KNOWLEDGE NODE AALBORG, KNA

AUGUST 3 1998

PROF. PER CHRISTIANSSON
pc@civil.auc.dk, Per.Christiansson@kstr.lth.se

Abstract: The ongoing Knowledge Node Aalborg, KNA, project will contribute to the long term development of IT-tools to support Innovation Environments, companies and Aalborg University in the knowledge communication process. It will show the directions and lay fundaments for future development of efficient knowledge communication support systems. The project contains three main parts: 1) intermediary connection and comparative analyses between ongoing projects within the area, and advises, 2) effective web-based delivery of findings (good and bad) and information mediation between the projects, and 3) demonstrator test cases development where findings from studied projects are utilized AUC, NOVI, the NJOL and the INNONET projects.

Keywords: *Knowledge communication, knowledge node, network, innovation process, commercialization, models, demonstration*

KNA

August 12 1998

Knowledge Node Aalborg, KNA.

CONTENT

1. INTRODUCTION

January 25 and February 22 1998 part of this report was delivered to NOVI and Sven Valentin. The report was later attached to an application concerning specification and prestudy for an University-Industry Knowledge transfer node at NOVI. In the first project layout I gave the proposed system the tentative name, Knowledge Node Aalborg, KNA. An amount of 600.000 DKK has been granted NOVI for the project by Erhvervsfremme Styrelsen at the Erhversvsministeriet. Erhvervsfremme Styrelsen also finances the project "Danske entrepreneurers virtuelle mödested - www.innonet.dk", below referenced as 'INNONET'.

This report gives a background to the project, its intended outcome and project layout.

2. BACKGROUND

There is today a great need for establishing efficient competence nets where people can meet, exchange ideas, and start projects for the next generation of profitable systems. These systems and services will be marketed at a global scale with high demands on originality and knowledge content. The proposed 'Knowledge Node Aalborg - KNA' will beneficially support activities to produce such systems and services.

The introduction of Internet based systems for communication and information storage is dramatically changing the possibilities for us to create efficient tools to support knowledge communication. We now experience the beginning of a shift to a global totally digital information handling. It has only gone five years since we started publish on the World Wide Web, WWW, and we are already in a phase of re-engineering it. This is necessary as we will store *all* information in digital form and we therefore need new mechanisms and tools to capture, filter, classify, structure, quality mark and search information on many abstraction levels.

The ongoing Knowledge Node Aalborg, KNA, project will contribute to the long term development of IT-tools to support Innovation Environments, companies and Aalborg University in the knowledge communication process. It will show the directions and lay fundaments for future development of efficient knowledge communication support systems.

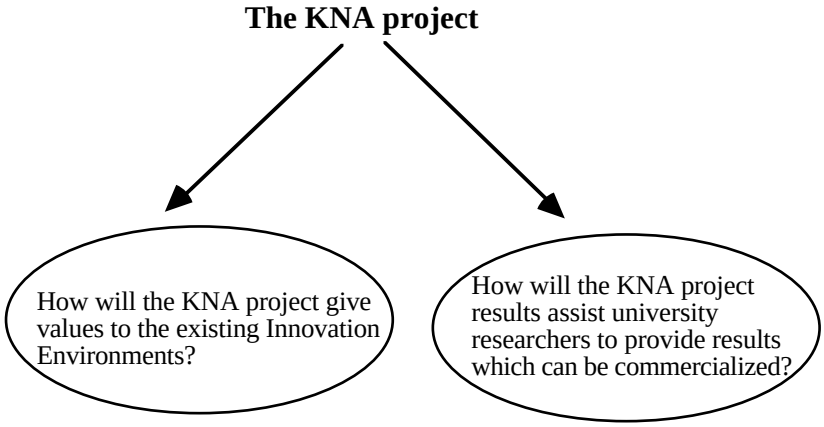


Figure 1 The KNA project looks at how knowledge nodes shall be designed to best assist existing Innovation Environments and researchers to provide results which later can be commercialized.

In the KNA project we phase the *challenge* of producing practical and immediately useful IT-tools in a global context where we at the same time do the long term design of these tools on still not formulated or discovered premises.

The project in itself has *emergent* characteristics in that it increases our knowledge about how to best design and build knowledge nodes and lays fundaments estimating the best future development direction.

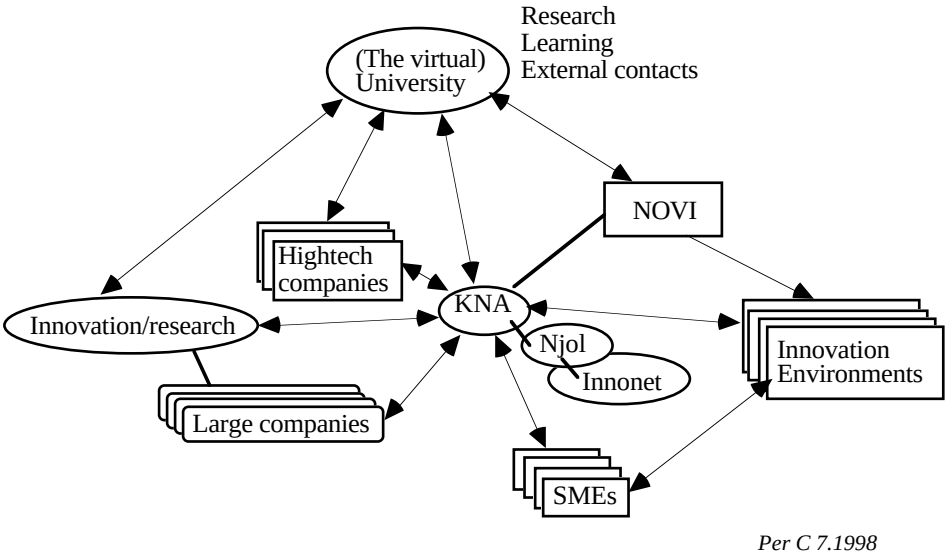


Figure 2 Information flow relations between University, Innovation environments, large/medium/small sized companies and knowledge communication nodes

The following two projects are for the time being considered of great interest for the KNA project (complementary projects);

- the NJ-Online, NJOL [my abbreviation], project which has been initiated by Nordjyllands Amts Erhvervssekr and Dansk Teknologisk Institut, DTI. see (Baastrup, 1998)

- "Danske entrepreneurers virtuelle mødested - www.innonet.dk", INNONET [my abbreviation], financed by Erhvervsfremme Styrelsen Erhvervsministeriet. see (INNONET, 1998)

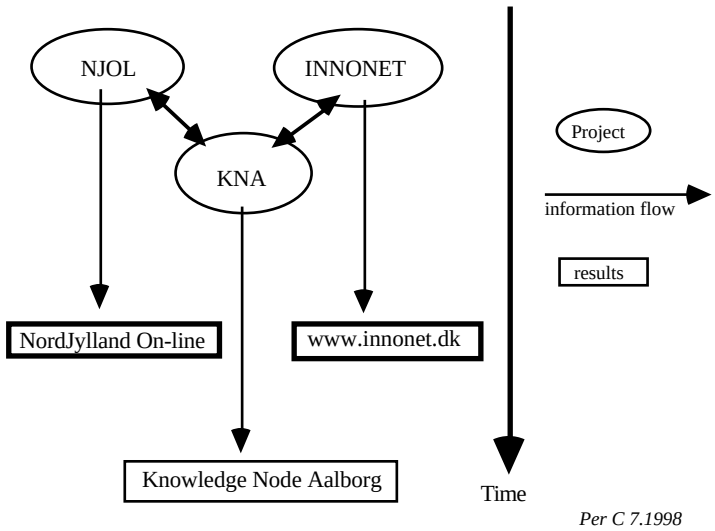


Figure 3 The relations between ongoing knowledge communication support projects.

3. CONTEXT

3.1 The NOVI perspective

NOVI supports the commercialization of research results in different ways. From providing physical closeness to pure virtual closeness between research, education, laboratories, and commercialization process. NOVI constitutes a high-tech innovation system where publicly financed activities are transformed to business oriented activities, (NOVI, 1997a), (NOVI, 1997b), and http://www.novi.dk.

3.2 The Aalborg University Perspective

For Aalborg University, AUC, it is important that the KNA project supports long term changes and that it helps implement good initial models and examples to support research, learning and external contacts.

The existing networks at the Center for Network Relations (Netvaerkscentret) http://www.auc.dk/nc/ may be active players. The Rector initiative on formulation of long term 'information and communication technology', IKT, strategies for the university is of great interest to the KNA project.

In a time of great changes AUC has an open mind in bringing together the best competencies within the university in formulating IT-supported operational solutions to key issues (diaries, electronic signatures, student smart card, etc.), see also figure 4.

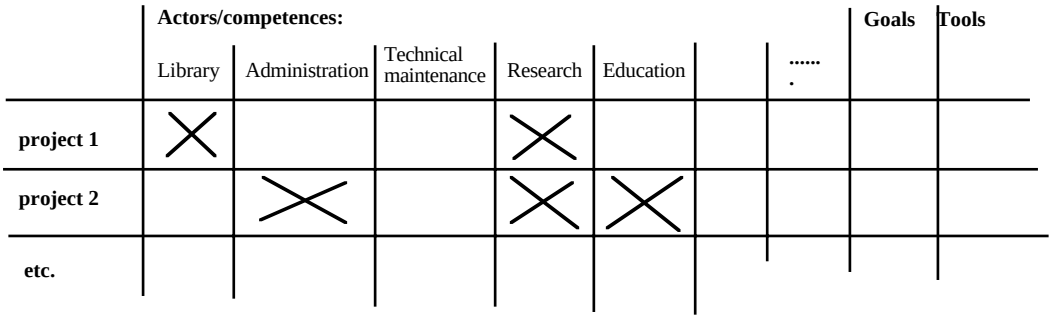


Figure 4 Aalborg University actively brings the best competencies from all areas together to solve key issues.

3.3 Company/project perspective

Companies and projects need to access (and thus give) knowledge and information in all phases of their lives to ensure high quality and profitable results/products, see also figure 5.

Companies can also form communication clusters for certain knowledge domains to facilitate this process. See for example Norcom (the Communications Cluster in Northern Denmark) http://www.norcom.dk with meta information about 20 firms and 2 knowledge institutions in the field of radio communications.

The INNONET is a planned knowledge node (see also http://www.innonet.ch) to provide

- entry points to Danish innovation environments
- a national and international library on entrepreneurial ship
- collection and spread of knowledge between innovation environments and the Erhversfremme Styrelsen.

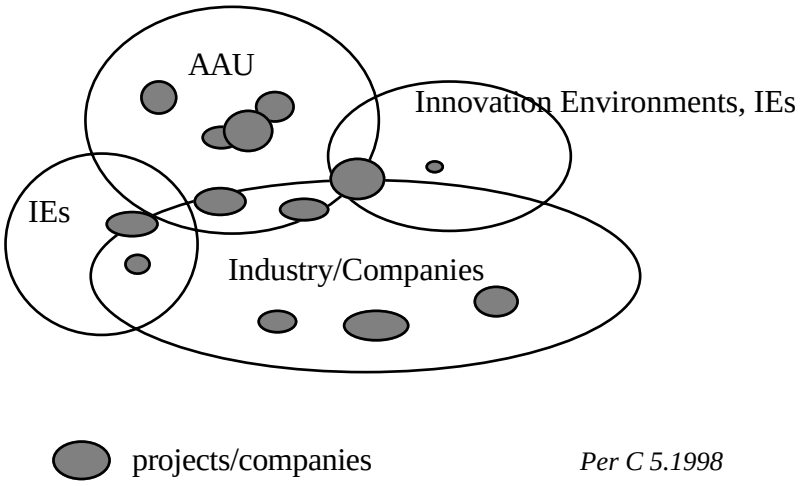


Figure 5 Projects/companies are formed within different business domains.

3.4 The World perspective

As the digital networks and storage grows the globe shrinks and virtually becomes a 'global village'. This lead to amplification of some issues like cultural meetings, language compatibility, search and discovery of information in global domains.

Below a few examples on projects from experiences can be drawn.

http://www.desire.org
"DESIRE is a major international project aiming to build large scale information networks for the research community."
http://www.bized.ac.uk/
"Biz/ed is a dedicated business and economics information gateway for students, teachers and lecturers." example on summary criteria, tools, and vocabularies,
http://www.adminet.com/world/sme
'aims to become a Cyber-Documentation Center delivering general information about governmental authorities and public services'
http://milvus.kstr.lth.se/merkurius
Merkurius - The Lund University Knowledge Node for Small and Medium, (Christiansson, 1997)

4. KNA PROPERTIES

Figure 6 places KNA in a context and gives example on services which can be provided. This chapter comments on services, the knowledge node concept and information handling issues.

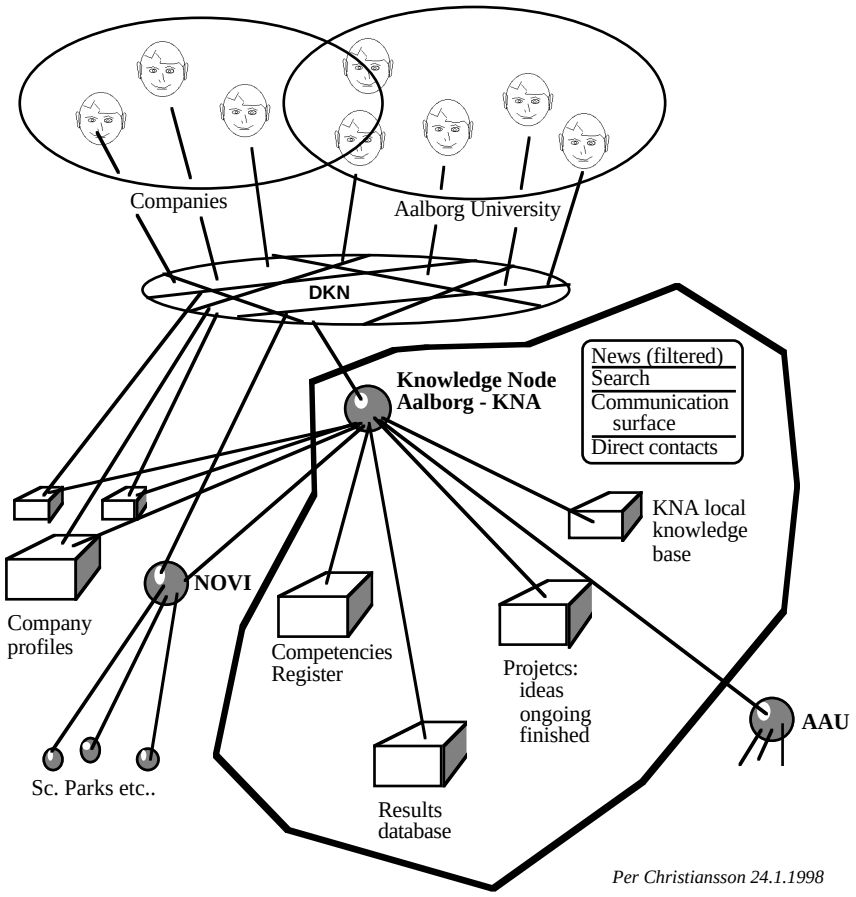


Figure 6 Knowledge Node Aalborg, KNA, services. The DKN, Dynamic Knowledge Net in the figure is today constituted mainly by Internet and World Wide Web.

4.1 Services

4.1.1 KNA LOCAL KNOWLEDGE BASE

KNA typically does only contain (or can produce) meta information about different knowledge domains. The local knowledge base contains information about user profiles, search mechanisms (top-down, bottom-up, degree of personal intervention, experiences from use, etc.)

Persons at companies and universities will be able to contact the Knowledge Node Aalborg, KNA, to access different services such as

- passive or active news dissemination
- search facilities to innovative projects at different stages
- project generation surface (systems, services, education,....)
- access to competent persons

- experience accumulation
- discussion, conference, and negotiation surfaces

KNA must give flexible support to innovation environments and companies which in many cases are under fundamental ongoing change processes. The KNA may thus also serve as an *idea generator* and support *knowledge discovery* and support virtual company/project activities.

4.1.2 PROJECT SURFACE

The Project surface/area can be used to

- get information about what do people ask about?
- find partners for project
- announce project ideas
- find project and learning needs
- provide a fresh easy to administer communication surface.

4.1.3 RESULTS DATABASE

This is one or many associated external containers containing results/products from projects and companies. It is of great value to be able to trace *intermediate* project results and in what *context* they are produced.

4.1.4 COMPETENCIES AND RESOURCE REGISTER

KNA may serve as entry point to search persons with different competencies. These persons may be situated in any environment (university, company, etc.)

Resource catalogues has been attempted before but would not function in most cases. The reason was that you as information provider knew that the 'catalogue' would probably only be published in version 1.

The difficulties to maintain and keep resources register up to date is well documented. This gives special requirements on information augmentation processes (see also '4.3 information capture' and '4.4 information structuring, storage, and maintenance')

Examples (except for personal CVs reachable from the web)

http://vted.rgs.vt.edu/engtopic_search.html
Virginia Tech Engineering Expertise Search. A searchable database of Virginia Polytechnic Institute and State University College of Engineering faculty expertise.

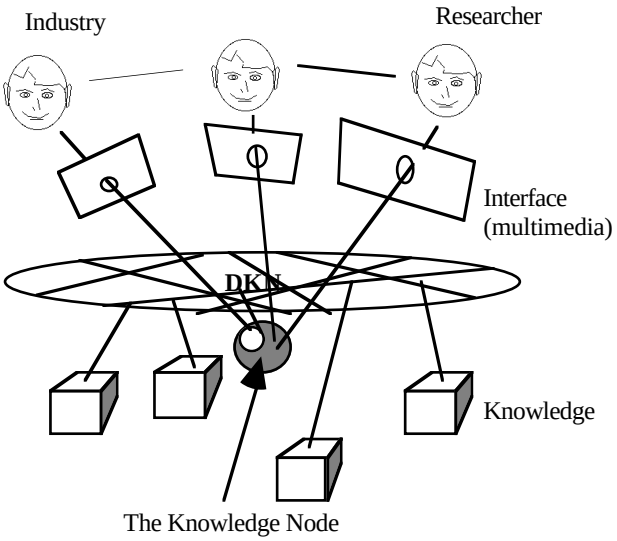
http://www.experimentarium.dk/dnf/sporg_index.html
'Spørg naturvidenskaben i samband med 'Dansk Naturvidenskapsfestival 1998'. This site is incremented continuously with answers and questions which are searchable. This resource can be used as a starting point to find information or knowledgeable people.

An embryo for a competencies register exist at AUC (to my knowledge reachable via persons at the switchboard service), se Table 1.

Fagområde	**Person**	**Titel**	**Institut**	**Adresse**	**Lokalnr.**
……	Navn	lektor	..	Shv.57	8545
Brandteknik	…..	ph.d.-stip.	4	….	….
Brobygning	…..	professor	5	……	…..
Brudmekanik	…..	……	6	……	……
…..	……	……	…	…….	…..

Table 1.

4.2 The Knowledge Node Concept



- Access and augment knowledge
- Communcation support

Per Christiansson, 1996

Figure 7 The Knowledge Node can be regarded as a meta knowledge container and knowledge access control mechanism (Christiansson, 1998c).

Persons and artifacts connect to the *Dynamic Knowledge Net*, DKN, (Christiansson, 1993). The Internet and its services as World Wide Web today constitutes the DKN. DKN will evolve and perhaps (using metaphors) possess resemblance to the human brains dendrites and axons connecting what in artificial neural networks are called artificial neurons or Processing Elements.
A Knowledge Node is kind of high level processing unit and today equal to an URL, Uniform Resource Locator, on the Internet. A knowledge node, (Christiansson, 1996), has three main functions (a) dissemination of information on request or automatically channeled, (b) two way communication and feed-back

capabilities through multimedia interfaces, and (c) access to a local knowledge bank and possibly meta knowledge about other knowledge nodes, see figure 7.

4.3 Information capture

It shall be easy or more or less *transparent* for researchers and others to supply information to a KNA. One separate issue with high relevance for researchers at the universities are the motives (motivation) for them to deliver information not only aimed at research colleagues.

Information is provided by both those who fabricated the information and by third persons giving feed-back and quality statements on published information.

Abstracts (short descriptions by authors in multimedial format) and feed-back information should be immediately searchable and available. Complete documents, processes, etc. may be made available on a higher service level which can involve money transfer before accessibility. This service could be part of the KNA control structure but raises requirements on companies and organizations to agree on among things meta level descriptions of the provided information (such as publishing date, author, language, etc.).

Special *tools* has to be designed and developed for information capture, filtering and storage.

4.4 Information structuring and storage

Every system contains models of the applications it handles, the users of the system, the IT-tools and the surrounding context. Models are more or less implicitly documented. For example the user models through the design of human computer user interface, HCI. What is usually not very well described is the context in which the application data was created - why was it created?, when? for whom? etc. The *context* (or situation it has been produced in) must be stated in order to provide information 'quality'. This is extremely important in the future as *all* information will be available digitally and is not filtered in the usual way as when contained in physical books, video tapes, etc.

The relations between and within *physical* and *logical* digital containers have to be defined to determine who is responsible for information storage and content. For example libraries can be responsible for University series reports storage and departments for temporal education material, working reports, etc.

The behavior and information structure of the knowledge node has *emergent* properties i.e. they are gradually explored, discovered and defined during the system design process. The design of a knowledge node are rather to refer to as creative than routine design.

It is also important to be able to make *changes* in the underlying information structure and associations and at the same time *minimize disturbance* on the user interacting with the system.

Information accessible from the KNA is provided by *all* interested parties such as researchers, developers, administrators, librarians, company public relations, etc.

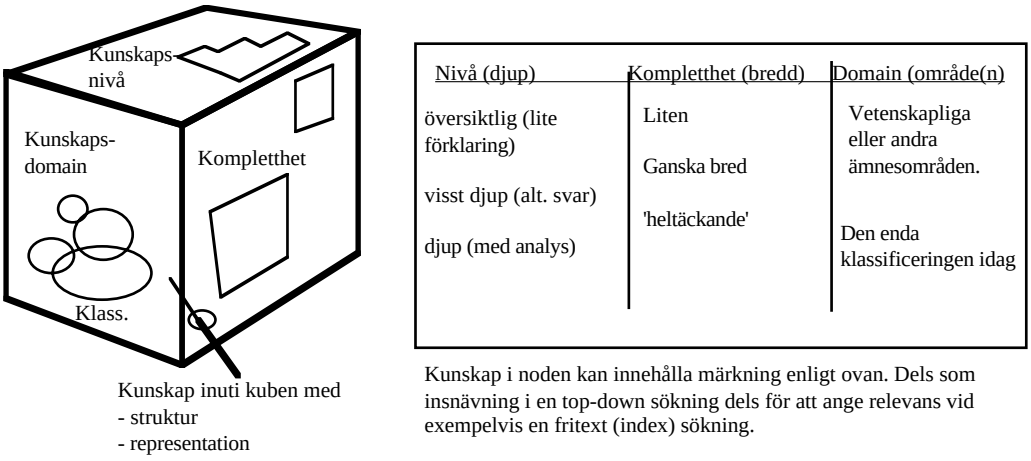
A main rule is that information is stored where it is *produced* which also may involve physical storage responsibility for a guaranteed time. Special agreements can be made with *long term storage* providers to guarantee access beyond project and company lives.

Agreements must be made on which data (multimedia) formats shall be supported when information shall be made available through KNA.

4.4.1 META INDEXING

It is probably necessary to agree on meta index formats to mark the information which is stored and made available through KNA. Existing formats or formats under definition should be used to ensure consistency with other globally available information available through for example meta index search machines. See also (Christiansson, 1998c).

4.5 Information access and search



"Figure 8 Access of knowledge via three facets. From (Christiansson, 1997)

Users in connection with KNA are both knowledge searchers and information providers. Figure 8 shows three facets to access an information space - knowledge domain, knowledge level from shallow to first principles and finally completeness of accessed information.

Vocabularies must be defined to increase the 'hit rate' as users search information. These may contain knowledge domains listings based on existing or emerging research areas at universities, company knowledge domains etc.

The information goal space during a search may change as new knowledge is discovered. The KNA can also be used as an *idea generator* by for example providing associations to unexpected knowledge domains.

Search is a combination of top-down search via information classification structures and bottom-up through information container information content.

5. PROJECT

5.1 Central questions

The first stage of the KNA project will focus on questions about *existing* and *needed* knowledge to serve as a vehicle to develop demonstration start examples. This questions can be treated in the NJOL and INNONET projects;

- Which *knowledge* is primarily *needed* to give the greatest impact for the regions existing and future companies?
- Where is that knowledge *located* today? (University and companies)
- Within which *domains* do interesting knowledge exist?
- Which type of knowledge is *available* today in the region? In what *form* does it exist (un-formalized in persons heads, facts existing in documented form, un-formalized skills? etc.)
- *How* is the knowledge *documented*?
- Which knowledge *do not exist* but is urgently needed?
- How can KNA *provide added value connections* between existing and needed knowledge.
- Which local *meta knowledge* can KNA house about other knowledge nodes and methodological issues.

How can KNA
- facilitate *maintenance* and guarantee *information freshness.*
- contribute to the dynamic growth of a *vocabulary* which can be used to minimize information noise.
- except active information search ('pull') allow user profiled information 'push' services.

Questions concerning knowledge communication needs, i.e. how can knowledge *communication* be *supported*?

- How can knowledge be made *visible? (a*ctive/passive news,..)
- How can knowledge be *searched* and *accessed*? (top-down/bottom-up,..)
- How can knowledge *needs* be *expressed*? (project surface,..)
- How do we wish to *automate* knowledge search?
- How do we *secure* access to information and *paid* access?
- How do we *filter* knowledge (domain, level, completeness)
- How do we *quality mark* knowledge? (feed-back, boards, specialist marking,..)

- Which *knowledge domains* can be chosen as key domains to support Investigation of common *terminology* and possible 'classification' *schemes* and common language definitions
- How can we describe existing knowledge and *personal competence* containers and their digital implementations

Questions concerning motivations to supply knowledge to KNA should be elaborated

- How do we secure *efficient personal connectivity*? (access to competent persons, project surface, communication support, ...
- How can the university *promote* researchers and teachers to *supply* information on different levels? (carrier points and credits, publishing teaching material on the net, provide university/industry meeting grounds,...)

What form of commercial body will fit KNA and how should the idea be sold?

- The KNA should start in a *small scale* with selected knowledge areas covered
- KNA should itself be a fertilizer to *create needs* for an expanded KNA.
- KNA should provide a structure and motivation for *expansion* of the Knowledge Node Aalborg concept with local integrated knowledge nodes.

5.2 Content

The KNA project shall act for long term changes and also support implementation of good starting/prototype/demonstrator examples. The project will contribute to explain the relations between Knowledge and the Innovation process.

The Knowledge Node Aalborg, KNA, project is of a very innovative type in itself and requires a fine tuned set-up and completion. It is very probable that new ideas will arise during the project accomplishment.

The demonstrator method (incremental prototyping) will be partly used which secures that the end user requirements will be taken care of and that ideas will be captured, communicated, evaluated and implemented during the project execution. A broad spectrum of competencies must be involved in the project.

Three main activities can be distinguished in the KNA project

1) intermediary connection between AUC, NOVI, the NJOL and the INNONET projects. Comparative studies of benefits and drawbacks. Comparisons to similar activities in the surrounding world. Advises.
2) effective web-based delivery of findings (good and bad) and information mediation between the projects. The results shall be publicly available and be of help to innovation environments for their own developments.
3) demonstrator test cases development where findings from studied projects are utilized.

The three parts will roughly cover 1/3 each of the total project cost i.e. 200.000 DKK each.

Questions as the above listed in '5.1 Project. Central Questions' will be posed in the innovation environments and DTI domains.

KNA will systematize findings and make them available for 3rd parties to raise quality on long term endeavors within the area of knowledge communication between university, innovation environments and companies.

5.3 Organization/method

The behavior and information structure of the knowledge node has emergent properties. They have to be defined in an explorative design process where end users and system designers work together. Preferably an incremental prototyping process can be used where ideas, findings and results are concretized in a demonstrator system.

Per Christiansson will personally do the main part of 1), see section '5.2 Content' and he will get assistance in parts 2) and 3) by for example researchers at the KBS-Media Lab at Lund University. (http://delphi.kstr.lth.se/)

Proper AUC Expert groups will be involved. These activities are supported by both Niels Maarbjerg and Per Christianssons involvement in some of these groups.

The time plan is highly dependent of the NJOL and INNONET project progress.

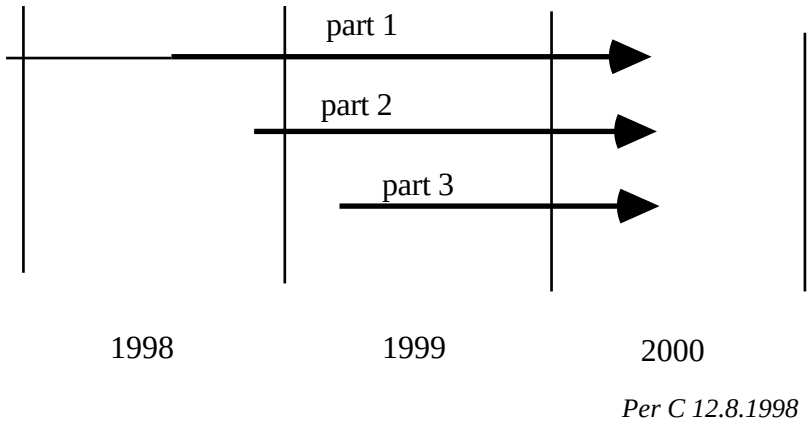


Figure 9 Tentative time plan for the KNA project

5.3.1 MEETINGS

Only those meetings where Per Christiansson has participated are listed.

December 12.1997. Svend Valentin, Per Christiansson at Novi

February 5, 1998. Svend Valentin, Jens-Jørgen Baastrup, Per Christiansson at NOVI.

February 23, 1998. Jens-Jørgen Baastrup, Per Christiansson, Niels Maarbjerg Olesen at NOVI

March 5, 1998, Jens-Jørgen Baastrup, Sven Vestergaard, Per Christiansson at NOVI.

May 28, 1998. Svend Valentin, Per Christiansson.

6. CONTACT LIST

Adm. Dir. Svend Valentin
NOVI A/S
http://www.novi.dk, sv@novi.dk, tel: 9635 4500

Prof. Per Christiansson
http://delphi.kstr.lth.se/~per, http://www.civil.auc.dk/i6, tel: 9635 8545

Projektkonsult Jens-Jørgen Baastrup
Nordjysk Informatik- og Virksomhedsudvikling
http://www.novi.dk/nivu/, jjb@novi.dk, tel: 9635 4555

Centerchef Søren Kielgast,
DTI (INNONET) , http://www.dti.dk, SNK@dti.dk, tel.: 43504902

Erhvervsministeriet
http://www.em.dk

Sekretariatschef Niels Maarbjerg Olesen
Aalborg Universitet, Tek. Nat. kontoret.
http://www.auc.dk, nmo@aua.auc.dk, tel: 9635 9630

Managing Director Sven Vestergaard, Hugin A/S
http://www.hugin.dk, sven@hugin.dk, tel: 9635 4546

7. REFERENCES

AUB, 1998, AUBs Virtuelle Biblioteker. http://virtbib.aub.auc.dk

Baastrup J-J, 1998, "NJ-Onlie". 3 februar 1998. (21 overhaed slides).

Christiansson P, 1998a, "Knowledge Node Aalborg - KNA". Januari 25 1998. (2 pages)

Christiansson P, 1998b, "Knowledge Node Aalborg - project start-up" (3 Pages). February 22 1998. (3 pages)

Christiansson P, 1998c, "Using Knowledge Nodes for Knowledge Discovery and Collaboration.". 'Artificial Intelligence in Structural Engineering. Information Technology for Design, Collaboration, Maintenance, and Monotoring'. Lecture Notes i Artificial Intelligence 1454. (Ed. Ian Smith). Springer-Verlag, Berlin. 1998. (pp. 48-59).
See also http://it.civil.auc.dk/it/reports/ascona_98/ascona98.html

Christiansson, P., 1997, "Merkurius - Lunds Universitets näringslivsnod. KK-projekt Status 10 april 1997/ Merkurius -Lund University company Knowledge Node - Status report 1 April 10 1997". KBS-Media Lab, Lunds Universitet. (12 pp.)
See also http://delphi.kstr.lth.se/reports/merkurius_status_4_97/merkurius4_97.html)

Christiansson, P., 1996, "Knowledge communication in the building industry. The Knowledge Node Concept". In Construction on the Information Highway. CIB Proceedings 198 (ed. Z. Turk) (1996) 121-132. (http://delphi.kstr.lth.se/reports/cibw78bled96.html)

Christiansson, P., 1993, "Dynamic Knowledge Nets in a changing building process. Automation in Construction", Vol 2, nb 2, Elsevier Science Publishers B.V. Amsterdam, (1993) 307-322

INNONET, 1998, "Udvikling av fælles videns- og informationssystem". Erhversfremme Styrelsen Erhvervsministeriet. 23 marts 1998. Köpenhamn (10 pages).

NOVI 1997a, "NORDJYSK Innovation - videreudvikling af det lokale, nordjyske innovationsmiljø til et sammenhængende system af forskningsformidlingsktiviteter med henblik på øget kommercialisering". NOV! A/S den 26-7-1998 (41 pages).

NOVI, 1997b, "Tilbud PÅ OPRETTELSE OG DRIFT AF INNOVATIONSMILJØ. I henhold til udbud Fra EhrhvervsfremmeStyrelsen af 16. oktober 1997". NOVA A/S, 1 deceber 1997 (44 pages)

APPENDIX A. TEKNIKPARKER I SVERIGE.

Teknikparker i Sverige (Ny Teknik 20/98).

NAMN	Antal Teknik-företag	Anställda	Kommentar
Chalmers Teknikpark, Göteborg	20	300	I huvudsak forskningsenhetefrån storföretag. Volvo har 100 anställda
Chalmers Innovation, Göteborg	13	41	Etablerades redan 1979 men har hittills haft begränsade lokaler. Efter en donation från Stena skapas nu en ny inkubator för avknoppningsföretag
Lindholmen Utveckling, Götegborg	1	250	Inom området arbetar totalt 2500 personer, inklusive Chalmers. Planerar en utbyggnad 1999.
Kreativt Center Skaraborg, Skövde	4	11	Tar hand om avknoppningar från högskolan.
Teknocenter, Halmstad	19	170	De flesta företag är avknoppningar från Högskolan i Halmstad.
Ideon, Lund, Malmö	130	1000	Landets första teknikpark, startades 1983. Företagen finns framförallt inom IT och Bioteknik.
Sundsvalls Utvecklingscentrum, Sundsvall	11	177	Företagspark med viss koppling till högskolan i Sundsvall.
Teknikdalen, Borlänge	19	133	Blandning av forsknings- och företagspark. Här finns ett stort material laboratorium.
Inova, Karlstad	2	2	Tidigare Hjernbruket. Flyttar till nya större lokaler 1999.
Mjärdevi, Linköping	140	3900	Drygt 2000 arbetar på Ericsson med tillverkning av mobiltelefoner. Övriga företag är främst inriktade mot IT.
Vidéum, Växjö	11	46	Bygger ut under hösten 1998
Softcenter, Ronneby	70	850	Nya softcenter byggs i Malmö, Örebro och Söderhamn
Aurorum, Luleå	56	455	75% av parkens anställda kommer från universitetet. Största företag är Frontec.
Uminova, Umeå	15	151	Inriktning mot bioteknik, miljö och medicisnk teknik.

Västerås Technology Park, Västerås	6	93	Nystartad park som bland annat kommer att inhysa två ABB-bolag.
Uppsala Science Park, Uppsala	50	400	Utöver teknikföretagen finns ett 60-tal tjänsteföretag och organisationer med 500 anställda.
Electrum, Kista	40	2500	Kompetescentrum snarare än teknikpark. De flesta av de anställda finns inom högskolan. Electrum håller på att ombildas Kista Science Park som omfattar 600 företag med 23000 anställda.
Teknikhöjden, Stockholm	40	120	Driver främst inkubatorversksamhet
Novum, Huddinge	14	546	Samarbete mellan Huddinge sjukhus, Karolinska institutet och FoU-enheter från storföretag. Även forskningscentra och utbildning.

(Efter Ny Teknik 20/98 sid. 20/Research MArianne Kängström.)

TOTALT	440	6119	I medeltal: 14 anställda/företag
	661	10916	enl Ny Teknik: 16.5/företag