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SWEDISH TELECOM AND ITS CONNECTIONS TO THE ENVIRONMENT
- an empirical study of managerial cognition over time

INTRODUCTION

Swedish Telecom is the main actor on the Swedish market for telecommunications products and services. For about one century it has also been the *sole* actor in most segments of this market - it is a government-owned organization which has been in a de facto monopoly position. However, during recent years changes have come fast. Market liberalization and increasing competition are examples of changes mentioned frequently by Swedish Telecom's Director General, Dr Tony Hagström.

It therefore appears as if Swedish Telecom's current position is becoming heavily turbulent. That is what it appears *today*, at a point in time when the changes have gathered momentum; at a point when experience of the changes has accumulated and become intelligible to Swedish Telecom. But what about the time when the changes began to unfold, i.e. when they were first encountered? As noted by e.g. Pfeffer & Salancik (1978 p 72), events in the environment do not present themselves to us with neat labels - we have to produce the labels ourselves. Sometimes we fail to do this; our cognitive system is characterized by imperfections that may result in ignoration of environmental changes (cf. Hogarth & Makridakis 1981, Nisbett & Ross 1980).

One of those imperfections is rigidity - we find ourselves subject to a severe resistance with regard to changes in perceptions over time. This rigidity has been shown to exist in many different situations. The failure of the so called "brain-washing" method to change the values of prisoners of war in Korea (Brown 1963), the general importance of the first impression of an object (Sproull 1981 p 212), managers' commitment to strategies despite changing environments (Levitt 1960, Starbuck & Hedberg 1977) and scientists' resistance to changing their theories (Mitroff 1974) are only a few examples. This aspect of human cognition is sometimes referred to as "anchoring", i.e. once we have made a first pass at a problem, the initial judgement may prove remarkably resistant to further information (cf. Nisbett & Ross 1980 p 41).

Yet we know that the world is changing. Therefore perceptions must change, too - we face a variety of problems if we attempt to apply models of yesterday to the world of today and tomorrow. We also know that perceptions are not totally rigid and that they do change, at least in the long run (see e.g. Fahey & Narayanan 1989, Fletcher & Huff 1990, Narayanan & Fahey 1990 for some empirical studies). It seems to us, however, as if we still know very little about this process of change.

This paper should be seen in the light of the limited amount of empirical studies with respect to changing environmental perceptions over time. The purpose is to examine to what extent changes in environmental perceptions have appeared in Swedish Telecom. This particular organization was chosen since its environment appears to have changed dramatically over time; it is a situation which raises heavy demands on the perceptive

ability of Swedish Telecom's decision makers.

The outline of the paper is as follows. We focus on one important aspect of environmental perceptions, *causal* perceptions, and we begin with a discussion of the socially constructed nature of causality. Then we present some descriptive dimensions to be used in the paper. Given our focus on causal perceptions, we turn to a presentation of the data collection method; derivation of decision makers' cognitive maps from archival sources, a method designed to deal particularly with causal perceptions over time. Our next step is a presentation of the data obtained by this method for the period 1983-1990. Finally, we discuss the empirical results in terms of the descriptive dimensions.

CAUSAL PERCEPTIONS - A THEORETICAL FRAMEWORK

The constructed nature of causality

Even if we look very carefully at the surrounding world, we would not find any causes or effects out there - not one single cause or effect. They exist only in our minds; we create them in order to make sense of the world. Thus, it can be argued that causality is a socially constructed phenomenon. A useful analogy provided by Smircich & Stubbart (1985) is how we "see" constellations in the heavens. We know very well that there is for example no Big Dipper out there. Anyway, we find it useful to imagine that there is - by drawing lines between the stars, it becomes easier to make sense of them. But the lines do not exist *out there*. They exist only *in our minds* - we have constructed them.

The socially constructed nature of causality becomes perhaps most clear when we turn to how different individuals explain "the same" event - we know that such explanations do not always include the same causes. An example from a research context is how industrial organization analysts explain the firm's behaviour. Most of them agree that causes are found within a group of variables typically labelled market structure. But there is no consensus with regard to which particular variables to include in this group, something that the reader may verify by examining the explanations offered by Bain (1966), Caves (1987), Scherer (1980) and Shepherd (1985).

We see the process by which causality is constructed as a legitimate object of study per se - as legitimate as the possibly more traditional perspective where the external observer attempts to construct general causal laws for events taking place "out there". One main reason why we find the social constructionist approach fruitful is that decision makers in organizations, particularly at high levels are not only producers of decisions; they are also "sense-givers" in so far as they provide explanations for other participants in organizations (cf. Beyer 1981, Daft & Weick 1984, Gioia & Thomas 1991, Pfeffer 1981). Thus, causal constructions by decision makers are likely to affect an extensive number of people in a society where an increasing number of activities are carried out by organizations. But what is actually taking place when causality is constructed? The answer is that events and objects are divided into cause and effect categories. This division is in fact one of the most fundamental aspects of human cognition (see e.g. Brief & Downey 1983, Bettman & Weitz 1983, Ford 1985, Weiner 1985). More specifically, as Schwenk (1988) has argued, causes and effects serve as interpretive lenses which will help decision makers select aspects of an issue as important for diagnosis. And it seems as if many authors assume that this process is characterized by

a high degree of rigidity (see e.g. Axelrod 1976 p 230, Brief & Downey 1983, Hewstone 1989 p 96).

In the following, we will present three descriptive dimensions which we use in order to find out if changes have occurred in the causal perceptions of Swedish Telecom's decision makers: relative importance of individual causal variables, complexity and locus.

Relative importance of causal variables

The first dimension to be dealt with here is concerned with the relative importance of individual causal variables over time. Empirical studies have shown that concentration towards some causal variables is common in causal systems; some variables are more central in cognitive systems than others (Bougon et al 1977, Holstius 1983, Stubbart & Ramaprasad 1988). Therefore, we assume that some variables are likely to be more important than others. We use a straight-forward definition of importance: a causal variable A is assumed to be more important than a causal variable B if A is causally related to more variables than B. For instance, if A affects five other variables, and if B affects only one other variable, A is regarded as five times more important than B.

It should in this context be noted that causal relationships are not the only kind of relationships that may exist between variables in a cognitive system. Other types of potential relationships between two variables A and B discussed by Huff (1990 p 15) are e.g. connotive association ("A reminds me of B") and degree of similarity ("A and B are highly different"). Given the general importance of causal attributions in sense-making efforts, however, we assume that causal variables say something about the total number of variables included in an individual's world view - we assume that causal variables can be regarded as particularly important variables from the individual's point of view. This assumption is crucial here, since we *only* study causal variables.

Complexity

The second dimension of interest here is complexity. Many authors suggest that decision makers' causal perceptions are fairly simple as far as the number of variables and relationships between them are concerned (Duhaime & Schwenk 1985 p 291, Kelley 1973 p 121, Kiesler & Sproull 1981 p 556, Weiner 1985). This assumption, however, can be seen in the light of some empirical studies that show a quite high degree of complexity in causal perceptions (see e.g. Bougon et al 1977, Holstius 1983, Stubbart & Ramaprasad 1988).

The question of simplicity or complexity is on the one hand perhaps a matter of definition; causal attributions derived from decision makers by empirical studies can of course be seen as simple in the sense that they do not contain *everything* in the subjects' world views. On the other hand, however, the degree of complexity seems to be highly related to the type of data collection instrument used by researchers. It has for instance been shown that obtrusive methods, such as "forcing" decision makers to evaluate potential causal relationships between variables organized in a matrix, produce more complex causal systems than less obtrusive methods - e.g. analysis of documents produced by decision makers (Axelrod 1976). One underlying explanation discussed by Hewstone (1989 p 43) is that people, most of the time, do not consciously seek

explanations - particularly not when engaged in routine activities. In other words, the presence of the researcher may initiate cognitive processes that would not normally occur.

Here, our interest is in the extent to which complexity in perceptions has changed over time. Our basic definition of complexity is straight-forward: if two systems of causal variables include an identical number of variables, the system with the highest number of relationships between the variables is the system with the highest degree of complexity.

We will also use an additional definition of complexity, which is inspired by the "Type 5" environment discussed by McCann & Selsky (1984). They point to an important characteristic of a causal system - the fact that the system may be partitioned; i.e. the system may be composed of several clusters of variables. It should be noted that McCann & Selsky (1984) do not discuss this issue in terms of cognitive systems, but in terms of social systems in general. Nevertheless, we think that a cognitive system may be composed of clusters, too. We define complexity in this dimension as follows: if a system A is composed of more clusters than a system B, the complexity in A is greater than in B.

Locus

In the third dimension a distinction is made between internal and external causes. In attribution theory, from where we have borrowed this distinction, internal causes refer to factors within an individual, e.g. personal traits, while external causes refer to factors in the environment of the individual. Earlier studies have shown for example that a person making causal explanations ("the observer") of another person's behaviour ("the actor") has a tendency to find causes in terms of the actor's personal traits rather than in the environment of the actor. It has also been shown that actors and observers make different attributions. The observer, as already mentioned, has a tendency to explain the actor's behaviour in terms of personal traits, while the actor himself is more inclined to find causes to his own behaviour in his environment.

One explanation to these findings is that western culture is more or less obsessed with the power of the individual to affect his own life; if we observe the behaviour of someone, we are inclined to believe that the behaviour is the outcome of a personal will to behave in this way. Another explanation is that the observer generally has a limited amount of information to base his attributions on, so he uses the most tangible information at hand - information about the actor himself. Thus, the actor becomes "a figure against ground" (cf. Hewstone 1989 p 50-54, Jones 1976, Kelley 1973, Watson 1982).

However, decision makers in firms are sometimes inclined to overestimate their own ability to affect the environment - they suffer from "illusion of control". One reason is that in order to function as a decision maker, one *has* to believe that one's activities will affect others - otherwise managerial work will probably become meaningless (cf. Duhaime & Schwenk 1985, Ford 1985, Kiesler & Sproull 1982, Schwenk 1984, Schwenk 1986). But there seems to be a restriction on the illusion of control. It has been shown that decision makers tend to attribute favourable outcomes, e.g. increasing profits, to themselves or to the activities of their organizations, while they tend to

attribute unfavourable outcomes to uncontrollable factors in the environment (Bettman & Weitz 1983, Hewstone 1989 p 57-59, Salancik & Meindl 1984).

Here, however, we use an extended definition of the individual's environment. When we talk about the environment below, we are actually referring to the *firm's* environment. This should be seen in contrast to the original meaning of the environment in attribution theory, in which the environment includes everything "outside" the *individual*. It can be noted that this distinction is usually given little attention by researchers who use attribution theory in the context of the firm. For instance, Ford (1985) and Salancik & Meindl (1984) refer to causes as internal if they reside inside an organization, not inside an individual. We will do the same here; by locus of causality we refer to causes that are internal or external from the firm's point of view.

What happens when the level of analysis is changed in this way? To illustrate just one aspect of the importance of this issue, we may return for a moment to the illusion of control concept discussed above. This concept appears frequently in studies where the firm is the level of analysis, and given the size and power of many firms, it is not hard to understand that decision makers in such firms are likely to suffer from illusion of control when they make statements about *the firm's* relationships to the environment. However, if these studies had been carried out on the individual level, e.g. by studying statements regarding the individual decision maker vis-a-vis relations to *his* environment, including the firm itself, illusion of control seems less likely to occur.

RESEARCH METHOD

Selection of data collection method

Since we are interested in perceptions over time, we decided to collect data with a method that reduces the potential for bias in terms of decision makers' reconstruction of events in hindsight. The method we selected is documentary analysis, i.e. analysis of documents produced by decision makers themselves. It is discusssed by e.g. Axelrod (1976 p 6), who argues that decision makers' perceptions "would have to be derivable from whatever materials that are left behind in the normal course of a decision making process". Furthermore, he argues that documents produced by decision makers are usually fruitful sources, in the sense that they are uncontaminated by the presence of the researcher. A similar discussion is found in Bouchard (1976). He claims that various archival sources - such as documents - are generally "unreactive". The reason is that the producer of the documents is seldom aware of the fact that he or she is subject to research interest.

However, the producer of documents may be highly aware of the fact that documents are going to be read by other people than researchers. This is particularly valid with regard to decision makers who take on a strong sense-giving function as discussed above. It highlights a potential limitation of documents. The problem - especially when documents are used that are accessible to the public - is that such documents may not reveal what decision makers actually think, but what they wish others to believe that they think (cf. Fahey & Narayanan 1989).

Selection of documents

Two criteria influenced the selection of documents. Firstly, we wanted documents that express the point of view of Swedish Telecom's top management. Secondly, we wanted documents that allowed us to make comparisons over time with regard to environmental perceptions.

The type of documents that we found to be suitable are Swedish Telecom's "Three year plans". Such plans are published each year, and they contain forecasts, discussions of trends - particularly environmental trends - as well as suggestions for changes in the operations. In a sense they resemble annual reports, but the plans are far more extensive and detailed. A typical plan consists of 80-90 pages of text.

Before 1984 the plans were only circulated internally, but since 1984 they have also been forwarded to the owner - the government of Sweden, represented by the Department of Communications. The owner uses the plans as inputs to decisions regarding Swedish Telecom.

Moreover, the plans have been subject to the approval of Swedish Telecom's Board of Directors. They are also signed by the Director General (a Swedish label for CEOs in some state owned enterprises) and the Director of Finance.

Plans published from 1983 to 1990 were availiable to us at the point in time when this paper was written, and we decided to focus our analysis on the two end points, as well as on one year in between the end points (1986).

Selection of coding procedure

It was mentioned above that documents provide the researcher with a data source that is likely to be uncontaminated by the presence of the researcher. However, this does not reduce the potential for contamination with regard to the *coding* of documents, especially since researchers' observations are generally highly theory laden (cf. Anderson 1983, Bagozzi 1984, Mitroff 1974). Wrightson (1976 p 294) has commented on this aspect in terms of coding of documents:

> "The chief danger of content analysis is that a coder may, in his search for assertions, impute his own assumptions into coding to create assertions. The danger of overzealously creating relationships that have no basis in the text is twofold. First, it immediately introduces coder bias and text distortion. Second, it opens the door to comparative coder incongruence. This problem becomes increasingly dangerous when the coder becomes familiar with the speaker's viewpoint. When this is the case, the coder may see a relationship where there is none, simply because he is familiar with the cause-effect relationships that he has seen a number of times previously."

One step to reduce some of the potential for bias is to explicitly present the rules that governed the coding. In this case we did as follows. We used the basic structure, "Cause Concept/Causal Linkage/Effect Concept", suggested by Wrightson (1976) in our coding. That is, all concepts that were linked by explicit causal assertions - e.g. "leads to", "is a result of", "because", and so forth - were coded as causal statements (cf.

Salancik & Meindl 1984).

However, we introduced one important restriction in the process. We were not interested in *all* causal statements; we were only interested in statements that involved *environmental* variables. It means that we only took account of statements in which external variables appeared as either a cause or an effect concept.

An example from one of the Three Year Plans may illustrate what type of statements we regarded as causal in the sense outlined above:

> "The fast technological development and the increasing competition result in shorter life cycles for telecommunications products"

This statement was classified as containing two cause variables, technological development and competition, and one effect variable - product life cycles. Moreover, the three variables were classified as external, since the statement is about environmental development in general terms. Here is another example of a statement:

> "Demands from customers regarding telephone variety have led to a broader assortment in the telecom shops, for example Diaset, Diabelle, DiaMark, Myntofon, etc"

In this case we treated customers' demands as a cause variable and assortment as an effect variable. Customers' demands were classified as an external variable, while assortment was classified as an internal variable. (Swedish Telecom was here referring to its own outlets at the retail level.)

Moreover, as one further step to avoid researcher bias, both authors of this paper were involved in the coding. Both of us read independently the Three Year Plans, and both of us made a list of all causal statements of the kind described above. Then the two lists were compared. The decision rule could be expressed as follows: any time one of us was in doubt as to whether a statement was causal, and/or whether external variables were involved, the particular statement was disregarded.

One weakness in our study is that we did not attempt to measure the degree of inter-coder reliability. Such measures, however, do exist and they have been applied by other researchers using several coders. We may perhaps defend our own lack of explicity in this area by noting that a high degree of inter-coder reliability is usually obtained in studies made by the same procedure as the one we used (cf. Axelrod 1976).

Thus, by following these lines, we hope that we have reduced the potential for bias. After all, this study is concerned with Swedish Telecom's decision makers and *their* construction of causality - not our own construction.

SWEDISH TELECOM AND THE DECISION MAKERS' CAUSAL PERCEPTIONS OVER TIME

Preparation of empirical data for the analysis

The number of causal statements we found in the Three Year Plans was 49 (1983), 63 (1986) and 59 (1990). In order to make the statements more analysable, we decided to merge some causal variables. As noted by Wrightson (1976 p 323) there is no single best way to merge variables, and the coder is advised to be conservative; all variables should be treated as separate and distinct until it is demonstrated that they are the same. Since we are primarily interested in environmental variables here, we decided to be more conservative with these than with variables related to internal aspects.

For instance, with respect to internal variables, all performance variables such as profits and return on investment were labelled "ST's PERFORMANCE", and all variables relating to accounting activities, such as depreciation time, were labelled "ST's ACCOUNTING". Thus, the decision rule we applied was to merge variables that seemed to fit into a common category in a natural way.

With regard to the external variables we were - as already stated - more careful. For example, "DEMAND", "TRAFFIC GROWTH" and "MARKET DEMAND" are variables in the statements that perhaps could be treated as *one* variable, since they are all related to market characteristics. But they *may* reflect distinctions that the decision makers feel are of importance, and therefore we kept them as separated variables with the same labels as the decision makers used themselves.

However, classification of variables in the internal-external dimension is not always an easy task. As noted by many organization researchers, it is hard to draw a clear boundary between the firm and its environment (cf. e.g. Weick 1979). One interesting example of boundary problems in this case is the telecommunications network. A major part of the Swedish network is owned by Swedish Telecom, and the network is present in almost every building in Sweden. In fact, according to OECD (1990:22 p 142), Sweden is the country with the highest penetration rate of main telephone lines per capita. Swedish Telecom is in other words actually physically present in many places in its own environment. Hence, it can be questioned whether the telecommunications network is an external or internal variable, and it is likely that a satisfactory answer is never arrived at.

Nevertheless, for analytical purposes it is necessary to draw a line somewhere. As a matter of fact, and more generally speaking, it can be argued that we *have* to assign objects to distinct categories - otherwise cognition becomes an impossible task (Stubbart 1989, Taylor 1975). Here, we did as follows: variables that could be assumed to be directly related to the influence of Swedish Telecom's decision makers were classified as internal, and variables that could be assumed to be directly related to the influence of forces in the environment were classified as external. This process resulted in a list of 35 variables, and they are presented in Figure 1.

Internal
1. ST's general activities
2. ST's products
3. ST's prices
4. ST's network activities
5 ST's modernisation activities
6. ST's company formation
7. ST's personnel policy
8. ST's investments
9. ST's financial activities
10. ST's accounting
11. ST's performance
12. ST's other internal aspects

External
13. Demand
14. Market change
15. Customers' demand
16. Customers' communications
17. Traffic growth
18. Customers' performance
19. Customers' activities
20. Telecommunications in the environment
21. Network capacity
22. Supply
23. Product life cycles
24. Government
25. Financial environment
26. Credit market
27. Technological development
28. Regional development
29. Inflation
30. Society
31. Liberalization
32. Competition
33. Regulatory bodies
34. International aspects
35. Standardisation

Figure 1: The Result of the merging and classification process

The next step was to arrange the 35 variables in matrices; one matrix for each Three Year Plan. In these matrices the rows contain cause variables and the columns contain effect variables. Moreover, in this case, all variables were placed in both the rows and the columns, since many of them were both cause and effect variables.

Then each relationship between variables in a given Three Year Plan was indicated inside the plan's matrix. More specifically, each relationship was indicated each time it occurred in its plan. This means that more frequent relationships automatically receive a higher weight with respect to relative importance. One could perhaps question if a relationship which occurs say three times can be regarded as three times as important as a relationship which occurs only once. But since decision makers seldom talk about the relative importance of variables in an explicit way, we assumed that frequency can be treated as an indicator of how decision makers themselves view the relative importance of various relationships (the same asumption about frequencies is found in Fahey & Narayanan 1989). Thus, the output of this initial step was three 35 x 35 matrices, i.e. one matrix for each Three Year Plan.

Such matrices should be read as follows: the row sum for a given variable gives the outdegree for the variable, i.e. the number of times the variable affects other variables. The column sums, on the other hand, give each variable's indegree, i.e. the number of times a variable is affected by other variables. The row and column sums gives us a first indicator of the relative importance of the variables in a matrix.

However, these sums only take account of *direct* causal relationships between variables. In this case, several variables were *indirectly* related to each other. One example is that

liberalisation was seen as leading to increasing competition in some statements, while increasing competition was seen as leading to more alternatives for end users in other statements. Hence, there is an indirect relationship between liberalisation and the alternatives available for end users.

In order to take account of indirect as well as direct relationships, it is suggested by e.g. Eden et al (1979) and Nozicka et al (1976) that indirect relationships can be located by raising the original matrix to successive powers. In other words, an original matrix M (which shows only direct relationships) is transformed to a reachability matrix R by means of the following formula (^ refers to "raised to the power of"):

$R = M + M^2 + M^3 + \ldots + M^{n-1}$ (n = the number of cause or effect variables)

The row and column sums of an R matrix show the *total outdegree* and the *total indegree* for each variable, i.e. the variables' cause and effect values when all indirect and direct relationships are considered. These are the two measures we are using in the analysis below. For the purpose of clarification: a variable's total indegree is here treated as an indicator of the variable's importance in terms of effects, and a variable's total outdegree is treated as an indicator of the variable's importance in terms of causes.

In this case, the longest possible causal path in each matrix is 34. However, we decided to set a limit to how far the search for indirect relationships should go. The limit was set at causal paths of the length 5. Hence, the R matrices were computed with the following formula: $R = M + M^2 + M^3 + M^4 + M^5$. The reason why we set the limit at 5 is that some trials with higher limits did not reveal any differences with respect to the relative importance of the variables.

The importance of cause and effect variables over time

In this section we turn to the variables in each of the Three Year Plans and their total indegree (I) and total outdegree (O). The distribution is presented in Figure 2 below. Variables 1-12, all the "ST" variables, are internal variables, and variables 13-35 are external variables.

Variables:

		Year: 1983		1986		1990	
Internal		**I**	**O**	**I**	**O**	**I**	**O**
1.	ST's general actiities	71	0	17	3	1	0
2.	ST's products	3	15	6	10	48	191
3.	ST's prices	0	1	19	8	20	1
4.	ST's network activities	0	0	0	0	49	1
5.	ST's modernisation	0	2	0	0	75	11
6.	ST's company formation	17	0	0	0	0	0
7.	ST's personnel policy	2	0	1	0	0	0
8.	ST's investments	20	0	51	0	18	0
9.	ST's financial activities	51	37	0	0	35	0
10.	ST's accounting	4	0	0	0	17	0
11.	ST's performance	0	0	170	0	5	0
12.	ST's other internal aspects	9	3	23	29	4	1
External							
13.	Demand	19	2	13	0	0	209
14.	Market change	12	1	8	4	34	101
15.	Customers' demand	1	17	0	12	160	9
16.	Customers' communications	5	3	0	22	0	0
17.	Traffic growth	0	4	20	28	0	4
18.	Customers' performance	5	0	117	0	154	0
19.	Customers' activities	13	0	59	3	103	77
20.	Telecommunications in the environment	1	9	16	4	0	57
21.	Network capacity	0	0	1	10	0	0
22.	Supply	0	0	1	4	0	98
23.	Product life cycles	0	4	1	3	18	0
24.	Government	25	90	6	28	0	8
25.	Financial environment	0	6	0	11	0	0
26.	Credit market	3	1	0	0	0	0
27.	Technological development	0	32	0	198	0	27
28.	Regional development	5	0	45	0	75	0
29.	Inflation	2	0	0	28	0	3
30.	Society	0	28	20	2	1	0
31.	Liberalisation	0	0	0	80	28	14
32.	Competition	0	13	2	94	46	6
33.	Regulatory bodies	0	0	0	0	0	9
34.	International aspects	0	0	0	0	53	115
35.	Standardisation	0	0	0	15	0	2
Total		268	268	596	596	944	944

Figure 2: The distribution of the variables' total indegree and total outdegree over time.

It can be noted that the sum of total indegree is equal to the sum of total outdegree in all three matrices. The reason is that all causes in each matrix are represented by an equal number of effects and vice versa.

A t-test was conducted in order to find out to what extent differences have occured over time with respect to the values of the cause and effect variables (the values used in this test refer to "true" cause or effect variables in Figure 2; i.e. variables with values equal to zero were not included). The resulting p values are presented in Figure 3 below.

	Total indegree:				**Total outdegree:**		
	1983	1986	1990		1983	1986	1990
1983	-			1983	-		
1986	0.094	-		1986	0.485	-	
1990	0.018	0.240	-	1990	0.091	0.348	-

Figure 3: P values resulting from a t-test of differences between the three years.

We see in Figure 3 that only the difference in terms of indegree between 1983 and 1990 is significant at the 5% level. It can also be noted that the p values for total outdegrees are generally higher as compared to the p values for total indegrees. We interpret this as follows: the effect variables have changed more than the cause variables.

Differences between the years can also be analysed in terms of correlation coefficients. In this case we used Spearman rank correlation coefficients, since the ranks of many of our variables have changed over time (cf. Wilkinson 1989). Moreover, we used all the variables in Figure 2, i.e. we included cause and effect variables with a value equal to zero. The correlation coefficients are presented in Figure 4.

	Total indegree:				**Total out degree:**		
	1983	1986	1990		1983	1986	1990
1983	-			1983	-		
1986	0.264	-		1986	0.427	-	
1990	0.061	0.206	-	1990	0.169	0.295	-

Figure 4: Spearman correlation coefficients.

In Figure 4 we see that the highest correlations occur between years which are close to each other in time. And again - there is a difference between indegrees and outdegrees. The cause variables are more correlated to each other over the years than the effect variables; i.e. the effect variables have changed more than the cause variables.

Thus, it seems clear that differences have occured in the decision makers' environmental perceptions when it comes to the time between 1983 and 1990. But what has actually happened in more specific terms?

Above other things, the distribution in Figure 2 reveals that one particular change may

be at hand - something seems to have happened with Swedish Telecom's view of customers. This part of the environment is covered by variables 13-19 in Figure 2. If we merge these variables, the following picture emerges:

	1983		1986		1990	
	I	O	I	0	I	O
Customer variables (13-19) 451444	55	27	217	69	451	400
All other variables	213	241	379	527	493	544
Total	268	268	596	596	944	944

Figure 5: Customer variables and all other variables over time.

With the data in Figure 5, we can - on the effect side - claim that customer variables represented 20% of all effect variables' values in 1983, 36% in 1986 and 48% in 1990. On the cause side, the proportions are as follows: 10% in 1983, 12% in 1986 and 42%. Thus, it seems indeed as if customer variables have become more important over time; Swedish Telecom has adopted a more customer oriented world view.

Complexity

The first definition of complexity we used above was as follows: if two systems of causal variables include an identical number of variables, the system with the highest number of relationships between the variables is the system with the highest degree of complexity. An operational measure in tune with this definition is *density* in a system, i.e. the number of all ties occuring in the system divided by the number of all possible ties (Knoke & Kuklinski 1982 p 45). The latter is here defined as 35 x 35 - 35 = 1190. With this definition, we obtained the following densities: 0.066 for 1983, 0.11 for 1986 and 0.118 for 1990. Thus, in other words, our matrices have becomed increasingly "filled" with relationships over time.

The second definition of complexity above referred to the number of clusters; if a system A has more clusters than a system B, A is more complex than B. In order to identify clusters in our matrices, we did as follows. We used the CONCOR (CONvergence of iterated CORrelations) procedure in GRADAP 2.0, a computerized graph analysis program, to identify blocks in our matrices. A block is defined as a number of variables that are similar in terms of structural equivalence; i.e. the variables in the block are similar when it comes to their interaction - both in terms of causes and effects - with all other variables in the system (see e.g. Brieger 1976, DiMaggio 1986 and Knoke & Kuklinski 1982 for detailed descriptions of CONCOR). What CONCOR does in brief is as follows. It computes the Pearson correlations among all pair of variables in a matrix, then correlations are computed on all pairs of columns in the correlation matrix, then on pairs of columns in the resulting correlation matrix, and so on. These iterations raise the absolute value of the correlations and force them towards values of either +1 or -1. When the absolute value of all correlations in the iterated matrix is greater than a convergence criterion, here set at 0.9, the program splits the variables into two blocks according to the sign of the correlations - positively correlated variables are put in the same block and negatively correlated variables in another block. Then the same procedure continues by performing subsequent splits on separate blocks.

Here, we decided to focus on the two extreme points in time, i.e. 1983 and 1990. The results are presented in the figure below.

1983		1990	
Block	Variables	Block	Variables
1	1, 14, 16, 18, 19, 28, 29	1	1, 11, 12, 17, 24, 29
2	2, 5, 15, 17, 20, 23, 24, 27, 30, 32	2	3, 9, 10, 23, 30
3	3, 6, 9, 10, 25, 26	3	2, 13, 14, 20, 22, 27, 33, 34, 35
4	7, 8, 12, 13	4	4, 5, 8, 15, 18, 19, 28, 31, 32
5	4, 11, 21, 22, 31, 33, 34, 35	5	6, 7, 16, 21, 25, 26

Figure 5: CONCOR blocks of variables with respect to 1983 and 1990.

Thus, we have an identical number of blocks for both years. In order to find out to what extent the two points in time differ in terms of the content of the blocks, we computed each block's causal value (i.e. the sum of outdegree and indegree for all variables in a block) and tested if the variance has changed from 1983 to 1990. The change is not significant; an F-test results in $p = 0.241$ (the F-ratio is 1.601). Thus, when it comes to our second approach to complexity, we cannot say that complexity has increased over time.

Locus and changes over time

The reader may remember from the discussion above that two types of relationships can be derived from attribution theory; "external causes lead to internal effects" (E/I) and "internal causes lead to external effects" (I/E).

Another type of relationship may, however, also exist when the internal-external dichotomy is used, namely "external causes lead to external effects" (E/E). This type is not covered in attribution theory, but since statements of this type appeared in our data, we decided to introduce an E/E relationships category in our analysis.

To complicate matters further, the reader may remember that we did only take account of relationships in the Three Year Plans which involved external variables. Nevertheless, the ouput was a number of relationship of the type "internal causes lead to internal effects" (I/I). The reason is that some internal variables turned out to be indirectly related to each other, i.e. they were indirectly related to each other via external variables. We include this category of relationships in our presentation below. Thus, we distinguish between four types of causal relationships in our data:

- external causes leading to internal effects(E/I)
- external causes leading to external effects(E/E)
- internal causes leading to external effects(I/E)
- internal causes leading to internal effects(I/I)

The distribution of the four types of relationships in terms of the three points in time is presented in Figure 6. The values were collected inside the R matrices; the E/I relationships are the row variables 13-35 and their effects on column variables 1-12, the E/E relationships are the row variables 13-35 and their effects on column variables 13-35 and so forth.

	Year:		
Type of relationship:	1983	1986	1990
E/I	146	266	171
E/E	64	280	578
I/E	27	29	124
I/I	31	21	71
Total	268	596	944

Figure 6: The distribution of causal relationships with respect to the three years.

A chi-square test indicates that all three years are significantly different from each other at the 0.01 level (the test statistic, Pearson Chi-square, is 56.15 for 1983/1986, 166.13 for 1983/1990, and 138.76 for 1986/1990).

Moreover, these differences seem to stem from the two relationships with external causes. The importance of the E/I type has decreased over time, from representing 54% of the total value in 1983, 44% in 1986, to merely 18% in 1990. At the same time, the importance of the E/E type has increased over time; from 24% of the total value in 1983, 47% in 1986, to 61% in 1990.

Thus, it appears as if Swedish Telecom has become less deterministic about its environment. At the same time, however, more reasoning has become devoted to the environment per se; the decision makers have, to an increasing extent, "disconnected" Swedish Telecom from their environmental statements.

DISCUSSION

Causality or "effectology"?

Our analysis suggests that the effect variables changed more over time than the cause variables. It raises an interesting question: perhaps there are other differences beween cause and effect variables besides the fact that they are located in different "ends" of a causal relationship? The question becomes particularly interesting if it is raised in the light of traditional attribution theory - in which focus is on causes per se. In fact, it is not uncommon to find statements of the following kind among attribution theorists: "a central feature of any theory about attributions is a partitioning of causes" (Wimar & Kelley 1982 p 1142) and "it is essential to create a classification scheme or taxonomy of causes" (Weiner 1979 pp. 5-6). Why this focus on causes? Why do we actually speak about "causality" and not about "effectology"?

An interesting discussion of this topic is found in Bougon et al (1977); a study of the causal map of the Utrecht Jazz Orchestra. They found no linear association between indegrees and outdegrees, which led them to suggest that there may be an important

asymmetry between variables as originators and the same variables as terminators of activity. They also suggest that effects are more important than causes for sense-making. With respect to the latter, they argue as follows (ibid p 615):

> "...in the construction of the world the participants' perceptions are biased toward caused variables rather than toward causing variables. Put another way, participants may pay attention to variables that are heavily controlled by other variables on the assumption that they too can control these variables since they too are causal agents."

Moreover, in their list of effect variables, they found that the effect variables with high indegrees looked like what are conventionally regarded as goals, those variables with low indegrees like the givens of a situation, and those with intermediate indegrees like a broad range of means.

What happens if we try to apply the same distinction in this case? Let us for instance take a closer look at the effect variables in 1990 (see Figure 2). Among the variables with high indegrees we find "Customers' demand", "Customers' performance" and "Customers' activities". They certainly seem to be reasonable goals in an era when liberalisation and competition is increasing.

However, at the bottom of the list, we find entries such as "Swedish Telecom's general activities", "Society" and "Swedish Telecom's performance". Society can without doubt be regarded as a given of the situation, but what about the other two? They may in fact be regarded as givens, too - since Swedish Telecom at this time was producing more deterministic statements (i.e. E/I statements) than statements of the "free will" type (I/E).

Finally, what about the variables with intermediate indegrees, i.e. the means in the typology of Bougon et al? "Swedish Telecom's financial activities", "Swedish Telecom's products" and "Swedish Telecom's network activities" fit nicely into the means category. Another variable in this range, however, is "Competition" and it can hardly be regarded as a means. Or perhaps it can? We know from other situations that external threats may prove to be highly useful in order to, achieve for example, motivation among personnel (cf. e.g. Brown 1963).

Thus, the distinction between goals, means and givens should perhaps be applied with caution as far as some variables in this case are concerned, but the distinction seems reasonable for many variables. This should be seen in relation to what we found about the effect variables; that they changed more than the cause variables, and that their ranks changed, too. Obviously, this means that changes did not only occur in terms of the decision makers' explanations in a general sense, but also with regard to what they felt were goals, means and givens of a situation.

The complex environment

Our data suggest that the environmental model of Swedish Telecom's decision makers has become somewhat more complex, in so far as the number of relationships between the variables in their perceptions has increased over time.

One explanation is that the change in complexity is a function of changing complexity in the environment per se. Many organisation researchers argue that the environments of organisations are becoming more complex over time (e.g. Emery & Trist 1965, Terreberry 1968), and given this assumption, one would also assume that the environmental complexity is mirrored in decision makers perceptions. In this case, we did not study the environment per se, but it seems likely that a study of that kind would prove that it indeed has increased in complexity.

On the other hand, let us assume for a moment that the complexity in the environment per se has been constant. Would the degree of complexity in the decision makers' perceptions of the environment then have been constant, too? It is by no means certain. Perhaps the change in complexity in the perceptions is a reflection of a cumulative sense-making process, i.e. decision makers start out with limited information and gradually learn more about the environment over time. And as they do this, they may find it reasonable to add an increasing number of causal relationships to their "model". Thus, the increasing complexity in the perceptions may reflect cognitive processes, rather than processes in the environment per se.

Which of these two factors - the environment per se or an ongoing process of making sense of the environment - provides the most satisfactory explanation of the change in complexity encountered here? We do not know that. It seems clear, however, that this area lends itself to some very interesting studies. For instance, is there a limit to the degree of complexity that can be reached by decision makers' sense-making efforts - does the cognitive system reach a level of saturation over time when it comes to complexity? And do the two systems correlate positively, i.e. is an increase in complexity in the real world followed by an increase in the complexity of models of the real world and vice versa? Or do they correlate negatively - is there a search for simplicity in the cognitive system when the real world becomes far too complex to comprehend?

Swedish Telecom and the causal relations to its environment

Our data shows a decrease over time in terms of the relative importance of relationship of the type "external causes lead to internal effects". Expressed in attribution theory language, this implies that the decision makers have shifted from an "actor status" to an "observer status", since it is assumed that actors are far more deterministic than observers (if they do not suffer from "illusion of control"). However, at the same time the relationships of the type "internal causes lead to external effects" remained fairly stable. Thus, the deterministic view of the environment was reduced over time - but it was *not* replaced by an increasing number of statements with opposite causality.

In spite of the latter it seems appropriate to speak of a shift to an "observer status", since what actually happened was an increase in the relative importance of relationships of the type "external causes lead to external effects". These relationships by definition include variables that are not causally related to Swedish Telecom in a direct way; they include events "out there" which are subject to Swedish Telecom's observations. Why has this change occurred? One explanation is that the environment has become less intelligible over time, and therefore it seems reasonable that Swedish Telecom's decision makers allocate more cognitive resources to the environment per se.

Whatever the explanation may be, relationships of the type "external causes lead to external effects" are clearly positioned outside the locus dimension in attribution theory. This suggests that the locus dimension needs to be developed in future studies; decision makers are apparently not so egocentric that all their causal attributions only refer to themselves.

CONCLUSIONS

This paper has dealt with environmental perceptions of Swedish Telecom's decision makers. Focus has been on their causal perceptions with regard to changes during the 1983-1990 period. The following aspects of change were studied: the importance of individual cause and effect variables, the degree of complexity in the causal system, and the relationships between the variables in terms of the internal-external dimension.

The interest in changing perceptions was derived from a number of authors who have claimed that a high degree of rigidity in perceptions is likely to be at hand. Rigidity appeared in this case, too. The differences between the causal variables' in the statements, in terms of the variables' indegrees and outdegrees, were not found to be significantly different at the 5% level with regard to 1983-1986 and 1986-1990. But a significant change was observed with respect to the effect variables in 1983 and 1990. It can therefore be concluded that changes in general terms took place at a slow rate. However, at a less aggregated level, it can be noted that variables related to customers have become more important over time.

We also found that effect variables changed more than cause variables. One possible explanation of this difference is that effect variables are more important than cause variables with regard to sense-making efforts, and therefore they are perhaps more likely to change when the environment changes. Given the reflection offered by Bougon et al (1977) - that effect variables with high indegrees can be regarded as goals - it can also be concluded that Swedish Telecom's goals have become more related to customers.

Furthermore, we found that the complexity in the perceptions increased slightly over time - when complexity is defined as the number of relationships between variables. Since we did not study the environment per se, however, we do not know the extent to which the increase in complexity is a reflection of complexity in the environment - or a reflection of a learning process with reference to the decision makers.

With respect to locus, it can be concluded that the decision makers' perceptions have become significantly less deterministic over time, but also that their perceptions have become more related to the environment per se. One possible explanation of the latter is that the environment has become less intelligible, and therefore more sense-making efforts have to be devoted to events taking place in that environment.

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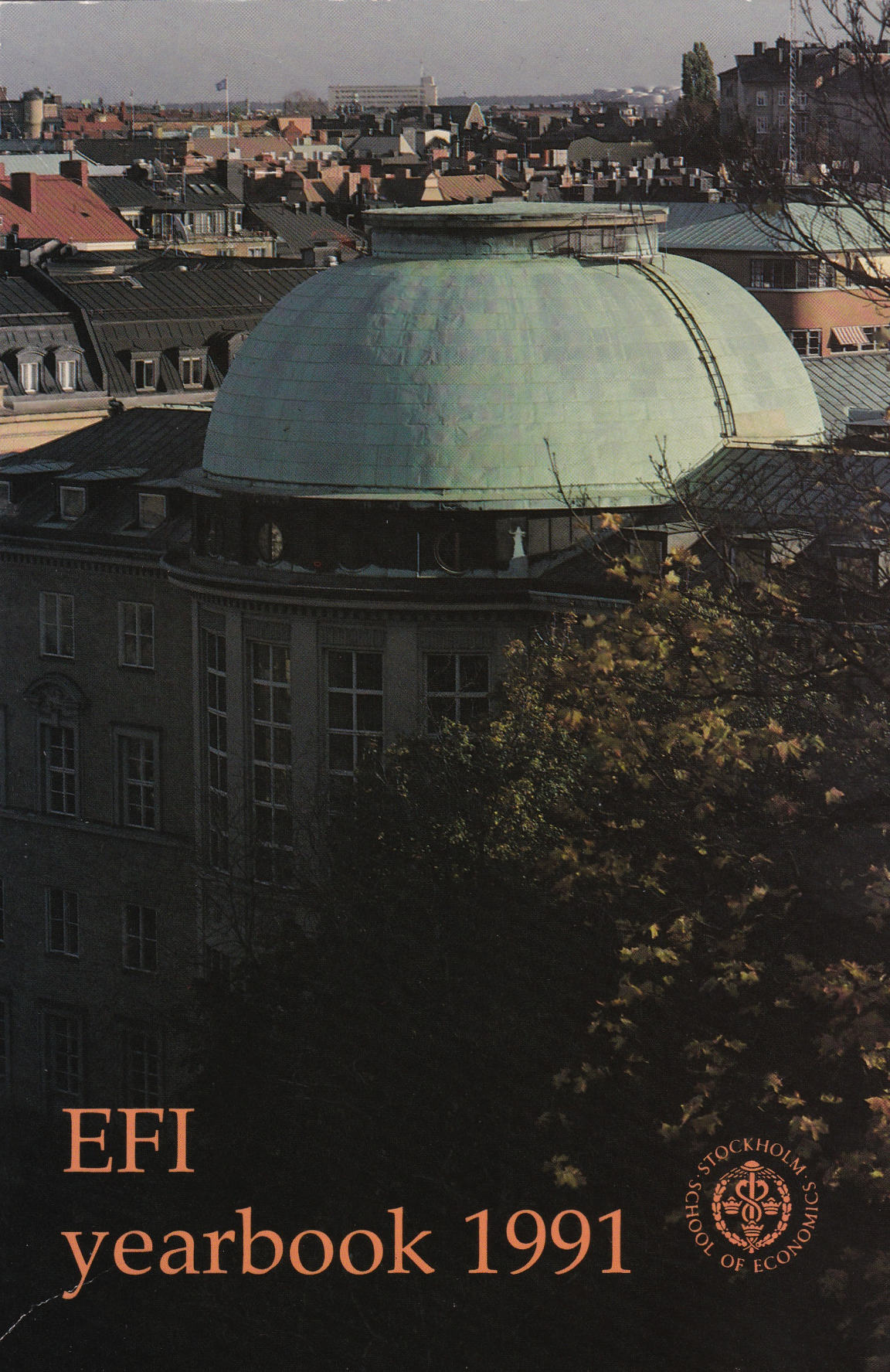

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