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the Danish way

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ICT Enabled Land Administration Systems for Sustainable Development – The Danish Way

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SUMMARY

This paper analyses the current Land Administration System (LAS) in Denmark with a focus on institutional arrangements, land policies, land information infrastructure, and the four land administration functions: land tenure, land value, land-use, and land development. The analysis, this way, builds on the land management paradigm. Some challenges and barriers are identified and the key initiatives for improvement are described.

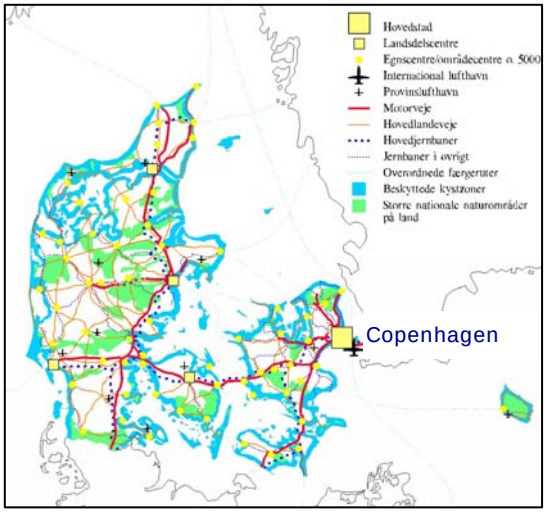
It is concluded that the system works well in the sense that it supports sustainable development through an efficient land market and effective land-use management. The property layer (the cadastre) is well integrated as the basis for a land information infrastructure in support of all four land administration functions. Furthermore, the LAS is well tailored for a decentralised approach to land-use management placing the decision-making power at regional and especially local level.

However, the land information infrastructure is complex and needs continuous attention to be adapted to ITC developments. Also, some institutional arrangements could be improved and, more generally, there is need for improving the awareness the land management area as coherent whole.

COUNTRY PROFILE

Denmark is a part of Scandinavia and a member of the European Union. The total area is 3,000 square kilometres, not including the Faeroe Islands and Greenland. The population covers around 5, 3 million people with a density of 123 persons per square kilometre. About 85% of Denmark's population lives in the cities and towns.

Denmark is low-lying country, its highest point rising 175 metres above the sea. Approximately 10% of the country is used for urban zones and transport installations, 67% is agricultural land, 12% is forests, and the rest is semi-natural areas such as hearths, lakes and streams. The total coastline stretches 7,300 kilometres. Copenhagen is the capital. Greater Copenhagen has 1, 7 million inhabitants, one third of the Danish population. The next four largest cities are Aarhus (population 275,000), Odense (180,000), Aalborg (160,000) and Esbjerg (85,000). The total number of residential units is about 2, 5 million. About 60% are owner occupied and 40 % are leased. About half of the leased units are private tenant housing, the other half is non-profit housing. The gross domestic product per capita is around 251,000 DKK (2001) equivalents to 33,000 USD. Agriculture and other primary production accounts for around 5 %, industry and construction 25%, private services 50%, and the public sector around 20%.



Denmark is a constitutional monarchy governed by a representative democracy organized on three levels: at the national level there is a parliament with legislative power and ministries responsible for certain fields; at the regional level there are 14 county councils responsible for regional matters such as hospitals, upper secondary schools, major roads, rural planning and administration; at the local level there are 275 municipal councils responsible for all local public functions. On average a municipality has around 20,000 inhabitants. However, as per 1 January 2007 a new administrative structure will be in force consisting of only 5 counties and about 100 municipalities.

SHORT HISTORICAL PATH TOWARDS SUSTAINABLE LAND MANAGEMNT

The Danish cadastre, which derived from the enclosure movement, was established in 1844. The main purpose was the collection of land taxes from agricultural holdings based on a valuation of the yielding capacity of the soil. From the very beginning, the cadastre consisted of two parts: the cadastral register and the cadastral maps. Both these components have been updated continually ever since.

In the late 1800´s the cadastre changed from being a fiscal cadastre primarily as a basis for land valuation and taxation to a legal cadastre supporting a growing land market. This evolution was completed in the early part of the 1900´s when taxation became based on the market value. Simultaneously, in the 1920´s a new Land Book System was established. The new system was based on the cadastral identification and a close interaction between the two systems was established.

During the first half of the 1900´s land was increasingly seen as a commodity and the focus was on agricultural production and industrial revolution. Land use regulations were introduced to improve agricultural productivity and at the same time sustain the social conditions in the rural areas. These regulations were based on cadastral information. The 1960´s introduced a close interaction between the cadastral process (e.g. subdivision) and the relevant land-use regulations.

An administrative reform was adopted in the early 1970´s to reorganise regional and local administration. The reform reduced the number of counties from 25 to 14 and the number of local authorities from almost 1,400 to 275. The reorganisation created the basis for transferring a number of responsibilities and decision-making power to the counties and especially to the municipal councils by means of decentralisation

Land was increasingly seen as a community scarce resource and zoning and planning regulations were introduced to control land development. Environmental concerns appeared in the late 1970´s and developed into the major issue in recent years. Today, comprehensive planning and environmental protection are seen as the main tools to secure sustainable development. Cadastral information based on a modern IT platform evolved to support these processes towards sustainable land management (Enemark and Schoeler 2002).

THE CURRENT LAND ADMINISTRATION SYSTEM

The Land Administration System in Denmark is tailored for a decentralised approach to land-use management placing the decision-making power at regional and especially local level. The system works well in the sense that it supports sustainable development through an efficient land market and effective land-use management.

The analysis of the Danish LAS builds on the Land Management Paradigm in which land administration is seen as an area dealing with rights, restrictions and responsibilities in land. This relates to the interaction of the three areas of land tenure, land value and land use. By including land development these four areas are called the Land Administration Functions. These functions are based on policies determining the overall objectives and they are managed on the basis of appropriate land information infrastructures providing complete and up to date in formation on the natural and built environment. This all sits within a country/state context of institutional arrangements that may change over time. The Paradigm is presented in Figure 1 below (Enemark et al., 2005):

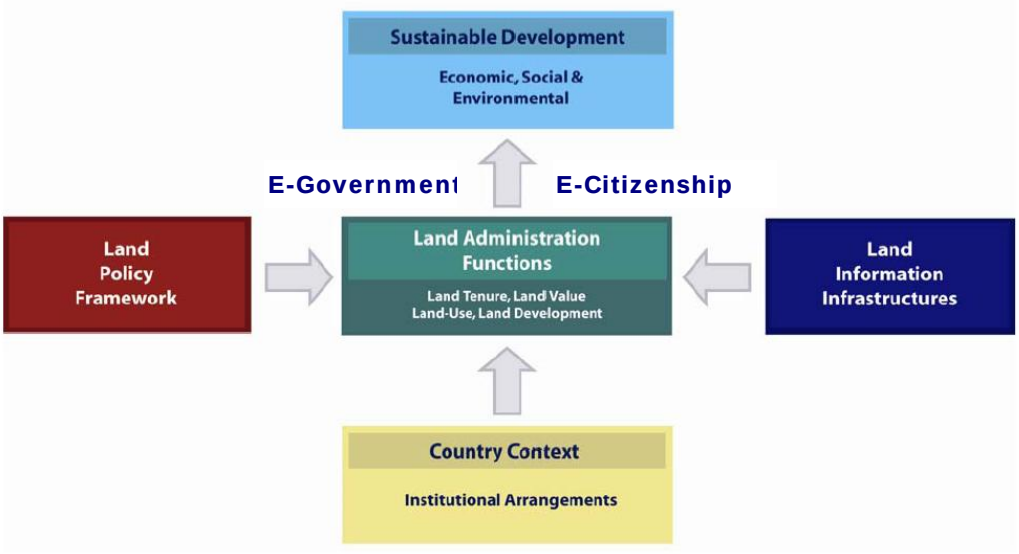


Figure 1. The Land Management Paradigm

The Land Policy Component

Land policies are expressed partly through the constitution and other more general laws such as the Land Registry Act, The Subdivision Act, The Valuation Act, and the Planning Act, and partly through the sectoral land-use acts such as the Agricultural Holdings Act, the Environmental Protection Act, and the Nature Protection Act.

A key land policy is laid down in the Planning Act that establishes a general zoning dividing the total country into urban, recreational and rural zones. This provides a low land value in rural areas, where no developments are allowed except for agricultural and forestry purposes. The provisions on rural zones, covering about 90% of the country, are intended to provide a clear delimitation between town and country, to prevent urban sprawl and uncontrolled land development in the countryside, and to preserve valuable landscapes. In urban areas, the land-use opportunities are determined by planning regulations at local

level. The Planning Act also provides a planning zone within 3 km of the coastline, in which special attention is given to protection of valuable features of the landscape.

Sectoral land policies include the requirement that all agricultural properties be operated in accordance with agricultural and environmental considerations. This duty applies to two-thirds of Denmark's land. The protection of agricultural land can be abolished when land is transferred into an urban zone, which is based on planning considerations and with due regard for the quality of the agricultural land. Conservation provisions apply to ensure responsible management of forest areas, which comprise 12 per cent of Denmark's land. The Nature Protection Act provides the legal basis for protection and conservation of nature, landscape features and historic elements. In addition the Act gives protection to certain areas and elements in nature and landscape by establishing fixed protection zones along coasts, lakes, streams etc. Heritage buildings are protected through conservation orders and certain regulations.

The Land Information Component

The goal of the Danish Land Information Infrastructure is to reduce duplication and costs of spatial data/information, to improve quality, to encourage co-operation on common standards and data models, to make spatial data/information more accessible to all, and to facilitate e-government and participatory democracy. However, an “official infrastructure” has not yet been created. A recent government analysis (The Digital Task Force, 2001) assessed that Denmark on the one hand is in a strong position for using geo-data in a digital management environment since all the basic registers and maps are now in place in a digital format. On the other hand, it stated that existing co-operation structures at the operational level are too informal and do not sufficiently support the most expeditious utilisation of spatial data. It was therefore recommended that a governmental body be established to ensure the drive runs in a more unified and holistic direction. The body was established 2002 and was named The Spatial Data Service Community.

The Spatial Data Service Community is led by a steering group in which in addition to representatives from Local Government Denmark and the Association of County Councils in Denmark, the Ministry of the Environment is represented by National Survey and Cadastre, the Ministry of Economics and Business Affairs by the National Agency for Enterprise and Housing, the Danish Ministry of Food, Fisheries and Agriculture by the Directorate for Food, Fisheries and Agricultural Business and the Ministry of Transport by the Road Directorate. Chair and Secretariat: The National Survey and Cadastre, the Ministry of the Environment.

The Spatial Data Service Community has published a vision stating that Geodata shall (i) constitute a natural tool for citizens, enterprises and the public administration, (ii) be harmonised, standardised, easily accessible and cheap; (ii) be a common basis for the digital administration, and (iv) create value growth for society. The strategic aims include

areas such as Division of Data Responsibility; Pricing Structure; Basic Data; Data Descriptions; Distribution and Presentation (Accessibility); Dissemination and Deployment; and International Cooperation. The Spatial Data Service Community draws up an Annual Work Plan based on the seven strategic aims and other important geo-related issues in society. Committees are appointed to focus on investigation and analysis of important components in the establishment and development of spatial data. The work is carried out in cooperation with private and public partners (www.xyz-geodata.dk).

The Danish society is one of the most mapped and registered societies in the world. Over the past two decades analogue maps and geo-referenced registers have been converted to a digital form, and new data have been created to fill the gaps. The figure below shows the most important building blocks for a Danish Infrastructure for Spatial Information (Brande-Lavridsen 2003). For more details see http://www.ddl.org/thedanishway/spatial_09.pdf.

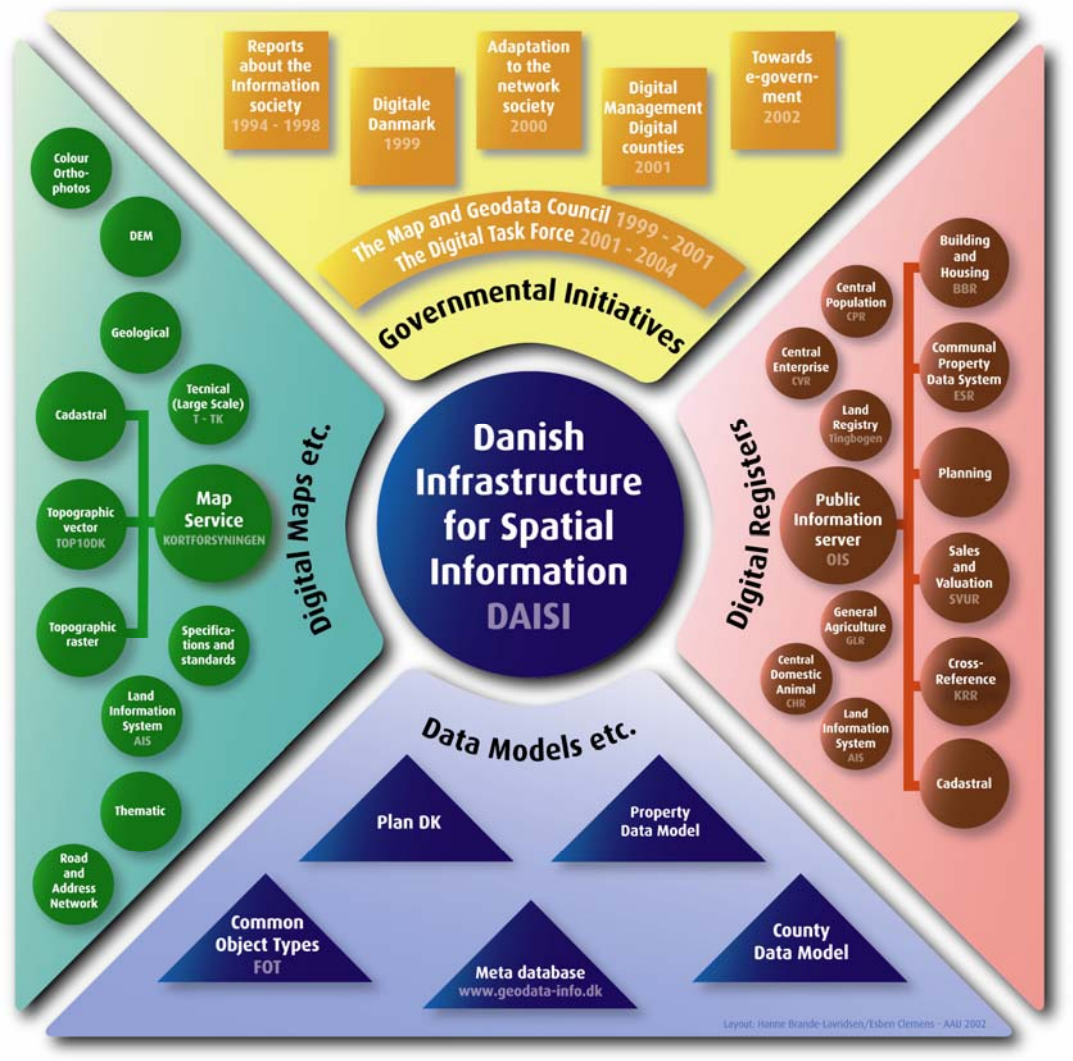


Figure 2. The Danish Infrastructure for Spatial Information

Digital Registers. The Danish concept for integrated land information is organised as a network of interactive subsystems containing the most relevant information such as the Cadastral Register, the Land Book, the Building and Housing Register, the Communal Property Data System (property valuation and taxation), and the Central Population Register. The responsibility for the spatial information registers is distributed among different public authorities at the state, county and municipal level. The registers can be linked by common identifiers such as cadastral number, property identification, and geo-referenced addresses, which are maintained in the Cross-Reference Register. Fundamental to the registers was the standardisation of addresses in connection with the establishment of the Central Population Register. At a later stage it has been widely accepted that the address issue is of great importance when talking about spatial information because the address can link data from registers containing personal, property and enterprise data sets. As all addresses in Denmark have a coordinate relating to the front door, all register data can be geo-coded to the digital map series (Brande-Lavridsen, 2003).
The contents of the key registers are available to the public through the web-based Public Information Server launched in 2001 (www.ois.dk). The use is free of charge.

Digital Maps. In December 2000 the National Survey & Cadastre finished a nationwide vector-based map database (TOP10DK) in a scale of 1:10,000. This map series is very important in connection with an integrated use of spatial data. The map database is designed to be used in GIS connections, and eventually the map will have different linking facilities e.g. to the property-related data. The map database includes a digital elevation model. Other topographic products in smaller scales (raster-based) are also available.
Large scale digital mapping in Denmark started seriously in the 1970s in connection with the introduction of natural gas. Large scale topographic maps cover Denmark in scales from 1:1000 (towns and built-up areas) to 1:10.000 (rural areas). As the maps are produced on demand from different users (municipalities, utility companies, etc.) and in different qualities, the maps do not form a homogenous nationwide product even if they follow the general technical specifications. Generally these maps are available on the map the service of the municipalities.
The computerisation of the old analogue cadastral maps (manly in the scale of 1:4000) was completed at the end of a ten year program in 1997. The maps are designed for integrated use in a modern GIS environment.
The maps are available to the public through the web-based Map Service Launched 2002 (www.kortforsyningen.dk). The use is based on subscription and payment. However, most of the maps are also available from the municipal and county services free of charge. Furthermore, the Plan Information Service was launched in 2003 (www.planforsyningen.dk) giving web-based access to various kind of planning information. Again most of this information is also available through the municipal services.

Data Models. An important condition of utilising spatial data across public institutions and sectors (and the whole geo-data business) is that the different data can "interact". Therefore, today we have data models for property data as well as planning and environmental data. However, the documentation and metadata is often a barrier for the wider utilisation of spatial data. Therefore, a meta-database was established, see www.geoinfo.dk. The meta-database gives a short overview of each data set, where to get further information about the data set.
Another initiative is the COT project (Common Object Types) that attempts to point out and describe common object types such as buildings, road centre lines, coastlines, etc. in topographic mapping. This way, the information can be shared by all kind of end users. The project is a co-operation between the National Survey and Cadastre, the county and municipal authorities, the utility owners, and private mapping companies.

The Land Administration Functions

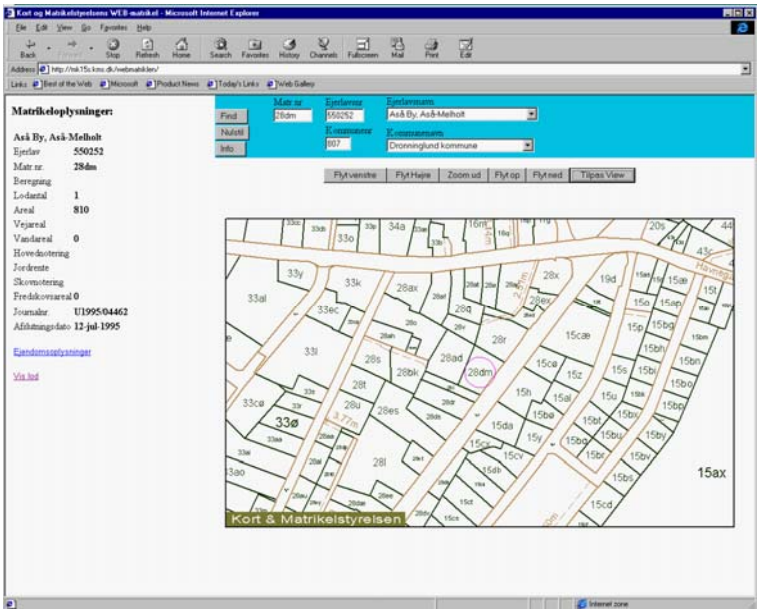
Land tenure and cadastral systems.

The National Survey and Cadastre under the Ministry of Environment is responsible for geodetic and small-scale topographic mapping, nautical charting, and for maintaining and updating the cadastral register and the cadastral maps. Cadastral surveying or surveying for legal purposes is the responsibility of licensed surveyors in private practice. As for the topographic maps these are no longer (since 2002) produced in an analogue format. Politically, this is considered to be a matter of private business based on the topographical datasets.

Legal rights to land including ownership, mortgage, easements and leases are recorded in the Land Book at the local districts courts under the authority of the Ministry of Justice. The land book is a positive title system based on the cadastral identification of the land parcels. Land transfers can then be entered into the land book just by referring to the cadastral number in a deed; consequently there are no maps or cadastral surveys available at the land registry. The process of land transfer does not include the use of notaries. When transferring a part of a property, subdivision has to be carried out prior to entering the deed to the land book. When a subdivided area is transferred from one property to another the legal rights of ownership and mortgage must be arranged prior to cadastral registration in order to ensure consistency between the two systems. This is the duty of the private surveyors. They must also ensure that the intended future land use is consistent with the current land-use regulations. A system of digital lodgement of the cadastral data is in place to facilitate on-line management of the cadastral data in the interaction between the private surveyors and the National Cadastral Authority. At the same time the system works as an integrated quality control system.

Strata titles are registered in the Land Book and are not included in the cadastre. To subdivide a property into strata titles, all the building units on the property must be included. The land of the property is then owned by the strata titles holders in an ideal partnership reflecting their interest in terms of e.g. the size of the strata title units. The opportunity of subdividing a property into strata titles is subject detailed political attention and regulations in order to ensure a proper supply of low cost housing in the urban areas.

Buildings are not included in the cadastre. This due to the origin of the cadastre that was established for taxation purposes based on the yielding capacity of the soil, and there has never since been any attempt to include the building in the cadastre. Buildings are considered a matter of local government management based on the large scale topographic maps. Information on the buildings is maintained in the Building and Housing Register that includes all kind of information on the year of construction, floor areas, building materials, technical installations, etc. This information is linked to the large scale topographic maps and is maintained by the local municipal authority in relation to the management of building permits and urban renewal.



The Web-Cadastre is an up-to-date raster version of the official cadastre. Information is easy accessible and useful for all kind of purposes in government, business and private.

There is, however, a need to also include to the land book information and relevant information on land-use restrictions. This common interface is till to be designed.

Figure3. The Web Cadastre

The cadastral system is well placed to serve multi-purpose needs by combining the datasets of the built and natural environments. It is generally agreed that the cadastral system should service all users, and their requirements for cadastral products should be carefully considered. The problem in this regard relates to the tension between the relative and absolute accuracy of property boundaries. Where the cadastral process traditionally focused on the relative accuracy between parcel boundaries, today some users, particularly local authorities and utilities, focus on absolute accuracy in order to fully combine cadastral and topographic datasets (Enemark 1998).

Land Value.

Land and property valuation is controlled by the Ministry of Taxation and managed by the municipal authorities. When a property is transferred, information on the sales price must be recorded at the municipal valuation authority prior to entering the deed into the land book. Although values are automatically assessed on the basis of recorded sale prices and property information, there is a "human factor" present in the valuation process represented by local valuation committees that comprise typical laymen. The valuation is based on information from the cadastre, the land book, and zoning and planning regulations. However, the key element is the mandatory recording of property sales prices.

The property value is assessed as the full market value of the property including land and buildings but excluding machinery, furniture and animals. The valuation is assessed to reflect the average cash price paid by a sensible buyer. The value should also reflect the

best possible economic use of the property. All public regulations such as zoning and planning regulations must be taken into consideration.

The land value is assessed as the full market value (assumed cash payment) of the land without the buildings or other construction facilities. Again, the value is assessed to reflect the best possible economic use of the land - disregarding any existing buildings and the present land use. The land value includes of site improvements such as drainage, sewerage or roads.

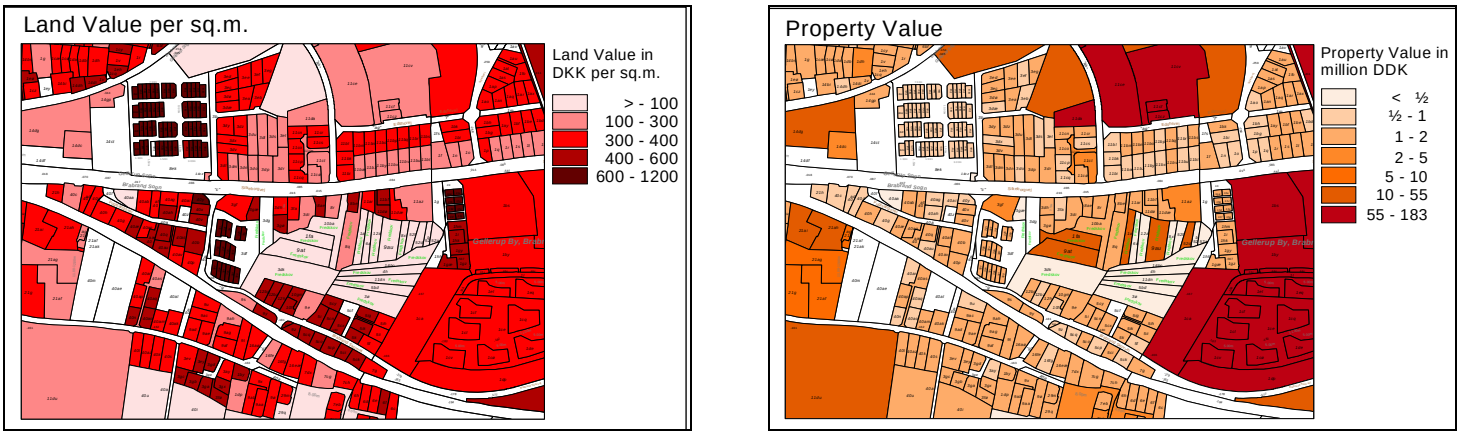


Figure 4. Examples presenting the land and property values in combination with the cadastral data

Land tax is levied by the county and municipal authorities based on the assessed market value of the land for all kind of private properties. Property and land taxes account for only about two percent of the total tax and duty revenue.

The organisation of the land valuation system is currently being revised due to the implementation of new administrative reform. The basic principles for land valuation and taxation will, however, remain the same.

Land-use and land development.

The system of planning control is based on the principle of framework control in which plans must not contradict the planning decisions at higher levels. The county councils carry out regional planning with emphasis on the regional infrastructure and the sectoral interests of the countryside. The municipal councils are responsible for municipal planning with emphasis on the local issues and the function and development of the urban areas. The municipal councils are also responsible for the legally binding detailed planning of their neighbourhood areas, and for the granting of building permits that serve as a final control in the system. The Minister for the Environment can influence the planning at regional and local levels through policies and national planning directives.

The system of planning control is supported by a number of the sectoral land use acts such as the Agricultural Holdings Act, the Environmental Protection Act, and the Nature Protection Act. The sectoral land use provisions are managed by the county and municipal authorities on the basis of sectoral land use programmes that also feed into the comprehensive planning at regional and local level. Furthermore, the system of planning control is supported by the land information infrastructure where the cadastre forms the basic layer for planning and administration. The system of integrated Land-Use Management is shown in the diagram below (Enemark, 2004).

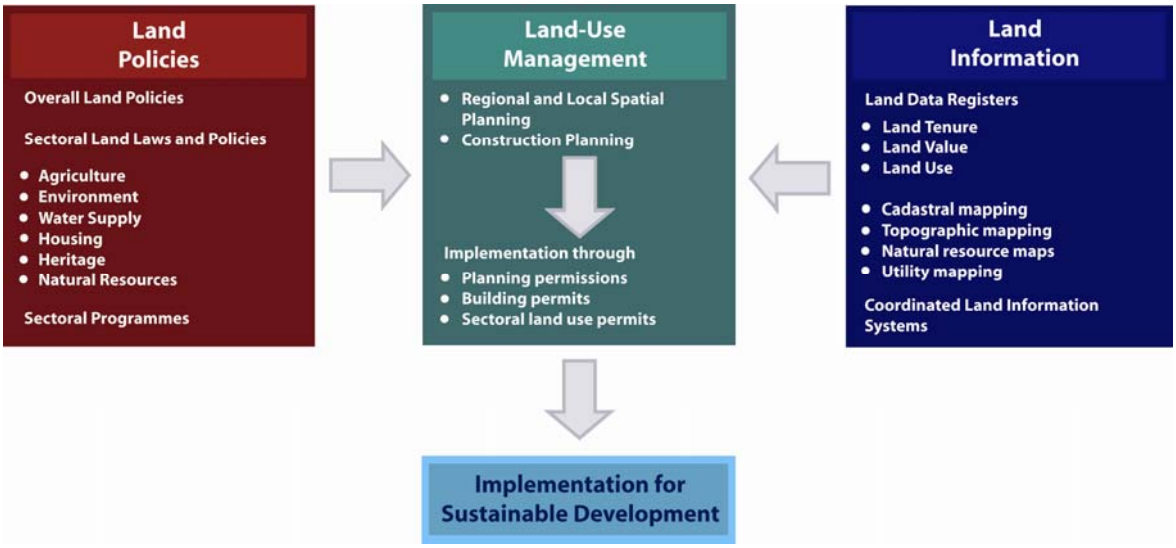


Figure 5. The Danish Concept for Integrated Land-Use Management

The impact of central versus local government in support of sustainable development is a mix of vertical connections where each sectoral policy is implemented by a top- down approach; and horizontal connections where the different sectoral policy areas are balanced on the same level through comprehensive spatial planning.

The principle of framework control ensures that planning decisions at regional and local level - in principle - will be in conformity with overall national policies. National planning policies, however, are not formally linked together to form a general national plan or a "blue print". A National Spatial Development Perspective such "Denmark towards the Year 2018" (launched 1993) is not a plan, but a vision, serving the purpose as a reference framework. There are no requirements or stipulations binding the regional and local decisions. Instead, the system of framework control operates by using two means of control: dialogue and veto.

The process for revising the regional plans every four years is based on a comprehensive national report presenting the current preconditions for managing the national aims and objectives within specific and topical policy areas. The report is prepared by the Ministry for

Environment and Energy and is based on negotiations with relevant ministries and national agencies. The report should thus prevent the use of veto against the proposed regional plans, because national interests are considered, discussed and dealt with in advance. The adopted regional plans have a binding effect on planning at municipal level. The preparation of the plans therefore also is based on dialogue and negotiations with the local authorities. To conclude the system of framework control, the Minister of Environment and Energy also may veto a proposed local plan when national interests are at stake. The power of veto based on national interest then leads to negotiations in order to achieve a balance between the three levels of administration.

In the Nordic setting, the decentralised model of land use control is based on a cultural tradition which strives for a broad political and social consensus. The concept of decentralisation comprises a precise and finely tuned relationship between a strong national authority and autonomous county and municipal councils. The purpose is to solve the tasks at the lowest possible level so as to combine responsibility for decision making with accountability for financial and environmental consequences. To put it simply: “planning is politics”.

CHALLENGES AND BARRIERS

Policy level. There is no overall comprehensive land policy in Denmark. On the other hand there is no need for such a policy since the system is already established and embedded in the cultural and institutional setting of the country. There is, however, a need for an overall policy with regard to the National Spatial Data Infrastructure. There is also a need for an overall policy with regard to the design and implementation of e-governance and e-citizenship in relation to land and property management.

Management level. Strategic aspects need to be considered with regard to the cadastral infrastructure and the institutional framework. For example, whether the Land Registries at the local district courts should be merged with the Cadastral Agency under the Ministry of Environment, and thereby increase the potential for access to and management of data related to land and property. The adequacy of the current cadastral infrastructure and procedures in relation to new ICT tools such as the provision of maps on-line from the relevant mapping database needs consideration. As does introduction of a 3D-cadastre to serve the registration of strata titles and some special construction works. Finally development of a marine cadastre to identify and secure rights and restrictions in the marine environment especially in the coastal zone should be considered.

Operational level. Fine-tuning of property concepts is needed in relation to the cadastre, the land book, and the valuation register. There is also a need to develop a user-friendly interface for access to land information in order to serve the needs of users in government, business, and the public in general as a basis for implementing e-government as the overall approach to land administration. This interface could be based on the web-cadastre in combination with the topographic database, and should also include information on

ownership, mortgage and easements, the land and property value, as well as restrictions and responsibilities related to individual properties. The information should be accessible by the postal address, cadastral identification, or the name of the landowner.

CURRENT INITIATIVES FOR IMPROVEMENT

A number of initiatives are currently discussed and considered for further improvement of the Land Administration System.

The ICT architecture. Technology development in recent years offers new opportunities for organising the spatial information. The buzz word is service-oriented IT architecture that can improve the communication between administrative systems and also establish more reliable data due to the use the original data instead of copies. This is now adopted in the governmental guidelines for service-oriented architecture e-government. The key elements are: (i) *Flexibility* and *accessibility* which facilitates decision-making at all levels, (ii) *Quality, authenticity* and *actuality* due to direct access for reading and updating in the basic databases, and (iii) *Standardisation* through homogeneously selection of communications and exchange standards such as XML etc. This is currently being applied in the area of land administration through close cooperation between the agencies and stakeholders involved.

The Land Book. The project includes a digitalisation of the land book archives (the deeds, mortgage and easement document) and adjustment of procedures to better reflect the ITC opportunities. The latter includes implementation of the service-oriented IT-architecture mentioned above. It also includes the introduction of on-line registration base on standard registration forms. Finally, the total organisation of the land registry is discussed. It is suggested to close down the local land registries at district courts and, instead, to establish just one national land registry authority. It is not yet decided whether this new National authority will remain under Ministry of Justice or maybe be established in relation to the National Survey and Cadastre under the Ministry of the Environment. In this regard, a new model is introduced for consideration, where property ownership is registered in the cadastral register, easements are identified at the cadastral maps, while mortgage could be registered in relation to the financial sector (as an asset paper compared to shares, etc.). It is, however, not likely that such a radical solution will be agreed upon at this stage. This is due to a constant tension between the various ministries and agencies caused by the ongoing fight for power and resources.

The Property Concept. The property concept in Denmark is a legal term that is defined slightly different in various laws (The Cadastral Act, The Land Registration Act, and the Valuation Act). There is a necessity to find a common term that should also accommodate various other types of properties and complex commodities. Such a common term should then form the basis for registration of all kind of property rights.

The Cadastral Map. There is a need to improve the accuracy of the digital cadastral maps in order to obtain better consistency with the large scale topographic maps. The project looks at ways and means to improve the accuracy and to make the maps more useful to the end users.

This problem derives from the process used for producing the digital maps. Accepting that the costs of computerisation of the old analogue cadastral maps had to be reasonable, the computerisation process was undertaken in two stages: (i) state control points and cadastral surveys connected to the national grid form a "skeleton" cadastral map (about 40 % of the boundary point s in urban areas and 20% in rural areas were entered this way); (ii) the remaining parcel areas were inserted in the map by digitising the analogue cadastral map and fitting in these to "skeleton map" by transformation. Identified elements in the digital map were also used to control the transformation of the analogue map. Metadata will indicate the way the boundary was established in the DCDB.

By using of this approach the accuracy of the boundary coordinates will vary considerably, ranging from a few centimetres in some urban areas and up to several metres in some rural areas. Therefore, the digital cadastral may not totally compare to a digital topographic map. However, it must be considered that the nature and origin of those two kinds of maps are fundamentally different. It must also be noted that the digital cadastral map is a graphic map, not a numeric map. This means, that the co-ordinates for the boundary points only represent the boundary in the graphic map. The final determination of boundaries must be done according to the cadastral surveys and regulations. The parcel co-ordinates in the DCDB therefore must not be used for exact calculation of parcel areas and dimensions.

The real challenge in this regard is to make this advanced product (digital cadastre map) understandable and useful to the wide range of users: They should understand that the digital cadastral map in no way replace or change the legal boundaries; and they should understand the nature of this map and the origin of the features… (Enemark, 1998).

The Multipurpose Cadastre. In 2005, the educated use of the cadastral map is still one of the mayor challenges. In recent years the cadastral authority has been imposed by the obligation of registration of new themes in the cadastre such as the coastal protection zone, the dunes protection zone, and soil contaminated areas. It has also been considered to include planning regulations and various land-use restrictions to be “hosted” by the cadastral map.

This concept of “hosting” land-use regulations in the cadastral map will now be replaced by the service-oriented IT architecture mentioned above. The focus will be on facilitating the use of the cadastral information as a basic layer for registering all kind land-use regulations and restrictions. The planning authorities and sectoral land-use authorities must then learn how to use the cadastral information within their area of responsibility including awareness of benefits and costs as well as legal and organisational impacts. The concept of the multipurpose cadastre therefore no longer means that all kind of regulations and responsibilities will be registered in the cadastre. It means that the cadastre represent the basic layer to be used by the relevant authorities for registering their information and presenting this information for decision making and to the citizens. This will require an educated use of the map to ensure consistency between cadastral changes and the connected land restrictions (Skrubbeltrang, 2005).

Implementation of the Administrative Reform. As mentioned above, a new administrative structure will be in place by 1 January 2007. The scope is to empower the local authorities by establishing larger municipalities of, in principle, more than 30,000 inhabitants. At the same time, the role of the regional level will change to include almost solely hospital management. Most of the responsibilities of the county authorities in terms of land administration are then transferred to the enlarged municipalities while some will be transferred to state level to be managed by the various state agencies.

The problems in this regard refer to the process for adopting this reform, where there was no time (or political will) to organise especially the environmental management responsibilities in a clear and structured way. The planning area is, however, well in place even if there will be a major change in relation the current system when the whole level of regional planning disappears. Instead, the new regions will be responsible for preparing a whole new and strategic tool that covers general and overall aspects of relevance to the development of the region.

However, these structural and institutional issues will of course find a solution over the coming years. The concerns are more around the land information data and expertise established over the years at the county authorities within areas such as nature protection, environmental management, water catchments, agricultural management, etc. How are this information, knowledge and expertise to be divided and transferred to the various municipal authorities within each of the former county areas?

This problem may in fact jeopardise the whole land information infrastructure at least in a short term perspective. On the other hand the situation may also offer new opportunities such as to organise the land resource data on the basis of e.g. the water catchments areas rather than dividing the datasets into the various administrative jurisdictions.

CONCLUSIONS

The Danish Land Administration System works well in the sense that it supports sustainable development through an efficient land market and effective land use management. The property layer (the cadastre) is well integrated as the basis for land information infrastructure in support of all four land administration functions. This is continuously improved and adapted to new ICT opportunities. Furthermore, the LAS is well tailored for a decentralised approach to land-use management placing the decision-making power at regional and especially local level.

However, the land information infrastructure is complex and needs continuous attention to be adapted to ITC developments. Also, some institutional arrangements could be improved and, more generally, there is need for improving the awareness the land management area as coherent whole.

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BIOGRAPHICAL NOTES

Stig Enemark is Professor in Land Management and Problem Based Learning at Aalborg University, Denmark, where he was Head of the School of Surveying and Planning 1991-2005. He is Master of Science in Surveying, Planning and Land Management and he obtained his license for cadastral surveying in 1970. He worked for ten years as a consultant surveyor in private practice. He is currently the President of the Danish Association of Chartered Surveyors and he is Vice-President of the International Federation of Surveyors (FIG) 2005-2008. He was Chairman of FIG Commission 2 (Professional Education) 1994-98, and he is an Honorary Member of FIG. His teaching and research are concerned with land administration systems, land management and spatial planning, and related educational and capacity building activities. Another research area is within Problem Based Learning and the interaction between education, research and professional practice. He has undertaken consultancies for the World Bank and the European Union especially in Eastern Europe and Sub Saharan Africa. He has more than 200 publications to his credit, and he has presented invited papers to more than 50 international conferences. For further information see http://www.land.aau.dk/~enemark

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