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ORGANISATIONAL DECENTRALISATION AND INFORMATION SYSTEM DESIGN

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SUMMARY

The basic characteristics of human organisations are identified at the outset with special attention to the question of decentralisation.

Where organisations are 'open' to the environment, and hence to the changes in it, they have to adapt their structure and process suitably - or die. As the organisation grows, a single or a few individuals could not face the environmental changes all by themselves (these challenges range from trivial to the most vital). Hence the decision making process needs to take a hierarchic shape, with policy decisions at top and all tactical and operational decisions with the field staff.

When decentralisation takes place, it is essential to see that the actions of the various decision-making levels or 'echelons' are well coordinated, or, in other words, that the goals of lower level individual decisionmakers are not in conflict with the organisational goals.

Two basic types of decentralisation which are in use in organisations, viz. **federal decentralisation** and **simulated decentralisation**, are examined in this paper. In the former, an organisation can be clearly divided into a certain number of fairly autonomous units (or separate businesses) which are centrally coordinated. In the latter case, it is not possible to clearly identify such separate 'businesses', but they are nevertheless organised into units in such a way that they behave as if they are autonomous units. The goals of these units have to be carefully spelled out in this case

The decision making process is one essentially of digesting information in order to evolve and evaluate alternatives. Therefore an information system is an essential part of any organisation's decision processes. **The paper goes into the logic of why a decentralised information system is necessary for a decentralised organisation**, and in general the need for an information system to be isomorphic to (i.e. to be in a one-to-one correspondence with) organisational structure. Such an information system is necessary for an effective integration of the organisation processes.

Finally some of the technological issues relevant to a decentralised information system are considered.

Organisations:

Organisations can be viewed as 'open system'¹, (that is, they have exchanges with their environment) they are goal-seeking systems, made up of several interacting goal-seeking sub-systems with different goals arranged in a hierarchy.

This definition leads to three characteristics of organisations:

(1) the 'Open System' nature of organisation, (2) their goal-seeking nature or purposiveness and (3) their hierarchical nature: the existence of more than one 'echelon'².

The '**open system**' nature of organisations implies that they are not totally independent entities, closed to exchange of matter-energy and information with the environment, but are in a state of continuous exchange with the environment. They **have permeable boundaries**, in other words, which permit this sort of exchange to take place.

This openness characteristic of organisations has the important consequence that they must have a control system to formulate responses to the environmental changes so as to remain in a state of dynamic equilibrium³.

Organisations are formed or evolved to meet certain goals and these goals percolate down into the subsystems in different forms⁴. It is needless to say that, for effectiveness, there has to be **compatibility among the subsystem goals and the organisational goals**. The absence of a full match between these goals (though regrettably frequent in real life) is costly, in that it leads to suboptimisation and intra-organisational conflicts.

Echelons:

Organisations invariably arrange themselves in a hierarchic fashion with more than one level of decision making. A level of decision making is referred to as an 'echelon' in Living Systems terminology. 'In general, the more the components a system has, the more echelons it has'⁵. An echelon is formed out of a logical requirement for some 'decider component'⁶ to receive and process information inputs from multiple sources, and pass on the decision to a next higher or lower echelon. The decision made at the top echelon is passed downward as command information. In general the information is abstracted or made more general as it proceeds upwards; and becomes more specific and detailed as it proceeds downwards⁷. If a given component does not decide but only passes on information, it is not functionally an echelon.

Decentralisation:

When the decider at any echelon has too many subordinates, it results in an overload of its capacity to process the information and make decisions. It will not be able to 'digest' all the inputs that comes to it. This leads to a high level of stress on the decider which means that either it may take incorrect decisions or may just not be able to take certain decisions at

¹All notes will be found at the end of the paper

all. At this stage it becomes necessary to form a new echelon or make the next echelon down more powerful, i.e. to 'decentralise' some of the decision making.

'Decentralisation' in other words is an evolutionary process necessitated to alleviate any undue stress on a 'decider component'. Let us trace the evolutionary sequence of cause-effect relationships that characterise the process of decentralisation of an organisation:

A small organisation with a single task is a highly centralised one, its activities are classified according to their nature, each person handling a part of it. The top man has the job of integrating or coordinating and only he has an independent responsibility for the whole task. This might be perfectly alright at this stage of evolutionary development, but it becomes disfunctional as the task environment changes.

Let us study what happens when the variety of tasks increases. If the same type of division of responsibilities is continued, it increases the monotony faced by the people at the lower echelon and makes them demotivated. Partitioning of the complementary functions necessitates all decisions to be taken at the top, leading to extreme stress on the decision maker or decider component.

In larger organisations, symptoms of overcentralisation manifest themselves visibly in a proliferation of middle management or in 'administrative fat', as it can be aptly termed, which is deprived of a creative role but has merely to carry information or messages between higher management and the environment. In such organisations, middle management does not have the capacity or authority to cope with the changes that take place in the environment and must depend upon the top management for decisions even on trivial issues.

This **low degree of openness to the environment** by and large is inappropriate and suboptimal except in the most unlikely case of a stable environment or in the less infrequent case of an administrative monopoly which is totally insensitive to its clients. Lack of openness makes the system maladaptive in a changing world. This is particularly so in the case of an organisation with a high degree of geographic dispersal in its activities, as for example any commodity-distribution system organised through a nationwide network of sales offices. A fairly high degree of openness to the environment, possibly through the field offices, is necessary for such an organisation to monitor the environmental changes and regulate itself effectively. If the decision making is going to be concentrated at the centre in such an organisation, then the organisation cannot maintain the necessary degree of openness and the consequent growth of 'administrative fat' will render it slow in responding to environmental changes. Wherever there is excessive growth of 'middle management', there is diluting of authority and responsibility, leading to unduly high delays or failures in decision making. As mentioned above, we expect and find also a loss of motivation and poor morale.

Maintaining openness to the environment, and therefore adaptability, is thus linked to having more freedom of action and freedom for decisions spread out in the organisation. Thus there is need to identify independent sub-tasks, the responsibility for which could be assigned to individuals or groups. An **echelon** in the true sense **will be created in this process**.

Note, however that it does not mean that the number of levels in the hierarchy between the top and the lowest decision maker would increase. On the other hand, it will be reduced to the minimum. The top decision maker as well as all decision components of subsystems have now the freedom to exploit their own variety-handling potential to the full extent, there is now more participation from all people and a sense of identification with organisational goals. Needless to say there would be better morale.

With increased decentralisation, however, the demands on the lower echelons, in terms of the required competence on their part in taking more important decisions,

correspondingly increases. This puts a natural limit on the pace with which an organisation can decentralise itself.

Need for Integration

Having seen the logic of decentralisation as an evolutionary process, we have now to examine the mechanics by which the processes of the subsystems of the organisation can be integrated.

In a decentralised organisation, the subsystems which have been vested with independent responsibilities may act as partially closed systems. In other words their boundaries exhibit the tendency to block information flow from the immediate environment leading to non-use of relevant information available elsewhere in the organisation. We are face to face here with the crucial problem of lack of coordination - the contradiction between the organisational goals and subsystem goals, which leads to suboptimal functioning and intra-organisational friction. This phenomenon may well lead to the weakening of the centre and the splintering of the organisation into fragments.

The question arises, does there exist a way by which an organisation can decentralise itself to just the appropriate extent without losing control of the subsystems?

When decentralisation takes place as an evolutionary process (evolutionary process in the sense that any interventions that take place are from within, and as a natural consequence to a changing environment) in response to the organisation's need to cope with environmental complexity, the global strategic decisions very naturally are retained at the top level and only the other decisions are delegated to the lower echelons. Now, for effective integration, it is necessary to choose appropriate performance indicators in order to monitor the activities of the various echelons.

A well designed management information system thus becomes necessary to manage the system. This subject is dealt with in detail later.

Decentralised Organisational design principles:

*Two major design principles for decentralisation applicable to two different organisational situations have emerged. One is **federal decentralisation**, in which, for example, an organisation is organised in a number of autonomous businesses, each unit responsible for its own performance and results. However, this is applicable only in the case of a company which can conveniently be partitioned into a number of genuine businesses*. To coordinate the activities of individual businesses in such a way as to meet the corporate objectives, Drucker and others suggest that the corporate headquarters should take all global strategic decisions, such as those concerned with the allocation of the key resources of*

* A genuine business in the sense that it is a complete business by its own right: For example, in India we have ITC, which has clearly distinct businesses such as tobacco, hotel, foodstuffs, etc. under the corporate head office. A genuine business would have easily identifiable as well as measurable objectives.

capital, and the planning of the overall direction of movement of the organisation. Effective decentralisation means a **strong centre** not bothered too much by the short term tactical issues and hence capable of **managing the future** effectively. Where it is not possible to identify distinct businesses, but still there is need for decentralisation owing to the largeness of the organisation, **simulated decentralisation** could be used as a design principle. This is the case where an organisation is organised into units, which are not businesses, but still set up

as if they were businesses with the maximum possible autonomy, with their own management, and with at least a simulation of the profit and loss responsibility, or other performance criteria.

The experiences of large materials businesses like the Japanese Steel companies, Aluminium Company of America and Republic Steel have shown that **simulated decentralisation is the most suitable design principle** to cope with their problems. Japanese steel companies market through separate "trading companies" both at home and abroad. In the Aluminium Company of America and Republic Steel, production is organised in geographic manufacturing units, each considered a P & L centre. Marketing, however, is organised in enduse units, i.e. by major industrial buyers of aluminium and steel, such as automobile industry, or construction industry. Each unit is set up on the basis of simulated decentralisation. Several other examples could be cited to illustrate the use of this principle.

In commercial organisations using simulated decentralisation, transfer prices determined internally could be used for tying up the goals of the individual subsystems with that of the organisation. In a complex multi-objective system, however, we may think of a general methodology of "transfer parameters" where there could be more than one parameter which collectively describe the target and performance of the subsystem.

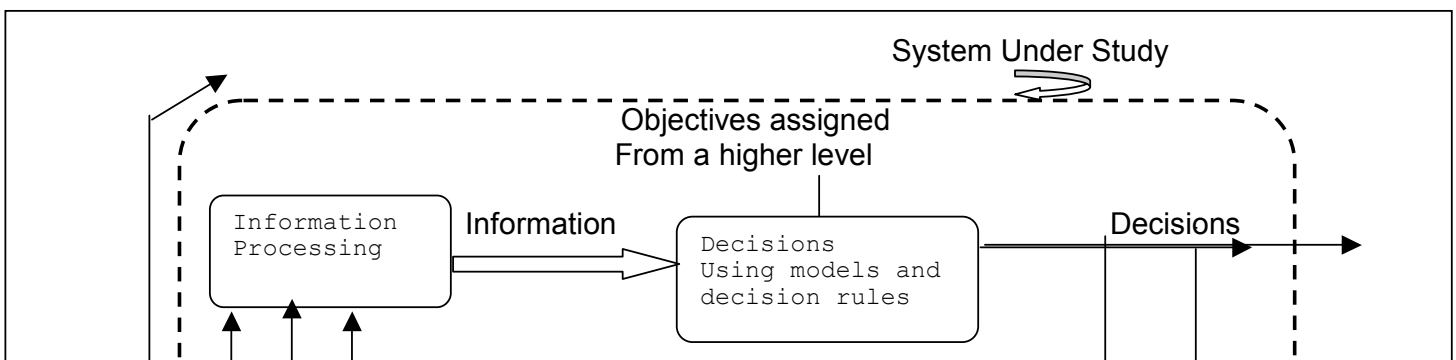
Information system design for decentralisation:

Information is the basic raw material for making decisions. As seen earlier, in an organisation, the decision maker at a particular echelon receives information from many sources in the lower and higher echelons. In making a decision, he processes the information to bring it to the desired format on which decisions can be taken.

An information system for an organisation, therefore, is an organised system of capturing and processing information and providing it to the various decision makers at the appropriate time and frequency and in the appropriate form. (See Fig. 1 below) There are two possibilities here:

(1) The information is processed to the desired extent at a central place and passed back to the various echelons where decisions are to be made. This means, however, that all basic documents have to flow to the central place, be processed and then returned to the various locations in the form in which they are needed.

(2) The other possibility is that the information is processed to the desired form as and where it is generated, and passed on immediately to the local decision maker as well as despatched to the other locations where it is needed in the system. The information processing capability in other words is **distributed** among the various echelons, depending on (a) the analytic capability required at each echelon, (b) the combined economics of processing and transmitting information. This means that each echelon owns a certain amount of information processing capability*.



Environment

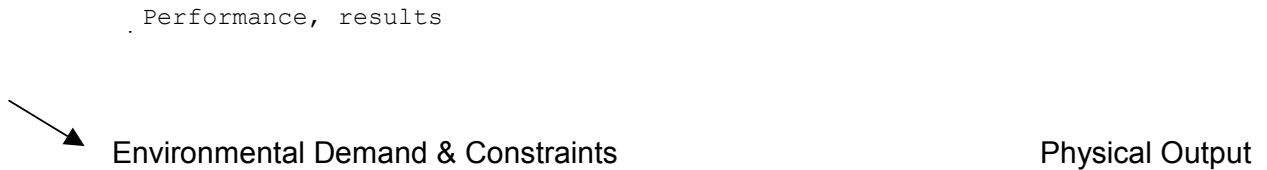


Figure 1: A model of an information system working as an integral part of the Organizational system.

The basic differences between the above two possibilities are:

- a) In the first case, processing is central whereas in the other it is decentralised.
- b) As a consequence, the raw data travels a greater distance (in terms of both time and space) in the first case than in the other case. When the raw data travels more, there could be the following consequences: (i) the delays are greater, (ii) more errors creep in, (iii) communication costs more, (iv) in general the reliability is lower.
- c) As a direct implication of (a), the ownership and control of the processing capability is with the Centre in the first case, and with the Echelons in the second case. This has the following political consequences: (i) Everyone depends on the centre for information in the first case and hence there is a perceived concentration of power at the centre. This is not so in the second case. (ii) Flexibility to do any new form of analysis at the various echelons is totally absent in the first case. As a result the morale and initiative of the decision makers in the organisation will be low. In the second case, they have an incentive to innovate creatively.

In the case where it is organised on the basis of the federal decentralisation principle, the subsystems have more evidently clear cut goals and more distinct boundaries than in the case of simulated decentralisation. The implications are that the information system designer should be more discreet and thorough in identifying the objectives and information needs in the case of an organisation designed on the basis of simulated decentralisation to avoid any misinterpretation of objectives.

** Note that the information processing capability at this stage is a general term which refers to a resource which is required in an information system and does not necessarily refer to any mechanised devices.*

Technology suitable to decentralised information systems - Distributed Intelligence:

Till recently only large scale general purpose computers were used for all applications. This was because of the non-availability of small computers suitable for a location with smaller and more specialised requirements and also because of the powerful promotion of IBM of largescale technology in which it had a high stake. As a result, even in organisations where decision-making has been decentralised to a significant extent, most information processing functions have always been centralised.

Most large-scale systems have high overhead costs in memory capacity and processing time because of the complexity built into the system to meet the diverse needs of users. The large system is characterised by higher requirements for memory for software 'overhead', and the need for high precision, high speed, batch type I/O devices. A Central system therefore results in greater turnaround time and outdated reports - particularly so in the case of geographically dispersed organisations. Consequently the user invests more - yet gets poorer performance.

An answer to some of these problems came in the form of 'teleprocessing' (a large computer at HQ connected to terminals at field offices through telecom links) in the developed countries where there was a highly sophisticated and reliable telecommunications infrastructure. In India where the communication infrastructure may not develop to this extent for a long time to come, this solution is not at all feasible. Further, this is still a centralised information system technology with all of its major disadvantages: undue concentration of processing power at the centre, low flexibility and hence poor morale at the lower echelons or field offices, higher communication cost and greater chances of system failure.

With the **rapid advances in minicomputer technology**, we now have minis packed with very powerful features, which are therefore available in a small package, suitable for a location with smaller requirements. Thus the corporate user has now the more attractive alternative of constructing, in stages, a network of mini data centres, each equipped with low speed, low cost I/O devices and modular memory devices according to the information analysis requirements of the echelon it serves. Thus a distributed minicomputer-based system has the characteristic of facilitating 'add-ons' when additional processing capability is needed by a particular echelon. It can grow or evolve with the organisation.

Under a decentralised regimen, much of the information processing would now be done locally, whence the minimal exchange of processed information among HQ and field offices could be through the mailing of cassettes and 'floppy discs' without depending on telecom lines. Thus the 'distributed intelligence' approach enables the development of information system which would be appropriate to the organisational needs.

To summarise the Conclusions:

1. For a growing organisation to remain in equilibrium in a turbulent environment there is a logical need to continuously reorganise itself to an appropriate degree of decentralisation by creating new decision-making subunits or 'echelons'. (See Fg.2)
2. Proper distribution of managerial responsibilities among geographically dispersed subordinate echelons maintains openness to the environment, therefore dynamic equilibrium, and also prevents loss of motivation.
3. It is essential in a decentralised organisation to see that the subsystem processes are integrated with the common organisational goals. A carefully designed information system which carries just the required information inputs to the decisionmakers is necessary for regulating the organisational processes.
4. For organisations with no apparently distinct units into which they could be decentralised, "simulated decentralisation" can be used as a design principle.

5. An information system having the same modular structure as the organization is essential for proper coordination of the decision processes of the subsystems with that of the total organization and its goals. (See Fig. 3)

6. **'Distributed Intelligence'** are the key words for future information systems designs. They mean the provision of information-processing power and information storage distributed throughout the organisation by means of modular minicomputer units attached to each echelon.

7. On the one hand centralised information system technology is dysfunctional because it does not have the same modular structure as the organisation, but on the other hand today, by means of mini data centres we can have information resources appropriately distributed with each echelon. Such 'decentralised information networks' are even more relevant where the telecommunications infrastructure is poor, as in developing countries.

Comparison of Centralised and Decentralised Organisation

Centralisation

Partitioning by functional departments which are not self-sufficient but are complementary to each

All decisions are taken at the top, leading to information overload and therefore the inability to act on long term issues.

Absence of echelons, in the true sense. However, departmental authority is sometimes shared in an ad hoc manner.

Growth of "middle management", i.e. persons who merely pass on and interpret information, but do not make decisions.

Decentralisation

Partitioning by identifiable units of responsibilities or other self-sufficient activity groups.

Decisions are more widespread and are taken closer to the problem. Consequently the long top echelon is not troubled with trivial issues and is able to give time to long term issues

There are clear-cut echelons to which units of responsibilities are assigned hierarchically, and in which sufficient authority is vested.

Each echelon has decision-making authority, hence such "administrative fat" is avoided.

Inevitable delays occur in awareness of the decision maker of changes in the environment because of the long channels through which the changes have to be communicated.

Long information channels also mean distortion of information and errors in the perception of the environment. This leads to inaccurate and/or irrelevant reactions.

Uncertainty about the future requires that a **large number of predefined contingency plans** be formulated in advance at the top, for the lower echelons to act upon depending upon depending upon what happens.

Lack of decision power below the top leads to monotony in the work at lower echelons, leading to loss of morale.

Centralised allocation of resources may reduce internal duplication and waste, at the cost of flexibility. This is efficient as long as the environment is static.

May function without problem in a monopoly situation, where there is no immediate threat to survival in being indifferent to the environment. However, in a competitive situation such an organisation may suffer failure because of delays and errors in information flow and rigidity in responses.

More specialists can be used, basically because of the partitioning by functions.

The problem of coordination is very crucial and must be taken care of

Very short channels contribute negligible delay, and hence the responses also can be quicker.

This sort of distortion will be much reduced. Hence the decisions are much more likely to be accurate and relevant.

Decision-making freedom at the lower echelons enables them to formulate and implement their own strategies to deal with uncertainty and change in environment as and when it occurs. Actions taken are therefore uptodate.

There is autonomy to define work patterns at all lechelons, hence high morale.

Functions which cannot be split must be duplicated in each echelon. This leads to additional cost but gives flexibility. However, flexibility may not be needed in a static environment.

Early perception of change, leading to quick informal decisions and responses, will be effective in dealing with a competitive environment

There is a need for competent generalists who can take on responsibility.

Coordination can only be achieved through the correct

in assigning tasks, as each person or group works in relative isolation.

specification of objectives to each echelon, and appropriate monitoring of these objectives. Detailed task specification is then done within each echelon

NOTES

1. 'Open' systems are in general those systems which are susceptible to influence by their environment. Many machines are, in contrast, relatively closed systems. Organisations belong to a more specific class of open systems viz. Living systems, which are capable of reproducing themselves and repairing breakdowns, thus reversing the normal processes of entropy.

2. **J. G. Miller** in '**Living Systems**'. Many complex living systems are organised into two or more 'echelons'. In such multiple-echelon systems, the "decider" - an information processing subsystem, is so organised that certain types of decisions are made by one component of that subsystem and others by another. These components are hierarchically arranged, and each level in this hierarchy is called an echelon.

3. Dynamic equilibrium, as against a static equilibrium, is a state of regulated exchange of matter-energy and information between the system and its environment. Living systems, being capable of self regulation, are in a state of dynamic equilibrium with the environment.

4. The overall goals of a system are translated into targets and eventually take on the shape of implementable procedures and steps, as they are passed on down the hierarchy.

5. J. G. Miller in 'Living Systems'. This is a hypothesis drawn from observation of all levels of living systems, from Cells upto Societies.

6. In the 'process taxonomy' of living systems, the 'decider' is one of the major information-processing subsystems. A 'decider component' is one of the many such components hierarchically arranged within the decider subsystem.

7. This again is a hypothesis about living systems drawn from observation. Any living system which is hierarchically organised into echelons has the means to translate generalised or abstract rules into specific procedures at the field level. The principle of least effort would then ensure that at higher level information is stored and treated in abstract rather than detailed form.

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