

SYSTEM DYNAMICS MODELLING OF GROUP BEHAVIOUR: A CONCEPTUAL FRAMEWORK

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ABSTRACT

This paper attempts to highlight how system dynamics methodology is useful in modelling and testing the dynamics involved in group interaction process to explain its behaviour over time. Out of the prominent group models, Gladstein's model of groups in context is taken as reference model. The SD model of group structure which is a system component consists of six modules: roles, goal clarity, specific work norms, task control, size, and formal leadership. This paper deals in detail, the module of formal leadership, and studies how the inter-relations and interdependence influence the system behaviour.

1. INTRODUCTION

Whether one wishes to understand or to improve human behaviour, it is necessary to know a great deal about the nature of groups. According to McGrath [1984], for an aggregation to be a group, it must include two or more people, but it must remain relatively small so that all members can be mutually aware of and potentially in interaction with one another. Such mutual awareness, and potential interaction provide at least a minimum degree of interdependence, that is members' choices and behaviours take one another into account. In other words, a group is an aggregation of two or more people who are, to some degree, in dynamic interrelation with one another. This definition normally includes family, work crews and many social or friendship groups.

"A time based, mutual interdependence can reasonably be termed 'dynamic'." (McGrath 1984;8).

Group is a social system reacting with its environment as a self-adjusting organization of response, whose parts are mutually interdependent. What acts and what reacts is not any single part or function of the social systems, nor any combinations of parts or functions, but the system as a whole; a totality whose mutual interdependence is the system. Cause and effect disappear. What must be looked for is the resultants of complexes of interacting forces. Interdependence, in turn implies some degree of continuity over time. These relationships have or quickly acquire some history and anticipated future.

System dynamics (SD) methodology is increasingly used in testing and analysing organizational behavioural studies. Sohn and Surkis [1985] successfully demonstrated how a motivation model of March and Simon could be analysed using SD and the results were compared with those obtained through algebraic

expressions. The detailed empirical statistical studies of group process could be better understood, if the interrelationships and interdependence between variables involved in the explanation of group behaviour are known.

Morecroft [1988] explains how behavioural decision theory focuses on the information and heuristics in real life functions. Only few of the information flows actually penetrate to the heart of the decision function where they influence the choices and actions of the 'players' (individuals, groups, sub-units), represented by the functions. Developments in different areas allow modellers to give emphasis on small transparent models and help the policy makers to play with their knowledge of business and social systems to debate policy and strategy change.

Organizational behaviour involves discrete event systems in which, the events happen at discrete times causing the system transferring from one state to another. Because of the lack of analytical results, simulation is an important tool in the field. Proper methods of constructing and validating simulation models of human behaviour have long been controversial (Ullrich 1980).

Sterman [1987] points out that in models of small groups like family, traditional social science techniques could be used to gather primary data. Interviews, surveys participant observation and other techniques can reveal the networks of information flow group structure and heuristics necessary to construct a useful model. The purpose of simulation models is to mimic the real system so that its behaviour can be anticipated or changed. Here the use of system dynamics methodology becomes handy.

2. CURRENT THINKING ABOUT GROUPS

Our review is selective and thematic. The intention is not to enumerate all possible models of group performance. We will select some representative models and then extract the basic themes and issues that characterise the model. The basic strategy is to capture how we currently think about groups and to suggest how SD methodology can be incorporated, to study group behaviour.

The basic thesis of the model developed by Nieva, Fleishman and Riack [1978] is that team performance is a function of four variables: external conditions, member resources, team characteristics and demands. The team characteristics are influenced by member resources, task characteristics and external conditions. The external conditions are said to influence all other variables.

The sociotechnical framework is a major intellectual perspective for understanding groups in organizations. An optimum fit between technology and social characteristics will set a stage for new forms of work groups (Kolodny and Kiggundu 1980)

The structure of the Hackman's model (Hackman 1983) gives an overview of the normative model of group effectiveness.

Effectiveness is defined in terms of whether the group output meets or exceeds organizational standards. There is an intermediate criterion which influences the group effectiveness and is called the process criterion. This, in turn, is affected by two classes of variables, namely the design aspect and the organizational context aspect.

For the purpose of this study, Gladstein's model (Gladstein 1984) of groups in a context as shown in Figure 1 is taken. Gladstein while studying the model of task group effectiveness was able to isolate some exogenous as well as endogenous constructs which affected the group performance. There are group level variables: adequate skills, heterogeneity, organizational tenure and job tenure which represent group composition. Group structure, which is another group level variable is a representative of role, goal clarity, task control, size and formal leadership. Organizational level variables are the outer boundary of the considered system. Markets served, training and technical consultation refers to the resources available, and supervisory control and rewards for group performance are inputs related to the organizational structure.

The inputs affect the group effectiveness represented by the attributes: performance and satisfaction, directly as well as indirectly through group process and mediation by group task. For our study, we take into consideration only the direct influence of group structure on group effectiveness. We would like to incorporate the concept of feed-back in this model, to see its impact on group effectiveness. This analysis is done using systems dynamics.

3. FLOW MODULES IN GROUP STRUCTURE

Group structure is one of the constructs that plays a double role in the Gladstein's model. It influences effectiveness both directly and indirectly. The indirect link to effectiveness is achieved through the influence of the group structure on the group process.

The organizational theorists' definition of structure suggests several group level variables as measurable indicators of group structure. These are the group's size, the clarity of its goals, member roles, specific norms about how to go about doing the work, task control, and formalized leadership.

For the system dynamics approach, we consider the different indicators of group structure as separate modules. Six modules have been developed as follows.

3.1 Size

Size of the group has a negative effect on the homogeneity of activity patterns and attitudes. This causal effect is represented in Figure 2a.

3.2 Goal Clarity

Goals are a form of structure around which efforts are organized and thereby made relatively efficient. Ullrich and

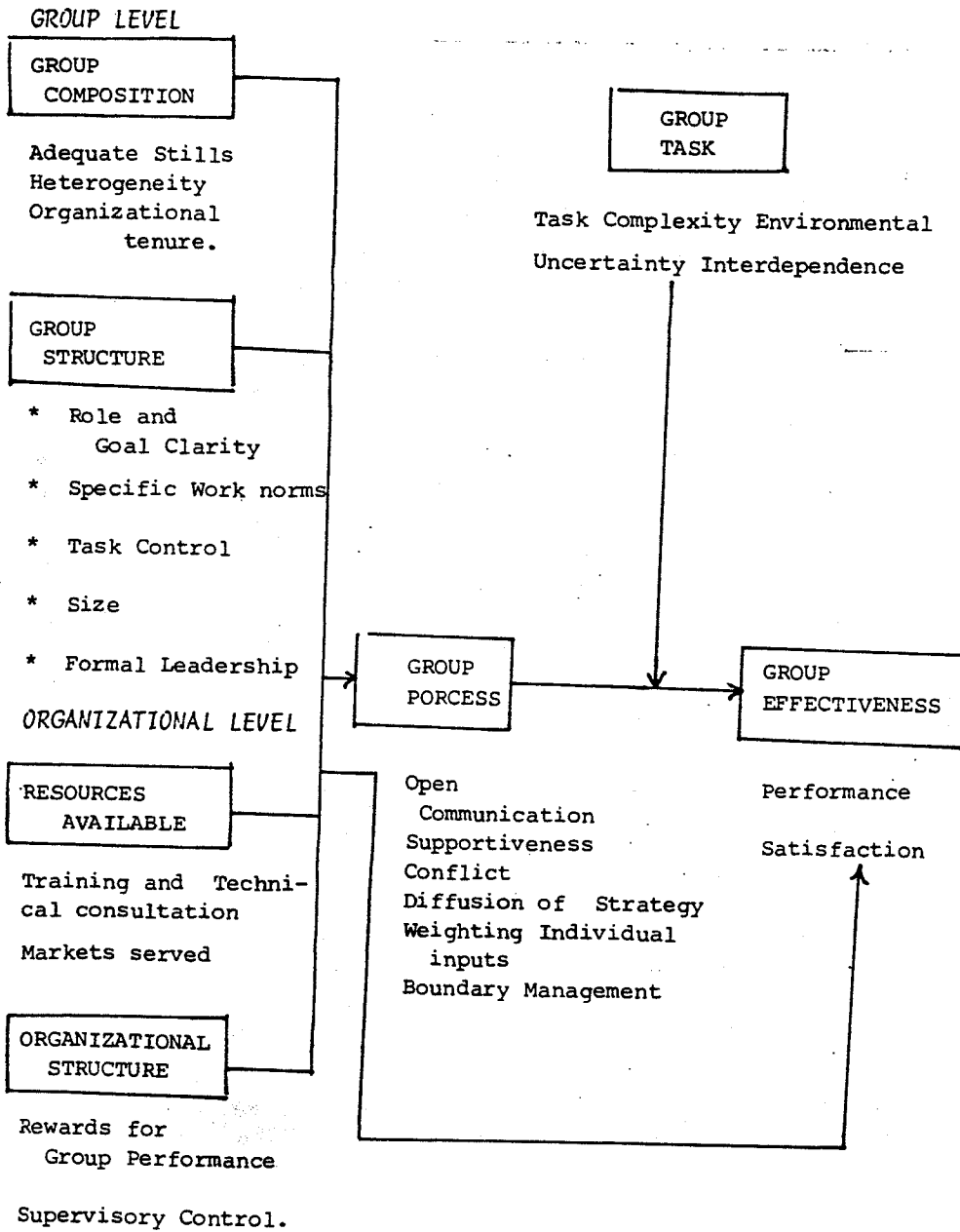


Figure 1. General Model of Group behaviour (Gladstein's model 1984).

Wieland [1980] describe goal clarity to include both relatively wide-spread goal information and agreement on the information. With an increase in the level of participation in goal setting, there will be more clarity of goals. This clarity will have an impact on the acceptability of the goal by members. Once the agreed goals are taken as their aim, the members work with greater motivation to improve performance and there by earn reward. When a motivated behaviour is rewarded, then there is a greater tendency to involve in the participation of goal setting. This causal loop is represented by Figure 2b.

3.3 Roles

An individual wishes to positively distinguish himself from others, but in addition wants the correctness or validity of this positive distinction to be confirmed by others. If two persons take the same role, they will not accept each other resulting in hostility (Drenth; Thierry, Williams and Dewolf, 1984). Depending on the expectation of roles, which the members obtained through other circumstantial factors influences the role taking resulting in role differentiation. In that process there are chances of role conflict which affects the performance and contingent rewards. Based on these rewards, again the members adjust their role expectation. The influences are illustrated in Figure 2c.

3.4 Norms

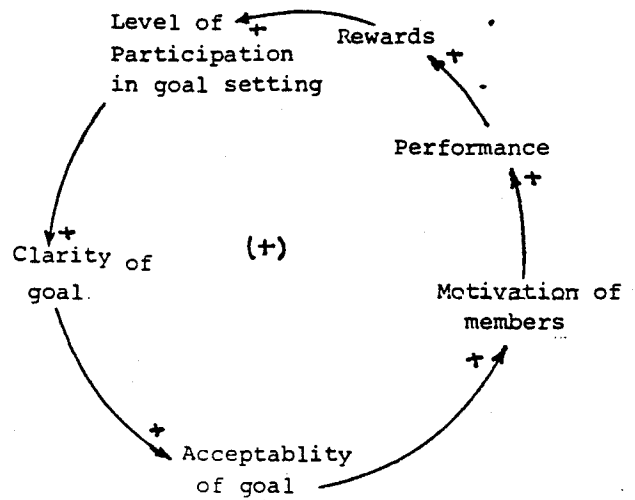
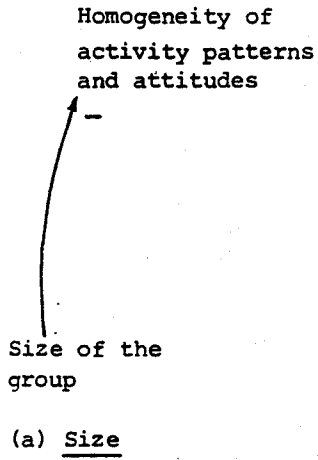
Norms are rules, which are either prescriptive or proscriptive. They provide guidelines for the members, to act within the group. Norms are not formally introduced but the members usually takes them for granted. Members internalize the norms and it becomes a part of the value system (Donelson 1983). Conformity to norms leads to greater homogeneity of activity patterns and attitudes which results in greater cohesiveness within the group. A more cohesive group is likely to perform better and reap higher rewards, which makes the members more motivated to conform to the norms. When a member deviates from the norms he is punished or forced to conform to the norms. These interrelations are depicted in Figure 2d.

3.5 Task Control

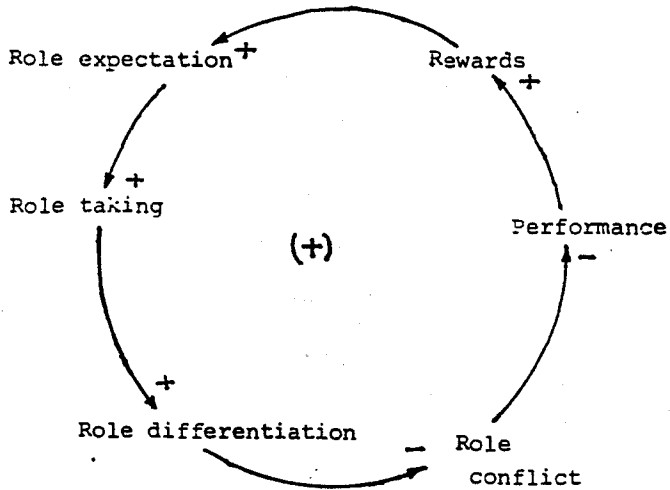
Task control refers to the degree of control or authority a group has over its internal work process (Cummings 1977; Hackman and Greg 1980). A group in which the members have greater control over the tasks will be more autonomous in nature. More autonomy gives more satisfaction for members, making them perform better. The members of an autonomous group could use their creativity as well as their aptitudes to perform better. But a better performance can lead to more concentration of authority resulting in less task control. These causal relationships are represented in Figure 2e.

3.6 Leadership

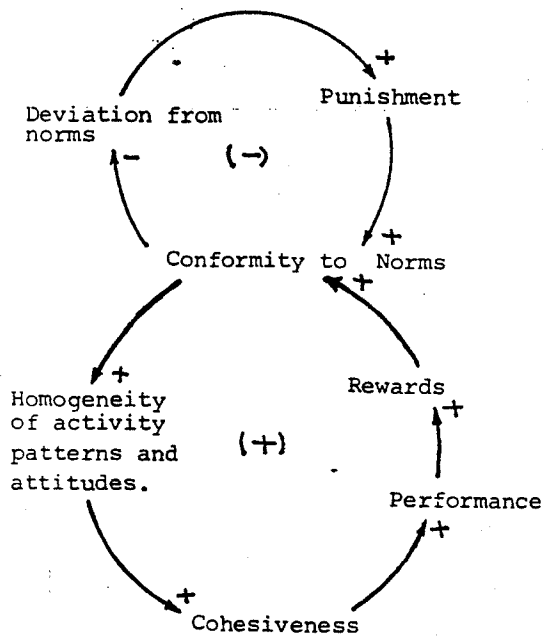
Through the gradual process of differentiation, members take up different functions in a group. The first level of differentiations is leader(s) and follower(s) (Hare, 1976). Leadership is another



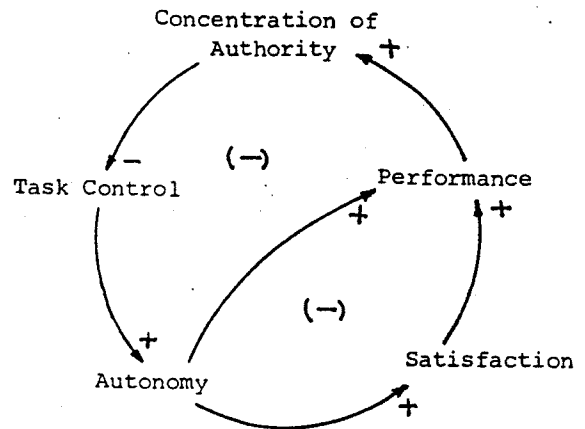
(b) goal clarity



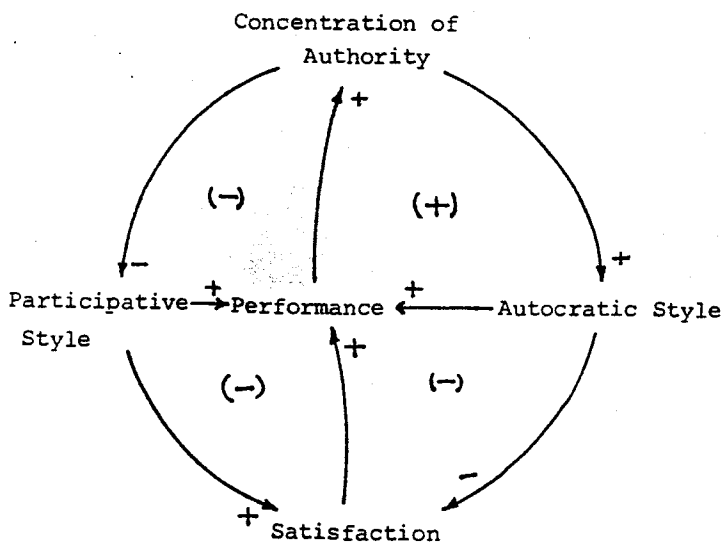
(c) Roles



(d) Norms



(e) Task Control



(f) Leadership Module

Fig. : 2 : Causal loop diagrams representing Components of group structure.

major structural pattern, which affects group behaviour. The detailed modelling of leadership module is done in the next section.

4. LEADERSHIP MODULE

Unlike "harder" sciences (e.g. Physics, Chemistry, Biology) where well accepted 'laws' may govern phenomena, the soft science "behaviour in organizations" remains imprecise, and inexact exploration into the causes and consequences of complex human interactions. Here an attempt is made to model the dynamics involved in the leadership which influences the group behaviour.

In a group, leader-follower differentiation is the first step towards role differentiation. For one to influence, another must permit himself to be influenced. One implicit assumption here is that leadership behaviour causes or determines group and organizational outcomes. Among these outcomes follower satisfaction and performance are the main attributes of the group effectiveness.

According to a group of researchers, the leadership is studied based on the behavioural styles, they adopt in influencing. At one end of the continuum autocratic leadership is characterised by highly centralised decision making and completely concentrated power. At the other end of the continuum, democratic leadership style is characterised by highly participative decision making and power equilization (Jago, 1982).

Assuming that the leader is competent, the advantage of autocratic leadership style is that tasks are more efficiently completed, but it often leads to low employee morale (Gray and Frederick 1984). That is, concentration of leadership increases group performance but lower morale (Bevalas, 1950). When the performance increases as a result of adopting autocratic style of leadership, there is a greater tendency for the leader to use, that style again and also in a more autocratic way.

Morse and Reimer (1956) suggest that democratic leadership provides followers with the opportunity to express and fulfill individual needs in the course of accomplishing group goals. Participative style of leadership enhances performance directly and also indirectly by enhancing satisfaction among group members. In participative style, the employee's feelings of self worth and satisfaction are increased, because the leader conveys a sense of confidence in employee judgement. Secondly, participation allows employees to satisfy high level needs such as esteem and self actualization by letting them take part in important decisions. Lock and Schweiger (1978) reviewed 46 studies and in that 26 studies showed a positive correlation between participative style and member satisfaction.

In addition democratic leadership is thought to directly enhance the effectiveness of managerial decisions (Maier 1963; Vroom 1969). Participative decision-making provides a vehicle for follower information, expertise and creativity to be brought to bear on for which leader's own information and acknowledgement may be insufficient. Power sharing can create a climate where constructive conflict is

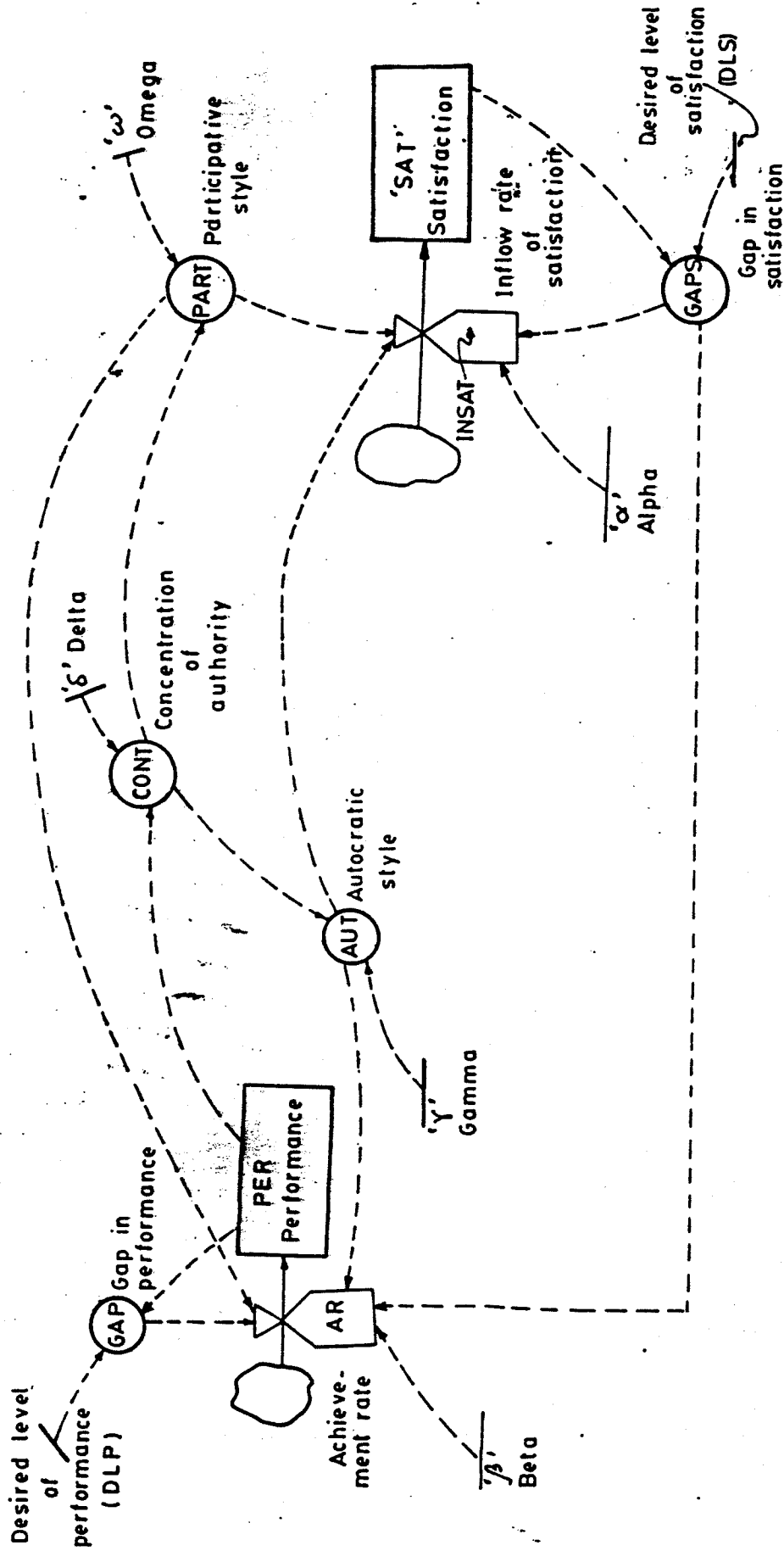


Fig.3 Detailed flow diagram of the leadership module

encouraged. Follower involvement may ease the implementation of a decision.

The causal loop diagram of the leadership module incorporating all the interrelationships between variables explained above is given in Figure 2f. The flow diagram based on this causal loop model is given in Figure 3. The detailed flow diagram may then be translated into a set of equations that can be simulated by using computer packages: DYNAMO, STELLA, DYMO-SIM, etc. These are simulation languages that provide a view of the feedback system described by equations as if it were continuous overtime. This is accomplished by examining the system at (DT) intervals of time. The smaller the DT, the more precise a view we get of the dynamic behaviour of the system.

5. CONCLUSION

The purpose of this paper was to demonstrate the usefulness of the SD approach as a prototype methodology to deal with the dynamic aspects of organization behaviour studies. As shown, SD helps in modelling the group behaviour in relation to the group structure of the Gladstein's model of Groups in context. This methodology yields the dynamic consequences of hypotheses concerning relationships among the variables in the model. Furthermore, it does not require extensive empirical data for model construction. There is a need to study how different inferences on subsystems components fit together. The SD approach clearly demonstrates its potential to deal with these unresolved issues in the current state of group models as well as in other areas of organization behaviour research. The major problem in the implementation of a SD model of this kind is the development of appropriate indices to quantify soft variables involved in the model of group behaviour.

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