Organization Design: An Information Processing View

Author(s): Jay R. Galbraith

Source: *Interfaces*, May, 1974, Vol. 4, No. 3 (May, 1974), pp. 28-36

Published by: INFORMS

Stable URL: https://www.jstor.org/stable/25059090

ORGANIZATION DESIGN:
AN INFORMATION PROCESSING VIEW

JAY R. GALBRAITH
European Institute for Advanced Studies

JAY R. GALBRAITH is currently serving as Professor of Organizational Behavior at the European Institute for Advanced Studies in Management. Formerly, he was affiliated with the Sloan School of Management, M.I.T. Professor Galbraith is interested in the design of organization structures and his most recent work is *Designing Complex Organizations* (Addison-Wesley, 1973).

The Information Processing Model

A basic proposition is that the greater the uncertainty of the task, the greater the amount of information that has to be processed between decision makers during the execution of the task. If the task is well understood prior to performing it, much of the activity can be preplanned. If it is not understood, then during the actual task execution more knowledge is acquired which leads to changes in resource allocations, schedules, and priorities. All these changes require information processing *during* task performance. Therefore *the greater the task uncertainty, the greater the amount of information that must be processed among decision makers during task execution in order to achieve a given level of performance.* The basic effect of uncertainty is to limit the ability of the organization to preplan or to make decisions about activities in advance of their execution. Therefore it is hypothesized that the observed variations in organizational forms are variations in the strategies of organizations to 1) increase their ability to preplan, 2) increase their flexibility to adapt to their inability to preplan, or, 3) to decrease the level of performance required for continued viability. Which strategy is chosen depends on the relative costs of the strategies. The function of the framework is to identify these strategies and their costs.

The Mechanistic Model

This framework is best developed by keeping in mind a hypothetical organization. Assume it is large and employs a number of specialist groups and resources in providing the output. After the task has been divided, into specialist subtasks, the problem is to integrate the subtasks around the completion of the global task. This is the problem of organization design. The behaviors that occur in one subtask cannot be judged as good or bad *per se*. The behaviors are more effective or ineffective depending upon the behaviors of the other subtask performers. There is a design problem because the executors of the behaviors cannot communicate with all the roles with whom they are interdependent. Therefore the design problem is to create mechanisms that permit coordinated action across large numbers of interdependent roles. Each of these mechanisms, however, has a limited range over which it is effective at handling the information requirements necessary to coordinate the interdependent roles. As the amount of uncertainty increases, and therefore in-

formation processing increases, the organization must adopt integrating mechanisms which increase its information processing capabilities.

1. Coordination by Rules or Programs

For routine predictable tasks March and Simon have identified the use of rules or programs to coordinate behavior between interdependent subtasks [March and Simon, 1958, Chap. 6]. To the extent that job related situations can be predicted in advance, and behaviors specified for these situations, programs allow an interdependent set of activities to be performed without the need for inter-unit communication. Each role occupant simply executes the behavior which is appropriate for the task related situation with which he is faced.

2. Hierarchy

As the organization faces greater uncertainty its participants face situations for which they have no rules. At this point the hierarchy is employed on an exception basis. The recurring job situations are programmed with rules while infrequent situations are referred to that level in the hierarchy where a global perspective exists for all affected subunits. However, the hierarchy also has a limited range. As uncertainty increases the number of exceptions increases until the hierarchy becomes overloaded.

3. Coordination by Targets or Goals

As the uncertainty of the organization's task increases, coordination increasingly takes place by specifying outputs, goals or targets [March and Simon, 1958, p. 145]. Instead of specifying specific behaviors to be enacted, the organization undertakes processes to set goals to be achieved and the employees select the behaviors which lead to goal accomplishment. Planning reduces the amount of information processing in the hierarchy by increasing the amount of discretion exercised at lower levels. Like the use of rules, planning achieves integrated action and also eliminates the need for continuous communication among interdependent subunits as long as task performance stays within the planned task specifications, budget limits and within targeted completion dates. If it does not, the hierarchy is again employed on an exception basis.

The ability of an organization to coordinate interdependent tasks depends on its ability to compute meaningful subgoals to guide subunit action. When uncertainty increases because of introducing new products, entering new markets, or employing new technologies these subgoals are incorrect. The result is more exceptions, more information processing, and an overloaded hierarchy.

Design Strategies

The ability of an organization to successfully utilize coordination by goal setting, hierarchy, and rules depends on the combination of the frequency of exceptions and the capacity of the hierarchy to handle them. As the task uncertainty increases the organization must again take organization design action. It can proceed in either of two general ways. First, it can act in two ways to reduce the amount of information that is processed. And second, the organization can act in two ways to increase its capacity to handle more information. The two methods for reducing the need for information and the two methods for increasing processing capacity are shown schematically in Figure 1. The effect of all these actions is to reduce the number of exceptional

cases referred upward into the organization through hierarchical channels. The assumption is that the critical limiting factor of an organizational form is its ability to handle the non-routine, consequential events that cannot be anticipated and planned for in advanced. The non-programmed events place the greatest communication load on the organization.

1. Rules and Programs
2. Hierarchical Referral
3. Goal Setting

4. Creation of Slack Resources

5. Creation of Self-Contained Tasks

6. Investment in Vertical Information Systems

7. Creation of Lateral Relations

Reduce the Need for Information Processing

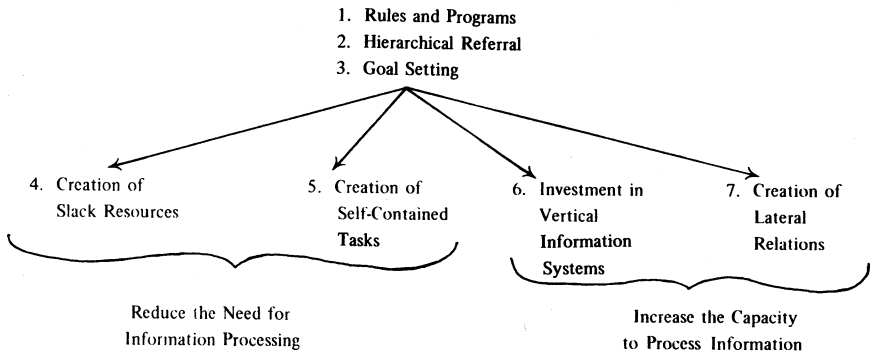Increase the Capacity to Process Information

FIGURE 1. Organization Design Strategies

1. *Creation of Slack Resources*

As the number of exceptions begin to overload the hierarchy, one response is to increase the planning targets so that fewer exceptions occur. For example, completion dates can be extended until the number of exceptions that occur are within the existing information processing capacity of the organization. This has been the practice in solving job shop scheduling problems [Pounds, 1963]. Job shops quote delivery times that are long enough to keep the scheduling problem within the computational and information processing limits of the organization. Since every job shop has the same problem standard lead times evolve in the industry. Similarly budget targets could be raised, buffer inventories employed, etc. The greater the uncertainty, the greater the magnitude of the inventory, lead time or budget needed to reduce an overload.

All of these examples have a similar effect. They represent the use of slack resources to reduce the amount of interdependence between subunits [March and Simon, 1958, Cyert and March, 1963]. This keeps the required amount of information within the capacity of the organization to process it. Information processing is reduced because an exception is less likely to occur and reduced interdependence means that fewer factors need to be considered simultaneously when an exception does occur.

The strategy of using slack resources has its costs. Relaxing budget targets has the obvious cost of requiring more budget. Increasing the time to completion date has the effect of delaying the customer. Inventories require the investment of capital funds which could be used elsewhere. Reduction of design optimization reduces the performance of the article being designed. Whether slack resources are used to reduce information or not depends on the relative cost of the other alternatives.

The design choices are: 1) among which factors to change (lead time, overtime, machine utilization, etc.) to create the slack, and 2) by what amount

should the factor be changed. Many operations research models are useful in choosing factors and amounts. The time-cost trade off problem in project networks is a good example.

2. Creation of Self-Contained Tasks

The second method of reducing the amount of information processed is to change the subtask groupings from resource (input) based to output based categories and give each group the resources it needs to supply the output. For example, the functional organization could be changed to product groups. Each group would have its own product engineers, process engineers, fabricating and assembly operations, and marketing activities. In other situations, groups can be created around product lines, geographical areas, projects, client groups, markets, etc., each of which would contain the input resources necessary for creation of the output.

The strategy of self-containment shifts the basis of the authority structure from one based on input, resource, skill, or occupational categories to one based on output or geographical categories. The shift reduces the amount of information processing through several mechanisms. First, it reduces the amount of output diversity faced by a single collection of resources. For example, a professional organization with multiple skill specialties providing service to three different client groups must schedule the use of these specialties across three demands for their services and determine priorities when conflicts occur. But, if the organization changed to three groups, one for each client category, each with its own full compliment of specialties, the schedule conflicts across client groups disappears and there is no need to process information to determine priorities.

The second source of information reduction occurs through a reduced division of labor. The functional or resource specialized structure pools the demand for skills across all output categories. In the example above each client generates approximately one-third of the demand for each skill. Since the division of labor is limited by the extent of the market, the division of labor must decrease as the demand decreases. In the professional organization, each client group may have generated a need for one-third of a computer programmer. The functional organization would have hired one programmer and shared him across the groups. In the self-contained structure there is insufficient demand in each group for a programmer so the professionals must do their own programming. Specialization is reduced but there is no problem of scheduling the programmer's time across the three possible uses for it.

The cost of the self-containment strategy is the loss of resource specialization. In the example, the organization foregoes the benefit of a specialist in computer programming. If there is physical equipment, there is a loss of economies of scale. The professional organization would require three machines in the self-contained form but only a large time-shared machine in the functional form. But those resources which have large economies of scale or for which specialization is necessary may remain centralized. Thus, it is the degree of self-containment that is the variable. The greater the degree of uncertainty, other things equal, the greater the degree of self-containment.

The design choices are the basis for the self-contained structure and the number of resources to be contained in the groups. No groups are completely self-contained or they would not be part of the same organization. But one product divisionalized firm may have eight of fifteen functions in the division while another may have twelve of fifteen in the divisions. Usually accounting,

finance, and legal services are centralized and shared. Those functions which have economies of scale, require specialization or are necessary for control remain centralized and not part of the self-contained group.

The first two strategies reduced the amount of information by lower performance standards and creating small autonomous groups to provide the output. Information is reduced because an exception is less likely to occur and fewer factors need to be considered when an exception does occur. The next two strategies accept the performance standards and division of labor as given and adapt the organization so as to process the new information which is created during task performance.

3. *Investment in Vertical Information Systems*

The organization can invest in mechanisms which allow it to process information acquired during task performance without overloading the hierarchical communication channels. The investment occurs according to the following logic. After the organization has created its plan or set of targets for inventories, labor utilization, budgets, and schedules, unanticipated events occur which generate exceptions requiring adjustments to the original plan. At some point when the number of exceptions becomes substantial, it is preferable to generate a new plan rather than make incremental changes with each exception. The issue is then how frequently should plans be revised — yearly, quarterly, or monthly? The greater the frequency of re-planning the greater the resources, such as clerks, computer time, input-output devices, etc., required to process information about relevant factors.

The cost of information processing resources can be minimized if the language is formalized. Formalization of a decision-making language simply means that more information is transmitted with the same number of symbols. It is assumed that information processing resources are consumed in proportion to the number of symbols transmitted. The accounting system is an example of a formalized language.

Providing more information, more often, may simply overload the decision maker. Investment may be required to increase the capacity of the decision maker by employing computers, various man-machine combinations, assistants-to, etc. The cost of this strategy is the cost of the information processing resources consumed in transmitting and processing the data.

The design variables of this strategy are the decision frequency, the degree of formalization of language, and the type of decision mechanism which will make the choice. This strategy is usually operationalized by creating redundant information channels which transmit data from the point of origination upward in the hierarchy where the point of decision rests. If data is formalized and quantifiable, this strategy is effective. If the relevant data are qualitative and ambiguous, then it may prove easier to bring the decisions down to where the information exists.

4. *Creation of Lateral Relationships*

The last strategy is to employ selectively joint decision processes which cut across lines of authority. This strategy moves the level of decision making down in the organization to where the information exists but does so without reorganizing around self-contained groups. There are several types of lateral decision processes. Some processes are usually referred to as the informal organization. However, these informal processes do not always arise spontaneously out of the needs of the task. This is particularly true in multi-national

organizations in which participants are separated by physical barriers, language differences, and cultural differences. Under these circumstances lateral processes need to be designed. The lateral processes evolve as follows with increases in uncertainty.

4.1. *Direct Contact* between managers who share a problem. If a problem arises on the shop floor, the foreman can simply call the design engineer, and they can jointly agree upon a solution. From an information processing view, the joint decision prevents an upward referral and unloads the hierarchy.

4.2. *Liaison Roles* — when the volume of contacts between any two departments grows, it becomes economical to set up a specialized role to handle this communication. Liaison men are typical examples of specialized roles designed to facilitate communication between two interdependent departments and to bypass the long lines of communication involved in upward referral. Liaison roles arise at lower and middle levels of management.

4.3. *Task Forces*. Direct contact and liaison roles, like the integration mechanisms before them, have a limited range of usefulness. They work when two managers or functions are involved. When problems arise involving seven or eight departments, the decision making capacity of direct contacts is exceeded. Then these problems must be referred upward. For uncertain, interdependent tasks such situations arise frequently. Task forces are a form of horizontal contact which is designed for problems of multiple departments.

The task force is made up of representatives from each of the affected departments. Some are full-time members, others may be part-time. The task force is a temporary group. It exists only as long as the problem remains. When a solution is reached, each participant returns to his normal tasks.

To the extent that they are successful, task forces remove problems from higher levels of the hierarchy. The decisions are made at lower levels in the organization. In order to guarantee integration, a group problem solving approach is taken. Each affected subunit contributes a member and therefore provides the information necessary to judge the impact on all units.

4.4. *Teams*. The next extension is to incorporate the group decision process into the permanent decision processes. That is, as certain decisions consistently arise, the task forces become permanent. These groups are labeled teams. There are many design issues concerned in team decision making such as at what level do they operate, who participates, etc. [Galbraith, 1973, Chapters 6 and 7]. One design decision is particularly critical. This is the choice of leadership. Sometimes a problem exists largely in one department so that the department manager is the leader. Sometimes the leadership passes from one manager to another. As a new product moves to the market place, the leader of the new product team is first the technical manager followed by the production and then the marketing manager. The result is that if the team cannot reach a consensus decision and the leader decides, the goals of the leader are consistent with the goals of the organization for the decision in question. But quite often obvious leaders cannot be found. Another mechanism must be introduced.
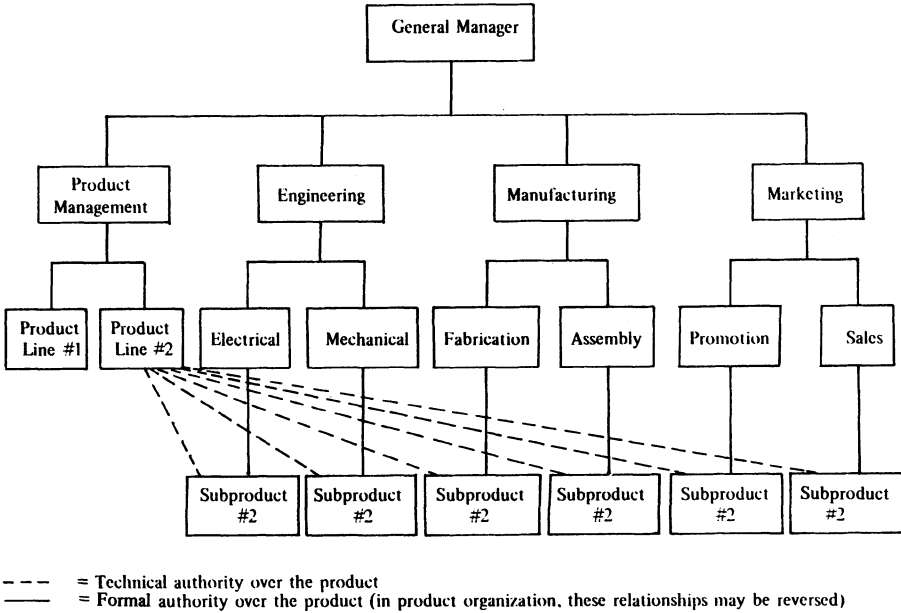
4.5. *Integrating Roles*. The leadership issue is solved by creating a new role — an integrating role [Lawrence and Lorsch, 1967, Chapter 3]. These roles carry the labels of product managers, program managers, project managers, unit managers (hospitals), materials managers, etc. After the role is created, the design problem is to create enough power in the role to influence the decision process. These roles have power even when no one

reports directly to them. They have some power because they report to the general manager. But if they are selected so as to be unbiased with respect to the groups they integrate and to have technical competence, they have expert power. They collect information and equalize power differences due to preferential access to knowledge and information. The power equalization increases trust and the quality of the joint decision process. But power equalization occurs only if the integrating role is staffed with someone who can exercise expert power in the form of persuasion and informal influences rather than exert the power of rank or authority.

4.6. *Managerial Linking Roles.* As tasks become more uncertain, it is more difficult to exercise expert power. The role must get more power of the formal authority type in order to be effective at coordinating the joint decisions which occur at lower levels of the organization. This position power changes the nature of the role which for lack of a better name is labeled a managerial linking role. It is not like the integrating role because it possesses formal position power but is different from line managerial roles in that participants do not report to the linking manager. The power is added by the following successive changes:

a)   The integrator receives approval power of budgets formulated in the departments to be integrated.

b)   The planning and budgeting process starts with the integrator making his initiation in budgeting legitimate.

c)   Linking manager receives the budget for the area of responsibility and buys resources from the specialist groups.

FIGURE 2. A Pure Matrix Organization

- - - = Technical authority over the product
——— = Formal authority over the product (in product organization, these relationships may be reversed)

These mechanisms permit the manager to exercise influence even though no one works directly for him. The role is concerned with integration but exercises power through the formal power of the position. If this power is insufficient to integrate the subtasks and creation of self-contained groups is not feasible, there is one last step.

4.7. *Matrix Organization.* The last step is to create the dual authority relationship and the matrix organization [Galbraith, 1971]. At some point in the organization some roles have two superiors. The design issue is to select the locus of these roles. The result is a balance of power between the managerial linking roles and the normal line organization roles. Figure 2 depicts the pure matrix design.

The work of Lawrence and Lorsch is highly consistent with the assertions concerning lateral relations [Lawrence and Lorsch, 1967, Lorsch and Lawrence, 1968]. They compared the types of lateral relations undertaken by the most successful firm in three different industries. Their data are summarized in Table 1. The plastics firm has the greatest rate of new product introduction (uncertainty) and the greatest utilization of lateral processes. The container firm was also very successful but utilized only standard practices because its information processing task is much less formidable. Thus, the greater the uncertainty the lower the level of decision making and the integration is maintained by lateral relations.

TABLE 1

	Plastics	Food	Container
% new products in last ten years	35%	20%	0%
Integrating Devices	Rules	Rules	Rules
	Hierarchy	Hierarchy	Hierarchy
	Planning	Planning	Planning
	Direct Contact	Direct Contact	Direct Contact
	Teams at 3 levels	Task forces	
	Integrating Dept.	Integrators	
% Integrators/Managers	22%	17%	0%

[Adopted from Lawrence and Lorsch, 1967, pp. 86–138 and Lorsch and Lawrence, 1968].

Table 1 points out the cost of using lateral relations. The plastics firm has 22% of its managers in integration roles. Thus, the greater the use of lateral relations the greater the managerial intensity. This cost must be balanced against the cost of slack resources, self-contained groups and information systems.

Choice of Strategy

Each of the four strategies has been briefly presented. The organization can follow one or some combination of several if it chooses. It will choose that strategy which has the least cost in its environmental context. [For an example, see Galbraith, 1970]. However, what may be lost in all of the explanations is that the four strategies are hypothesized to be an exhaustive set of alternatives. That is, if the organization is faced with greater uncertainty due to technological change, higher performance standards due to increased competition, or diversifies its product line to reduce dependence, the amount of information processing is increased. *The organization must adopt at least one of the four strategies when faced with greater uncertainty.* If it does not consciously choose one of the four, then the first, reduced performance standards, will happen automatically. The task information requirements and the capacity of the organization to process information are always matched. If the organization does not consciously match them, reduced performance through budget overruns, schedule overruns will occur in order to bring about equality. Thus the organization should be planned and designed simultaneously with the planning of the strategy and resource allocations. But if the strategy involves introducing new products, entering new markets, etc., then some provision for increased information must be made. Not to decide is to decide, and it is to decide upon slack resources as the strategy to remove hierarchical overload.

There is probably a fifth strategy which is not articulated here. Instead of changing the organization in response to task uncertainty, the organization can operate on its environment to reduce uncertainty. The organization through strategic decisions, long term contracts, coalitions, etc., can control its environment. But these maneuvers have costs also. They should be compared with costs of the four design strategies presented above.

Summary

The purpose of this paper has been to explain why task uncertainty is related to organizational form. In so doing the cognitive limits theory of Herbert Simon was the guiding influence. As the consequences of cognitive limits were traced through the framework various organization design strategies were articulated. The framework provides a basis for integrating organizational interventions, such as information systems and group problem solving, which have been treated separately before.

BIBLIOGRAPHY

Cyert, Richard, and March, James, *The Behavioral Theory of the Firm*, Prentice-Hall, Englewood Cliffs, N. J., 1963.
Galbraith, Jay, "Environmental and Technological Determinents of Organization Design: A Case Study" in Lawrence and Lorsch (ed.) *Studies in Organization Design*, Richard D. Irwin Inc., Homewood, Ill., 1970.
Galbraith, Jay, "Designing Matrix Organizations", *Business Horizons*, (Feb. 1971), pp. 29-40.
Galbraith, Jay, *Organization Design*, Addison-Wesley Pub. Co., Reading, Mass., 1973.
Lawrence, Paul, and Lorsch, Jay, *Organization and Environment*, Division of Research, Harvard Business School, Boston, Mass., 1967.
Lorsch, Jay, and Lawrence, Paul, "Environmental Factors and Organization Integration", Paper read at the Annual Meeting of the American Sociological Association, August 27, 1968, Boston, Mass.
March, James, and Simon, Herbert, *Organizations*, John Wiley & Sons, New York, N. Y., 1958.
Pounds, William, "The Scheduling Environment" in Muth and Thompson (eds.) *Industrial Scheduling*, Prentice-Hall Inc., Englewood Cliffs, N. J., 1963.
Simon, Herbert, *Models of Man*, John Wiley & Sons, New York, N. Y., 1957.