Value Assessment in Managing Cartography and Geo-communication

A Standard Design Process for Geospatial Communication

Ass.prof., Dr., Lars Brodersen
Aalborg University
Fibigerstræde 11
9220 Aalborg Ost
Denmark

e-mail: lars@land.aau.dk
tel. +45 96357214

ABSTRACT

This paper presents the result of a collaboration project carried out by Aalborg University and the Danish Ministry of the Environment, National Survey and Cadastre (KMS).

During the last 10 to 20 years there has been a paradigm shift in cartography in general. It has been a shift with quite dramatic changes particularly within the following areas: technology, availability of geo-information, professional skills and mobility of labour, conventions as well as resources. It was recognized at the KMS that the existing professional skills and methods were no longer sufficient for the design and the management in modern cartography and in modern geo-spatial communication projects.

It was recognized that there was a lack of adequate theories, models, methods and techniques. This forced the cartographers and the project managers to lock several parameters to well known values. One example is that the prevalent processes for design revision, if any, were based on historical conditions. Previously it was common praxis to make changes in each separate step of the whole process without recognizing the overall aspects of the entire process or the entire project.

The aim of the project was to create a standard that leads to conscious choices and decisions about both contents and form in modern cartography. The project has developed a comprehensive model allowing simultaneous, systematic and controlled optimization of all recognised parameters. This model is called ‘Value Model’, and it is now in general use at the KMS.

1. INTRODUCTION

The necessity of this new model and methods for 'modern cartography' was spawned by the general IT paradigm shift. The consequences for the geospatial professions were not only a change in dissemination technologies, but also a far-reaching change in behaviour amongst service providers, value adders and end users. This paradigm shift means that the provider of geospatial information has to understand a wide range of concepts. These concepts range from assessing the end user's requirements over various levels of abstract information modelling to presentation and portrayal. The outcome of assessing all these aspects is the essentials of the developed ‘value model’.

Handling information is a term with broad meaning. It includes both the producer's and the value adder's domain; gathering, manipulation, fusion, filtering, storing and retrieval, procurement and finally dissemination. It includes also the end user's domain; finding the optimum combination of decision supporting information bits (actual answers to real-world questions) through trusted web-portals from open or undisclosed sources.

2. PURPOSE OF THE STANDARD

There are two purposes for this standard. The first one is to ensure, that a project’s cartographic results meet those aims, defined in the project’s identity, i.e. that the cartographic expression corresponds to needs of the geo-communication. The second purpose is to support the optimal use of the resources allocated in a project.

The purpose is fulfilled in two ways. Firstly, the producer should follow the structure given in the diagram for geo-communication, se Figure 1. This diagram shows the structure of those processes that any given geo-communication project will go through. The systematic allows the producer to control the resources, the contents, and the cartographic result. In this way it is possible

to carry out the work in a systematic and controlled manner. This allows the producer to define and to measure the *quality.*

The second fulfilment of the purpose is the presence of the necessary resources. However, this aspect falls outside the scope of this paper.

2. REASON FOR EXISTENCE

2.1 PARADIGM SHIFT

It is the contention that these procedures described in this standard actually always have been carried out. The only problem is that the procedures rarely have been carried out consciously, systematically and documented, if ever. Previously many producers experienced monopoly-like conditions and the amount of data and information was limited. Therefore the producers did know everything and therefore it was not necessary to write things down! The producers had a complete overview of their domain. The domain was limited in size and the production systems and the production procedures were transparent.

2.2 TECHNOLOGY

The new technology has lead to a reduction in the costs of the production systems. Today these costs are small compared to previous production systems. The old productions systems were so extremely expensive that they were kept for the few like governmental institutions. The costs of the modern production systems allow everybody to be a producer. This has the implication that the necessary *implicit knowledge* on geo-communication and cartography not necessarily are closely linked to each other, as it was the case previously. This increases the demand for *explicit knowledge!*

The new technology has lead to a change in the apprehension of the technology. The previous understanding of technology as a technical tool is no longer valid. The new technology must fulfill many rolls, e.g. as a tool for the construction of the graphic expression, as a database-tool, and as a tool for the distribution.

Previous production systems exposed the *pedagogic of the production procedures*. The pedagogic was directly visible! Modern production systems are abstract in their structure, and therefore there is an increasing need for explicit knowledge, e.g. for the pedagogic in the production procedures. This could be achieved by e.g. a standard as a guideline.

2.3 THE MARKET

The shift from monopoly like conditions to the free competition has lead to that situation that all geo-information has to be available and usable for many different kinds of use by many different types of users. This will inevitably lead to in-appropriate use of geo-information!

The example in Figure 1 shows an example where geo-information has ended up being used for non-intended use. This was caused a missing awareness about the *content,* mainly caused by missing documentation. The example is from a travel-planning web-service. The task was to find the public transportation between two airport terminals. The result was a plan for the user to start a walk, which ends on the airplanes run-way. The *reason* for this defect is that the base-map is created on a definition of the airport as an *area*; where as the user's definition of an airport is the *door into the check-in facilities.* It is *not* relevant for the user to know about the position and extension of runways etc.

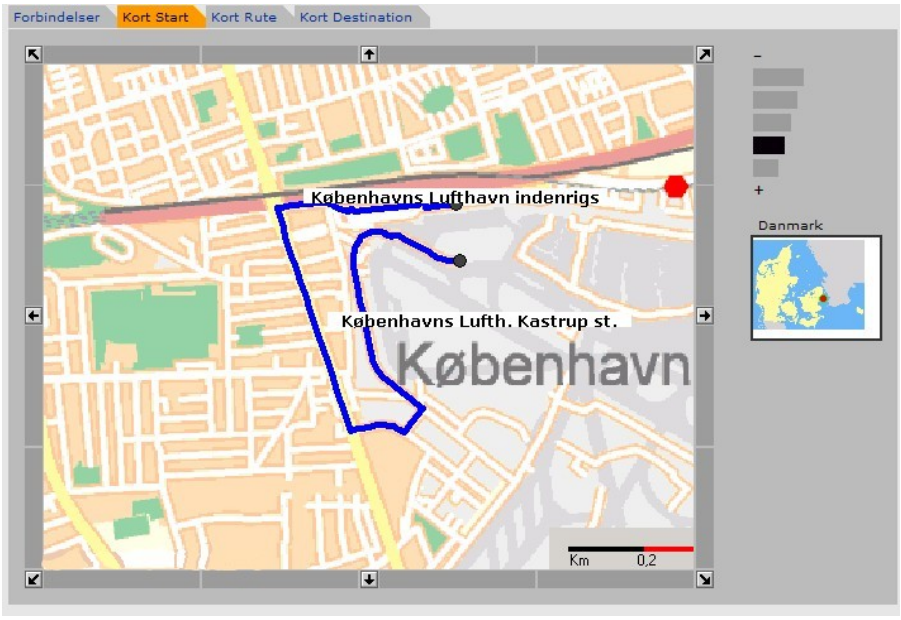

Figure 1. An example showing what happens when geo-information is exposed for in-appropriate use caused by missing awareness of the contents and missing documentation. Different definitions of the objects lead to wrong information. The task was to find the public transportation between two airport terminals. The result was a plan for the user to start a walk, which ends on the airplanes run-way.

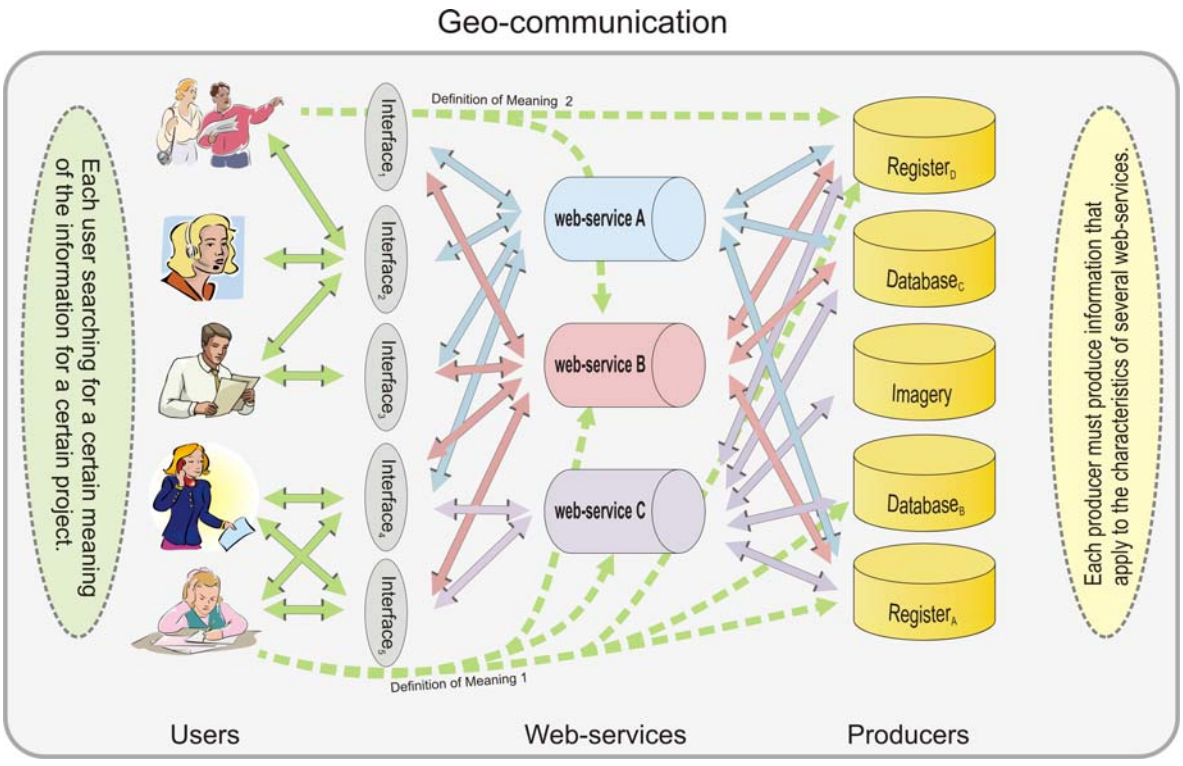

Figure 2. Geo-communication consists of several types of players, several types of activities and several types of information, where maps are a small part of it.

To be able to avoid such mistakes, as shown in Figure 1, it is necessary to promote the systematic and controlled work regarding both contents and documentation.

Today there is a large number of producers, a huge number of 'products', a large number of distributors (e.g. web-service providers), and a huge number of users, as shown in Figure 2. On top of this the users have the right to, thanks to the web, to shop wherever they like. The producers have lost control of the users! The countermove is to promote the consciousness about the *contents* as well as the *documentation* with the intention of creating more *explicit knowledge.*

2.4 PROFESSIONAL SKILLS

When the good *craftsman* designs a map on the basis of given principles *how it should be* he actually makes a lot of decisions. These decisions should have been discussed in an open forum and, above all, these decisions should have been documented including the procedures leading to the decisions. The good craftsman is of high value in a stable environment, because he possesses a lot of implicit knowledge and therefore it is not necessary to spend recourses to communicate about the work. In a changeable environment, like the modern geo-information domain, there are requirements that the craftsman can not meet! The mobility of labour reduces the amount of implicit knowledge and increases the need for explicit knowledge, e.g. in the form of standards.

2.5 CONVENTIONS

When domain is characterized by a high level of mobility of labour as well as a general change in many conditions there is a reduced opportunity to create implicit knowledge. One logical consequence is that *conventions (and myths)* will disappear. In an environment dominated by monopoly-like conditions there stable conventions about e.g. *contents* and *form.*

One obvious convention is that it is only possible to make maps based on a geometric description of the visual, observable objects, e.g. the size of buildings. As the example in Figure 1 shows the geometric description of the objects is not necessarily the best ways of doing things. There are other conventions, e.g. that roads and hydrography must be part of a map. Such decisions are often taken on the basis of implicit knowledge with respect to previous usage, and therefore the domain is kind of locked and not able to react on new conditions.

2.6 THE STANDARD AS A MEANS FOR CONSCIOUS DECISION-MAKING BY THE PRODUCER

In the above paragraphs it was argued that the paradigm shift from traditional cartography to modern geo-communication based on modern technology has lead to an increased demand for:

- Systematic and controlled (conscious) definition and creation of the *contents* in maps and geo-communication
- Systematic and controlled definitions and creation of the *form* by which the cartography and geo-communication is being carried out
- Guidance through and comprehension of those procedures leading to good results based on systematic and controlled work
- Standardized documentation of procedures, form and contents.

The means by which all the conscious choices and procedures are given by:

- A model that allows systematic and controlled thinking and work-procedures
- A standard that leads the reader through the above model guidance), which consists of the necessary elements for geo-communication: Value assessment (requirements), registration, data-management, aesthetics, visualization, distribution among others.

- The concept of geo-communication includes therefore the following procedures:
    - The identification of the values (requirements) that must be met by the projects result
    - Identification, derivation, getting hold of, filtering, and further working on of the contents
    - Identification of the demands set up by the distributor, e.g. the web-service provider
    - Production of the channels, e.g. web-services, through which the transmission will happen
    - The result, presentation of the information to the user, the expression.
    - Quality control, measurement of the user quality.
- Specifications, sub-documents to the standard that document contents, form and procedures.
- The aim of the geo-communication is that the result is presented to the user of e.g. a web-service. The result must be presented in a way that makes it possible for the user to identify the meaning (VB to figure 1), to decide and hopefully also act.

3. PRECONDITIONS AND RELATIONS

This chapter is a description of the standard's target group, a description of how the standard can be used, and a description of the context where it can be used.

3.1 TARGET GROUP

The target groups for the standard are:

- Groups and functions, typically the project manager, who are responsible for the development of new geo-communication
- Groups and functions (typically people) that develop execute and maintain the geo-communication
- Persons who write specifications, i.e. sub-documents to this standard.

3.2 USAGE

The standard describes a model for all processes and states in a geo-communication-project. The standard can be used to gain an overview of the entire process and to gain understanding of the order of the processes, dependencies and contents. The standard can be used as a guide, so that all relevant topics will be treated correctly, i.e. in the right order with the right contents by the right people when a geo-communication project is developed, executed and maintained. The standard can be used when writing the specifications belonging to the standard as sub-documents. The structure of the standard should be used as a template when writing the specifications.

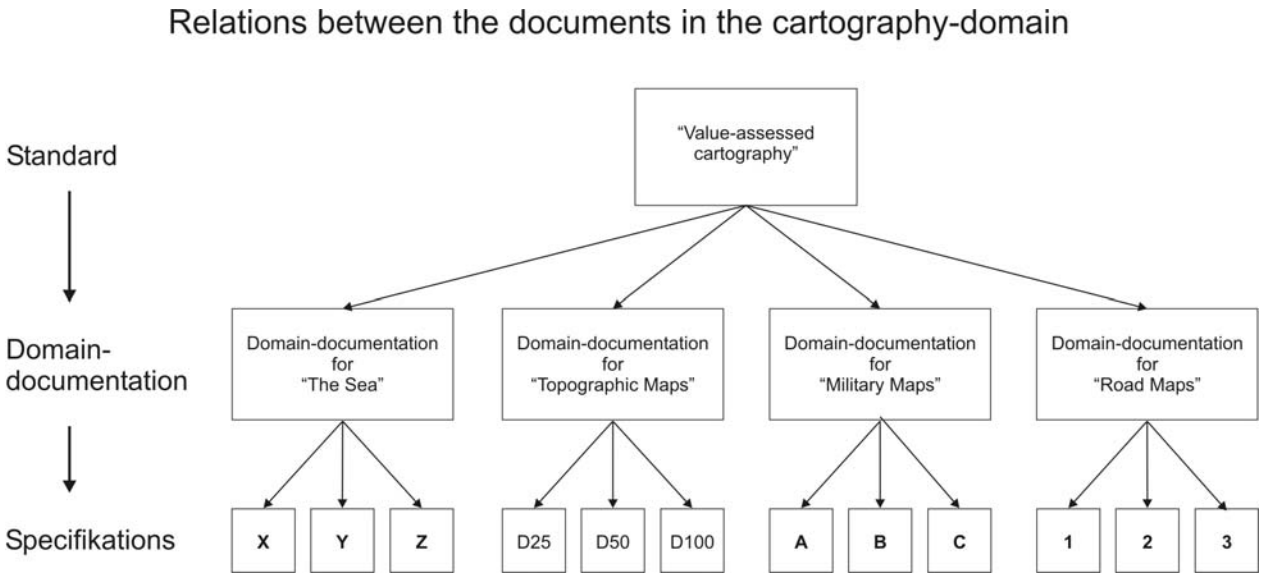

Figure 3. The figure shows the relations between documents in a cartography domain.

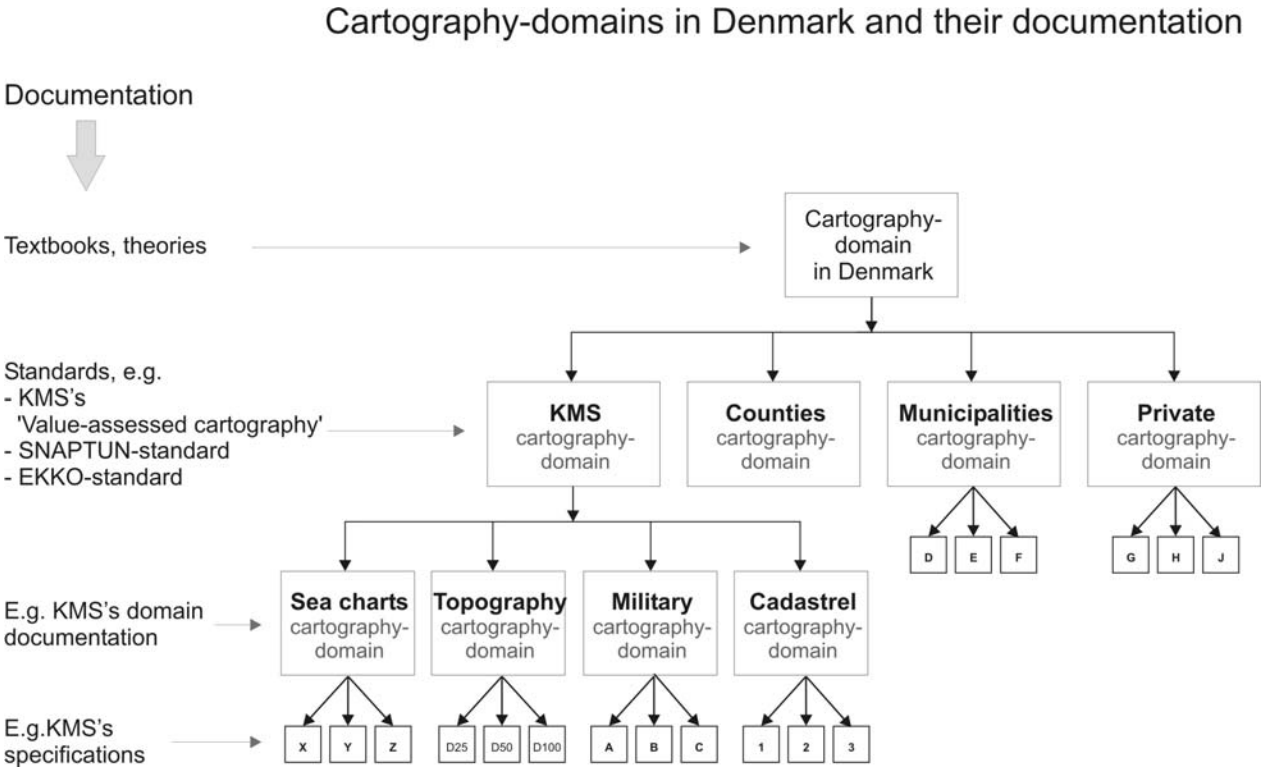

Figure 4. The diagram shows examples of cartography-domains in Denmark as well as their respective documentation.

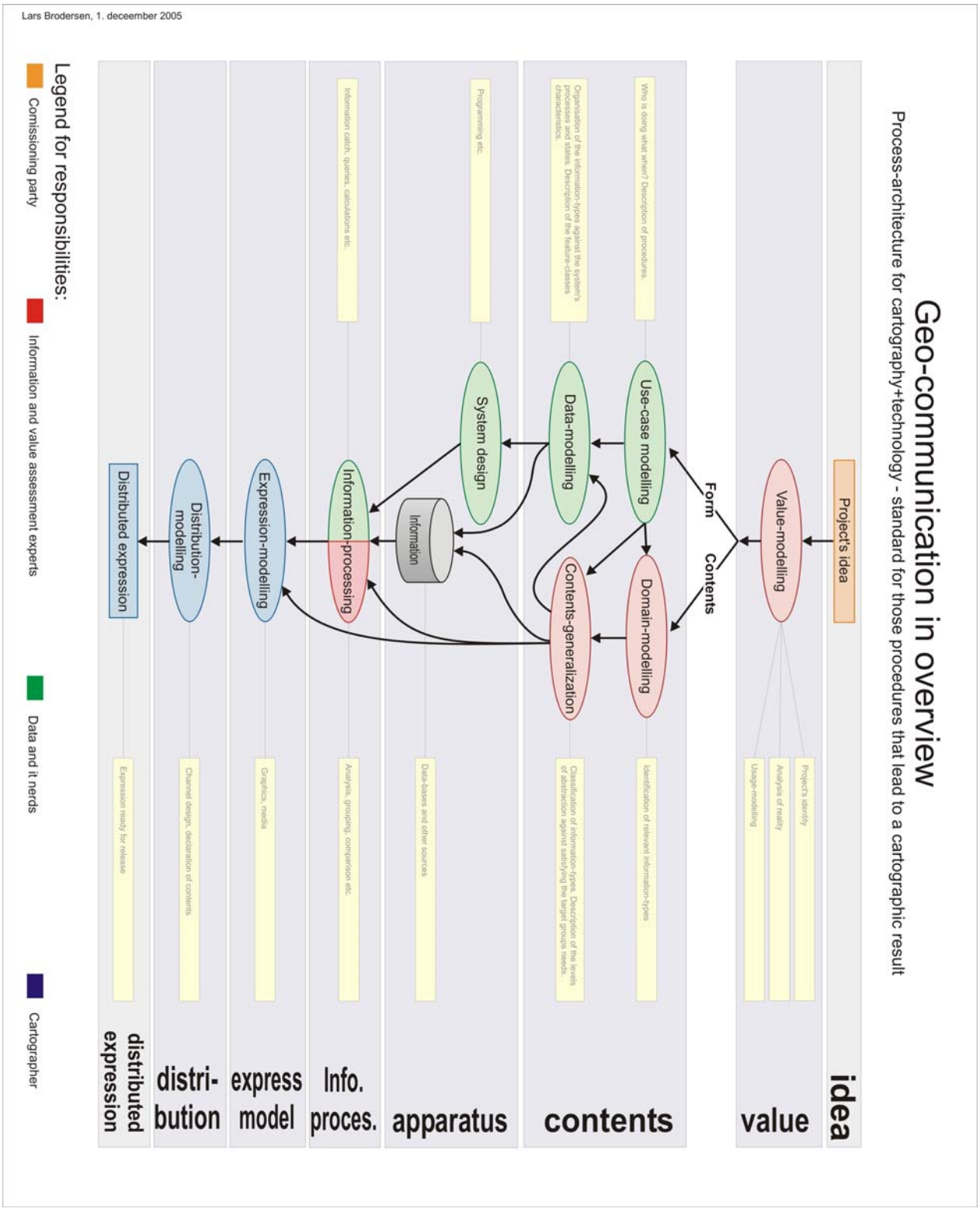

Figure 5. The diagram describes an overview of the procedures of a geo-communication-project. The diagram can be found in large size on http://www.land.aau.dk/~lars/karsta/geocom_overviewdiagram.jpg

3.3 REFERENCE DOCUMENTS (STANDARDS, THEORIES, SPECIFICATIONS ETC.)

- The standard is formal with respect to those specifications that will develop in the cartographic domain of National Survey and Cadastre Denmark (KMS). That will make these specifications uniform and comparable.
- The specifications will be profiles of the standard. The profiles are not standards in themselves. The specifications will be that set of documents that settles and specifies a given geo-communication-project.
- The standardization-hierarchy consists of two levels:
  - The standard with a very long life-time and is maintained at very long intervals
  - The specifications as profiles of the standard. The specifications emerge, are maintained and die along with the concrete projects.
- The specifications shall reference the system of concepts (the domain specific thesauri) given in the standard
- The theoretical aspects of geo-communication are relating to ”Semiotik i geokommunikation” by Lars Brodersen.
- The standard is inspired by but not controlled by the ISO-19100-series. The standard is not a profile of the ISO-19100-standarderne.

3.4 INTERESTS, CONSTRAINTS AND ROLES

- The standard shall be used in KMS’s Map-domains. It is suitable for both cartographic projects as well as for other publication-projects containing geo-components; i.e. geo-communication in general.
- KMS’s Office for Topographic Data is responsible for the development and maintenance of the standard.
- The standard is suitable for publication outside of KMS.

3.5 SYSTEM OF CONCEPTS (DOMAIN SPECIFIC THESAURUS)

The system of concepts covers mainly the geo-communication domain. However, there are also included concepts that go further. This is to ensure the relations to related domains. The complete system covers 52 concepts. The entire system of concepts can be seen in the standard, which is available, in Danish language, at the web-address http://www.land.aau.dk/~lars/karsta/value-assessed-cartography_version-0,9.pdf

Attribute

A characteristics of a phenomenon, an object or a concept.
The characteristics (the attribute) is described by *type* and *values*.

Example:
object: a road
attribute: width of the road
attribute-type: distance
attribute-value: 3.47 meters

4. REQUIREMENTS AND SOLUTIONS

This chapter gives a brief overview of the description of those procedures and interfaces that lead to the cartographic result. In the standard this chapter covers twenty pages.

4.1 BACKGROUND

Maps, geo-information and geo-communication have an outstanding capability to show a phenomenon's position. One example is the unambiguousness in travel-planning through web-services. It is not unimportant *what* bus, train or airplane. It is also not unimportant where the polluted ground is or what buildings are going to be bombed. This unambiguousness demands carefulness and consciousness at the producer's end.

The start of every geo-communication-process is to find the answer to the question: Why start this project? Why not leave untouched? The answer to this question is the *project's idea* and one part of the project's identity. From here an answer to the next question is sought: How do I get from the idea that I want to communicate certain meanings to the right contents of the geo-communication?

The *value modelling* deals with these essential questions of *why* and *what values*. The value modelling process leads the producer through a logic sequence from the project's idea to a systematic list of contents. This contents-list serves as input to the data-modelling. Data-modelling is production and documentation oriented. Data-modelling answers the questions: *What* and *how*. Together the value-model and the data-model build the information-model. The output from the data-modelling is the input to the expression-process. The expression can be both verbal, text, graphics and any combination hereof.

The transition from value-modelling to data-modelling is not a sharp line. There is an interaction between them. This is illustrated in Figure 5 as well as in the detailed diagram, sees below. The red colour represents the value-modelling, the green colour represents data-modelling and system-development, and the blue colour represents the expression.

4.1 THE MODEL FOR PROCEDURES IN GEO-COMMUNICATION

The diagram in Figure 5 is available in a detailed version too. The diagram including some explanation can be downloaded in large size from the web-address: http://www.land.aau.dk/~lars/karsta/geocom_detaildiagram.jpg. All processes and states do in principle know the state of all other states (not for the procedures). There are primary relations, here drawn with arrows, and there are secondary relations. The secondary relations are not shown, but they are present in an actual process and they link all processes and states together.

5. CONCLUSIONS

In the new era of 'modern cartography', better called geo-communication there have over the last 10 to 15 years been created many new procedures, systems, applications, data, etc. But most of all there has been an immense growth in the number of 'players', i.e. producers, distributors, users etc., which has lead to a quite confused and incalculable state, mostly with respect to the producer's domain.

It was the scope of this work to create a standard that can be used within the cartographic domain of the National Survey and Cadastre Denmark (KMS). The purpose was to provide primarily project-managers with a 'tool' to gain overview and to be able to manage the work in a systematic and controlled manner.

After finishing the creation of the standard, in version 0.9, there are still some tasks to be resolved:

- Discussions and evaluation in scientific forums and producer forums
- Further development of the standard
- Promotion of the standard in the different departments of the cartographic domain in KMS
- Follow-up by the creation of the necessary specifications as described in the standard

Time will show whether it is possible to systematize the work to that extend described in the standard, or not.

The standard, in Danish language, can be downloaded from
http://www.land.aau.dk/~lars/karsta/value-assessed-cartography_version-0,9.pdf

6. REFERENCES

Brodersen, L. (2005). Semiotik i geokommunikation – fra virkelighed til handling. Frederikshavn, Denmark: Tankegang a·s.

Bødker, K., Kensing, F. & Simonsen, J. (2004). Participatory IT design : designing for business and workplace realities. MIT Pres.

Caquard, S. (2003). Internet, Maps and Public Participation: Contemporary Limits and Possibilities. Maps and the Internet. Oxford, UK: Elsevier Science Ltd.

GSDI (Global Spatial Data Infrastructure). (2004). Spatial Data Infrastructure Cookbook. Editor: Nebert, D.D. http://www.gsdi.org/docs2004/Cookbook/cookbookV2.0.pdf.

Hjelmager, J., Delgado, T, Moellering, H, Cooper, A, Danko, D, Huet, M, Aalders, & H, Martynenko, A. (2005). Developing a modelling for the spatial data infrastructure. ICA: Proceedings ICC2005

ISO/TC211 Standardisation on Geoinformation and Geomatics. ISO-19100 series. http://www.isotc211.org/

Jiang, B. (2003). Beyond Serving Maps: Serving GIS Functionality over the Internet. Maps and the Internet. Oxford, UK: Elsevier Science Ltd.

OGC Reference Model, Editor: Percivall, G. Open Geospatial Consortium Inc. Reference number: OGC 03-040 Version: 0.1.3

Peterson, M.P. (2003). Maps and the Internet: An Introduction. Maps and the Internet. Oxford, UK: Elsevier Science Ltd.

Østergaard, M., & Olesen, J.D. (2004). Digital forkalkning. Frederikshavn, Denmark: Dafolo Forlag A/S.