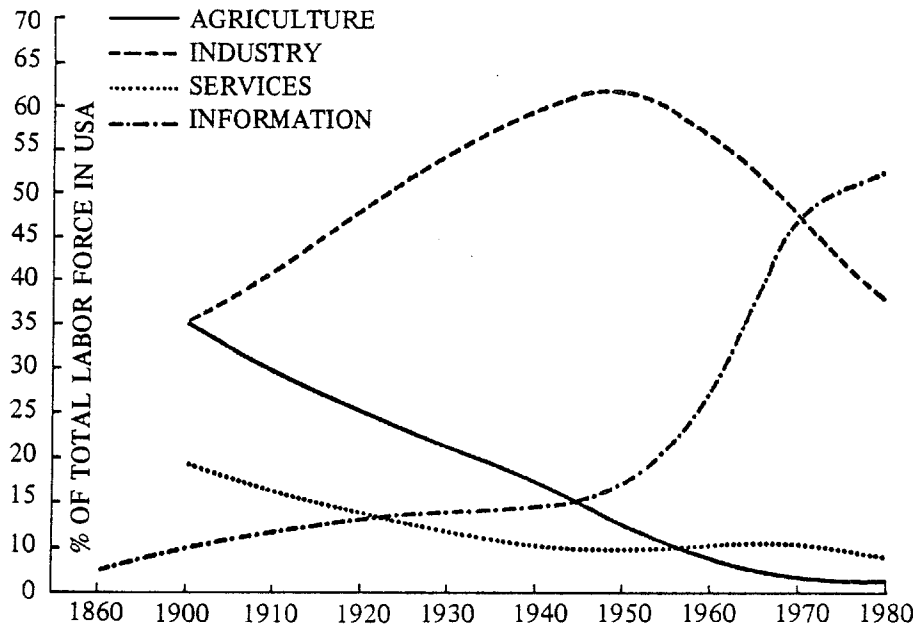


CHART 1. SHIFT IN USA OCCUPATIONAL CATEGORIES 1900-1980  
 shifts in the deployment of the work force have indeed taken place (see Chart 2).

	1954		1974		Δ %
	Numbers	%	Numbers	%	
Professional, Technical	5,705	8.9	12,647	14.0	+5.1
Managers, Officials and Professionals	6,282	9.8	9,124	10.1	+0.3
Clerical	8,397	13.1	15,808	17.5	+4.4
Sales	4,103	6.4	5,691	6.3	-0.1
Craftsmen & Foremen	8,718	13.6	12,014	13.3	-0.3
Industrial Workers	13,269	20.7	15,086	16.7	-4.0
Non-Farm Laborers	4,038	6.3	4,878	5.4	-0.9
Household Help	1,859	2.9	1,264	1.4	-1.5
Service Workers	5,256	8.2	10,840	12.0	+3.8
Farmers & Farm Managers	3,846	6.0	1,626	1.8	-4.2
Farm Laborers	2,628	4.1	1,445	1.6	-2.5
Total	64,103	100.0	90,335	100.0	0

CHART 2. SHIFTS IN OCCUPATIONAL CLASSIFICATIONS.

BUREAU OF LABOR STATISTICS, U. S. DEPARTMENT OF LABOR  
 (EMPLOYMENT IN 000's)

Unfortunately, the eye is not adequately sensitive to rate changes (the rate at which the share of a total varies) and therefore I have extracted in Chart 3 the absolute numbers representing this change. What you see is truly astounding. Between the top three "information" oriented categories we have added over 17 million "white collar" workers, mostly to our industrial and governmental bureaucracies. We

	1954 Population	1954-1974 Change	% Increase
Professional, Technical	5,705	+6,942	+122%
Managers, Officials and Proprietors	6,282	+2,842	+ 45%
Clerical	8,397	+7,411	+ 88%
Sales	4,103	+1,588	+ 39%
Craftsmen & Foremen	8,718	+3,296	+ 37%
Industrial Workers	13,269	+1,817	+ 14%
Non-Farm Laborers	4,038	+ 840	+ 21%
Household Help	1,859	- 595	- 32%
Service Workers	5,256	+5,584	+106%
Farmers & Farm Managers	3,846	-2,220	- 58%
Farm Laborers	2,628	-1,183	- 45%
	64,103	+26,232	+ 41%

CHART 3. 1954-1974 CHANGE IN USA OCCUPATIONAL CATEGORIES. BUREAU OF LABOR STATISTICS (EMPLOYMENT IN 000's)

have more than doubled the professional and technical headcount from its 1954 base. But the headcount base of looking at the overall economic impact is not sufficiently sharp.

Since the support cost of a professional and technical worker in terms of average wages, benefits and associated overheads is about 2½ to 3 times the comparable factor for a clerical worker, 3 to 4 times the comparable factor for an industrial worker and 4 to 5 times that of a service or agricultural worker, the reallocation of the GNP from direct labor to overhead labor implies a relative growth rate for the professional, technical and clerical bureaucracies well in excess of 250% in dollar terms.

The only offsets in resource allocation shifts can be found in the capital asset accounts. Most of the new capital resources went into the agricultural sector (at about \$50,000/capita) and industrial sector (at about \$25,000/capita), whereas the bureaucracy sectors had to satisfy themselves with a paltry \$3,000 per capita for the clerical worker and less than \$1,500 per capita for the professional and technical worker. This is where information systems enter into the picture. Whereas agriculture spends about \$1 of capital charges per dollar of labor, and manufacturing spends \$0.50 in capital charges per dollar of labor, the office sector remained—despite its heavy computer investment programs—highly uncapitalized at only \$0.05 per labor cost in the clerical sector and \$0.01 per labor cost in the professional sector.

#### The 1970's

So we came out of the 1960's, despite frantic computerization, with a steady decline in industry profitability and rational productivity. All the gains made in the highly capitalized and productive sectors of the economy were quickly eaten up by the burgeoning industrial and governmental bureaucracies. All of the glamor of the computer industry and all of the fantastic improvements in information processing technologies that yielded dramatic throughput improvements did not gain us that much on the "bottom line", because the composition of EDP budgets quickly shifted from predominance of the machines to the predominance of labor (see Chart 4).

<u>WEIGHT</u>	<u>FACTOR</u>	<u>PERCENT INFLATION RATE/YEAR</u>
.47	Labor	+ 7 to + 10%
.15	Supplies	+ 7 to + 10%
	Computers	
.14	- CPU	- 15 to - 25%
.10	- Peripherals	- 5 to - 8%
<u>.05</u>	<u>Telecommunications</u>	<u>0 to + 5%</u>
1.00	TOTAL EDP	+ 1.3 to + 1.4%

CHART 4. EDP BUDGET FACTORS—UNIT COST CHANGE RATES

When the devaluation of the dollar started taking place in the early 1970's, inflation rose and real income per capita started declining as the beginning of what appears to be a long term trend; the primary cause was not the deterioration of our exterior national economic posture, but the lack of internal productivity because we do not know how to make information oriented workers more productive.

This is evidenced by the fact that the rate of real growth on EDP budgets of governmental and industrial organizations has clearly declined. Attractive new investment opportunities are increasingly difficult to find, especially since the cost of capital has more than doubled in the intervening decade and the attendant capital funds rationing has put a crimp on the loose purse EDP people enjoyed in the 1960's.

Whither do we go then? Should the future be viewed with dark glasses? What is the role of the MIS professional? What relevance can O/R/MS bring into this situation?

#### The future

I believe that a whole generation of EDP people weaned on easy money, easy projects, easy clerical displacements will have to change justification attitudes. In absolute numbers, growth rates and dollar impact, the target of opportunity for capitalizing labor into inflation resistant task automation is located in the professional, technical, middle management and official infrastructure. The profitability leverage is clearly in this area, because it is so large, so costly and because hardly anything worthwhile has been done to measure its productivity as a start for a productivity improvement program.

The leverage is also high because of its secondary effects. The large growth in the clerical sector, which in absolute terms exceeds any other employment increment, is significantly influenced by the needs of each professional and technical worker to generate support needs. Clerical to professional/technical staffing ratios average between four to eight. One to two million clerical support jobs could be redirected to much more socially productive occupations if the management consumers of support labor were themselves more productive.

The conclusions of this first part of the column then become a prelude to what is to follow: How do we employ known methods and techniques to bring information systems into the forefront of improved effectiveness? How do we manage the most advanced technology that our culture has developed and advance it to serve our needs for improved economic performance? What are the rules to guide us toward achievement of new objectives?

All of these are tough questions, some to be answered in the next column.