SISU dokument

Key Charts

– a visualization technique for business analysis

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Abstract

The interest in describing different aspects of an organization is increasing. Key Charts offer a possibility of creating multidimensional general survey models of an organization.

This paper introduces the concept of the Key Charts, which combines at least two models and visualizes their interaction. We point out some areas where Key Charts could be used and also describe how they are developed by experts within the organization. Experience gained from working with Swedish Telecommunications Administration's Key Charts is also discussed.

Contents

1 Background

In recent years enterprises have come to realize more and more the importance of having a clear and accurate description of their organization. In system development various different types of models for describing the projected data-system have been in use for some time. Nowadays most business models are made in conjunction with the development of a data-system, which fact influences the character and extent of the models. Similar business models could be used to make better, more all-encompassing descriptions of the business. There is, for example, a particular need for a enterprise to have clear and well-structured business models at times of reorganization.

At the Swedish Institute for Systems Development (SISU), work is being carried out to develop methods, techniques and support systems to aid in the production of business descriptions. Amongst other things, SISU is developing and testing techniques for presenting interacting models on a Key Chart.

The idea of showing two models on one and the same diagram is a by-product of a business analysis carried out at Saab Scania. In a model are described the basic communication within and between two important processes in the company, product development and production. Since communication presupposes well designed concepts the idea was born to show the object of the communication in the same graph. Together these models form strategic goals for a future development of computer systems and communication. The chart of these models can still be seen on many walls within Saab Scania.

SISU has worked jointly with Swedish Telecommunications Administration (Swedish Telecom) in running a project whose purpose was to create an overall and integrated picture of the Swedish Telecom Concern on a general, survey level. One of the aims in so doing was to create a platform for information exchange between different sections of Swedish Telecom, with a view to eventually co-ordinating their databases. The work resulted in two Key Charts for Swedish Telecom.

Swedish Telecom's organization has central units which co-ordinate the whole and which are divided up according to specialized areas within the whole, for example the areas of marketing and construction of telecommunications networks. There are at the same time local units, so-called tele-districts. These tele-districts have independent responsibility, and they run practical operations, such as marketing and network construction.

2 Three model types and Key Charts

2.1 Introduction

A organization can be described from various different aspects. In working with Key Charts we focus on **why, what** and **how.** Each such aspect is described in a separate type of model. The goals, which answer the question of why the organization exists, can be seen in a goal model. Concepts, described in a conceptual model, indicate what the organization works with, and the flow, described in a flow model, shows how the organization operates.

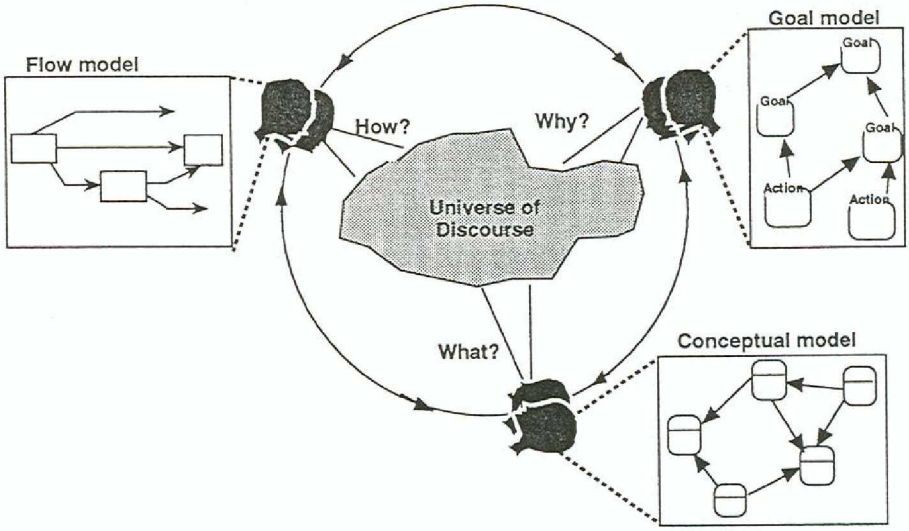

Figure 1 Three aspects of the Universe of discourse

In this section we describe the syntax and concepts for the three different types of model by presenting the metamodels for each of them. In the three metamodels the same syntax is used as in the conceptual model.

A model is a description of one or more person's idea of an organization. This idea can be expressed in several ways, e.g. by verbal description or by symbols in a graph. We sometimes use the word chart to clarify the fact that a model is being described graphically.

2.2 Conceptual models

2.2.1 The conceptual metamodel

The conceptual metamodel is inspired by IBM's AD/Cycle Information Model [IBM] and Swedish Telecom's Telmod [Tvt-Tel].

In order to give a clear view of the concepts and syntax we use for conceptual models, we illustrate here with an example.

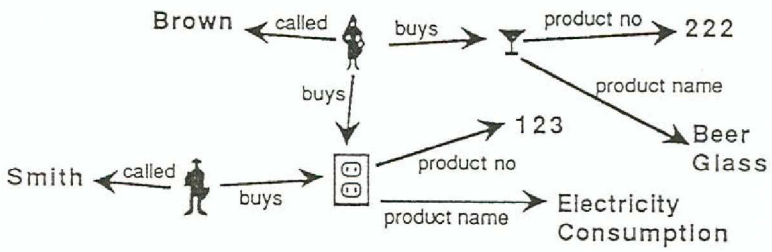

Figure 2 Examples of objects.

Smith, Jones, Beer Glass and Electricity Consumption are **objects.** Objects can be classified into **object types**. In our example, Smith and Jones are CUSTOMERs, and Beer Glass and Electricity Consumption are PRODUCTs. Other examples of object types are SALES PRODUCT, PHYSICAL PRODUCT, and SERVICE. An object type is represented by a rectangle with

rounded corners, with the name written in the upper section of the rectangle. An object type can be described by using an unlimited number of **attribute types**. CUSTOMER in our example is described by using the attribute types "is called" and "address". In the graph, attribute types are shown in the lower section of the rectangles.

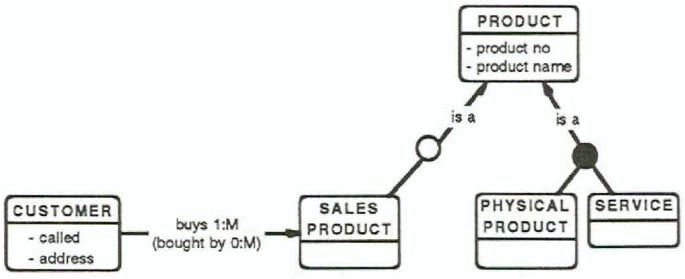

Figure 3 A enterprise handles products, which could be either physical products or services. Some of these products are sales products, which are bought by the customer.

We also describe **relationships** between objects. A relationship can be seen as a connection between two objects. Relationships are neutral, i.e. they are not directed. There is, for example, a buying relationship between Smith and Electricity Consumption. A relationship can also be seen from the perspective of the different objects involved. Smith *buys* the Electricity Consumption, and the Electricity Consumption is *bought by* Smith.

Each perspective is a **relationship link**. Relationships and relationship links can be classified as **relationship types** and **relationship link types** respectively.

In our example, the two relationship link types *buys* and *bought by* together constitute a relationship type. The relationship link type *buys* is the main direction, and *bought by* the inverse direction. In the graph, relationship types are indicated by an arrow, which points in the main direction. On the arrows are written the names and mapping restrictions of the relationship link types. A mapping restriction consists of two components where the first part indicates the minimal and the second part the maximal number of related objects. Thus the restriction 1:M on *buys* between CUSTOMER and SALES PRODUCT indicates that a CUSTOMER *buys* at least one SALES PRODUCT and might buy several. The restriction of *bought by* is 0:M indicating that a SALES PRODUCT does not have to be *bought by* any CUSTOMER but may be *bought by* several.

An object type can be specialized according to one or more criterion. In our example PRODUCT is either PHYSICAL PRODUCT or SERVICE, i.e. they form a **subtype set** of PRODUCT. SALES PRODUCT belongs to another subtype set, sales aspect. The object types belonging to a subtype set inherit all the attribute types of the super object type. A SALES PRODUCT thus has both product number and product name, and is either an example of PHYSICAL PRODUCT or of SERVICE.

A filled circle represents an **exhaustive** subtype set, indicating that a PRODUCT must belong to either PHYSICAL PRODUCT or SERVICE. Sales aspect is an example of a **non-exhaustive** subtype set, i.e. products can be SALES PRODUCT. In other words, products exist which are not SALES PRODUCTs. This type of subtype set is indicated by an unfilled circle.

Irrespective of whether or not a subtype set is exhaustive, the object types included are exclusive, meaning that a particular PRODUCT cannot belong to both PHYSICAL PRODUCT and SERVICE.

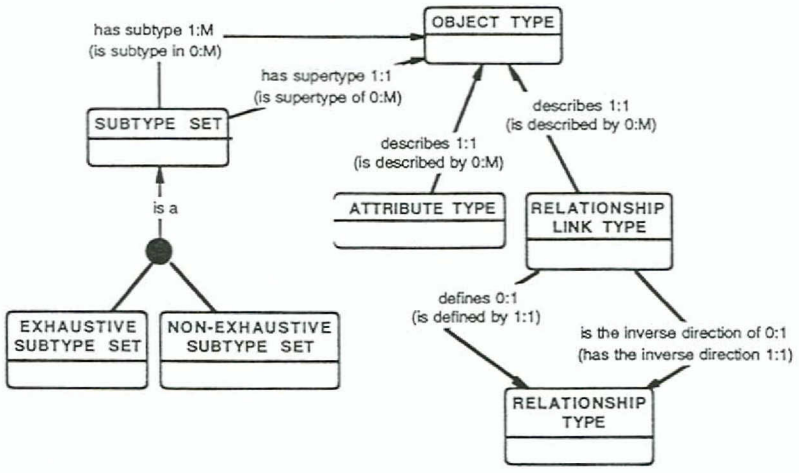

Figure 4 Metamodel for conceptual models, expressed by graphic representation.

The graphic description is complemented by a verbal definition of each object type. This includes a brief description of and a motivation for the object type. It is also possible to include rules and an identifier to clarify the definition. The definition document also covers some administrative details, e.g. who is responsible for the definition, and the number of instances of the object type within the enterprise. A graphic description of the object type and its immediate surroundings is also included.

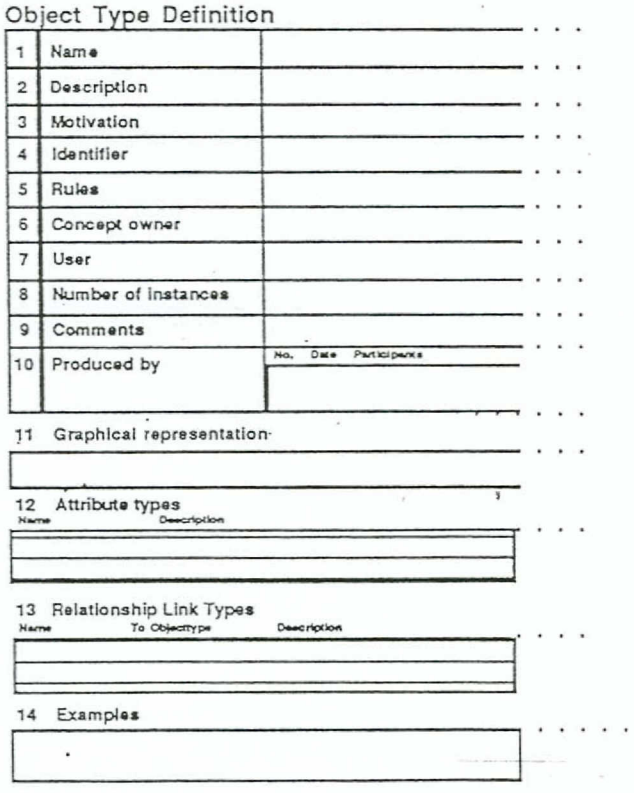

Figure 5 Definition document for object types.

2.2.2 Business-orientated conceptual models.

According to our method of approach, four different categories of conceptual model can be perceived.

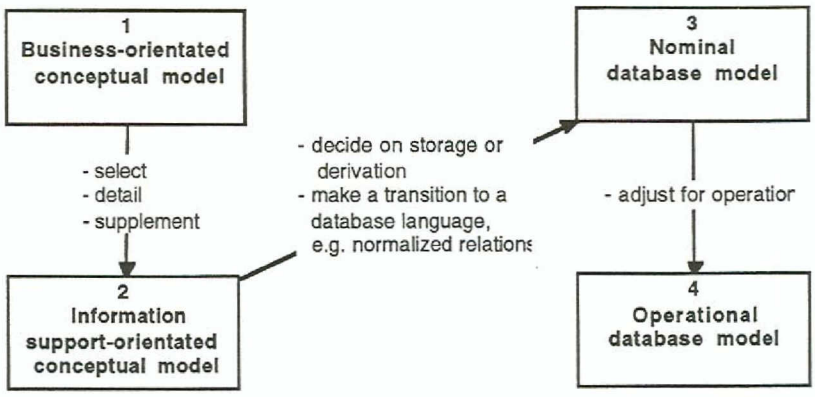

Figure 6 Different categories of conceptual model, and the main differences between them.

A business-orientated conceptual model shows the enterprise's collective concepts, with their definitions and their relationships to other concepts. The model is generally described by a graph and by verbal definitions of the object types. It is often in outline form, lacking details, thus enabling easy rapid survey. For the object type, only the most characteristic attributes are given. Also typical of a business-orientated conceptual model is that it often shows the subtype set structures of the object types.

A business-orientated conceptual model gives a clear indication of the relevant concepts within the business area in question. Apart from relationships which are to be stored in databases, relationships which would be regarded as redundant in a database solution can also be included.

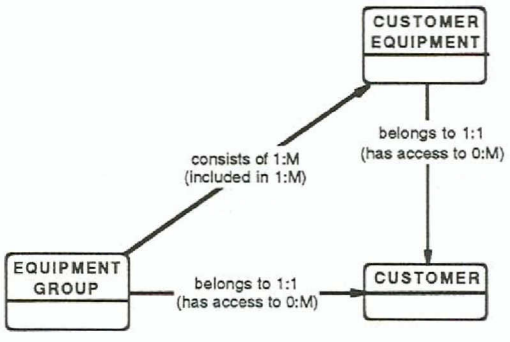

Figure 7 Example of relationships which it is important to show in a business-orientated conceptual model, but which would be regarded as redundant in a database model.

The business-orientated conceptual model is completely free from implementation aspects, according to the so-called conceptualization principle (ISO).

Since Key Charts describe the business/organization, it is the business-orientated conceptual model which is used in Key Charts.

2.2.3 Other types of conceptual model

An **information support-orientated conceptual model** shows that part of the business-orientated conceptual model which is to be handled in a certain information system. This model is more detailed, and shows all the concepts in the planned information support system, according to the so-called 100% principle (ISO). Thus it shows not only those concepts which are to be stored, but also those which are to be calculated, or derived in some other way. The model is also complemented by attribute and domain descriptions and identifiers. For relationships, missing mapping restrictions are specified.

The **nominal database model** shows what is to be stored in the database. The model is described either graphically or using declarations of, for example, tables in a relational database.

The **operational database model** shows the database as it has been structured for efficiency with regard to restrictions concerning loading profiles, techniques, economy, security, quality etc.

2.3 Flow models

A flow model describes how information is exchanged within an organization. **Information blocks** are produced and consumed in **activities.** An activity can be broken down into **tasks.**

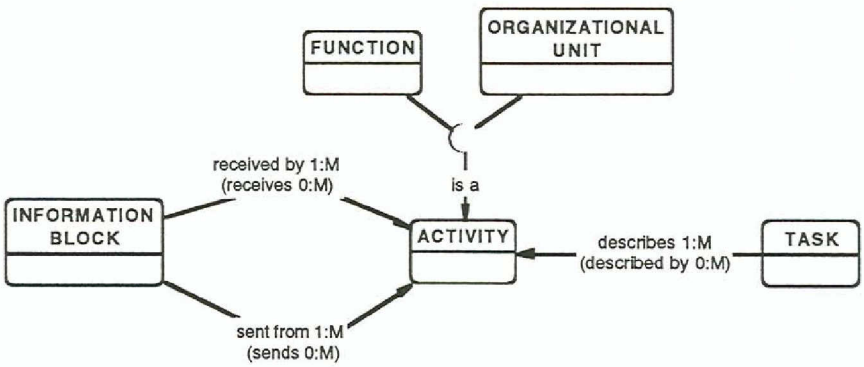

Figure 8 Metamodel for flow models expressed by graphic representation of the conceptual model.

An activity is expressed graphically by a rectangle. In certain situations it can be practical to write the name of the activity in the upper section of the rectangle and tasks in the lower. An information block is represented by an arrow and the name of the block.

Activities and information blocks are described not only in the graphic model, but also in definition documents similar to those used for object types.

Different aspects of an organization can be described in a flow model. For example, a flow model can be function-orientated, and describe the type of work being carried out without considering where in the organization it is being carried out. Another alternative is to let the flow model be organization-orientated, and describe the information flow between organizational units. The information flow can represent information blocks or physical bearers of information - so-called documents. Examples of documents are papers, telephone conversations, magnetic tapes and microfiches.

In both of these alternatives the choice can be made to focus the flow model on either the production flow or the support flow. By production flow is meant all work carried out according to the business idea of the enterprise, the production. The support flow, on the other

hand, denotes work which supports the production flow, such as personnel administration, economy and administrative development.

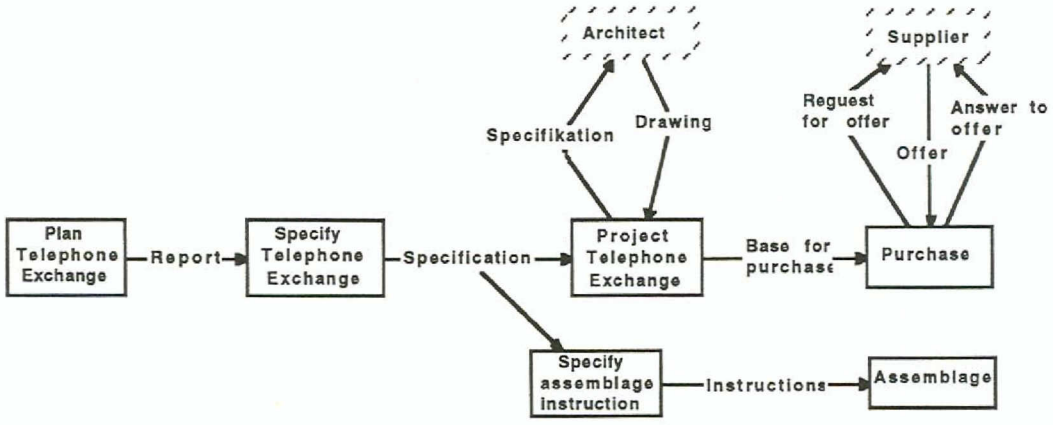

Figure 9 Example of flow model.

2.4 Goal models

A goal model illustrates the aims of the enterprise, telling us why it exists. The usual way of describing goals is in text form accounting for the plans of the enterprise. Describing the goals in a graph facilitates a lucid generalized view of the structure of the goals. It also clarifies the relationships between different goals, and conflicting goals are exposed.

Goal objects can be of three different types: **Goals, Problems** and **Actions.**

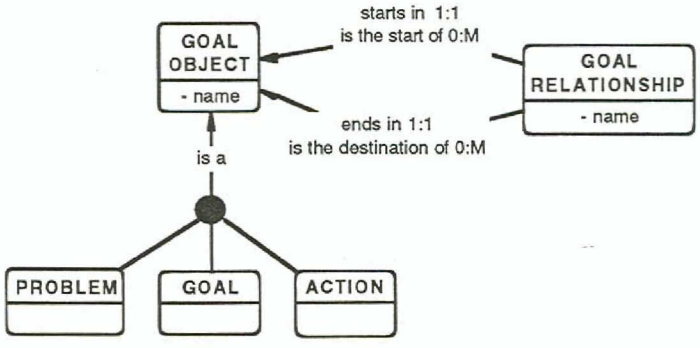

Figure 10 Metamodel for goal models, expressed by graphic representation of the conceptual model.

Connections between goal objects are shown by goal relationships, which indicate which goals contribute to other goals, which problems obstruct the attainment of other goals, which goals are in conflict with other goals etc.

In a graph, the goal objects are represented by rectangles with rounded corners, and the goal relationships by arrows.

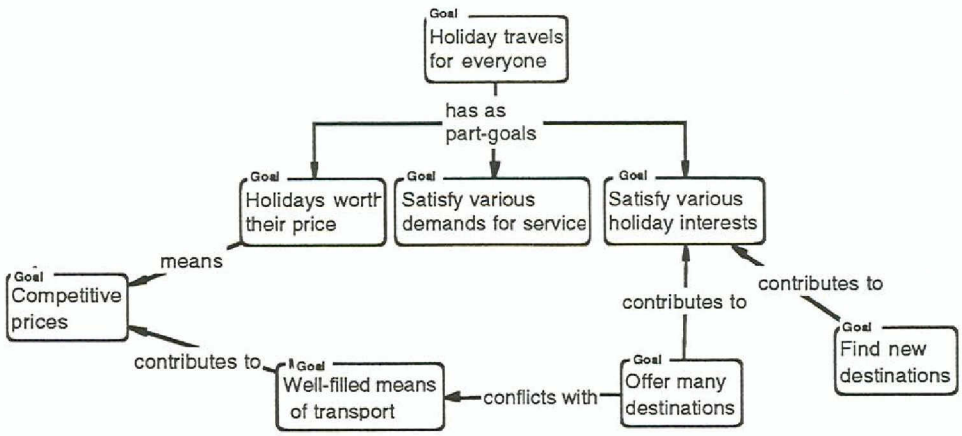

Figure 11 An example of a goal model showing a few possible goal relationships.

2.5 The three model types in interaction

The three model types described above can be used to describe different aspects of one and the same organization. They then complement one another, and clarify interactions which are not visible in an isolated model type.

As we have pointed out, a functional flow model shows what is carried out within an organization. The goals describe why the organization exists and what it wants to achieve. Thus goal models justify the presence of a certain function in the flow model, and the flow model shows which functions work towards which goals.

The flow model describes not only how the enterprise is run, but also the information exchange between different activities. In working with flow models, concepts defined in the conceptual model are used. The concepts explain and clarify the flow model. The flow model also justifies the presence of a certain concept in the conceptual model.

The conceptual model also explains the goal model. If the goal model is formulated according to the concepts found in the conceptual model, the reader is able to interpret it in the way intended by the management.

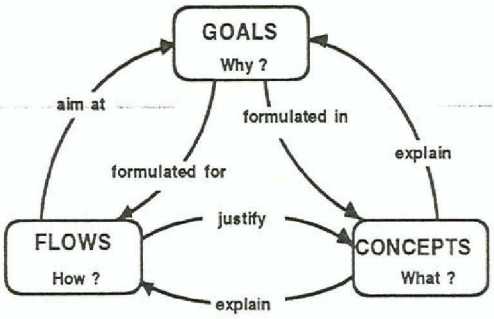

Figure 12 Three model types in co-operation.

By describing the same enterprise with all three model types, we gain a collective picture which gives us more than does the sum of the three single models.

2.6 Key Charts

2.6.1 What a Key Chart is

> A Key Chart is a visualization of two or more models and their interactions so that a third dimension is achieved. [Tvt GK]

A Key Chart

- shows at least two models and the interactions between them
- presents an overview of the enterprise being described, and therefore does not show details
- is business-orientated, and therefore not made for the purpose of describing a datasystem
- describes a large and complex enterprise, such as Swedish Telecom, or a smaller part of the enterprise in rather more detail.

2.6.2 Visualization of Key Charts

The essential difference between Key Charts and other general survey models is that an interaction between the different types of model is visualized. Many make use of matrices to make such an interaction clear. Matrices are often found to be difficult to read, and for this reason we have endeavoured to visualize the interaction in a more accessible way in the Key Charts. In making Key Charts, we have aimed to present an overview, while at the same time avoiding searches through numerous papers. We also aim to express more than is possible in a single matrix by using e.g. different colours and patterns.

The interaction can be visualized in different ways, depending on what model types are being combined and what the interaction shows. One way of showing interactions is by marking them in a group of lines. The similarity to a musical stave has led us to call this group of lines a stave. Unlike musicians, however, we are not bound to a limited number of lines. The lines of the stave correspond to the lines of a matrix, while the columns can be replaced by, for example, arrows. The end points of the arrows can also be connected to a text or symbol, thus furthering the possibility of visualizing information. The direction of the arrow can be used to carry further information, e.g. it could indicate whether the information block is being delivered or retrieved. Different colours and patterns can also be used to mark interactions.

What is expressed by the interactions varies from one Key Chart to another, so that every Key Chart contains clear instructions as to how it should be read.

Every line in a stave can for example correspond to a database in use in the enterprise. By connecting the database to activities in a flow which shows organizational units, it is possible to show who uses a certain database. At the same time, the use of different colours can show which object types each database contains.

A stave is not the only way of visualize interactions between different models. Sometimes it is enough to use arrows and colours. Even other symbols, such as circles divided into sectors, are possible. Graphic symbols combined with different colours and patterns give numerous possibilities.

2.6.3 Swedish Telecom's Key Charts

Two Key Charts have been produced for Swedish Telecom. One shows an interaction between a conceptual model and a flow model, and the other an interaction between a conceptual model and two goal models.

The work has been conducted by a project group whose assignment was to steer, present and co-ordinate the project, and to integrate the models produced. The project group consisted of members of Swedish Telecom's various working areas, and two members of SISU. The group's project leader was from Swedish Telecom.

In Swedish Telecom's Key Chart Concept-Flow (ST-cf), a model of Swedish Telecom's collective concepts is connected to a model of Swedish Telecom's functional flow. The interaction shows how the responsibility for the definition of object types is distributed within the total organization. The aim of ST-cf is that it should form the basis for the planning of the next generation of databases and applications within Swedish Telecom.

The work in the production of this Key Chart was conducted in the form of modeling seminars, where experts from different areas of the organization created a model of their area as it should appear today, with the help of the two present writers from SISU. The modeling participants represented different sections of Swedish Telecom's central and local organization. In each modeling seminar, a certain area of the organization was focused upon, and its concepts and flow were described. Every modeling seminar has been attended by a member of the project group. The models from these groups have then been integrated by an extended project group.

The conceptual model shows concepts which are applicable to the whole of Swedish Telecom. Between the tele-districts and central units, the same name can be used to denote different concepts. Even within one and the same tele-district or one and the same central unit, different people can have different ideas of what a name denotes.

Since the project group wanted to show a collective conceptual model in ST-cf, the work groups' models had to be integrated into one model. The project group chose from the suggested part-solutions those alternatives which could be combined with the others to produce a coherent and balanced model.

The flow model in ST-cf is a generalization of how the work is carried out in different tele-districts. There are considerable differences in the internal working methods of the different tele-districts. For this reason they cannot be described in a collective organizational flow model, but a collective functional flow model is possible. **How** the work is done can in other words vary, but **what** is done is governed by Swedish Telecom's central management.

The flow model shows the production flow, i.e. only those functions which directly work towards Swedish Telecom's business goals. One exception is, however, the material flow, which can be classified as a support flow. This is noticeable too in that the activity Material handling has relationships to several more other activities than is normal for any one activity.

In the flow model we have chosen to separate two different types of information flow. There is one direct flow in which a function creates an information block and ensures that it reaches the function designated to consume the information. There is also a type of flow in which the producer of the information block makes the information generally available in Swedish Telecom's common information resource. The information can there be reached by all activities concerned.

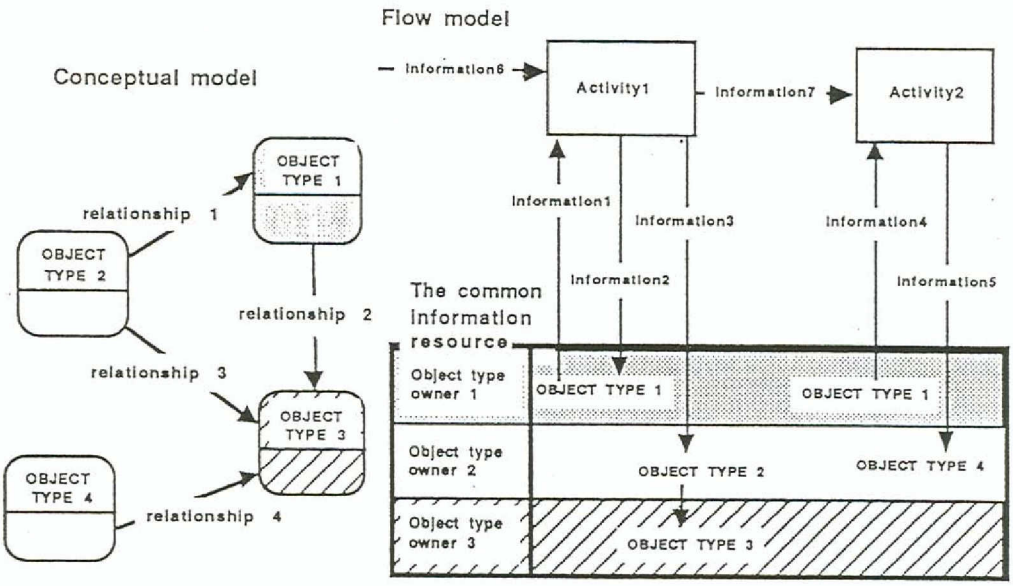

Figure 14 Fundamental sketch for a Concept - Flow Key Chart

The interaction between the models is shown in ST-cf in a stave with the use of different colours (patterns). The stave as a whole represents Swedish Telecom's common information resource (information base (ISO)). The arrows to and from the stave show, via this common resource, on which object types a certain function delivers and retrieves information.

The object types in the conceptual model are divided into six groups, depending on which organizational unit bears the responsibility for defining the object type. In the Key Chart's conceptual model every such organizational unit has been given its own colour (pattern). Also, one colour (pattern) has been used to mark object types whose definition responsibility is unclear, and whose responsibility has therefore been temporarily directed to Swedish Telecom's Administrative department. In addition to the use of different colours (patterns) to show the different organizational units for the object types in the conceptual model, the stave has been divided into six lines with six separate colours (patterns). The vertical arrows show which information blocks are communicated via this common resource. At the head or tail of every arrow is indicated the names of the object types dealt with.

In Swedish Telecom's Key Chart Concept-Goal-Goal (ST-cgg) is shown the same conceptual model as in ST-cf, plus two goal models. The first goal model shows goals for the entire Swedish Telecom Concern and the other shows the goals for how the telecommunications network should be changed and maintained. The goal model is based on an interpretation of a section of Swedish Telecom's enterprise plan. It has in other words not been developed during modeling seminars.

In ST-cgg, arrows are used to show how the models co-operate. Naturally there are several goals around the telecommunications network which are linked to a certain Concern goal. For this reason, goals in the goal model of the telecommunications network which have the same type of relationship to one and the same goal in the goal model of the Swedish Telecom Concern, have been grouped together, and connected to that goal by one common arrow.

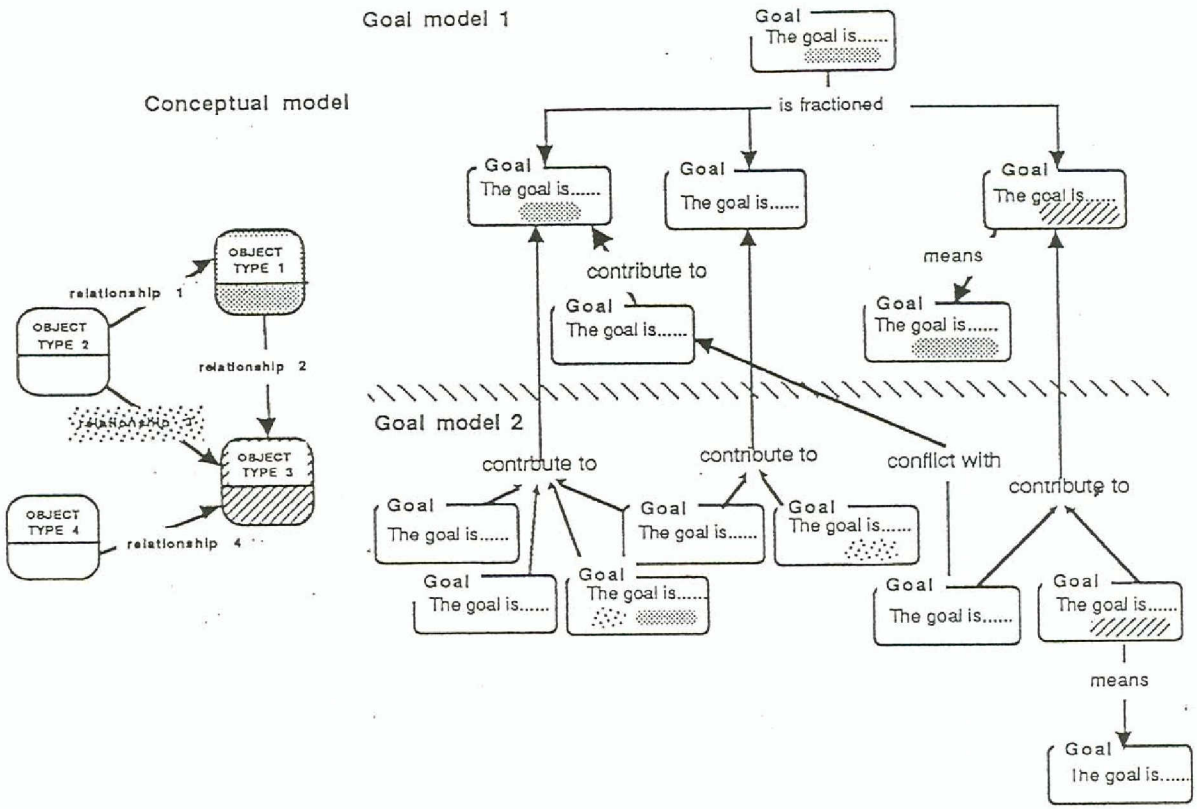

Figure 15 Fundamental sketch for a Concept - Goal - Goal Key Chart

The idea is that the goals should be expressed with the help of the names of the object types as defined in the conceptual model. In order to emphasize that a goal formulation includes the name of an object type, the name is marked in the goal model with the same colour or pattern as was used for the object type in the conceptual model.

3 Beneficial effects from utilizing Key Charts

3.1 Business development and rationalization

> "The development of administration and information systems should be more strongly linked to business and enterprise development. This is essential if we are to run the organization more effectively, strengthen competitiveness and create the readiness and flexibility which future changes will demand." [Tvt IP-90]

The main purpose of a Key Chart is to act as a strategic "guiding star" in future development of the organization. A Key Chart creates a collective and unified picture of the organization in question.

A Key Chart which covers a conceptual model, a functional flow model and a stave, representing the common information resource, gives a general picture showing which

functions produce and consume information. It also shows which object types the information concerns.

With the help of the generalized description offered by a Key Chart , it can clearly be seen in what ways any changes in the organization will affect functions. For example, the company can see a generalized picture of which functions and object types will be affected when a new product is introduced. The chart gives the definition of the concept PRODUCT, and shows which functions use the object type and will therefore have to be involved in the change.

A Key Chart can also form the basis for rationalization. If an organizational model is connected to a Key Chart of the kind described above, the company can get an idea of where in the organization a certain piece of work is carried out. Thus less effective constructions can be discovered and potential areas for rationalization localized.

By connecting the flow model to the goal model in a Key Chart , it becomes easy to discover activities which lack a goal, or even goals towards which no-one is working.

3.2 Utilization of collective data

> A total datamodel facilitates information exchange between different units since the collective object types and relationship types are standardized. These latter should be sacred, and should govern the datamodels from the various business areas. [DA-HUR]

The computer technology of today makes it possible in practice to let different databases work together, or to handle the data of large organizations in one and the same database.

In a Key Chart which shows the interaction between a flow model and a conceptual model, and where the lines of the stave represent different databases, it can easily be seen which functions use which databases. Which object types are handled by the databases can also clearly be seen. Such a Key Chart shows which databases handle object types within the same sphere, and can therefore be used as the basis for decisions on the amalgamation of databases. It can also clearly be seen which functions use these databases and would therefore be affected by such an amalgamation.

In an organization there are generally several databases, which have been developed during different periods, by different people and with varying aims. This means that the databases contain data about object types which are either corresponding, overlapping, or completely dissimilar. What is more, the databases will between them have different names for the same object type with the same meaning - synonyms - and similar names for object types with different meanings - homonyms.

Let us study an example which shows how data can become completely useless without a unified conceptual idea.

Definition of customer in database 1:	Definition of customer in database 2:
A customer is a company or a private person. A customer can have several subscriptions. Identifier: - customer number Properties: - name - address - turnover within Telecom - delivery address We have 100 customers. Our customers give a turnover of on average 20 000 Ecu/year.	A customer is a company or a private person. A customer can only have one subscription. A company with several subscriptions is regarded as several customers. Identifier: - customer number Properties: - name - address - turnover within Telecom - delivery address We have 500 customers. Our customers give a turnover of on average 6 000 Ecu/year.

A comparison between details of customers based on such unequal definitions would inevitably be rather unfruitful. In producing statistics using data from both databases, one would have to be aware of the differences in definition.

Exchange of data between databases which have not been adapted to a common conceptual idea cannot, then, be carried out without conversion of data. How the object type CUSTOMER is to be interpreted should be steered by the approach of the organization, as it is mirrored in the business-orientated conceptual model. We are of the opinion that the collective object type definitions should be governed by the organization, and not by definitions in existing databases.

To avoid the need for conversion, it is necessary in the long run to change existing databases so that they follow the agreed conceptual model. When creating new databases, one should naturally have the business-orientated conceptual model as a basis, so that exchange of data will be possible.

3.3 Language development

> The language presents a profile of the company.....It should mirror Volvo's identity, values and norms. [Wildfang, Volvo]
>
> A business-orientated conceptual model is fundamental to an effective communication between people in the organization, both directly and via the information support system. [Tvt-Tel]

One of the aims of the Key Chart could be to create the use of a common language. A Key Chart which in the connection between conceptual and flow models shows the definition responsibility, indicates to whom one should turn when explanations or changes are required. It can also be seen from the Key Chart who will be affected by any changes.

The Key Chart's conceptual model can be used to spread and bring about changes in the organizations collective concepts. If the management should want to introduce a new concept for e.g. products sold only to trade customers, a Key Chart can be used as an effective marketing medium within the company.

By using in the goal models the concept names as defined in the conceptual model, an unambiguous interpretation of the goals is ensured. If the goals are to be meaningful, a prerequisite is that they are understood in the way intended by the management. This is a

basic requirement if everyone within the organization is to be able to work towards the same goals.

3.4 Personnel development

The Key Chart can be used in further training around an organization. For example, the Key Chart could be used when recruiting, to present the organization and as well as to show the new employee where in the organization he/she will be working.

The trend within modern management philosophy is that today's management staff need to be able to see "both the wood and the trees" simultaneously. A comprehensive overall view of the organization, and the ability to when necessary perceive details, are all-important.

Those who need comprehensive knowledge of an organization, and those who wish to reach large sections of the organization with information about decisions regarding change can use a Key Chart .

Key Charts should be available to everyone working within a company. They could, for example, be hanging in the corridor, and in a natural way form a frame of reference for discussions.

The Key Chart contributes to the creation of a group feeling by showing how a person's work is connected with others'

4 Working methods

4.1 The course of the project

Within SISU we use modeling seminars for producing business models. When somebody in an organization presents a problem, we begin by specifying the nature of the problem. We discuss what types of models and interactions between them could be of use in solving the problem. Together we make a rough draft of a plan for the modeling assignment and a rough timetable for the modeling seminars. Then a project is defined and a project leader from the organization concerned appointed. At this stage in the planning it is vital to thoroughly discuss and establish the aims of the models. Everyone involved in the work should be able to have a clear picture of the aims. Therefore they have to be documented, for example by using the model types here described.

The planning phase also involves appointing participants for the modeling seminars. We discuss what characteristics are desirable in the potential participants, and what fields of knowledge should be represented. The project leader then appoints the seminar participants.

The participants are interviewed by the modeling leaders. In this way the modeling leaders become acquainted with the participants' background, and learn which questions are thought by the individual participants to be central. During the course of the interviews, the modeling leader describes how the modeling will be conducted, and demonstrates the type of thought which is fruitful in modeling. The modeling participants' thoughts around questions of modeling are thus set in motion long before the modeling seminar. These thoughts then have time to mature before the seminar, which can thus be conducted more effectively. The modeling seminar opens with a very short introduction of the modeling technique to be used. The simple syntax and conceptual apparatus contribute to the participants' quick assimilation of the technique. After just a few minutes the discussion and model construction can begin. The participants' modeling skills then develop progressively.

After the seminar the modeling leader records the result. The layout of the models is revised to give the most easily surveyed and read graph. At SISU we use Business Modeler [SISU-BM], which is a drawing tool especially designed for the easy drawing of these types of model. While the model is depicted with the use of Business Modeler, the modeling leader analyses the result, and makes a note of any obscurities or gaps in the model.

At the next modeling seminar the group discusses the points of view which have emerged and further develops the model. The work continues in this way until an adequate quality of the model has been arrived at. Between the modeling seminars it is a good idea for the modeling participants to work in their own time on developing and establishing issues which for one reason or another the group has been unable to sort out.

Since a Key Chart covers several models, it is usually necessary to conduct several series of modeling seminars as described above. Depending on the project's direction and organization, one or more integrations have to be carried out. If several groups have described the same part or aspect of the organization in separate models, then an integrated model has to be produced by negotiation.

When the models to be included in the Key Chart are ready, the work on visualizing the relationships between the models is focused. A new group is formed with participants from different modeling groups. In this group the contents of the stave or its equivalent are discussed, and the interactions between the models are visualized. The work, which is conducted in a number of seminars, is documented and analyzed as described previously.

The project ends with a seminar in which the model and experience gained are discussed. The result of the project can be seen in Key Charts which include definitions.

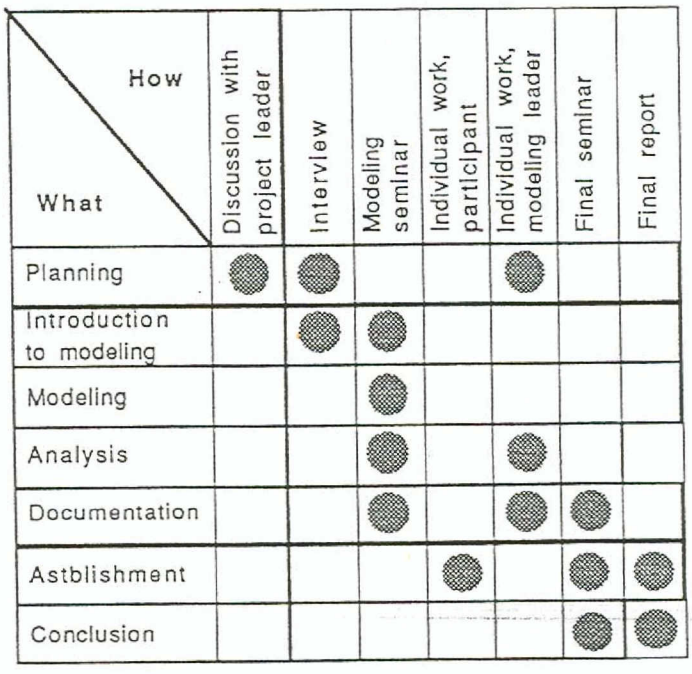

Figure 16 An summery of the method.

4.2 Modeling seminars

During the modeling seminars the models are built up in a large scale on the wall, so that they can be read by all the modeling participants simultaneously. Activities, information blocks,

object types etc. are represented by different-coloured slips of paper, which are fastened onto the plastic sheet using "blu-tack". Arrows are drawn directly onto the plastic using a pen with water-soluble ink. This gives a flexible model which is easy to change in the course of the seminar. One advantage of the sheet is that it is easily folded away for transport.

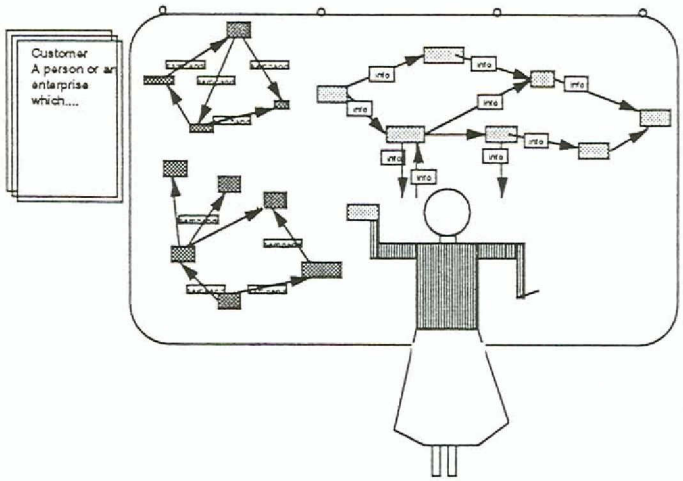

Figure 17 A modeling wall

Modeling can take place in such a way that the modeling participants gather by the plastic sheet, and as the discussion advances all assist in cutting, sticking and writing. The modeling leader supports the work by for example hinting at alternative solutions and asking leading questions when the discussion stagnates.

Another alternative is for the modeling participants to concentrate on thinking and discussing around their work while the modeling leader keeps the discussion running and cuts, sticks and writes up whatever the group agrees upon.

We arrange the modeling seminars in such a way that group-dynamic effects can be benefited from. The flexibility in the technique we use liberates the participants' own creativity. An idea from one of the participants can easily be tested and further developed by the group.

5 Experience from practical work

5.1 Well-defined aims crucial to the quality

As we described earlier in the section Beneficial effects from utilizing Key Charts, many different fields of application for Key Charts are apparent. The choice of model types to be combined and what the interactions between them should show are governed by the aims. It is, then, important to clarify how the chart is to be used before deciding to make a Key Chart. The aims must then be borne in mind during the entire modeling process.

Examples of questions to be answered are:

* Should the chart describe the situation as it actually is today, or as it should be today or in the foreseeable future, or...?
* Whose picture of the organization should the Key Chart show?

* How great a part of the organization should be covered by the chart (demarcation)? A concern a single company, a department or...?
* If a flow model is included in the Key Chart, should it be functionally or organizationally orientated?

It has proved difficult to bear all aspects of the aims in mind during all phases of a modeling seminar. The modeling leader has to be constantly aware, noting the participants' deviations and asking appropriate leading questions.

The content and extent of a model are established by the participants of the modeling groups. Their background and view of the organization make their mark even on a Key Chart. By choosing the participants of the modeling seminars, one chooses also the aspect of the organization to be represented.

If a Key Chart is intended to describe the management's view of the organization, that is, to be a management instrument, then people in positions of management must take part in the actual modeling process.

In the project with Swedish Telecom, one Key Chart, ST-cf, was made describing the employees' view of how the organization should be run today while the other Key Chart, ST-cgg, represents the management perspective.

During the production of the flow on ST-cf, it was found to be difficult to keep a fast hold on the functional orientation. People work within an organization and see their tasks and areas of responsibility on the basis of that organization. The functional orientation forces them to disregard this backbone and focus on **what** they do. This means that they at times have to broaden their perspective and see not only their own situation. Certain tasks can, for example, occur in several places in the organization. An employee who normally deals with complaints will sometimes also register orders. This person works in the organizational unit complaints but in two functional activities, Complaints reports and Sales.

5.2 Difficulties in producing a uniform level of detail

Since a Key Chart is a description on a general survey level, the model types included in it must also be on a general survey level. During the work on the production of the models, it must be decided which object types, activities, information blocks, goals etc. should be included in the models.

In the work with Swedish Telecom, the choice was based on the participants' idea of how important a concept was. This idea is in its turn based on widely varying factors such as the participants' own total view of the organization, and their idea of what is the organization's primary function. Some see working with customers as the most important function, while others see maintenance and development of the telecommunications network as the most vital.

Examples of criteria for deciding whether a function is important enough to become an activity in the flow model of the Key Chart are the number of people employed in that function, and how lucrative the function is. For the conceptual model it could be considered how many areas or people use the concept in question. Thus the selection is based on the subjective ideas of the modeling participants. It might be hard for some to accept that the area of work to which they have devoted their lives is not important enough to be shown on the Key Chart. After a whole day's modeling, one person dropped the comment that his area of work would probably only be represented by a single activity in the flow model of the Key Chart.

In certain situations one might also wish to introduce object types into the conceptual model in order to give the model balance and symmetry. In the flow model one could be forced to introduce activities merely to make the flow continuous.

To achieve high quality and a uniform level on the Key Chart, the group has to discuss what selection criteria should be used. This discussion must be based on the purpose which the Key Chart is intended to fulfil.

It is our view that the criteria on which this selection is to be based should be discussed prior to the beginning of the modeling seminars. The discussion should not, however, end at that point, but must constantly be kept going. The rules should be seen as guidelines, and decisions should be taken in each separate case after debate in some responsible group.

The general selection criteria should be simple and clear, for example, that there are five equivalent areas within the organization, and each area may contribute a maximum of ten object types to the conceptual model, and ten activities to the flow model; an object type should be of interest to at least three of the five areas; at least 10% of the employees should work within any one activity.

5.3 Choice of name is important

To produce a Key Chart of high quality, many people's knowledge should to be used in creating the models. We therefore chose to work with many different groups. The work groups represented different central units and several tele-districts of varying sizes. The conceptual and flow models which were created during these modeling seminars describe different sections of Swedish Telecom's organization, or different people's ideas of one and the same working area. This meant that they had to be integrated. The members of the project group had participated in the modeling seminars and took upon themselves the job of integrating the part-models and deciding on the contents of the conceptual model and the flow model in ST-cf.

During the modeling seminars, situations sometimes arose where a group spent some time discussing the meaning of a word without being able to agree. Different people have different interpretations, and a word is used with different meanings in different situations. In these cases there is no right and wrong. The mutual agreement solutions which are aimed at in conceptual modeling proved to be unattainable. Someone had to decide which definition should apply, and in this instance it was the project group.

Our experiences show that it is more fruitful to discuss the meaning of a concept and postpone the choice of the name until an agreement of the definition of the object type is reached.

During the integration work certain problem areas arose, that is to say, the definitions of certain object types did not penetrate deeply enough and the names of certain object types were dubious. In these cases the object group decided which object types should be included in ST-cf, and which definition and name these should have. It was at the same time decided that the analysis would continue at a later stage and that ST-cf would then be further developed within these problem areas.

The integration of the conceptual models proved considerably easier. As mentioned earlier, the different tele-districts do the same thing, even if they do it in different ways. The greatest difficulty consisted in finding the right name for the activities.

Since in the production of a general-view flow model one groups detailed work operations into activities, it can be difficult to find suitable names for such groups. When the flow describes functions, the name should not call to mind organizational units. The choice of name should also facilitate the intuitive understanding of what sub-operations are included in an activity.

In two of the flow models, the activities projecting and planning occurred in different situations. It was discovered that two tele-districts were using these two terms with inverted meaning. In order to discover this type of situation it is important to make the part-models

more detailed in the working groups than the integrated flow model should later be in the Key Chart.

If the aim of the model is to achieve a common language use, then it is not enough to describe the real situation, it must also be changed. This means that some or all must, hard as it may seem, change their language use.

As we see it, the most difficult aspect of naming, both of object types and activities, is to use an old term in a new way. This often causes confusion and communication problems. It is better instead to introduce a completely new term, which has not been used previously. In this way no-one will need to use an old, familiar term in a new way.

Sometimes we have, too, to find names for new object types, since models of this type demand naming and definition of concepts which previously have merely been sailing diffusely in the background. For example, no name is required for an object type covering articles in a certain store, store articles, until we wish to describe them in a model.

6 Continued work

6.1 Modeling of internal support flows

During the work with Swedish Telecom's Key Charts, two types of flow have emerged. One is the productive flow, which develops, sells, produces and receives payment for products, and the other is the support flow, which makes the first flow possible. Examples of flows which are included in the support flow are budget work, personnel administration and economic follow-up. Since a large number of people are employed within the support flow, it is important that even this part of the organization is described.

Since most of the activities in the productive flow are surrounded by a support flow, a Key Chart would grow out of all proportion and become unsurveyable if the support flow was also included in the same model. For this reason we think that the support flow should be described in a separate flow model. Our assumption is that all activities using a certain type of support flow do so according to the same set of principles, and therefore it should be possible to model the support flow around a standardized activity. We plan to experiment around the description of a support flow for a large organization, to see if a standardized activity can be used and what problems this involves.

6.2 Further analysis of information blocks

For the information blocks delivered to and retrieved from Swedish Telecom's common information resource, ST-cf indicates which concepts are affected. To obtain a description at the same detail level of all information blocks, an equivalent description of those information blocks which flow directly between the activities must be introduced. Also, the work involved in producing these descriptions would further consolidate the flow and conceptual models of the chart.

We plan to produce suggestions as to how a further analysis of the information blocks could be structured, and to apply it practically.

6.3 Description of the assignment flow

In ST-cf, the functional flow has been described. In Swedish Telecom there are also assignment flows. These flows are recognizable in that they are initiated by a customer and end when the customer's needs have been satisfied. If the functional description method clarifies the internal work, the assignment flow will give a description of how we meet market requirements and external demands.

We plan to try alternative methods of expanding the Key Chart with assignment flows.

7 Conclusions

The use of Key Chart is a technique suitable for describing an organization on general survey level. By combining several models and showing the interactions between them, the information value of the models is increased. Models can be combined in many different ways and every combination has its advantages. Which model types should be included and which aspects of the interaction should be shown are governed by the aims.

Key Charts can be used as, for example, a basis for business development and rationalization. They also facilitate the usage of collective data by creating a unified view of the business concepts, while at the same time pointing out where in the organization these concepts are used.

Our approach involving many different groups means that many different ways of perceiving the relevant situations are taken into account. This approach also makes it possible to begin the discussion, and the documentation of the participants' views of the organization, in an open and informal manner. At a later stage these views are integrated and formalized.

The continued work around Key Chart is being oriented towards the description of support flows, assignment flows and the conceptual structures of information blocks.

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