COMPARTING STRATEGIES FOR EFFECTING SOCIAL CHANGE IN LARGE ORGANIZATIONS BY MEANS OF MODELING

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INTRODUCTION

Effecting social change in large organizations can at once be both a simple and a complicated task. It can be a simple task because business and industry have always been involved in the process of managing change; that's the very essence of their existence. It can be difficult because managing social change in this country is one of the more challenging problems of the century. This paper will attempt to delineate what some of the problems are and how they can be studied in the industrial environment.

What is meant by social change? There are a large number of topics of broad social interest today, such as ecological, environmental, safety, and health that are of considerable interest to the private and public sectors alike. However, for this paper, we are going to restrict our attention to the topic of effecting social and organizational change within the human resources of large industrial organizations.

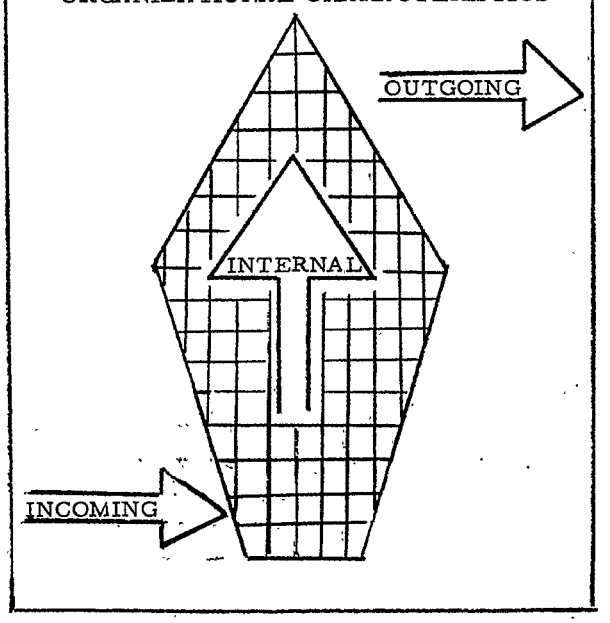
Large organizations have been specifically selected for this discussion. Clearly, the problems that would face a small businessman, a store owner, a shopkeeper can be handled in a much different fashion than with a company which represents thousands of people in perhaps hundreds of locations. For the purpose of definition here, organizations will be considered as large if they consist of 100,000 people or more. The reader might react and say there aren't many organizations of that size until he thinks of perhaps the top 50 industrial organizations, many educational and religious organizations, and certainly a large number of government and military organizations. Approaching this problem with this size limitation has some widespread significance, and certainly will have measurable impact on the country as a whole.

ORGANIZATIONAL CHARACTERISTICS

Certain characteristics are common to any organization be it industrial, educational, military, or governmental. Typically, there exists a hierarchy of levels of responsibility within the organization as shown in Figure 1. There are entry level positions, first-line supervision, middle management, and upper management positions wherein policy and procedures are set for that organization. Furthermore, there are areas of specialization; that is, in thinking of industrial organizations there are administrative functional areas where particular expertise is applied depending upon the particular product. There will be sales, there will be financial, there will typically be manufacturing and other functions which are dependent upon specialized training generally received prior to entrance into the

FIGURE 1

ORGANIZATIONAL CHARACTERISTICS



organization. Lastly, in this generalized organization, there tends to be an overriding interest, desire, and concern for progress through the organization. Not all people in the organization want to filter to the top, but a predominantly large percentage are interested in achieving at least another measure of success by increased responsibility and authority with the operations of the organization. Thus, upward mobility through the organization is a characteristic of interest when addressing social change.

Other characteristics which are common among large organizations include the concepts of incoming and outgoing streams to that organization. That is, people leave the organization for a host of reasons and are generally replaced by others moving into and upward through the organization. Losses may be incurred at the upper levels which will create a domino effect of several internal promotions and an external hire at a lower point within the hierarchy of the organization. Another characteristic which is common among large organizations is to find them relatively invariant in size. That is to say, large organizations are moderately stable, mature organizations. Consequently, in modeling social change it is generally quite acceptable to consider that all exits by way of the outgoing stream will be replaced by entrance within the incoming stream.

EFFECTING SOCIAL CHANGE

How can these incoming, internal and outgoing streams determine the rate by which social change can be affected within the organization? Social change can only be effected when opportunities are presented to the management of an organization to bring about a change. Bringing about social change in order to meet government regulations should not, and traditionally has not, been brought about by reductions in force and subsequent replacement by the particular class of persons necessitating the social change. Management uses opportunities presented by means of normal attrition and turnover to bring in a different mix of people and thus effect a social change. It is an opportunistic system in which management must capitalize at every chance it gets to effect a change but alternatively cannot bring change about without such opportunities being presented. Therefore, even though bottom line results are important, the real measure of success is rate of change.

Within this opportunistic system, as management seeks opportunities to effect change in the organization, it must be defined what is a normal rate of change. If an organization is seeking to alter its profile from one which is non-technical in nature to one which is more competitive in technical market places, then a rate must be established at which the new technical graduates will enter the organization. Full recognition must be made that the external labor force represents the major source of opportunities for altering the profile within the organization. The availability of persons within this local labor force really becomes the driving force to determine what the rate of change can be. It's not as simple as looking at gross figures of technical graduates in the local labor force without looking at requisite skills and interests. Considerable study needs to be undertaken to determine true representative availability for persons with requisite skills for a given job in order to decide on a rate of change.

PLANNING FOR SIMULATION

Thus, we have established at least two major characteristics which must be studied in order to effectively model social change in a large organization. The first of these are the characteristics of the organization itself in terms of level of responsibility and functional areas of interest and capability. Secondly, studies need to be conducted with regard to the availability of new persons to enter this particular organization. Ways to accomplish these two objectives will vary from company to company, but in general they should proceed as follows: A complete historical study of past company practices must be undertaken. This will reveal the general promotional patterns, the general trends in terms of attrition, the general replacement characteristics with regard to whether opportunities are replaced by hires or promotions, the general requirements of the organization with regard to educational attainment which might determine particular areas of responsibility, the characteristics of the current workforce in terms of sex, race, and length of service with that organization. This kind of study will require a large data base of information which almost certainly must be computer processable in order to arrive at intelligent estimates of the probabilities needed for the modeling. The second area of pursuit that must be undertaken is the whole evaluation of external availability. Particular reference

is made to the memorandum published by the Equal Employment Advisory Council entitled, "Human Resources Management Planning", which details many of the sources of data that can be used in this area as well as many of the pitfalls and problems in trying to establish a particular availability for any particular facility. Clearly, as indicated in that book, the requirements in this area are extensive and expensive.

PREPARING THE MODEL

Once having gone through the data collection phase which includes knowledge about both the internal workings of the organization and external availability, then it becomes necessary to create a model which describes that particular organization. The model generation can be accomplished by a multidiscipline team which studies the functions within the particular industrial concern being discussed. These people can then write descriptive equations that describe the existing profile of the organization and the changes that take place to effect any particular modification therein. To run a detailed simulation of large organizations requires a computer program so that the many approaches to effecting social change can be studied. Next, examples are in order to illustrate some of the major philosophical issues that need to be resolved in establishing the model.

BASIC EXAMPLES

There are three examples which best illustrate the problems associated with effecting social change. The first of these begins by recognizing that an organization is generally composed of several levels of responsibility and several functional areas. Consequently, it's usually necessary to pull out a single level and a single functional area to study an isolated example of what we might call a single cylinder engine study. Imagine a particular single level organization, which we might call a job group, with a total of 160 employes, at the beginning of time, and 10 minorities present. For this example, let this be an entry level job group where all the replacements come from new hires. Furthermore, we might imagine that the external minority availability is say 12% for this particular community and that historically this job group maintained an average of approximately 10% turnover rate per year. Example IB gives you a year by year example of what actually happens to this job group in terms of losses for each year, the new hires, the net gain, accumulative number of minorities present

EXAMPLE IA

SINGLE LEVEL ORGANIZATION

Total Employes	160
Minorities	10

- SOURCE OF REPLACEMENT 100% NEW HIRES
- EXTERNAL MINORITY AVAILABILITY = 12%
- LOSS RATE = 10%

in that job group, and as a memo item, the percent minorities present in that job group in a given year. If the external availability is 12% and each year the new entrants feed into the job group at a 12% rate, then the ultimate objective of that job group is to reach a 12% profile for minorities. (This objective is usually referred to in government regulations as the ultimate goal.) As is illustrated by this example, the first year the minority loss is only 1, but each year the losses for the minorities climb in a manner almost similar to that which the net gain is made in terms of numbers of minority present. In other words, as it approaches a steady state condition at 12%, then we are going to have to get to the point where the losses will be exactly equal to the gains, or in this case, 1.92 losses and 1.92 hires. Thus, it is illustrated that even after 30 years in this theoretical organization the percent minorities has still not reached the ultimate target.

The reason for this illustration is to show that it is not sufficient to deal with the problem exclusive of either age or length of service within the organization, because it becomes a convergent problem and one which is theoretically never able to get all the current incumbents out of the job. With no consideration for age then, the problem does not drive towards a known and realistic solution in any time period.

Recognizing this point about age, the following example demonstrates an important concept. It can best be entitled, "Time Required to Effect Complete Replacement." First of all, imagine a hypothetical organization that at the beginning of the study employs no minorities or college graduates, or women, or any other unique human resource. (See Example II).

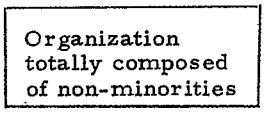
EXAMPLE IB MINORITIES

CHANGE IN COMPOSITION OF A JOB GROUP

Number of Minorities:	Year 0	1	2	3	5	10	15	20	25	30
Loss		1.00	1.09	1.18	1.32	1.56	1.71	1.80	1.85	1.88
New Hires		1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92
Net Gain		.92	.83	.74	.60	.36	.21	.12	.07	.04
Cumulative	10.00	10.92	11.75	12.49	13.76	15.99	17.30	18.07	18.52	18.79
Percent Minorities:	6.25	6.83	7.34	7.80	8.60	9.99	10.81	11.29	11.58	11.74

EXAMPLE II

TIME REQUIRED TO AFFECT COMPLETE REPLACEMENT



Given:

- Organization employing no minorities at year 0.
- Mandatory retirement at age 65.
- Minimum entrance age of 18.
- Normal distribution of ages from 18 to 65 at year 0.
- Nominal annual loss rate.
- At year 1, company hires externally equal to the availability of whites and minorities.

Process:

- Losses during first year will be all non-minorities
- Entrance rates of minorities and non-minorities will be equal to availability.
- Losses during succeeding years will impact both non-minorities and minorities.

EXAMPLE II (cont'd.)

Result:

- Each year the minority percentage within the organization increases.
- The internal minority percentage will not equal external availability until the entire cohort present at year 0 has moved out of the organization 47 years later (65 - 18 = 47 years).

Describe the organization with a mandatory retirement at age 65. Suppose there is a minimum entrance age of 18. Thus, there's some sort of a normal distribution of all ages of people in this organization at the beginning of the study varying between age 18-65. Agree upon some nominal annual loss rate. Then, at the end of the first year, assume the company will externally hire equal to availability of the whites and minorities to replace those losses that took place during the first year.

The process takes place as follows. The losses during the first year will be all whites or non-minorities since they are the sole occupants of the organization at the beginning of time. The entrance rates, however, during that first year will be equal to availability of both the minorities and the non-minorities external to the organization. The losses during succeeding years will impact both non-minorities and minorities. Thus, each year the minority percentage within the organization increases. Based on these assumptions, the internal minority percentage will not equal external

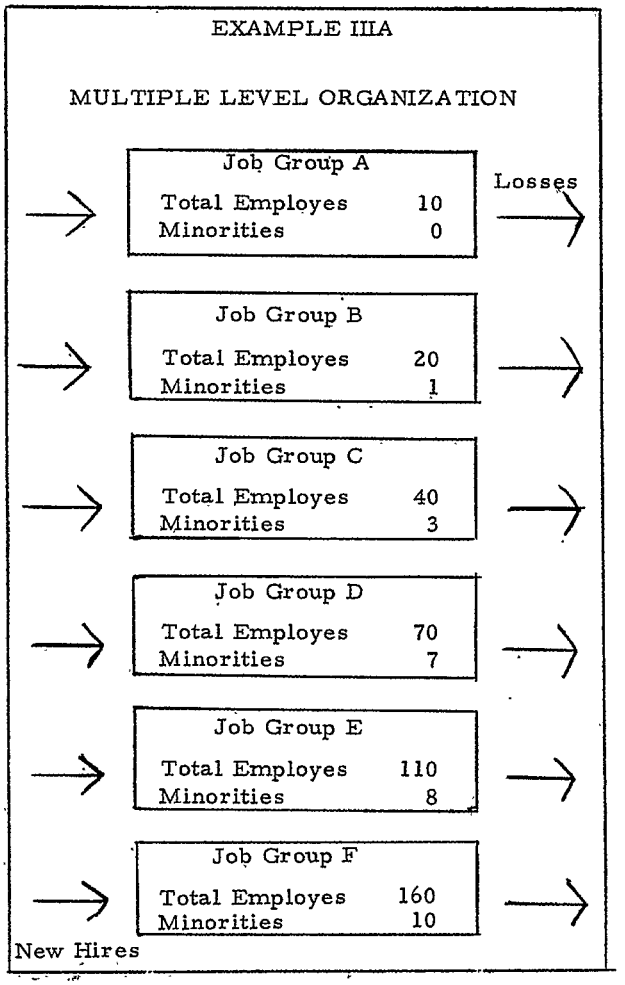
availability until the entire cohort group present at year 0 has moved out of the organization some 47 years later. (That is, 65 - 18 = 47 years for a complete replacement.)

Although this example may seem simplistic and theoretical, it does develop at least a reasonable upper bound to the length of time it would take to effect a complete replacement and hence arrive at an idealistic profile which is equal to that of the local labor force.

One last example is needed to illustrate the complexity of the problem. As indicated earlier, most organizations maintain different levels of responsibility, e.g., entry level, first-line supervision, etc. Example IIIA illustrates six levels of responsibility, or job groups, going from A through F. Examples

EXAMPLE IIIA

MULTIPLE LEVEL ORGANIZATION



are displayed for typical numbers of employes in these job groups with example numbers of minorities that could be present at the beginning of the study. Example IIIB illustrates a process for the calculation of ultimate goals for each level, or job group. Since both internal promotions and outside hires combine to form the candidate pool, internal availability is used to fill promotional opportunities and external availability for new hires to arrive at a total ultimate goal. The ultimate goal for each of these job groups is calculated by using the composite availability. Example IIIC shows the resulting utilizations obtained in years 1, 2, 5, 10, 15, etc. Consequently, after a reasonable period of time, the utilizations can be obtained for each of the levels that are desired. A 35% external availability for the new hire pool has an overriding impact on the number of minorities which will be fed to the upper system. After 30 years, the upper level job groups, although attaining their original goal, will not have reached external parity because as illustrated here, the penetration to the upper levels is a much longer, slower process.

TECHNICAL DECISIONS

To proceed to model development calls for some specific decisions. Rather than display for the reader the specifics of the mathematics of the model, a review of the major decisions made concerning model philosophy will be discussed.

Characteristics of the employes in the simulations will include sex, race, level (of responsibility), functional area, education, and length of service. The first two, sex and race, were selected because they represent the underlying reason for effecting profile change. Level and functional area are necessary because they represent skill requirements; education and length of service because they are predictors of success as well as indicators of skill attainment.

All personnel transactions that influence profile change must be characterized. These are incoming streams, internal streams, and outgoing streams. Within these, substreams are enumerated; for example, internal streams consist of promotions, demotions, and transfers.

The model is a probabilistic one in which tables are generated from past history depicting the likelihood of an event happening in one of the streams. Stream characteristics are represented by likelihood of any given source being available. Monte Carlo techniques may be used, but were not in our case; rather fractional statistics are carried and rounded at appropriate time to evaluate strategies. This decision was made because of the many small sub units that were studied wherein fractional goals are important.

EXAMPLE IIIB
CALCULATION OF ULTIMATE GOALS FOR EACH JOB GROUP
(PERCENTAGES)

Job Group	Utilization of Minorities	Loss Rate	Source of Replacement		External Availability	Ultimate Goal
A	0.0	4.0	IP	100	5.0	5.0
			NH		2.5	
B	5.0	5.0	IP	98	7.5	7.4
			NH	2	3.8	
C	7.5	6.0	IP	95	10.0	9.8
			NH	5	5.1	
D	10.0	8.0	IP	80	7.3	7.8
			NH	20	10.0	
E	7.3	10.0	IP	60	6.3	11.0
			NH	40	18.0	
F	6.3	12.0	IP	0	0.0	35.0
			NH	100	35.0	

Key: IP - Internal Promotion
NH - New Hire

Markov chain logic can be used, but again was not. It is felt that variations in results because of changing probabilities caused by the evolving skill, experience, and education of the population are more descriptive of the real process.

Finally, the simulation can either be established as a set of difference equations or as the underlying differential equations. We have used both, but generally have worked more with the difference equations in order to avoid approximation required by the smoothing of input data for coefficient functions (in the set of differential equations). Furthermore, these equations, besides lending themselves to simple computer programming techniques, have also been more readily displayed and explained to the Human Resources Manager.

IMPLEMENTING THE MODEL

The application of simulation to the personnel process 10 years ago was generally looked upon with some disdain and was a difficult concept to explain and/or sell to the personnel manager. Two events took place which turned this attitude about. First was the exploding demand for technology that caused many industries to reexamine their selection, acquisition and development of college graduates. Second was the absolute insistence of the regulatory agencies that organizations provide timetable estimates for the achievement of ultimate goals. When these regulations were first promulgated, the implications of timetable requirements were not fully studied. Any organization involved with establishing timetables would be well advised to carefully study the issue paying particular regard to anticipated opportunities. The ideal tool to use in this analysis is some form of simulation so that multiple strategies can be easily evaluated. This approach may well avoid commitments to timetables that are unachievable. As the reader may know, selling the concept of simulation to some planners has been difficult, but in these cases of executive development and EEO obligation, it is becoming more readily accepted by both the planner and operating managers.

STRATEGY EVALUATION

Many localized strategies can be developed to effect social and organizational change. For instance, organizational needs for specific skills in given functional areas can be studied. Changes in foreman characteristics, engineering fields, management skills, secretarial training and many others can be simulated to study time and cost considerations.

EXAMPLE IIIC

PROJECTED UTILIZATION OF MINORITIES
YEAR 0 TO YEAR 30
(PERCENTAGES)

Job Group	Utilization	Year 1	Year 2	Year 5	Year 10	Year 15	Year 20	Year 25	Year 30
A	0.0			1.0	2.0	3.0	4.0	5.0	6.0
B	5.0	5.0	5.5	6.0	6.5	7.5	9.0	10.5	12.0
C	7.5	7.7	8.0	8.2	9.2	11.0	13.2	15.7	17.7
D	10.0	9.7	9.6	9.9	12.4	16.0	19.1	21.3	22.7
E	7.3	7.8	8.9	13.2	19.8	24.1	26.2	27.3	27.8
F	6.3	11.7	16.1	24.9	31.5	33.7	34.6	34.9	35.0
TOTAL		9.3	11.4	16.1	21.0	23.9	25.6	26.7	27.4

In the area of social change, it may be desirable to be able to estimate the maximum allowable and minimum achievable time for goal attainment. An estimate of the maximum is to project every future opportunity to be filled according to local representation. The minimum would be to fill all future opportunities by members of the protected class. Clearly, these extremes have disadvantages. Intermediate steps can be simulated, such as; 150% affirmative action for five years reducing to 100% in 10 years. When the spectrum of possibilities is considered, ramifications of cost, experience degredation, public demand, government pressure, legal requirements, negative employe reaction, etc. must be weighed. These alternatives can be spelled out for management in order that they might make their own professional judgments before selecting a solution.

CAUTION TO THE MODELER

A word of caution needs to be added. There is an aura of mystery that surrounds the use of modeling in the human resources management game. Both the manager who uses it and the government agency that must evaluate the results, need to be properly schooled in its application. All input, all computations, all results must be held up to the cold light of good management judgment.

Recall that this paper deals with comparing strategies. If this is done and multiple approaches are explored for bringing about social change, the judgment about the model results must be made by the manager. This is largely due to the fact that the techniques for change normally result in tradeoffs. What areas can respond most quickly? Where is experience most needed? What aspects about personnel changes are fact and what are fiction? Most simulations today cannot do the optimizing that needs to be accomplished because of all of the non-quantifiable parameters.

The caution then to the modeler is to not oversell solutions that have many assumptions. Be sure the manager knows the assumptions, the limitations, the approximations in your model. Demand participation by management in the strategy comparison phase. Don't permit selection of a strategy because it "gets there first" without carefully weighing the tradeoffs.