RECEPTIVITY TO INNOVATION - OVERCOMING N. I. H.

by

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Submitted to the Alfred P. Sloan School of Management on May 5, 1967 in partial fulfillment of the requirements for the degree of Master of Science.

ABSTRACT

Not Invented Here (N.I.H.) has been used among technical organizations as a shorthand to describe the attitude (often spoken of as if it were a disease) of technical organizations who resist adoption of an innovation proposed from a source outside of the organization. This study is an attempt to understand some reasons why N.I.H. exists, how it works and to develop a hypothesis about how it may be overcome.

Several cases have been chosen from a series of interviews in which examples were described of successful and unsuccessful attempts by an engineering research center to introduce innovations to manufacturing plants. Each case is analyzed by Lewin's Force Field concept and a Force Field Diagram is constructed for each. The forces of all the cases are summarized and what appear to be the major characteristics of the successful and unsuccessful cases are examined using the findings of various writers who have explored resistance to change.

The major conclusion reached is that from the cases examined, it appears that N.I.H. is to a large degree created by those attempting to introduce an innovation. In every unsuccessful case, the plant that was the "client" of the research center was excluded from participation in establishing research on the problem from which the innovation was developed or was excluded from the research itself. Conversely, in the successful cases the client played an active role throughout in several phases of the innovation development, even if it was simply adapting the innovation to his needs. At the conclusion of the case examination, several methods are suggested for introducing innovations to technical organizations, based on the findings from the cases.

Thesis Advisor: Leo B. Moore

Title: Associate Professor of Management

May 5, 1967

Professor Edward N. Hartley
Secretary of the Faculty
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139

Dear Professor Hartley:

In accordance with the requirements for graduation, I herewith submit a thesis entitled, "Receptivity to Innovation - Overcoming N.I.H."

Without the sympathetic cooperation of those interviewed, this thesis could not have been written. Without their interest and insight the cases described would be much less complete.

I wish to thank Professor Moore for his guidance and to thank Professor Rubin for his suggestions of both methods and sources at several steps during the investigation.

Sincerely,

Robert P. Clagett

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CHAPTER I

INTRODUCTION

The Problem

My experience as engineer and manager at an Engineering Research Center led to this investigation. Over a period of years I have observed the difficulties experienced by the Research Center in having the manufacturing engineering organizations "pick up and run" with new process developments originating at the Center. From the view of the Research Center this reluctance was of course a difficiency of the manufacturing locations. The reluctance of various departments of an organization to fully cooperate with other departments is familiar to most and I will add that it has appeared to me that technical departments have a particularly difficult time in cooperating with each other. It was at the Company Product Laboratories that I first heard the term, N.I.H. for Not Invented Here, used to describe the reluctance of another technical department to use an innovation created in the narrator's department.

The term N.I.H. expresses to many the sum of the problem of resistance to change, to accept an "outside" innovation and especially that authoritative resistance righteously thrust up by an "expert" when presented with a new idea in his field. The problem and the reactions are not confined to an industrial research organization, of course. In fact, the Federal Government has gathered a group of experts to explore, through the case method, what the best ways are to foster cooperation among agencies and contractors working in the same field. I might further mention that my description of N.I.H. has caused knowing smiles among many here at M.I.T.--apparently the disease is widespread.

I will confine my investigation, however, to several examples of innovations developed at the Engineering Research Center and look at them in terms of some concepts that have been proposed in areas that seem to bear on this problem. By far, the most extensive work is in the area loosely described as "resistance to change," but additional insights may be gained by looking at work done in marketing investigations on how new products are introduced. The concept that I will apply to all the cases is Kurt Lewin's "Force Field Analysis."[1] I feel the force field concept will help clarify this investigation in the same way it is designed to help clarify the situation for a problem solving manager.

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[1]Kurt Lewin, "Frontiers in Group Dynamics," Human Relations - June, 1947, Vol. I, No. 1 pp. 5-41.

That is, by attempting to segregate and define the "forces", the situation may be made clearer and some hypotheses proposed from the various cases.

Purpose

The purpose of the study will be an attempt, by examining the cases through the several concepts, to develop some hypotheses about why some innovations are accepted and enthusiastically used and others are not, why N.I.H. exists, some examples of how it works and some proposals to overcome it. Lastly, some suggestions will be made regarding testing the proposals and where further work might be effective.

Data Collection

As I have mentioned, I was associated with the Research Center for several years and so have intimate knowledge of much of the background information given here. In addition, while not directly connected with any of the cases used here, I have some general knowledge with several of them. I also know many of the people at the various plants listed in the cases. It was not necessary, therefore, in my interviews for those being interviewed to go into detail of background or to explain the position of the Center relative to the plants. While my association with the Center may have aided the interviews, I am sure my reporting of the cases is less than objective even though I have been away from the Center for several years and had nothing to do with the cases used.

The interviews were all in person at the Research Center with the men (both supervisors and engineers) who worked on the cases. They took several days and were conducted during January and February 1967. One interview was conducted by telephone, and this was the one "client" or user of an innovation that was contacted. Since there is current work being conducted between the Research Center and all the plants mentioned and in most cases by the same individuals, I did not feel it appropriate to contact the plants, since I am still identified with the Center and would not be looked upon as an unbiased investigator. As mentioned at the beginning of Case III, the client I contacted was in the unique position of having been associated with two cases at different plants, one which adopted an innovation and the other which did not. This was the one client I felt obliged to attempt to interview.

In order that my interviews have some semblance of uniformity, I used a series of questions after a fairly consistent introduction of my purpose to all those interviewed. In every case the questions led to more questions and even to several suggested by those being interviewed as being appropriate to the investigation. Listed below are the major or category questions put to all of those interviewed.

1. Describe the innovation you have chosen as an example.

2. How was contact made? That is, were you contacted, did a third party tell you of an application, did you contact the plant and what level (engineer, supervisor) made the contact?

3. Who was contacted in the plant, a friend of yours or someone here at the Center, a name given or someone known to be working in the field?

4. How was the innovation introduced?

5. What was produced - i.e., did anything come of it?

6. Has it been used elsewhere?

7. If a failure, that is no one is using it, have you tried to introduce it elsewhere (if so, go back to 1, 2, 3 and 4).

8. Do you mind if I interview others here at the Center involved in the case in order to get the picture from where they sat?

CHAPTER II

BACKGROUND

Case Setting

Before outlining the cases, it may be well to describe the setting in which they take place. The Company has many manufacturing locations, and at each there is a force of engineers. The engineer force is set up in departments, several for product or production engineering, plant or factory engineering, often a development department and usually a machine design and a quality department. The innovations that will be examined in the cases are production innovations, so the pertinent engineering departments will be those of product and development engineering. These departments may be looked on as the customer or client of the Research Center, for the innovations must be put into use by the development and product engineers.

The Research Center was established in 1958. It was fairly novel at that time in that it was established to do only manufacturing research and development, no product development which is done by the Product Laboratories for all the Company divisions. The staff of the Research Center was composed initially of men from the various plants, but the Center rapidly recruited non-company engineers and scientists in disciplines and advanced degrees not available at the plants. The "charter" of the Research Center was to develop "new ways to make things" and was to attack both the short range bottleneck problem and the long range new art or application of new art to old-art problems. All the plants were solicited for tough problems and many were received. Since managers and supervisors were brought together first in order to build a Research Center staff, the problem of solicitation was done by these managers with their counterparts at the plants. Later, when work was begun on a few of the problems, the Research Center engineers were started on their investigation with little or no consultation with <u>their</u> counterparts at the plants. Most significantly neither engineer group shared in discussing the problems to be examined and whether they were appropriate for Research Center investigation. In most cases the problems selected initially were felt to be critical ones with high payoff and with reasonable prospects of success. The Center is now in its eighth year so that I must admit that a good portion of the problems in receptivity to innovations had to do with establishing a reputation and acceptance both among the plants and with the Product Laboratories. However, I feel that problems of acceptance are a portion of many situations of receptivity to innovations so do not feel the choice of cases is atypical.

The Concept of Force Field

As mentioned earlier, each case will be examined using the concept of Force Field Analysis proposed by Kurt Lewin.[1] Such an analysis will hopefully give a common basis of examination from which conclusions or implications may be drawn. The total concept was evolved in order to examine managerial problem-solving and the force field analysis technique used as a means to conceptualize a problem situation at a given time. Lewin felt strongly that opposing forces set up a "quasi-stationary equilibrium" in any given situation and that by defining these forces a beginning could be made in understanding how changes took place. If a goal were pictured as an upper level (in our case the acceptance and use of an innovation) Lewin conceived of increasing (I) forces moving toward that level and restraining (R) forces opposing. He represents the situation at a point in time as some level short of the goal where the forces are momentarily balanced. One of the more significant facets of the force field concept is that the opposing forces create tension.

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[1] Ibid.

If I forces are increased, especially as the goal is neared, R forces tend to increase and tension is considerably increased. The lesson for managers (and Research Centers) is that it makes a great deal more sense to reduce R forces in order that the level move toward the goal and at the same time reduce tensions, rather than increase I forces in order to move toward the goal and therefore increase tensions. Not only are tensions increased by increasing I forces, but any success in goal attainment appears short lived, for the R forces are still intact and the change tends to revert or be cancelled as the I forces are removed.

In my analysis of receptivity to innovations, the I forces are those pushing toward acceptance and use of the innovation and the R forces those opposing. In all cases except the two mentioned earlier, Cases III and IV, the forces do <u>not</u> represent the point of view of the client directly. That is, the client was not contacted to get information on how he saw the R forces. There is no doubt that this fact is a shortcoming of the investigation since R forces are constructed from statements and actions as relayed through the filter of the innovator. As the reader will discover, however, even with this filter the hypotheses are not drawn in favor of the innovator. The problem is more with the point of view, however, for as Thomas[2] shows, there is a tendency for I forces to be those of the person constructing the analysis and the R forces to be those of others and the environment. All the analyses are the author's and, therefore, suffer this tendency. Each case description will follow with a force field analysis and diagram of the problem field. The relative strengths may not be pertinent in that the cases have been resolved one way or the other and are not currently in a state of tension waiting to be resolved. Not that tensions are not still present, the interviews revealed attitudes and views that constitute ready-made forces whenever a new innovation is introduced. It may, therefore, be fruitful for organizations to analyze past attempts at introduction of innovations to understand the forces in any new attempt at introduction.

My resume of force field does not do justice to the thorough and detailed theory that has been built up but only explains that portion of the concept that will be used in examining the cases.

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[2] John M. Thomas "Managerial Problem-Solving and Force Field Analysis," Unpublished report of investigations at the Indian Institute of Management, Calcutta, India.

CHAPTER III

THE CASES

The cases described below are all from examples of attempts to introduce innovations, developed at the Research Center, to the manufacturing plants for use in production. They have been chosen as having represented substantial effort at the Center and for having mixed success in reception. It is the fact that the success of introduction varied that may give some insight into factors affecting introduction.

Each case will be followed by a force field analysis and diagram in an attempt to highlight some of the I and R forces visible in the case. The following chapter will then treat the cases in conglomeration and will attempt to apply theories and thoughts to what appear to be common situations.

CASE I COIL WINDER

The coil winder case was one of the first investigations of the newly created Research Center. In looking for likely projects with which to begin, the Research Center managers talked to their counterparts in the engineering organizations at the manufacturing plants. Not only were new problems looked at, but new concepts or ways of manufacturing old, high volume, products were considered to be potential cases. One such class of high volume product was the various coils manufactured at several plants in high volume. A coil here is defined as a fairly small, say one half-inch to four inch long, many-layered winding of fine wire. They are used in electro-mechanical equipment as electro-magnetic actuators and in electronic equipment.

There appeared to be area for improvement in manufacture, because while very high speed machinery had been developed for winding the coil, the finishing operations were done by hand. Finishing operations include such things as pulling or "fishing" the leads out to a terminal, removing the insulation, cutting the leads to length and soldering them to terminals. The labor cost for hand finishing constituted a substantial portion of the total coil cost, so with millions of coils in production, automatic finishing could pay off handsomely! It is significant that the managers agreed that this was an appropriate project, more on this later.

A group was set up at the Research Center to work on the case. The problem areas such as insulation removal, cut off, terminal attachment (wrap and soldering) wire tension and others were assigned to individuals or teams. As progress was made discussions and consultations within the group evolved a concept for an automatic machine. Some product design changes were necessary but preliminary checking indicated the changes could be allowed. Experimental set ups of the components of an automatic machine were built and finally it was decided that a prototype machine would be built to prove in all the concepts working together. I will examine introduction of the machine at each of several plants that eventually became involved to see what the various receptions will reveal.

Plant I

At this point we have progressed to where an operable prototype machine had been built at the Research Center. Not much contact had been made in either direction between the Research Center and Plant I where the project concept originated.

The machine was taken to the plant for a demonstration. The plant engineer's reaction was, "Why are you working on coil winding? We are!" The machine did not get much farther than that. Some of the individual concepts incorporated in the machine were said to be somewhat novel and could possibly be incorporated in the local machine, but it did not in general appear to solve the problem.

In my interviews it was apparent that the essentially total rejection of the machine by Plant I still bothered the Research Center after two years. In addition, there is evidence (see Plant 5) that Plant I continued to hold some resentment toward the Center regarding the coil winder. The Center resentment is particularly interesting in that they are now aware that the project had been started in direct competition with an effort at Plant I. They are aware it appears to the Plant I engineer level, where none of the initial discussions had been held, that the Center simply moved in to get the credit for what seemed to be a lucrative cost reduction case. The Center, knowing this, and now making rules for itself about taking on a case where others are working, still has some resentment which will probably interfere with future communication. It would appear then that rejection of innovations may have effects beyond those observed at the time of rejection.

The concept that comes to mind that would apply here is that of Coch and French[3] and Zander[4] that resistance can be expected if those to be changed (Plant 1) do not participate or have some "say" in the nature of the change. As mentioned earlier, all the discussion and decision making was done at a high level, from which vantage point the project appeared to be a good one. However, none of the engineers working on a new machine at Plant 1 were brought in on the discussion, yet they were the men who would be required to incorporate the Center developed machine into Plant 1 production. It seems, however, that there was some recognition by the high level managers that possible difficulties might develop in having the two engineering groups competing on developing an automatic machine, even working on the same coil. The recognition appears in words used at the time, such as: "The potential savings are so large the investment in competing teams is justified," or "By having competing developments, the very best should evolve." The difficulty, of course, was that the development was in no way cooperative and one of the teams (Plant 1 engineers) would decide

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[3] L. Coch and J. R. P. French, Jr., "Overcoming Resistance to Change," In Proshansky and Seiderber, eds. Basic Studies in Social Psychology (New York, 1966), pp. 444-460.

[4] Alvin Zander, "Resistance to Change: Its Analysis and Prevention," Advanced Management, Vol. 15, January 1950, pp. 9-11.

which development to use.

Plant 1 Force Field Analysis

At this point one of Lewin's precepts comes into focus, that is that if an R (restraining or negative) force is reduced it may actually be converted into an I (increasing or positive) force. If the Plant 1 engineers had been made accomplices to the Research Center effort, they would probably not have resisted as much and would possibly have worked actively toward adoption of the innovation. It would seem, however, that when two groups are in competition (as expressed by R Force No. 1 below) by working on the same project there will be problems. Schein[5] states that, "... competition between the units or groups of a single organization or system must in the long run reduce effectiveness because competition leads to faulty communication, ... and to commitment to subgroup rather than organizational goals." My interviews did not touch all facets of the problem, I am sure, but I will construct a force field diagram and will list those forces that were either expressed or implied:

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[5] Edgar H. Schein, Organizational Psychology, Englewood Cliffs, New Jersey. Prentice-Hall, 1965, p. 105.

R FORCES

1. Plant 1 engineers working on own machine

2. Resented "surprise" intrusion of "outside" group

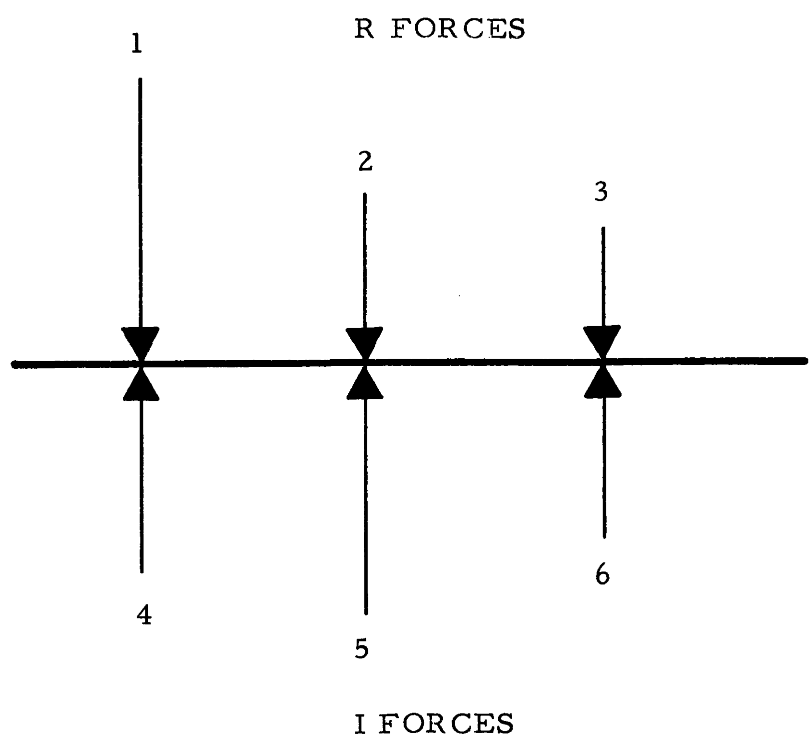
3. Machine not adoptable to peculiar problems of Plant 1

I FORCES

4. Development "agreed to" by Plant 1 (at top level--engineers not committed), therefore, Plant 1 should be receptive. Research Center self righteous

5. Conviction the Center machine a step forward, unique and better

6. Need to get innovation accepted by a Plant



Force Field Diagram No. 1 Coil Winder, Plant 1

The major feature of the Plant 1 coil case appears to me to be the way in which the Plant 1 engineers were forced into an attitude of N. I. H. They were given no voice in the agreement to use their development domain for a Research Center Case. They were not brought in during development, not allowed to identify with the Research Center work. Finally, they continued their own competitive development, and then before it was completed and proven or disproven they were asked to accept the competitive machine. Could they have reacted in any other way? Not if they had developed even the smallest amount of group pride and team spirit. This case might suggest that N. I. H. is not so much an inherent attitude of technical groups as it is the creation of the proponents of the change. We may see other cases that confirm this.

Plant 2

This plant, in contrast to Plant 1, had a problem with a new type coil and had no development staff to work out new manufacturing methods. The production engineers at Plant 2 heard about the machine being developed at the Research Center and asked could the machine be adapted to their coil. The center agreed to modify the drawings and build an experimental machine. This contact and agreement occurred during the time the prototype machine using the Plant 1 coil was in final development.

The Plant 2 engineers had production schedules to meet so purchased a commercial machine which left many operations to be completed by hand. During development and construction of the Plant 2 machine, frequent meetings were held by Center and Plant 2 engineers to discuss needs, designs, capabilities and priorities. The machine that was built was completely automatic; bobbins were dumped in one end and completed, wound, taped and terminated coils were automatically unloaded at the other. The machine was not, however, economically much superior to the commercial machine including the manual finishing operations. Plant 2 engineers asked that the Research Center restudy the problem and make recommendations; the automatic machine concept was <u>not</u> rejected, but it was recognized that to be competitive the machine would have to produce coils at a much higher rate. Two more commercial machines were purchased in order to complete schedules but interest in the Center machine remained high.

The Research Center examined those portions of the automatic machine that added most to cost while inhibiting higher output. By eliminating the automatic load and unload features and redesigning other portions for higher speed, the machine was reduced in cost by about one quarter and output was considerably increased. The machine thus developed was particularly attractive to Plant 2 because it not only proved to be an excellent cost reduction over the commercial machine, it automatically performed some of the most troublesome operations. There are currently six of these machines in operation at Plant 2 with three more on order to provide complete capacity.

There are a couple of features of the Plant 2 case that are interesting. First, Plant 2 engineers apparently never lost enthusiasm for the Research Center machine, although it would have been easy to do so after the failure of the first experimental machine. An understanding of <u>why</u> they did not lose their enthusiasm would be most revealing. My conjecture would be that they were thoroughly <u>committed</u> to the Research Center effort because <u>they</u> had initiated it with a request for help. If this is even partly what is behind the enthusiasm, effort to get a client involved to the point of <u>asking for help</u> is extremely useful in innovation introduction. There is support for this view in Bennis, Schein, Berlew and Steele where among conditions listed for a change to take place, under "defensive" or poor conditions is, "Target (client) role non-voluntarily acquired," while under "positive" is, "Target takes role voluntarily." Also in the same list is another aspect which has meaning in this situation which is that under "positive" is listed, "Target is free to leave situation," and "Target can terminate change process."[6] When the client asks for help both conditions are met, that is, he voluntarily assumes the role of client and he feels free to leave the situation. The second feature is that during the interview it became apparent that after the failure of the first machine the Research Center considered dropping the project. They had invested considerable time and money and had no assurance further effort would pay off. It seems, however, that a supervisor was sure the machine was basically a good design and was determined to see it used. Through his effort development was continued and the successful machine was designed and built.

The emergence of a "champion" for the machine is a particularly interesting development, Morison[7] and Shon[8] both feel that a champion is often, if not always, necessary to carry a new and different innovation from development to use. The concept is that the inventor is often not the person best able to

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[6]Warren G. Bennis, Edgar H. Schein, David E. Berlew and Fred I. Steele, Eds., Interpersonal Dynamics, Homewood, Illinois, The Dorsey Press 1964, p. 375.

[7]Elting E. Morison, "A Case Study of Innovation," The Planning of Change, Bennis, Benne and Chin, Eds., New York, Holt, Rinehart and Winston 1961, pp. 592-605.

[8]Donald A. Shon, "Champions for Radical New Inventions," Harvard Business Review, (March - April, 1963), pp. 77-87.

carry an innovation through to use. Morison feels the inventor is often satisfied with the pleasure of invention and does not have the sense of social necessity needed to push it. What is needed, he feels, is an entrepreneur type who sees the application and widespread use of the innovation as his goal. The champion may be useful to an R and D organization for other reasons. Case IV will look at a champion type and how he interacts with a receiving organization. The summary will suggest an overall strategy and purpose for use of champions as well as some difficulties.

Plant 2 Force Field Analysis

This portion of the case is a successful example, so the analysis shows the level to have reached the goal level, that is, use of the coil winder in production at Plant 2. The interesting point that this analysis reveals is that some of the R forces found in Plant 1 have been converted to I forces that helped push to the goal level.

R FORCES

1. Schedule requirements-production requirements before the Research Center machine could be completed

2. Commercial machine that could do the job. Once purchased, inertia to continue works against machine change

3. First experimental machine not economically attractive

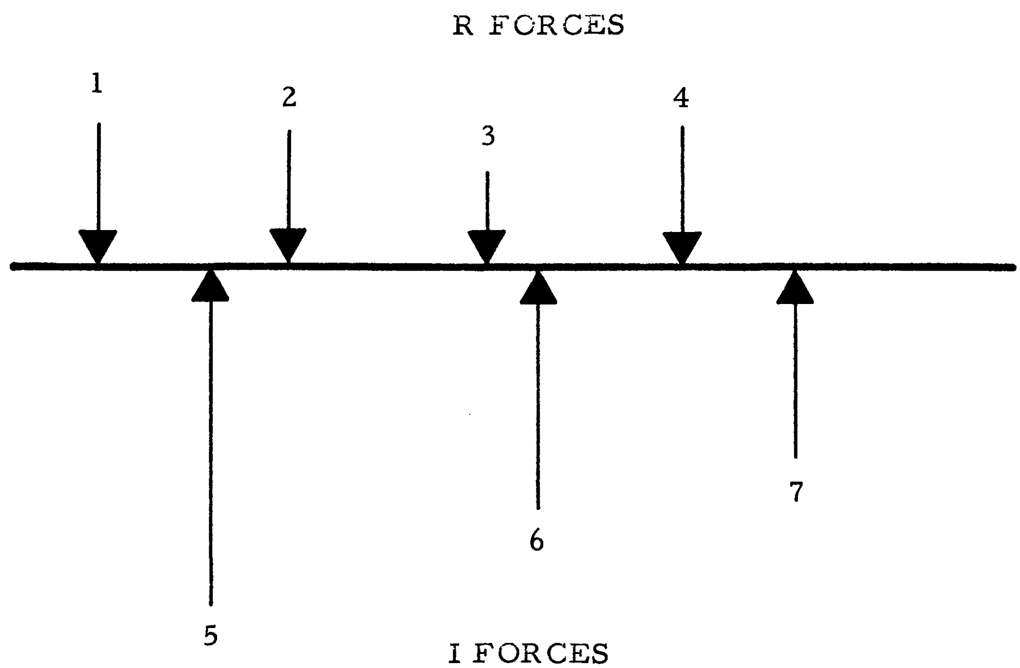
4. After first failure, too much time and money spent by the Research Center

I FORCES

5. Enthusiasm of Plant 2 engineers that the automatic features of the Center machine were much better than the commercial machine

6. Conviction of the champion that the machine was better and could be made economically attractive

7. Need to get an innovation accepted by plant



Force Field Diagram No. 2 - Coil Winder, Plant 2

Plant 3

The Plant 3 story is similar to the Plant 2 story without some of the complications involved at Plant 2. Plant 3 had a new complex coil to manufacture of the new type that the Research Center machine was designed to produce automatically. The coil required all the automatic features of the machine, and therefore made the full machine economically attractive. The Plant 3 engineers, much as the Plant 2 engineers, had a problem and were actively searching for a solution. They visited the Center as soon as they heard of the coil machine, which was at about the time the first Plant 2 machine was being checked out. They were so sure of success of the machine they requested modified drawings for their coil and ordered a machine. They now have two machines that are producing their full requirements.

Plant 3 Force Field Analysis

Again the goal level was reached and this time with no apparent R forces at work.

R FORCES

1. None

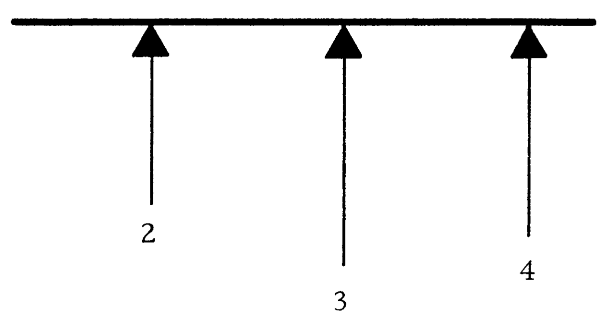
I FORCES

2. New, difficult coil with no production solution

3. Enthusiasm of Plant 3 engineers that the Center machine could automatically produce their coil as it could the Plant 2 coil

4. Conviction of the Research Center that the machine could do the job

R FORCES



I FORCES

Force Field Diagram No. 3 - Coil Winder, Plant 3

Plant 4

At one point in the evolution of the machine a short movie was produced to demonstrate its capabilities in a way observation of the machine would not reveal (slow motion, focusing on one function of the machine and magnifying some portion). This film was seen by several plants including Plant 4. Engineers at Plant 4 became interested in using the machine on a miniature coil, again the machine presented a solution to a problem. The Plant 4 people came to the Center to see the prototype machine. By this time the Center had had the experience of both machines at Plant 2, and modified drawings for the miniature coil less the automatic load and unload features per Plant 2. That machine has been in production now about a year and is producing total Plant 4 requirements.

Plant 4 Force Field Analysis

The analysis is identical with Diagram number 3 - Plant 3.

Plant 5

This case is the most recent, and from a company standpoint is hopefully not closed as yet. Plant 5 also had a coil it thought could be produced on the new machine and so visited Plant 3 and Plant 1 in that order. If my report has not conveyed it, I want to say that my impression is that Plant 2 was the most enthusiastic of the plants (which is probably apparent from the sustained enthusiasm required).

I say this in order to contrast Plant 3, which I think was happy with their machine, but since they overcame no difficulties were just that - happy with it. At any rate Plant 5 engineers visited Plant 3 and then Plant 1 (who now had their own machine) and wrote a report. The report indicated that the Center machine at Plant 3 was unsatisfactory, had given serious maintenance problems and would therefore not be considered. I was told that the Research Center called Plant 3 where it had some close contacts and was told that none of the derogatory information had come from Plant 3 and that when the Plant 5 people had left, they had been enthusiastic about the Research Center machine! Now it is obvious that my case is incomplete in that I was not able to interview Plant 5 on this and did not, partly because I felt the situation was still active and did not want to introduce some feelings that would possibly hinder future negotiations. In addition, Plant 5 may get further information from other plants, such as Plant 2, but it must be remembered that Plant 5 now has a report that it must defend so it is not likely that they will use a Center machine.

One of the most interesting aspects of this situation to me is the point mentioned under Plant 1; that after several years, Plant 1 still bears a grudge against the Research Center of such magnitude as to cause them to still shoot down the Center development. Again I must add that I do not know whether Plant 1 feels <u>their</u> machine applicable to Plant 5, but the report mentions only the failure of the

Center machine. There is no question that when R forces are marshalled against invading I forces, the R forces are not easily dispersed.

<u>Plant 5 Force Field Analysis</u>

The same forces are at work here that are at work in several of the other plant cases, Plants 1, 2, 3 and 4. Not all, but many of both the increasing forces and restraining forces are summarized here and at the moment the quasi-stationary level is far short of the goal level.

R FORCES

1. Plant 1 resentment made up of the forces analyzed under Plant 1:

    a. Research Center "intrusion"
    b. Plant 1 developing own machine
    c. Center machine does not solve problems

2. Maintenance of Center machine highlighted

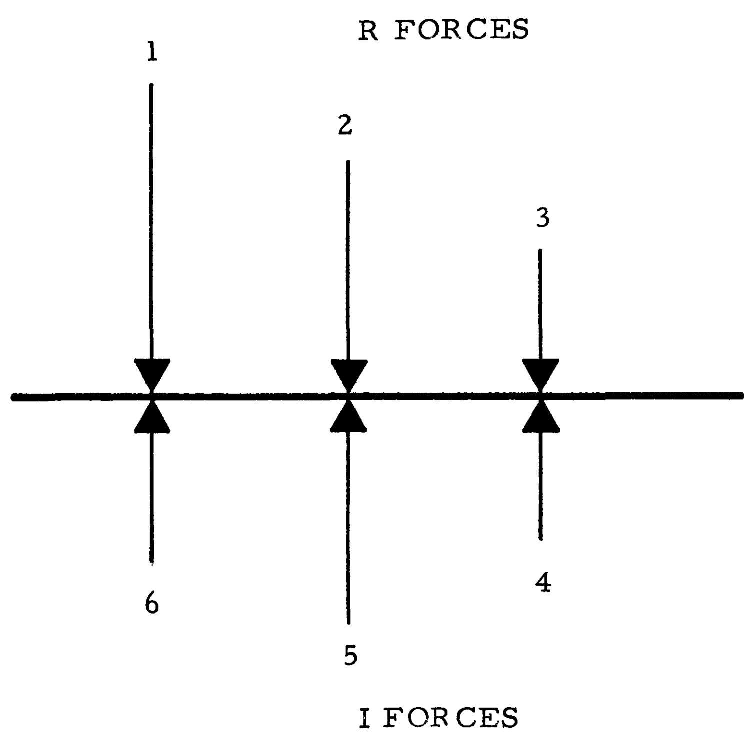
3. What might be called an I force reduction - the moderate "selling" job of Plant 3

I FORCES

4. Plant 3 satisfaction with the machine

5. Need for an automatic machine by Plant 5

6. Conviction by the Research Center that their machine will do the job



Force Field Diagram No. 4 - Coil Winder, Plant 5

The Force Field Analysis certainly points up the fact that when resistance is created, either directly as in Plant 1 or indirectly, as in Plant 5 it is a difficult thing to overcome indeed. The analysis suggests further, as does Lewin, that the most effective way (in this case the only way) to achieve the goal level is by reduction of R forces. It also seems that the R forces are not only reduced, they are usually converted so that as in the case of Plant 2 they substantially contribute to the change in level. Again from this case it would appear that N.I.H. is made not born.

CASE II CAPACITOR STUDIES

The second case in my investigation began quite differently from the first case and, since it was begun some years after the Center started, is more applicable to the continuing problems of rejection of innovations. The case was an application in a new field developed from a previous Research Center success. The Center envisaged a radical new method of manufacture of an existing product which was the responsibility of engineers at one of the plants. Unfortunately, the plant responsible for the existing product was not made a partner in the investigation, apparently because the Center assumed the innovation would be so appealing that the responsible engineers would do handsprings to incorporate it as the method of manufacture at the plant.

I will call this plant, Plant 6, not only so that we may differentiate it as a case from the plants of the coil winder case, but because it happens to be a plant not involved in the other cases, so did not have attitudes generated by previous experience with the Center. I should also take the time to describe Plant 6 in relation to the other plants and, indeed, to the Company. It is the mother plant. All the other plants can trace their origins to Plant 6. At one time it was headquarters for all company engineering, and even as other plants were built, it historically had been given the pre-eminent engineering role.

It is now an old plant, and newer, more modern plants have been given engineering control for the newer products. Today Plant 6 is much like France, living in the memory of former glories and where possible exerting all the intransigence that was formerly her right and an expression of her position. Of course, the plant has been and is being modernized, and the engineers have been assigned challenging new problems, but to many the haughty attitude remains. I cite this to highlight the fact that the Center should have been overcautious in involving Plant 6 in the project, of making sure they were committed and "on board." The Center is made up of scientists and engineers, not behaviorists, and so relied on the inherent appeal of the innovation to overcome all objections.

To get on with the case, the Research Center had been successful in developing a method of passing parts into and out of a vacuum on a continuous basis without breaking or reducing the vacuum. It occurred to some of the Research Center engineers that the new ability opened the door to an entirely new concept of capacitor manufacture. The particular type capacitor being considered was currently in production at Plant 6. The first step in current manufacture at the plant consisted of inserting a large, wide roll of plastic film in a specially designed vacuum chamber that then deposited metal on the plastic as the film was unreeled and rereeled. The total process took place inside the chamber, so the vacuum had to be broken and repumped for each roll. After metal deposit, the roll was sliced into narrow strips the size of the finished capacitor. There followed many separate operations of winding, terminating and finishing the capacitor.

The concept that evolved at the Research Center would use plastic strip of the size of the completed capacitor. With the coil winder experience behind them a completely automatic operation was envisaged. Plastic strip would be fed into the vacuum chamber, metal deposited and the strip fed into an automatic winding, terminating and sealing machine that would eject completed capacitors. The project was divided into teams or groups that were to work on the major components of the system. As mentioned earlier, there was little or no contact between the Center and Plant 6 on this project. The whole idea had been generated at the Center and was being pursued there. It turned out, as so often happens, that the portion that had looked achievable was extremely difficult, and the portion that had appeared doubtful yielded to the effort. In particular it was found that feeding thin plastic foil in and out of a vacuum was a different problem from feeding parts in and out of a vacuum. In addition, continuous metal deposition presented problems different from the batch process. On the other hand, the machine designed to automatically wind, terminate and seal came along very well. It had several novel features and turned out to be of interest on its own for manufacture of several types of film capacitors.

As work continued on the vacuum and deposition equipment, a working model of a capacitor winder was constructed. Some key people from Plant 6 engineering were invited to see the machine and comment on it. This was a good move by the Center, for although Plant 6 may have been opposed to the Center effort on principle, these men were given an "inside" look and were solicited as to criticisms and suggestions. An approach of this sort can indeed help relations, for Plant 6 felt that many of the ideas incorporated in the laboratory machine were unique and could solve problems they were having on winding other types of capacitors. The Center and the Plant 6 engineers agreed that the winding and terminating equipment held immediate promise without the full concept of complete assembly from plastic film to finished capacitor. The Center, therefore, took steps to design a machine for another Plant 6 capacitor of different construction that could, nevertheless, benefit from the winding and terminating techniques. There was some interaction of Research Center and Plant 6 design engineers, but it was not overly friendly or collaborative. Plant 6 eventually ordered several of these machines, but the capacitor for which they were designed was discontinued, so they were modified for still another design. From the Research Center end there was continual frustration as the capacitor design changed, for they found they were tooling for what was an experimental capacitor. When that capacitor was abandoned, the machines were modified for another. The machines have not been particularly successful and have been criticized for their difficulty of maintenance. The Center feels the machines are now producing a product for which they were not intended and point out the equipment is fairly sophisticated and requires knowledgeable repair. Instances were cited where a portion of the machine was removed when no one knew how to repair it.

The project has slowly drifted into disillusionment as Plant 6 continued to criticize and showed no interest in further investigation. It became the habit of some Plant 6 engineering supervisors to make digs about the money wasted in the investigation, so that today the Center is quite hostile to that group (and I assume vice versa). About two years ago the Center decided to abandon the investigation. After the chronological narration of the case had been given me, I tried, as in the other cases, to get those I interviewed to speculate as to what went wrong and what they would change if they had it to do over. The strongest reaction I got from all those I talked to about this case was that as the Center progressed in its investigation, Plant 6 built up its own research staff to do parallel investigation.

They now say that if nothing else, they have spurred Plant 6 into doing (constructive) things they would not have done, such as build competence in research. Obviously, it is a moot point whether in fact that happened, but the Center feels that in every area in which investigation was started it soon had a large force doing similar work at Plant 6. I heard such phrases as, "completely frustrating but not a waste" and "never will get a sense of accomplishment." As to what they would change there is a strong feeling that the "Center can't design a big piece of equipment and hand it to someone unless there is very complete understanding." The case was a particular disappointment to the Research Center because no other plant could use the development, in contrast to the coil winder case. I was told the Center would not now start a case (or at least this group would not) unless there was prospect for multiple applications.

Plant 6 Force Field Analysis

I feel that the analysis should only cover the winding-terminating machine, for if this had been successfully adopted, the case would have been considered a success regardless of the fact that the complete concept had not been achieved. Even though several of the machines are currently running, they are apparently being used in a manner much less sophisticated than their design intent so that the Center considers the project a relative failure. In the force field view, also, it is apparent that the R forces were never reduced to the point where a goal level was achieved. It is again significant to note that, as in Plant 1, there still exists some enmity between the groups that continue to affect future dealings. This price may be a much higher one than that invested in the case.

R FORCES

1. Center working in area in which Plant 6 responsible

2. Center proposing to change existing methods developed by Plant 6

3. Plant 6 pride - "we can do anything the Center can in this area" historical eminence

4. No skilled repairmen trained

I FORCES

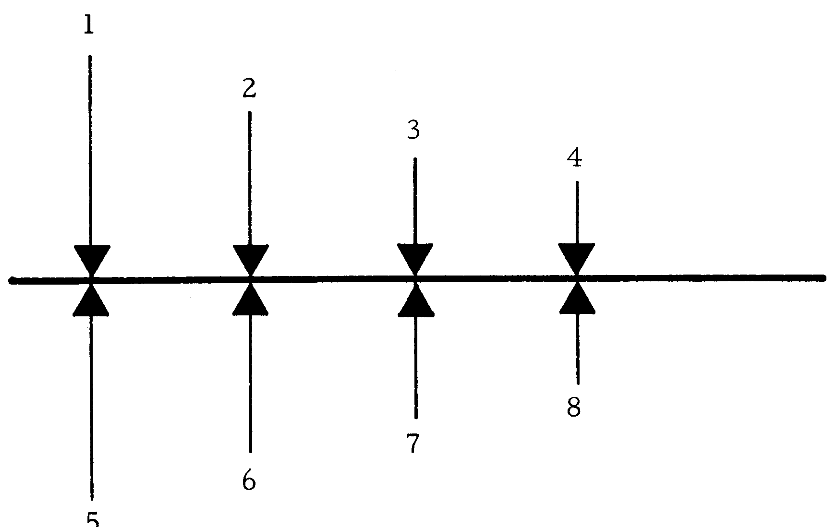
5. New development uniquely applicable to capacitors

6. New concept could only be developed at Center where vacuum concept originated

7. Plant 6 engineers brought in to see laboratory model

8. Plant 6 capacitor winding problems

R FORCES



I FORCES

Force Field Diagram No. 5 - Capacitor Studies, Plant 6

CASE III INVENTORY CONTROL

This case and Case IV are associated for two reasons. They were both conducted by the Operations Research section of the Research Center, but more important for this study, even though they involve different plants, one of the plant supervisors is associated with both cases. It seems he was transferred (and promoted) in the time between the two cases. Because of this I made an effort to obtain an interview with this man because it so happened that one case ended in failure and the other success. I felt this circumstance should be a particularly useful one because here was an outsider - non Research Center employee - working with the Center on two projects, one a success, the other a failure. The question immediately is: what was the difference? What circumstances, approach, individuals or what-have-you made the difference?

Case III, like Case I, was begun as one of the early efforts of the Center. It also resembles Case II in that the Center felt it had a package to offer, to apply to problem areas in the plants. Unlike the mechanization group who looked for specific plant problems to attack, the operations research or computer specialists looked for general problems with which to propose solutions, and then to fit the newly developed techniques to a specific plant problem. The Center, therefore, spent some time working out concepts, computer programs and appropriate equipment before it looked for a plant at which to apply them.

The reader may ask, is the stage already set to create N.I.H? It is interesting to notice as the interview unfolds with the then Plant 2 supervisor that his reactions of a development being forced on him are so much like those of the antagonistic Plant 1 and Plant 6 even though with his Case IV experience he has no ill will toward the Center. The Plant 2 in this case is the same Plant 2 of Case I. This case occurred before Plant 2 was involved in Case I, and it was obvious on that case that the plant as a whole (different departments were involved) had no "built in" resentment from this case.

The Research Center developed some ideas about improved inventory control and scheduling techniques that had been checked out by model simulation. They looked for a likely shop in some plant in which to apply the concept and used the criteria of high pay-back quickly realized as was described earlier for the first cases. They picked an old shop at Plant 2 with which some of the Center people were very familiar. They felt that here was a very likely spot to prove the worth of the concept, with a long history of operation that could be used to verify improvement and one in which progress would show good gains. The Center investigation at Plant 2 was approved at a high level, and the Center started in to study the shop and implement the new concept. It was not until this time that the Plant 2 engineers were brought into the picture. They were hostile to the ideas. They had some ideas of their own about what computer should be used and how it should be used. When the Research Center went into the shop, they met resistance. They were young, bright men with advanced degrees and talked a jargon foreign to the shop jargon. They had no shop experience or background. The shop foremen were old, experienced hands who resisted the ideas of these outsiders. The Research Center found continued resistance as they worked. They were unable to implement any of their ideas and in frustration decided that an old shop was not the place to begin work with the new concepts. They requested and were given backing to withdraw from Plant 2 and begin work at a new plant recently opened in which the new concepts could be used from the start. The Research Center engineers felt Plant 2 fought them, was resistive to new ideas and was in general difficult to work with. A typical case of N. I. H.

Let us go back now and examine how these same events appeared to the Plant 2 engineering supervisor responsible for this shop. His general statement as to how the Research Center effort appeared, "They had a solution and were looking for a place to put it." He then told me the shop and engineering situation at the time the Research Center appeared. The shop had a long history of quality difficulties;

it had had "fourteen years of quality misery" in which it had been out of control. I was told that the one thing the shop did not want at that time was for anyone to come in and rock the boat. Small wonder that the Center got little cooperation from the shop.

The Plant 2 engineers also had internal reasons to be less than enthusiastic about the Center coming on the scene. They had been working for some time on a scheme to perhaps do half the things the Center proposed. An authorization for a computer had just made it to the desk of the Plant Manager (we can imagine the work to get it there) when the Research Center showed up. The authorization was sent back, and the engineers were instructed to wait and see what the Center wanted. Several expressions were used by the supervisor to describe the resulting conflict. He saw the "pride of ownership" of his engineers in wanting the computer and concept they had developed, and he also spoke of the Center pride in insisting that the computer they recommended was the only one. He told me there was never any attempt to come to some compromise on the two approaches. In the end neither was followed as the Center withdrew, but the authorization had been killed. About half of the Plant 2 scheme was eventually implemented by means other than with a computer. The wonder is that the Plant 2 rejection of the Center was not more widespread and longer lasting!

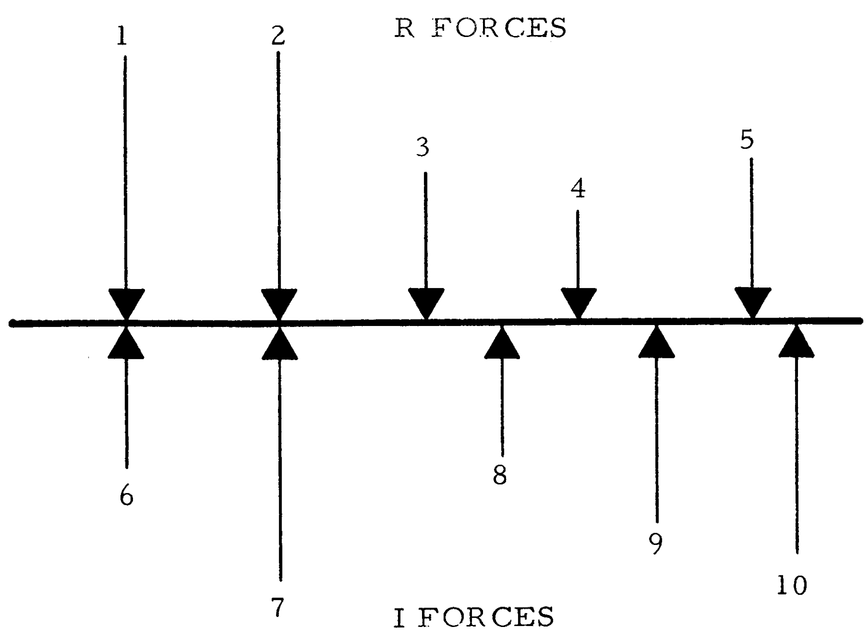
Force Field Analysis

R FORCES

1. Shop quality concerns
2. Inventory plan of Plant 2
3. Rejection of computer authorization
4. Pride of ownership: own shop, own plan; outsiders to dictate
5. No participation in shop selection for Center study

I FORCES

6. New concept to cure plant ills
7. Need for first application success
8. Prove success to old associates
9. Backing of Plant 2 upper levels
10. Plant 2 need for modern inventory system



Force Field Diagram No. 6 - Inventory

Control - Plant 2

CASE IV TEAM PROJECT

This project differs from the others that have been discussed in that this was a multi-plant project. The fact that a team was put together of men from several organizations may, in part, explain the project's success. The previous cases indicate that much group resistance to change has to do with group pride and defense of group norms and ways of doing things. The project team had no history of association so had no reservation about the project group working on the problem. Individual members had the defense of their old group attitudes to remember, of course, but at least the new group had no incentive to reject the project out of hand. There were other reasons why the project should succeed as we shall see. Not only were inter-personal and intergroup relations well handled, but the innovation itself was a dramatic success!

The problem facing the company managers was this: for the last several years demand of electrical cable had exceeded total company capacity. In each of these years several million dollars premium, that is cost above the cost of company produced cable, had been paid outside suppliers. There was also concern about the quality of this cable as compared to that produced in house. Cable was produced at four plants, two of which produced all but a small quantity of specialty orders produced at the other two plants. One of the two large producing plants was located in the Midwest, the other on the east coast. Since the product was so bulky and customers were spread all over the nation, orders were allocated to the plant by the geographical location of the customer, the Mississippi River the dividing line.

As the managers discussed the problem of production capacity, several questions arose such as: is there a more efficient shift configuration, three shift five days or six, two shift seven, etc., with relation to employee cost and machine maintenance and repair down time. Also, with the hundreds of combinations of cable design, number of conductors, color coding, conductor size and cable sheath material, were the plants making the most effective set-ups and most economical production runs? How did these runs fit in with the shift alternative? And finally, how about the most economical shipping, did we have it? Even with all the facts assembled, the answer combinations were formidable, so the Research Center was asked in essence, can you get any more production from the plants?

The engineering supervisor who had been at Plant 2 during Case III and was now at the east coast plant felt that one of the main differences in dealing with the Center on the two cases was that in this one the response was "maybe we can help" when asked, rather than "we have a solution, show us some of your problems." Indeed, the Center did answer that yes, they did have some techniques that might apply to this problem. The idea, of course, was to build a linear program that would include all the many variables. A task force was set up with representation from all the interested parties, and it was decided after some meetings that a work group should set up shop at the Research Center where computer facilities were at hand. The first task was to gather data, and here again the former Plant 2 supervisor indicated the right moves were made. One knowledgeable Research Center engineering supervisor became the contact for the plants and the representative of the group at the Center. It was said of him that he listened. This comment seems to me to be particularly significant for what it implies. To say that he listened is to indicate that he was not only attentive and made an effort to understand but was also somehow sympathetic to the speaker's point of view (in this case the plant's). The fact that listening was highlighted as a particularly complementary attribute also indicates that it was absent from the Plant 2 experience with the Center. He spent time making sure that the plants were well informed of the status of the work. An example was given in which the total capacity of the plant had to be determined, including down time, shift changes, cable code changes and the like. The team gathered all the components to make the estimate. During the time the estimating was being done, the plant started to conjure up the injustice of the over estimate that they were sure would be produced by the team. Counter arguments were formed, for no estimate was as good as actual production experience and the plant knew all the kinds of things that could go wrong but would not show up in an estimate. They were quite surprised and pleased when the estimate came out less than the figure believed to be the best the plant could possibly do. The plant felt then that no one was trying to "beat them down" in order to make it appear on paper that there was more capacity. It was also reported with pleasure that the team representative always came back with any figures that were to be used, such as the estimate above, for approval by the plant before they were used, but more important before anyone else saw them. These figures were treated as the property of the plant, and the plant sensing this, had confidence in the team. It is obvious here just how important is consideration for the group being effected. The team representative was in some measure like the project or innovation champion spoken of earlier. He was the fellow who understood the technical people at the Center but also understood the needs of those at the plants. Through him both groups had their say and felt they were a part of the effort.

The solution has had dramatic results. All ordering for the nation is being done at a central control with access to a computer. The control establishes which plant will produce the order using criteria such as customer location, similar orders, length of run, machine and labor availability and order priority. It examines all of the some four thousand combinations of cable design and machine combinations available and how they relate to geographic location. The run takes two hours each day on a 7094 computer, but daily delivery promises and daily production runs are given incorporating each order. Not only that, but management can now ask questions such as what effect shift combinations or maintenance combinations might have on production and get an answer back to questions that were heretofore impossible to answer quantitatively. Did the effort solve the problem? By more efficient scheduling and combining of production runs on a national basis, capacity has been "created" to the extent that no outside purchase will be required and the two low level (and higher cost) plants will no longer produce cable. The statement was made during the interview at the Research Center that no N.I.H. was evident in this case. When asked to compare the two cases, the engineering supervisor at the plants said that in the Case III approach, the Center had its mind made up, ignored the plant and was intent in getting only those ideas implemented. In Case IV, they actively asked for plant participation and suggestions. They continually solicited approval and listened to comments. Here was the same man, the most influential individual on both projects as far as acceptance by his plant was concerned, considered on the one hand to be resisting the innovation to such an extent that the Center withdrew to a new plant, and on the other considered to be one of the major factors in implementing acceptance of the innovation. It would seem that the approach of the Research Center helped create N.I.H. in the first case and helped overcome it in the second.

Force Field Analysis of Case IV

The attitudes and convictions that constituted the major R forces were not reported in the body of the case. The primary one was a conflict between the work group at the Center and group in the Finance organization whose job it is to oversee all computer applications. The complaint of the Finance group was that this scheme did not fit in with their overall and long range plans. This conflict was resolved when a "good theory x" decision was made by a Finance supervisor that this project shall run. With that consideration set aside the basic problem became the problem itself, with the solution the largest linear program ever written for the company or at the Research Center.

R FORCES

1. Finance group's own long range plans

2. Concern of plants that they would be "used"

I FORCES

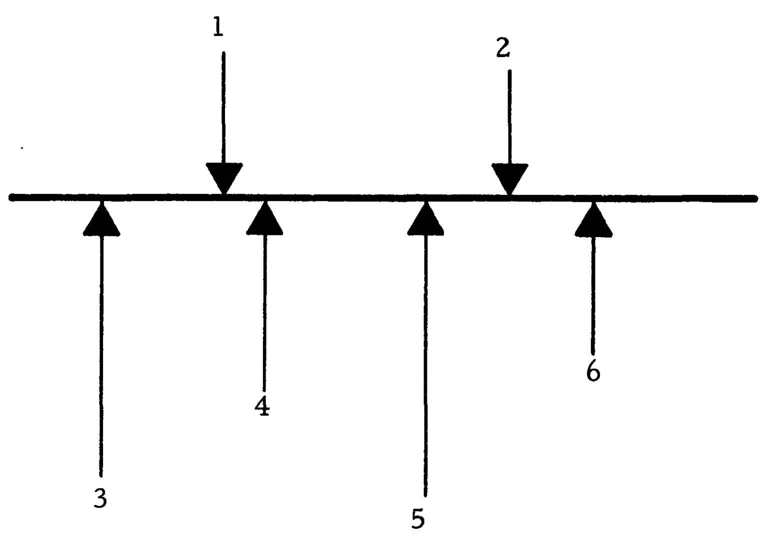
3. Multi-organization team

4. High level backing

5. Understanding approach to plants

6. "Champion" established as go between

R FORCES



I FORCES

Force Field Diagram No. 7 - Team Project

CHAPTER IV

CONCLUSIONS AND SUGGESTIONS FOR FURTHER RESEARCH

Conclusions

The major impact of the examination of the cases seems to me to be that contrary to the proposition set forth by the title, the problem is not, "how to overcome N.I.H.", but how to prevent creating it. How to prevent creating N.I.H. will be the first area examined in looking at ways in which a research organization can operate to gain acceptance. A major source of information will be the force field analyses. By examining those cases in which N.I.H. was created as opposed to those in which it did not appear we may have patterns develop that will allow a hypothesis to be proposed. Following the first examination, several concepts will be presented for what might be called "techniques" that could be used in introducing technical innovations to technical organizations. Some of these concepts can be somewhat substantiated by the cases. Others evolve from studying the literature with the experiences of the cases in mind. Concepts that will be covered include; the champion versus the inventor, the innovator role, identification with the present state and the group climate.

Force Field Analyses

I have just stated that the major impact of this study is the hypothesis that N.I.H. may be created. That is the innovating group, by its approach and treatment of the client group can set up the conditions whereby the client group is forced to react negatively or resist the innovation. If we examine the cases that had negative results we should see these forces in each. In order to reinforce this view, an examination of the positive cases where an innovation was accepted should show that the client group was allowed and encouraged to react positively. This hypothesis does not deny that there are groups and individuals who are prone to reject innovations as a matter of policy or who expend considerable effort to find flaws that will allow rejection. Far from it! As a matter of fact, I feel technical people are generally prone to be critical and pessimistic of innovations both because of pride in their expertise which rejects new information not of their own creation and as a matter of discipline that requires rigorous proof of innovations before acceptance. No, this just makes the job of creating change more difficult. It means that those who propose innovations to technical people must be aware, be sensitive to these points of view in order to cope with them.

Negative Cases

Let us examine the failures among the cases to see if there are any common flaws of procedure that might be spoken of as creating N.I.H. In order to do this, we should look at the R forces listed for the failures, since these are the verbalized reasons given for rejection. The cases that ended negatively, in which the innovation was not accepted, are: Case I, Plants 1 and 5; Case II and Case III. The first R force type, I will call this force A, might be characterized as invasion in an area of vested interest. Each of the negative cases (see list of negative case R forces below) has a force relating to prior client work in the area in which the Research Center has chosen to concentrate some effort. Now this alone should not be a deterrent to research investigation. Rather, it should tell those interested in introducing a prospective innovation that at the time the investigation is started the client should be brought in on the work. If not actually made part of the effort, the client should at least be made a constant consultant. An even more effective first step, where it can be managed, is to have the client ask for help. During the initial phase of investigation, if the client refuses to cooperate, shows no interest and resists the investigation, the researchers should face the fact that the innovation will likely <u>not</u> be accepted and used by <u>that</u> client regardless of the technical "success" of the innovation. The counterpoint to the last statement will be seen in the examination of the positive cases that have clients with vested interests, all right, but in which the client feels he has an unsolved problem where Research Center effort can help.

The second R force, called force B, seems to be lack of consultation with the client. The client feels left out of the process as if his thoughts and experience were of no consequence. Little wonder that when it is the client's turn to control the situation they are less receptive to the change. One point for the prospective innovator to remember here is that in two cases the Research Center assumed the client group had agreed to Center work in the particular area but it turned out upper management on both sides had agreed, not the engineers, who would ultimately institute the change. I would say, therefore, that it is incumbent for innovators to be sure all levels are aboard and not rely on client inter-level communication (which may still not achieve engineer commitment). The "B" force is probably at the nub of N.I.H. Coch and French, Zander and Moore[9] all make the basic point that those who are to be changed _must_ become aware of and be made a part of the _process_ of change. While I have described some techniques, and will describe more, for "overcoming N.I.H.", the basic fact shown by these cases seems to be that _receptivity_ is created by making sure the client group early and often is made aware of and becomes a part of the innovation process. That statement says positively what R force "B" says negatively, that _resistance_ is created by excluding client participation.

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[9]Leo B. Moore, "Too Much Management Too Little Change," _Harvard Business Review_, XXXIV No. 1 (January-February 1956)

The "C" force in this trilogy of things not to do appears to be technical, and possibly a "front" or scapegoat. Each failure case generated some R force that had a physical, usually technical reason why the innovation would not work at that plant. I suspect this is the good old human ability to rationalize any emotion into an unemotional "reason" for action or attitude. In a business, especially in a technical portion of a business, some "facts" must be found for actions taken, in this case, rejection of an innovation. Various reasons for rejection appeared in the cases, but I will label them all as surface, or for the record, reasons not having much to do with the real problems listed above.

Negative Case R Forces

Type A

Case I Plant 1 No. 1	Plant 1 engineers working on own machine
Case II Plant 6 No. 1	Center working in area in which Plant 6 responsible
Case III Plant 2 No. 2	Inventory plan of Plant 2 ignored

Type B

Case I Plant 1 No. 2	Resented "surprise" intrusion of "outside" group
Case II Plant 6 No. 2	Center proposing to change existing methods developed by Plant 6 - no consultation
Case III Plant 2 No. 5	No participation in shop selection for Center study

Negative Case R Forces
(continued)

Type C

Case I Plant 1 No. 3	Machine not adaptable to peculiar problems of Plant I
Plant 5 No. 2	Maintenance of Center machine a problem
Case II Plant 6 No. 4	No skilled repairmen trained
Case III Plant 2 No. 1	Shop quality concerns

Positive Cases

If the negative cases were characterized by lack of client identification and participation in the evolution of the innovation, then hopefully the positive cases would show evidence of these characteristics. For the point to be well proven, positive cases with the same initial conditions of vested interest (force A) should show that an altered approach to the client created the positive acceptance of the innovation. Unfortunately, the Research Center acted consistently throughout the study period and no such change in approach was observed. What then distinguishes the positive cases from the negative, and does this difference reinforce the concept that N.I.H. is created? All the positive cases had one thing in common: the client came to the Research Center with a problem. As indicated in Case I Plant 2, asking for help is a very significant way in which a client identifies with and will accept change. It would seem this would be one of the best ways to introduce an innovation, where possible. However, is this action (asking for help) the same as, or can it be correlated with the proposed requirement that positive cases must have client participation? I think it can without a very large jump from one to the other. The positive cases had the first step missing from the total approach required of the Center approaching a neutral or hostile client. That is, the Center would have to interest the client in the innovation development and get him actively interested in becoming identified with the effort. When the client comes to the Center saying, "I have a problem I think you can help solve" the Center would have to be "talented" to turn off interest. The way it could be turned off would be for the Center to say they would study the problem and contact the client when a solution was developed. Fortunately, in the cases studied, either the Center did not do it or the client would not allow it. So I feel the positive cases lend partial support and at least do not oppose the concept. More will be said later about future investigation that might have positive supporting results.

The Champion Versus The Inventor

I have already outlined the concept of the innovation "champion" of Morison and Shon in the Case I Plant 2 discussion. A good measure of the success of that project appeared to be because of the continued faith and effort of a champion for the machine. A much more active champion, whose role was team representative, appears in Case IV. He became the focus and channel through which the innovating team and the client communicated. By being sensitive to the needs of the client - to participate, identify with the project, be kept informed and not be bypassed - he achieved very complete acceptance of the innovation. The ideal champion appears to be an entrepreneur type who identifies or makes his own the innovation in question and is determined that it will be accepted and succeed. At the same time our ideal must be knowledgeable of the needs of the client, and so approach and work with him that the client is able to become a part of the innovating effort.

Shon also speaks of the problems created by a champion within the innovating organization, both because an outsider may be the only one capable of playing the champion role and the disruptions that an over-enthusiastic champion could cause by keeping the organization in constant turmoil. There is no question that it would be difficult to recruit and interpose a champion on an innovating group. Yet the technique is so valuable, effort should be expended in the attempt. One possibility is for organizations to actively seek such skills among its own members and openly develop the champion role. I suspect those suited may not be at the top of the technical heap and may well flower when given the ability to act as the innovating team representative. A natural ability to get along with others, plus some technical understanding could be augmented by training in the work done in the area of overcoming resistance to change. A model group in which a champion is a part is probably the best way to introduce the concept. I have no doubt that Case IV will be used in this way at the Research Center. Here it will be noted the champion was a skillful member of the team.

The Innovator Role

I am here talking about identifying the innovator in the client group. There has been considerable research toward understanding how new products or concepts are adopted among consumers by marketing people. Two such studies that bear on this point are one by Coleman, Menzel and Katz[10] and the other by the Foundation for Research on Human Behavior.[11] The Coleman study deals with an attempt to identify which doctors in a town were the first to adopt the use of a new drug and how use spread to others. A certain group of doctors were identified as innovators to whom others looked for

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[10] James Coleman, Herbert Menzel and Elihu Katz, "Social Processes in Physicians' Adoption of a New Drug," Journal of Chronic Diseases, Vol. IX, No. 1 (January, 1959).

[11] ______ "The Adoption Process: Foundation for Research on Human Behavior," The Adoption of New Products: Process and Influence (Ann Arbor, Michigan: Foundation for Research on Human Behavior, 1959) pp. 1-8.

new ideas. The innovators were held in high esteem technically, were successful and could afford to innovate and, in general, presented themselves to new ideas through attending technical meetings, reading journals and the like. The point of the study was that by identifying the innovators, producers of a new drug could concentrate more effort on convincing them of the efficacy of the drug in the hope that if adopted by them a general adoption would follow. The second study is similar on an entirely different group in which adoption of a new hybrid corn is traced among innovating farmers. Traits similar to the innovating doctors were found: technically looked up to, succesful enough to experiment and an inclination to be sensitive to and look for new ideas.

Allen and Cohen have proposed similar methods of innovation introduction in their study in an R & D Laboratory. They call the innovator leaders "technological gatekeepers" and characterize them in three ways:

> "a. They will be the people to whom others in the Lab most frequently turn for technical advice and consultation.
>
> b. They, themselves, will be more exposed (than others in the Lab), to such formal media as the scientific and technological literature.
>
> c. In addition to exposure to formal media, the gatekeepers will maintain a greater degree of informal contact with members of the scientific/technological community outside of their own Laboratory." [12]

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[12] Thomas J. Allen and Stephen I. Cohen, "Information Flow in an R & D Laboratory" Working paper #217-66 of the Alfred P. Sloan School of Management, Massachusetts Institute of Technology, August 1966

If this is the case, it would certainly pay for the Research Center to identify and cultivate these people in the various client organizations so that when an innovation appears to have promise for a particular location, the first contact and hopefully easiest convert would be that individual. I did see one such attempt at the Center, where a group responsible for Laser development was keeping a file on contacts, requests and summaries of inquiries so that they would know where to go in each plant for any future negotiation.

Identification With The Present State

It is not necessary to make this comment to anyone working in the area of resistance to change, but it was a surprise to me to realize that just because an individual works in a field in which creating innovation and change is his stock in trade is no reason to believe that he will be more receptive than anyone else to change himself. One of the mysteries of N.I.H. as I started this study was that I thought some special force must be at work to prevent innovators from accepting change. Both Morison and Shon examine the "normal human instinct" to oppose technological change. Morison's case deals with the U. S. Navy as "not only an armed force (but) it is a society...(which has) been forced to accommodate itself to a series of technological changes."[13] His point is that the Navy is no special case when it

[13] Morison, p. 600

resists change but is just the same as any other group who identifies with the present state and resists a change upon the present way of life. As I say, this point should surprise no one, but I feel it worthwhile to repeat in order to point out that a prospective innovating group should approach the technical client with the same expectation of resistance to change as if the client were, say, a shop group about to have a new manufacturing method imposed on them.

Group Climate

My last observation is another in what might be called techniques that an innovating group might keep in mind when considering how and to whom an innovation will be introduced. R. P. Biller[14] ran a study among R & D organizations in which, among other things, he sought to identify those organizations most adaptive to change. Among the many findings of the study: "There are direct relationships between an organization perceived to be adaptive and the extent to which it is both effective and able to initiate change internally when needed." This says to me that the innovating group should, where possible, seek out and attempt to deal with those client groups noted (they may

[14] R. P. Biller, "Research on Change in Research and Development Organizations" unpublished study conducted at the U. S. Naval Ordnance Test Station, China Lake, California (1966).

have to search and pry, their own experience may be the best guide) for adaptability. Too simple to make a point about? I am not so sure that overt consideration is given to the place most likely to accept an innovation as the place to start. Acceptance and use by a sister plant is probably the best argument the Research Center can use in suggesting adoption of an innovation to a plant. This is one method for inducing plants (after the first plant has used the innovation) to ask for help.

Findings

The list of how to do it gained from this study goes something like this:

1. Foster the situation in which the client asks for help.
2. Where possible, develop a champion or team representative to act as go between with the client.
3. Contact the client at the time the innovation focuses on use at a particular plant. Make the client a part of the development, help him to identify with and become a part of the work.
4. If the client continues active and strong resistance at this point, expect no change after final development.
5. Be sensitive to past experiences, try to picture the research organization as the client sees it and act accordingly.
6. Attempt to identify adaptive groups and innovators within groups and work with them first.
7. Expect resistance to change, and work to reduce the resistance not increase the outside pressure to change.

<u>Suggestions For Further Research</u>

The follow-on to the case studies listed here should be an attempt to apply the findings with a new innovation to a client group similar to those negative cases in which the innovations were not accepted, since all innovations cannot be introduced in response to a request, as the positive cases were. Only in this way can any positive steps be taken along a route to understanding receptivity to innovations and eliminating N.I.H. Perhaps there are cases now where some or all of the listed techniques or other techniques of introduction have been tried with success.

Introduction of technical innovations to technical groups is at once the same as and different from introduction to non-technical groups. Certainly most individuals react in similar ways to change and to the extent that the technical group is resisting change the general body of knowledge applies. However, the technical group is different in that it is better able to resist change because of the expertise in its possession. The technical group can counter scientific proof with scientific disproof and is quite capable of dreaming up an endless list of technical obstructions to change. This only makes the job tougher. It says that the innovator approaching a technical group must be <u>more</u> understanding, <u>more</u> sensitive and <u>more</u> open if he hopes to succeed.

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