

MANAGEMENT OF INFORMATION:  
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This paper discusses the management of information within the context of the information industry and indicates some likely future trends related thereto. The information industry itself is first briefly described. Then the process used in producing information, the organizational structure required for such production, and the legislation relating to the information industry are discussed in turn. Finally, some approaches to solving the problems of the future are suggested.

## 1. INTRODUCTION

The purpose of this paper is to discuss the management of information and indicate some likely future trends relating to such management. Either of two obvious directions could have been chosen for the discussion: the management of information as it related to the internal management of organizations, or the management of information within the context of the information industry. The nature of the discussions relating to each of the above possible choices are not mutually exclusive.

I have chosen the latter perspective. It is broader in scope, bears directly on the question of public administration, and has some essential lessons for the former that might not be apparent if the focus of the discussion were changed.

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<sup>1</sup> Adapted from a paper presented to the Conference of the Institute of Public Administration of Canada, September 7, 1977.

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## 2. THE INFORMATION INDUSTRY

In a study of the information industry published in 1959 [13], Professor Fritz Machlup noted that it was not useful to distinguish between the meanings of the terms "knowledge" and "information". Hence, he accepted the definition that "information is knowledge communicated by others or obtained by personal study and investigation", or alternatively, "knowledge of a special event, situation or the like" and that, in his study, the two words were sufficiently synonymous that it was not necessary to use the redundant phrase "knowledge and information"<sup>1</sup>. For the purposes of this paper, we take the same position. In addition, Professor Machlup took pains to indicate that the industry was not well defined and that statistics relating to the various components were fragmentary, incomplete, and often not relatable.

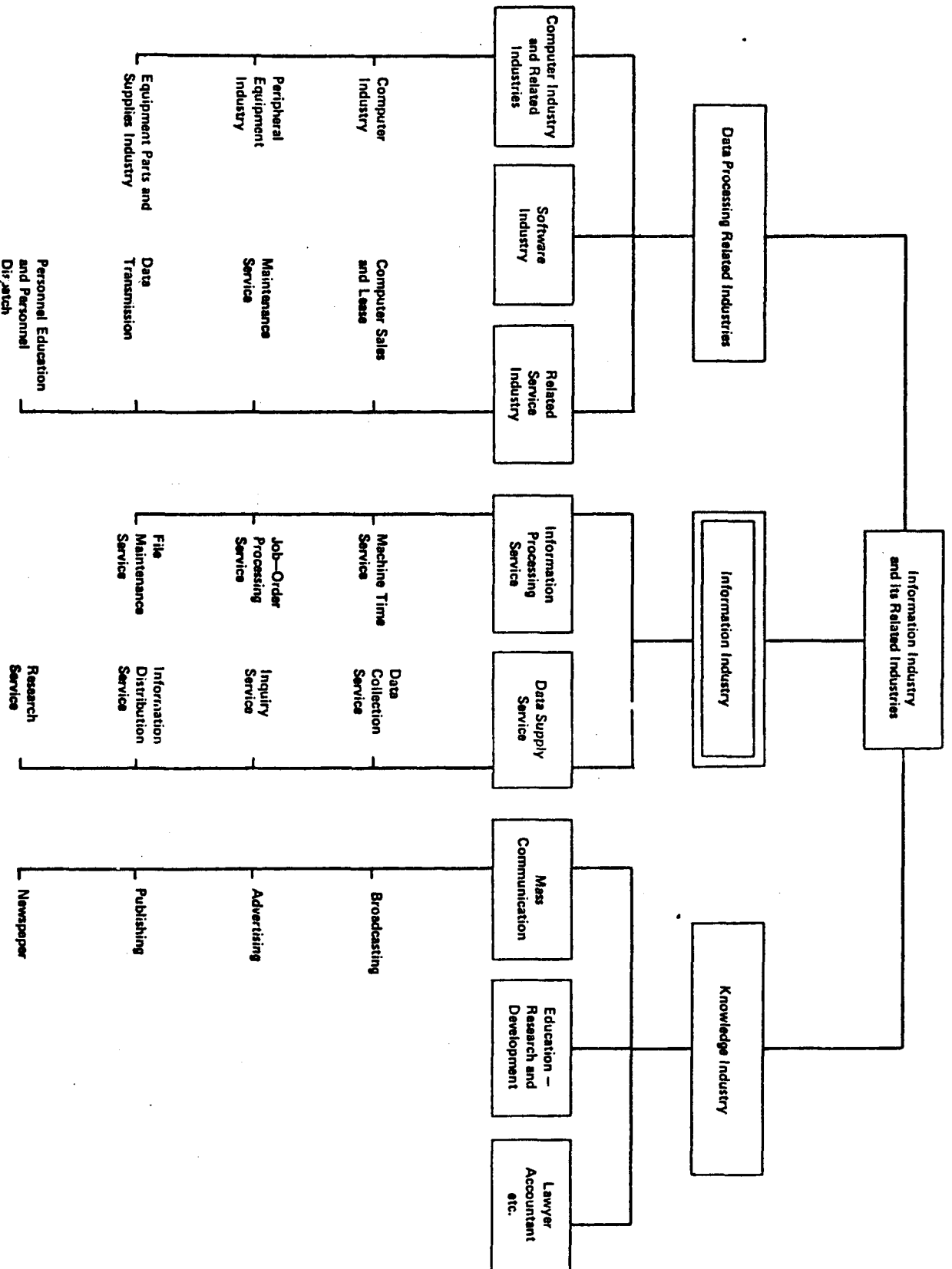
More recently, a Japanese study [21] defined the "information society", albeit primarily in computer terms, to be comprised of the information industry (which includes data supply and information processing services), data processing related industries, and the knowledge industry (which includes mass communications, education, research and development, lawyers and accountants). Figure 1 (taken from Appendix II of [16]) more clearly identifies the scope of the Japanese definition.

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<sup>1</sup> Professor Machlup provides a detailed discussion of the definitional problems relating to such terms as "information" and "knowledge". Drucker [5], Kochen [11] and Ludlow [12] provide alternative definitions. Diener [4] in part distinguishes between "information" and "knowledge" by the type of questions that can be answered by each; "information" can be used to answer such questions as What?, Where?, When? and Who? while the answers to such questions as How?, and Why? require "Knowledge". The arguments in this paper are not contingent upon a precise definition of these terms so the subject is not pursued further here. However, a more complete and detailed exposition of the subject would demand careful consideration of the meaning of these terms.

FIGURE I

# Information Industry and its Related Industries



The lack of clarity with respect to the scope and dimension of the industry, and the absence of any reliable statistical profile of its activities, is a handicap to our more complete understanding<sup>1</sup>. Nevertheless, the more advanced industrial societies are heading towards what have been termed information societies, that is, post-industrial societies in which processing and handling of information constitute the leading sectors of their economies (see, for example, [5] or [20]).

Referring to Figure 1, it becomes immediately apparent that a very vast diversity of firms, organizations and activities are summarized under the umbrella of this information industry. The difficulty that this immediately presents is that there is no unified organization with respect to the industry, nor the availability of an appropriate forum wherein the views, needs and plans of the various components of the industry can be presented and discussed in a manner that would foster some uniformity in terms of standards and development. It has been observed that there is a need for a conceptualization of the industry and the design and promotion of co-ordination of the industry and the design and promotion of co-ordination mechanisms to foster its orderly development. Further, there is a requirement to review existing legislation as it relates to the many facets of this industry in order to ensure that each piece of legislation fits one with the other and, in total, is in appropriate legislation structure within which this industry should operate. See, for example, [18], p. viii, where it is stated that "A key question is how to structure the policymaking process so that the country can begin to develop a national information policy that is comprehensive to the implications of the Information Age".

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<sup>1</sup> Kettle [10] provides an estimate of the size of the Canadian information industry.

This article will describe the developments and plans that are being fostered within Statistics Canada and relate these developments to the many issues that are implied in the above discussion. I hope that such an institutional case study will make the more general discussion of these topics in the literature more concrete and meaningful.

The remainder of this paper is divided into 3 basic parts, the production process used in producing information, the organizational structure required for such production, and the legislation relating to the information industry itself.

### 3. THE PRODUCTION PROCESS

In the past, the typical product of a statistical agency was a fixed set of statistical outputs, normally produced in the form of a hard copy publication, deriving from a specific survey or census. The product originated with a request by one or more users to supply a specified set of information. This information request was translated into a specific collection vehicle, usually a survey, and an organizational entity accompanied by budgetary resources was structured to carry out the total activity. Invariably, as a consequence, the statistical product, its associated survey, and the organizational entity performing the activity, became a fixed reality. The accompanying argument for the necessity for "continuity" in statistical series soon assured this total activity a degree of permanence in the statistical fabric.

Consequently, when new demands for statistical information were received, these demands had to be met either by directing the requestor to a less than perfect existing substitute in the form of a printed publication or incrementally adding another survey, with its attendant organizational unit, to the statistical program.

While there was a continual effort to redirect existing resources in the light of perceived shifting priorities, the changes to existing programs were usually limited by the above-noted rigidities.

The whole question of priority setting within statistical agencies is exacerbated by the nature of the product. Machlup [13] succinctly summarizes the dilemma:

"There are several insurmountable obstacles in a statistical analysis of the knowledge industry. In the first place, there are no physical outputs. Indeed, for most parts of the production of knowledge no possible measure of output can be conceived that would be logically separate from a measure of input; and those relatively rare kinds of knowledge for which independent indices of output could be concocted cannot in any meaningful way be compared, let alone aggregated, with other kinds of knowledge. In addition, most of the services of the knowledge industry are not sold in the market but instead are distributed below cost or without charge, the cost being paid for in part or in full by government (as in the case of public schools), by philanthropists (as in the case of some private schools), and by commercial advertisers (as in the case of newspapers, magazines, radio and television). Hence, we lack the valuations which for most other industries the consumer puts on the product by paying a price for it. There are no "total sales" and no "selling prices".

Because of the non-measurability of the product, the consequent lack of productivity data, and the absence of market prices, one cannot even state with assurance that an increase in the expenditures for knowledge, relative to Gross National Product, will result in more knowledge being provided to society. Even in the few exceptional instances where we do have consumption expenditures in the form of purchases of products at market prices, the heterogeneity of the product makes a quantification of output most difficult.

Thus, while there have been periodic calls to apply the principle of cost/benefit analysis to the priority-setting problem little progress has been made in this area to date and the prospects for any near-term breakthroughs are not great. [19] has a good discussion of the problems and summarizes some of the latest views on this matter.

The implied method of management of information within statistical agencies, explicitly or implicitly identified in the foregoing characterization of their activities have, in the past 25 years, been taking place in an external (and internal) environment that has itself been undergoing a change of revolutionary proportions.

Nanus [17] has described five information revolutions in the history of mankind: language, printing, mass media including TV/radio, computers, and community information facilities, the last representing the whole complex of computer hardware, software databanks, and communication systems operating in an environment where a wide array of information services is available to public and private users, including individuals, on-line in their own environments. The radical changes began with the "fourth information revolution", the introduction of computers. Certainly within the statistical sector of the information industry, the advent of the computer was initially foreseen as the "potential saviour" of the production problems inherent in the manual processes which were then required within mass data processing. On the other hand, many of the industry participants did not anticipate the very radical shift in user behaviour and demand patterns that would simultaneously emerge with the introduction of the computer.

As we all know, the consequences were just the converse. On the production side, the shortage of trained personnel plus the continuing difficulties with computer-software development did not allow the agencies to resolve their production problems as originally envisaged. At the same time,

these difficulties were compounded by the explosion of demand for information occasioned by user access to the computer in conjunction with the influx into the public service and other user organizations of university trained personnel knowledgeable about the computer and associated analytical research techniques.

These developments have led to strenuous efforts on the part of information suppliers to meet the level of demand articulated. In retrospect, we have now reached the stage where decision makers can be inundated with copious quantities of information relating to practically any decision or issue they wish to address. The problem is that for the decision maker the range of choice of data is so extensive that it becomes difficult to make a rational selection of the data/information most appropriate to the decision-making situation.

This situation is exacerbated by the fact that the existing information systems are largely what Churchman ([11], p. 33) has termed "suggestive information systems"<sup>1</sup>. Such "suggestive" systems do not make strong assumptions about how the whole system, to which the information in question relates, ought to work. In the absence of "decisive information systems", where strong assumptions about the whole system are made and courses of action more clearly indicated, there is likely to be a built-in level of frustration for users with existing information systems. This appears to have manifested itself in part in further user data demands of a very specific nature for very specific purposes, with the clear intent to make the information more directly applicable and decisive in the decision-making context. This non-substitutability of data supply has brought about large and growing demand for more and more data in micro-form which are, or appear to be, more specific and, hence, more decisive.



In addition, where data choices had to be made for specific decisions, the plethora of possible choices, even from often admittedly inadequate data, and the inability to consider rationally all of the available data, led to ad hoc, uneven choices in the information that did get used.

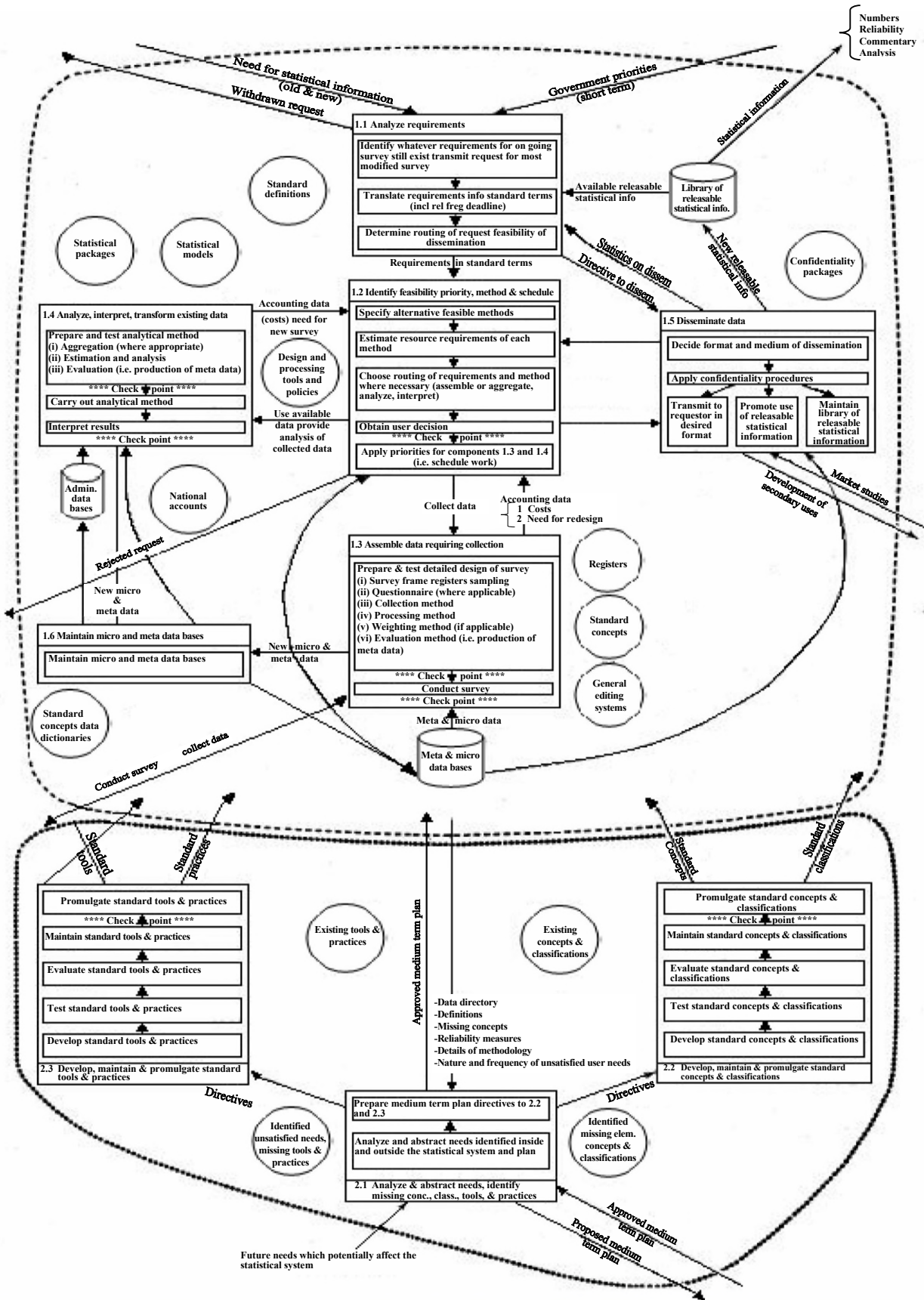
In summary, there is now a growing recognition that it is not more data that are needed but rather a better synthesis of existing data, a synthesis or "packing-down" which would lead to easier, more relevant and informative choices relating to the decision-making situation; alternatively, a synthesis that comes closer to the characteristics of a "decisive information system" in contrast to a "suggestive information system".

Another offshoot of this current situation is the growing demand for more "custom-tailored" information, especially in micro-data form. Such custom tailoring becomes extremely difficult when all of the existing production processes are geared to producing fixed statistical products, often in hard copy form.

The recognition of the above situation by Statistics Canada has led to a fundamental re-thinking of the manner in which we produce our information. The thrust internal to the agency is now to specify, from a systems analysis point of view, the individual functions that must be performed in the statistical process. Figure 2 (taken from [20]) describes such a systems analysis of the statistical production process. While Figure 2 and the subsequent discussion is in the context of the statistical system, I believe appropriate modifications could easily generalize this discussion to deal with the broader problem of management of other forms of information.

It may be noted that, in Figure 2, the systematic analysis of functions to be performed in any statistical process highlights several important requirements for any such statistical system.

Figure 2 Functional Chart of the Statistical System.



First, there must be a function, labelled 1.1 in figure 2, to analyse user requirements and effectively determine what is needed. This is not always a simple task because users often do not have a good idea of precisely what they want, and, even if they do, such a description may not be in a form (standard terms, quality, frequency, scope of population) that is easily translatable into terms used in the statistical system.

Second, there must be a data clearing-house function which makes it possible to search an index listing of the detailed information to be found in existing data bases, using standard terms and definitions, to determine whether the request can be met out of an existing inventory, whether close, acceptable substitutes exist, or whether a new collection activity must be initiated to satisfy the need. If it is determined that the latter alternative is the only course of action, such a request must be considered in the light of the other competing requests and the resources available to meet such requests. In figure 2, this latter function is shown as 1.2.

Naturally, if the data, or close, acceptable substitutes are available, they must be in a form readily available for access and dissemination. This dissemination function is identified as function 1.5.

Several other functions are included in figure 2. The survey or census design and the actual collection of the data is shown as function 1.3, and the analysis and interpretation of the data collected is function 1.4. An important intervening point is represented by function 1.6, the maintenance of micro and meta data bases. These data bases result from the collection process and represent the clean edited micro data series obtained in the collection process plus the meta data which describe the characteristics of each micro data series, including name, definitions, scope, frequency, measures of quality, etc. It is these micro and meta data bases that represent the true raw material for analysis and publication of information and which are, collectively, the data capital resource about which statistical agencies in the future must be crucially concerned. Only through the conscious production of such micro and meta data, under conditions of rigid

quality control, can the necessary raw material required for custom-tailored products and meaningful analysis be generated.

The old concept of producing a predetermined finished product must be supplanted by the idea of manufacturing common sub-components that can be assembled in many ways in order to produce multiple end-products. Such an approach not only promises great efficiencies in the direct costs of operations but also a potential significant reduction in the indirect costs inherent in the response burden of data collection.

The bottom half of figure 2, representing functions 2.1, 2.2, and 2.3, relate to the planning process and the development, maintenance and promulgation of standard concepts and classifications, tools and practices.

Traditionally, all of the functions just described were handled by each survey group within statistical agencies. Naturally, over time and between groups, the functions were not always handled in an even, uniform manner, and the priorities attached to each function varied considerably. In other instances, with this survey-by-survey approach, it was not possible to handle other functions at all.

#### 4. THE ORGANIZATIONAL ARRANGEMENTS

The foregoing discussion has focused on the process of production and has not addressed the question of how such a process is to be organized. There are two aspects to the organization of such a statistical system in Canada, namely the organization internal to Statistics Canada and the organization of all other components in the system.

Internal to Statistics Canada, the functions explicitly identified in figure 2 are being organized on the basis of several basic principles. First, the concept "sphere of observation" has been coined. Four specific examples of spheres of observation are the business sector, the household sector, the agriculture sector, and the public institutions sector, the last providing statistics on such services as justice, education, health and government.

The concept "sphere of observation" connotes two aspects. First, it is a distinct phenomenon about which information is desired in its own right, not only for the purposes of understanding the entity itself, but because programs relating specifically to the entity exist and policy analysis and decision-making revolve around such entities. Second, each sphere of observation represents a "respondent universe" from which information is sought and for which the information to be collected must be integrable and reasonably balanced in terms of coverage.

While one may wish to formulate issues and undertake analysis in terms of a single sphere of observation, issues for which information is sought increasingly span more than one sphere of observation. Thus, the concept, "sphere of observation", is usefully viewed as a construct focused more on collection and the issue of integrability of data, rather than the concern for analysis, although the latter is not ignored in this model.

In the present organization of the bureau, organizational units have already been assembled into "spheres of observation", and considerable progress has also been made in allocating, within the latter, organizational responsibility for the operations and analysis functions respectively.

The operations group(s) will be in charge of function 1.3, namely survey design and data collection, relating to a particular sphere of observation. This grouping will design surveys and collect data according to pre-determined specifications and will be responsible for producing the data, on the basis of clearly defined quality control standards, up to the point of providing the clean micro-data and meta data for the data bases identified in function 1.6.

The data content and analysis group(s) will be responsible for data analysis, interface with the user community, analysis of data user needs and provision of specifications for such data needs, for purposes of survey work. The data analysis groups will be organized according to appropriate user groupings and will be expected to know enough about the relevant area of user concern

so that the user can obtain the data and analysis desired but also to permit the analyst to act as a true consultant to the user.

Such analyst groupings may be organized around issues of concern that span more than one "sphere of observation". For example, labour market analysis must draw upon information collected from virtually all of the "spheres of observation". In order to be able to do this, the compatibility and integrability of the data must be established at the specification stage in the survey design process, and all the relevant data relating to the labour market contained in the micro and meta data bases identified in function 1.6 must be accessible to the group.

The third component, the program control group, which does not yet have explicit organizational recognition, will be responsible for function 1.2 and for ensuring that adequate inputs are provided for function 2. The program control group is charged with the responsibility of controlling the complete "information collection program relating to its sphere of observation", ensuring the necessary integrability of the data to be collected, the adherence to standards and production quality, and introducing and ensuring that a proper balance is maintained in the collection of various components of information from that "sphere of observation".

Three other points should be noted. First, the organization above is based on the principle that interfaces across organizational boundaries should be as simple as possible and, if complicated interfaces are required, they should be kept internal to an organization where the problems are better understood and the human contacts are presumably better established. Thus, in the collection phase, the interface between a given respondent community and the collectors of data is simplified; at the same time, an attempt is made to organize the analytical component so that it best conforms to well defined user groupings and interests, with the object of facilitating "one-stop" shopping on their part.

Second, it was noted earlier that there was a continuing escalating demand for information, particularly in micro-data forms, but that this demand was accompanied by an increasing frustration on the part of the user who could not obtain the information most relevant to the problem, while at the same time being overwhelmed by the supply of existing data, making it virtually impossible to use it all in the decision-making process; further any selection process was ad-hoc and uneven. This issue is dealt with organizationally in several ways. First, in function 1.1 where requirements are analyzed, it should be possible to introduce some aid to data selection. Second, the clearing house function documenting what is available will help in this selection process.

Finally, the micro-data bases, combined with the analytical groups, will permit much more "custom work" to be done for users, and their expertise in modelling and the use of other analytical techniques, combined with data specifically designed to be integratable and comparable, should allow the process of "packing-down" the data into fewer signals, each with more informational content, to be achieved. This latter development will also simplify the selection process.

Further, the analytical function, particularly as it related to modelling and other techniques, embodies the kinds of assumptions, in addition to the raw data, that translate the data base, in Professor Churchman's words, from a "suggestive" data base to a "decisive" data base.

The foregoing discussion of the production process and the internal organization of Statistics Canada has emphasized process and underplayed the specific forms of product to be produced. However, it should be perfectly clear to all concerned that in spite of the sweeping, all-inclusive mandate given to Statistics Canada in the Statistics Act, it is virtually impossible to expect the agency to meet all of the needs of the total potential user clientele.

The current thinking internal to Statistics Canada is that the functions of the agency need to be explicitly identified and operationally defined. These functions should at least include:

- (a) providing the necessary statistical capacity (statistical vehicles) capable of carrying out the level of information production required of the agency;
- (b) to generate and maintain an agency data base(s) of clean micro and meta data files essential for the production of a set of "national statistics" and its associated publication program;
- (c) the capability to respond to special user requests which draw upon, in an essential way, the information/data contained in the agency data base(s);
- (d) provide sufficient but limited statistical capacity, especially in the area of survey design and collection, to satisfy special user ad-hoc requests for information/data not contained in the existing agency data base(s);
- (e) help foster, coordinate, provide and maintain the necessary analytical capacity and data clearing house facilities required to provide an efficient information/data search facility for users;
- (f) through intellectual leadership and coordination help conceptualize, design, and foster the construction of a total systematic or holistic approach to the management of information within the context of the information industry in Canada.



Several issues arise from this partial listing of functions. First, Statistics Canada cannot do everything in the way of meeting the informational needs of the user community. Emphasis is given above to the satisfaction of national needs with the proviso that where special needs can be met from the same micro data base, capacity will be available to handle this demand. Such a statement leaves open the question of what level of capacity will be provided and what cost recovery or pricing policies would apply.

In addition, there is a provision in this suggested scheme to do some collection, albeit limited, of data for special user groups utilizing our existing statistical vehicles. In other words, the proposal would be to have a regular core of national statistics from which national needs are met and, in addition, have a limited "custom-product" capacity to serve special user requests.

Clearly such a policy would signal the need for alternative statistical capacity, whether it be for collection or analysis, located outside of Statistics Canada. Such statistical capacity could reside with other levels of government or be located in the private sector.

To the extent that some or all of the statistical collection vehicles of Statistics Canada could be geographically located in the regions or provinces of the country, arrangements could likely be developed whereby such capacity could be utilized and shared with other levels of government, thereby in part meeting their needs for more specific local products. And presumably to some extent it could, in special circumstances, also be available to service private sector requirements.

In such cooperative or shared ventures, the intent would clearly be, where feasible, to employ concepts, standards, definitions, and survey design procedures which would permit the data collected to be utilized in more than one application and by more than one user group.

Furthermore, the intent is clear from the above suggestions that such arrangements would allow the promotion and fostering of an information industry that is privatized to the greatest degree possible and/or desirable and in which no single party has an unduly dominant role<sup>1</sup>. There are clearly basic informational requirements that must be performed by a government agency. But similarly there are specific functions as well as products that are probably better handled privately. The above conceptual approach to the statistical process and the accompanying organizational arrangements would facilitate the fostering of this private involvement wherever possible within the context of an overall conceptual, organizational approach to the total requirements.

Specifically, various functions in figure 2 can be organizationally and geographically distributed throughout the industry with, in some cases, groups of functions being performed solely by one organization, and in other cases, a single function being carried out by a large number of organizations.

If this conceptualized approach is followed and all parties adhere to certain common practices, relating to standards, concepts, definitions, survey design and subsequent processing, the resulting micro and meta data bases acquire a potential usefulness for all users within the system.

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Diebold [3] has observed that "No matter how we re-organize things to produce management efficiency, nothing is going to keep increasingly unproductive, labour-intensive public services in important areas of life from declining .... Most of our really important activities - education, public transport, medical service distribution, the running of cities - don't rely on advanced technology and therefore decline in quality and their costs spiral up.

The real problem here is not to try to force technology and modern management through the system ... but to see if we can't find ways to create the kind of demand that stimulates innovation and high productivity in the private sector".

The suggested approach to statistical information management discussed in this paper allows such potential developments as prescribed above by Diebold to take place to the extent that it is felt to be feasible and desirable.

Such data bases, irrespective of organizational or geographic location, if interconnected by a computer network, create the potential for a truly useful reservoir of information for the decision-maker both inside and outside of government. For example, it should be possible for a user, utilizing a high-level computer language, to request information from any node in such a network. The request should automatically generate a search of the data clearing house mechanism to locate the information desired, the required data bases should be accessed automatically, the appropriate data massaged into the form desired, and transmitted to the user at the point where the initial request was made. On the dissemination side, CANSIM, the Statistics Canada computerized data base is an embryonic version of a very primitive mode. The realization of a fuller model is dependent upon the development of the organizational arrangements referred to, plus the appropriate legislative structure to support such a statistical information system design.

## 5. LEGISLATIVE POLICIES FOR THE INFORMATION INDUSTRY

The technology required for the realization of the previous scenario is available today. The literature provides an extensive discussion of this technology and since, in my view, this aspect will not be one of the constraining factors in future trends, it is not treated further here.

The fundamental determinants of future developments are threefold: the social attitudes of the Canadian people towards information and its management within our society, the legislation required to embody these public attitudes and views into practice, and the "people problems" inherent in any organizational and cooperative ventures necessary for the implementation of such practices.

The societal issues relate to privacy, confidentiality, compulsion versus voluntarism in response, and the question of freedom of information. The resolution of these issues in turn will determine the outcome of such subsidiary issues as the degree of sharing of information, who has access

to information, who must supply information, the use to which various sets of information can and will be put, the use of common identifiers, questions of data-linkage, the level of response burden acceptable in the system, who will control the system, how it will be controlled, and the forms of checks and balances necessitated by any particular organizational form.

Specific legislation in Canada relating to such issues includes the recently enacted human rights legislation, the proposed freedom of information legislation, statistic acts in general and the Federal Statistics Act in particular. Other legislation, less often identified with these issues but nevertheless relevant, include copyright laws as they relate to photocopying, data banks, computer software protection, information exchange and third-party record keeping; in fact the whole concept of public and private property. Trade secrets, patent laws, the impact of information sharing on the publication industry and standardization of computer hardware technology are additional concerns. In summary, the level of public understanding of such fundamental issues as privacy and confidentiality and the final determination of the preferred public position on such issues, reflected in such laws as the now existing human rights legislation and the proposed freedom of information legislation will structure the range of organizational choices within the context of the previous scenario.

In order to ensure that the optimum choice is made from the point of view of the public, substantial public discussion and debate of the underlying issues must take place and the legislative framework within which the information industry needs to operate must openly and fairly reflect the public's opinion on these matters.

Substantive work designed to address these issues has been proceeding in a number of countries. (For example see [18], [20], [1], [15]). However, a current dilemma in many countries is captured in the remarks of the Conference Board (see [16], p. 6):

"Within the [US] Federal Government, policy responsibility relating to the information industry is still distributed and fragmented among different agencies, precluding the formulation of comprehensive and coherent "alternative" policies that extend beyond the needs of a particular agency".

Such a dilemma is further exacerbated in a country like Canada by the fact that the concept of an information industry is still ill-defined. For example, Mauerhoff ([15], p. 35), has recently observed "in Canada the concept of an information industry is still fragmented. There is a publication industry, a broadcast industry, a computer industry, a telecommunications industry, but no attempt has been made to include them in a single framework with information as the common denominator". Further, few writers have given explicit recognition to the role of the statistical system in such an industry. One notable exception is Kettle ([10], p. 40), who explicitly identified Statistics Canada as part of the "Professional Services" sub-component of the Canadian information industry. However, not only will the statistical system of the future represent an increasingly effective source of information in its own right within the industry, on the basis of data obtained from surveys, censuses, and increasingly from administrative data bases, but the data clearing house function of the statistical system identified in figure 2, will also play a crucial role in any such industry.

The data clearing house function of the future must provide a mechanism whereby the numeric and qualitative information within statistical agencies can be cross-referenced and associated with the textual material in books, articles, periodicals, and scholarly works located in libraries. While, in the first stage of development of such clearing houses, perhaps only an index listing of information will be available, ultimately there will be a requirement for an "intelligent search and selection" requirement to be built in. In the absence of such devices, the deluge of information will render the system grossly inefficient at best and inoperable at worst. (See [1], p. 30).

The foregoing discussion has highlighted the need for an overall view of the legislative structure of the information industry. What has not been emphasized is the equally important need to ensure that the organizational arrangements take account of the need for the services of this industry to be as wide open as possible and available to society as a whole.

The respondent, who supplies the information in the system, has often been in the past an individual or small organization who has not had either the resources or the capacity to benefit from the information within the system. These respondents have been the "information-poor", but the information that they have supplied has often been used by those who do access the information system, "the information-rich", in ways that often have been interpreted by the small organizations as detrimental to their interests.

Unless the system can be developed in an open manner, in which information is available to all in an accepted, equitable fashion and in which, through the provision of facilities and training, the "information-poor" are given equitable treatment, the source of the information to be put into the system could well dry up.

Finally, the foregoing discussion has highlighted the diversity of functions, activities, and organizations within the information industry on the one hand, and the need for a common approach to concepts, definitions, terminology, organization, conduct and behaviour on the other. Since so many different organizations with different levels of authority and mandates must come together in this industry, one must ask what the possibility of achieving some kind of co-ordinated approaches really are.

Arrow ([2], pp. 68-70) has summarized the dilemma especially in those instances where the price system does not work well<sup>1</sup>:

"authority is needed to achieve a co-ordination of the activities of the members of the organization ... An organization whose members have identical interests and identical information will be one in which spontaneous consensus would be efficient ... When either interests or information differ among the members of the organization, the costs of achieving consensus rise, and hence the value of consensus as a mode of organizational decision-making declines relative to that of authority".

These remarks suggest that in the absence of co-ordinated legislation designed to promote the orderly development of this industry and the provision of intellectual leadership in the conceptualization and design of the overall organizational approach, the orderly, uniform development of the industry will be difficult to achieve. If, on the other hand, such legislation and conceptualization can be structured to promote individual initiatives that are both in self-interest of the individual organization within the industry and in the collective interest of all the other participants, the proper development of the industry will be assured.

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<sup>1</sup> Note that Professor Machlup identified the absence of an effective pricing system as a major characteristic of the knowledge industry. [13], p. 8.

## 6. CONCLUSIONS

The full realization of major organizational trends and developments required within the information industry must await the partial or complete outcome of public debate on the issues involved and the related legislative changes.

In the meantime, the national statistical agency is attempting to re-structure its internal activities along the functional lines outlined in figure 2, define its mandate in operational terms, and compile a set of medium term plans consistent with such a mandate. Emphasis is being given to the process to be managed with a clear attempt to structure the substantive work content in such a way that more meaningful, multi-purpose uses, better suited to user needs, will become a statistical reality.

The functional approach to the production of information and the conceptual approach to its organization offers a very robust model; robust in the sense that, from the point of view of the statistical agency, just about any position taken by society on the issues of privacy, confidentiality and the other areas of concern can be accommodated within the model. Naturally, the degree of privatization of functions and the degree of sharing of information is heavily dependent on the particular position taken, but the general approach described can, it is hoped, accommodate a wide range of possible public positions in these matters. I also feel that the management of non-statistical information can be usefully approached on the basis of the concepts discussed.

In addition, in keeping with the expressed need for openness in the system, in order to ensure better public understanding and acceptance of our role in the management of information, efforts are being made to develop mechanisms that will effectively meet these perceived needs of openness, fairness and equity within the system.



Recognition is also given to the problem of escalating quantities of information. Clearly the steps outlined here to deal with this problem fall short of providing a full solution. The whole area of decision-making and the development of theories and approaches to decision-making have been completely omitted from this discussion.

In part, the suggestions by Churchman ([11], p. 33) with respect to a "decisive data base" go part way to meet this concern. However, people like Marschak [14] clearly see the need to include, in a much more fundamental way, the issue of approaches to decision-making in any discussion and design of a rational information system.

This does not necessarily mean that the system must be geared to produce only sophisticated, technical information relating to highly scientific subjects. As Kochen has observed ([1], p. 195):

"Though that is important, it does not compare with the seriousness of the day-to-day problems faced by community leaders and individuals as non-specialists, and with which information systems could perhaps be expected to help. Much of the knowledge and understanding they need or get is not scientific".

But, in the final analysis, the crucial issue remains: "the most serious shortcomings ... are to be found in the management and organization of the services engaged in the collection, processing and redistribution of information" ([1], p. 28). The suggestions put forward in this paper address many of those issued directly and offer a promising direction of development in resolving them.

#### RESUME

L'auteur examine la gestion de l'information dans le contexte de l'industrie de l'information et présente quelques tendances futures possibles s'y rattachant. L'industrie elle-même est brièvement décrite au début. L'auteur examine ensuite successivement la production de l'information, la structure organisationnelle nécessaire à cette production et la législation qui s'y rapporte. Enfin, l'auteur propose quelques solutions aux problèmes de l'avenir.

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