Cadastral Modernisation: the Centrality of Human Resources, Training and Post-secondary Education

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Summary

Cadastral modernisation affects almost every aspect of human resources in cadastral organisations. Human resource issues and needs are identified, and the importance of motivation, team building and team ownership of business processes is emphasised. The relationships between business processes, appropriate staffing, and the locations, delivery and timing of training, are considered. The constraints that limit the potential contributions of post-secondary institutions to cadastral modernisation and training are discussed, and suggestions are made for eliminating these constraints.

Background

During the past 20 years programmes of cadastral modernisation have been initiated in a large number of countries – both developed and developing. Many of the projects are still underway. More are planned or are contemplated. As cadastral organisations are created, restructured or amalgamated; governments determine new mandates for the organisations; economic objectives are sharpened; cost recovery is required; business processes are re-engineered; and new technology is introduced; the human dimensions of change become important.

Objectives

Within the context of modernising legal cadastres, the objectives of this paper are to:

- Review human resource (HR) issues and needs.
- Examine the requirements for and strategies of training in-house staff.
- Consider the role of post-secondary education in cadastral modernisation.

Mention will be made of surveying, mapping, remote sensing and information technology (IT) insofar as each supports cadastral modernisation. The paper will not attempt to address the technical aspects of each.

Cadastral modernisation

A wide variety of circumstances have prompted cadastral modernisation in the large number of countries in which it has been completed or is occurring. Nevertheless, the following broad classes of cadastral modernisation can be recognised.

1 Computerising the hard-copy indexes and registers of all parcels in an existing deeds registry, and amending business processes appropriately, with similar conversion of hard-copy cadastral maps into a digital cadastral map or digital cadastral database.

2 Converting an existing deeds registry of hard-copy indexes and registers into a computerised titles registry, the new titles being full or qualified, and amending business processes appropriately, with a similar conversion of hard-copy cadastral maps into a digital cadastral map or digital cadastral database.

3 Computerising an existing titles registry of hard-copy indexes and registers, and amending business processes appropriately, with a similar conversion of hard-copy cadastral maps.

4 Modifying, expanding, redefining business processes, and computerising an existing system of land registration to allow the legal interests in newly privatised housing stock, commercial and industrial enterprises, and large state, collective and cooperative farms to be registered for the first time. In addition, many large farms are converted into joint stock companies or new cooperative associations prior to being broken into new smallholder plots. Subdivision takes place throughout the whole of each farm or selectively as individuals apply to leave the company or association in order to farm independently. This is the situation in most independent states of the former Soviet Union, and much of central and Eastern Europe.

5 Incorporating informal transactions into an existing or new land registration system, which may be coupled with computerisation of the registers, conversion of hard-copy cadastral maps into a digital cadastral map or digital cadastral database, or new cadastral surveys and mapping.

6 Carrying modernisation further to provide full electronic registration of title through the use of documents in electronic format, electronic submission, rules for the checking and approval of electronic documents, acceptance of electronic signatures, and ensuring the legal integrity of the electronic registration data (Burdon 1998).

The status of cadastral surveying systems varies considerably. Classical field survey methods are still used widely by those cadastral organisations that for economic reasons have not had access to electronic theodolites and data loggers, total stations, and the associated software. The use of GPS for strengthening the geodetic network and densification of control is still modest in many countries. Using GPS in actual cadastral surveys is in its infancy (Brooke 1998). This should not be construed as an argument for adoption of so-called ‘high technology’. Rather it recognises the likelihood that cadastral modernisation in classes 4 and 5 may require large numbers of land parcels to be surveyed as quickly as possible, and the fact that lenders and donors are prepared to finance the procurement of modern surveying technology. The implications for human resources, training and education are significant.

Base maps on which the cadastral parcel fabric may be overlayed are often in the form of line maps at scales of 1:1000 to 1:10 000. Typically the existing base maps require substantial revision or recompilation and, in the case of class 4 and perhaps class 5, additional mapping must be produced. In many cases both cadastral plans and cadastral maps (McGrath and Sebert 1999) are still produced manually. Expanding and accelerating the production of base maps and cadastral maps is likely to utilise semi-analytical plotters, analytical plotters or digital photogrammetric workstations (Lemmens 1998, 1999). Again there are significant human resource implications for organisations that are considering the conversion of photogrammetric production lines to a digital environment.

A recent UN Economic Commission for Europe inventory (MOLA 1998) shows that of the 40 countries which responded, 69 percent of land registers have been wholly or partly computerised, the majority being in classes 1 to 3. Within the group are 15

countries that commenced projects during the past nine years with support from external donors and lenders. All but two are in class 4. Information was not received from nine republics of the former Soviet Union in which cadastral projects are proposed or are in progress, and in most of these IT is a central component of modernisation. The transformation from manual to computerised registers, indexes and maps requires recruiting, training and retaining new staff with appropriate IT skills, evaluating the current business processes to determine which should be changed and how, testing and documenting the new business processes, and retraining many existing staff.

Human resource issues and needs

Each nation is a unique combination of historical, political, economic, social and cultural factors, providing the context in which a national legal cadastre is viewed. Yet despite the diversity of circumstances, change is a common denominator for the majority of cadastral organisations. Until recently ministerial responsibility for legal cadastres, and their organisational structures, have reflected the view that providing secure legal interests in land and property through registration is wholly a responsibility and operational function of government. This decade has witnessed a questioning of that operational function caused by the continuing debate on:

- Appropriate roles for government, particularly in the collection, storage, and supply of data on land and property that might be termed production tasks.
- How to ensure the integrity of data on land, improve the integration of land-related data sets, and increase accessibility to the data.

An additional factor is the high investment cost in modernising cadastres. As a consequence new organisational models have emerged. A model might separate the provision of advice to the minister, the regulatory function (for example in checking cadastral surveys undertaken by the private sector), and the operational functions of collecting, computerising, storing, and supplying data to clients. Although the provinces of Ontario and New Brunswick in Canada, the Netherlands, and New Zealand exemplify new thinking on a suitable organisational model, they demonstrate a variety of solutions. These include government retaining responsibility for advice and regulation but cooperating in a public/private sector joint venture to pursue the programme of modernisation; the creation of a state-owned corporation which amalgamated previously separated cadastral functions; a semi-privatised cadastral function; and amalgamation with related functions in a restructured government department. It is clear there is no singular organisational model that has universal application. Change may affect the mandate of the organisation, and almost certainly will affect the conduct of its business. For example, a governmental directive on cost recovery may require a new emphasis on clients for cadastral data, and improved access to and easier retrieval from land records. Cost recovery suggests that market research be undertaken to identify new customers for existing selected cadastral data and for new value-added products. Marketing these data sets then becomes a new task for the organisation, with new staff appointed in preference to using existing staff (Robertson and Gartner 1997). Information technology may be the chosen method for improving access to land records.

The typical management structure in cadastral organisations, and the internal organisation of work, continue to reflect the well-known Weber theory of bureaucracy. It is characterised by a strong hierarchical structure with multiple layers of management, and a subdivison of tasks and delegation to separate departments (Obermeyer and Pinto 1994). In common with many parts of the private sector, consideration should be given to flattening the management structure by removing one or more layers. Rigid subdivision of tasks between departments should also be reviewed. An alternative that

is consistent with modern theory of motivating employees is to organise workgroups or teams that are assigned responsibility and held accountable for a complete business process. Although each team will have a leader, emphasis is placed on developing the self-motivation and commitment of each member of the team, the team's 'ownership' of the business process, and the team ensuring proper performance (Benwell 1993). The overall theme is 'more participation, less direction'. The creation of workgroups or teams does, however, require knowledge of team dynamics which should be reflected in management education or training.

Much experience has been gained of the impact of IT innovations on human resources, the risk of staff resistance to technological change, strategies for organising such change, and identifying the causes of failure in IT. These and other topics have been discussed widely, for example by Eason (1993) and Huxhold and Levinsohn (1995). Senior managers embarking on the implementation of IT would be well advised to develop an information management strategy that is not determined solely by institutional goals or by the technological solutions to be adopted. With the objective of securing acceptance by individual employees and the organisation as a whole, the strategy must also recognise the significance of organisational issues, and the impact of IT on job content, individual responsibility, employee status, training and compensation. To this end staff should be consulted on the technological and business changes that are proposed, and appropriate non-managerial staff should be involved in the design of the implementation strategy (Campbell and Masser 1995)

Dale and McLaughlin (1988) identified ten factors affecting the performance of staff: job security, job clarity, clear objectives, variety, use of skills, decision making, career prospects, interpersonal contacts, status and living standards. These factors all contribute to motivation. Stimulating and sustaining staff motivation is arguably the leading challenge confronting all managers. It applies particularly when a strongly hierarchical management and decision-making structure has been flattened, and responsibility and accountability for specific business processes has been devolved to teams or workgroups. It applies equally when cost recovery and revenue generation lead to reorientating the organisation to a business environment. It is needed during periods of substantial change in business processes and the introduction of technology, when civil service regulations on classifications and compensation exclude flexibility, and even more when salaries cannot be paid. The last two might suggest that performance-based compensation as a substitute for civil service pay scales will not be realised for some time. Yet there are grounds for optimism. Ordnance Survey Great Britain has been allowed to adopt a performance-based system (Rhind 1997). Negotiations for the privatisation of a cadastral agency, or its transformation into a self-financing state-owned enterprise, provide the opportunity for forceful bargaining on performance-based compensation that will reflect the achievements of individuals in a restructured organisation with a changed mandate. This applies equally when a new cadastral organisation is to be created.

A desirable element of restructuring cadastral organisations is an in-house programme of quality assurance. Assistance in designing and implementing a quality assurance programme will almost certainly be needed from a central source within the organisation, and external advice may be beneficial. But wherever possible quality assurance should be associated with team building. Whether the organisation seeks ISO certification must depend upon a wide range of circumstances. A related matter is the role of private sector professionals in quality assurance. Though many cadastral organisations have examined and approved cadastral surveys undertaken by private sector surveyors, the Association of Ontario Land Surveyors provides clear evidence that a self-regulating professional body can assume and uphold this responsibility.

The principal functions of managers have been recognised as short and long-term planning, organising the work environment and operational procedures, supervising the workforce through motivation and leadership, the selection, training and professional development of staff, and controlling work activities and performance (Obermeyer and Pinto 1994). Most of these functions require a strong analytical capability in problem identification and solution. No less important is the manager's ability to synthesise and integrate separate solutions; and given the present and likely future emphasis on cost recovery, a managerial orientation to markets and marketing is increasingly significant. Dale and McLaughlin (1988) identified HR analysis as an area for policy review, and this they defined as the determination of technical and professional skills. The importance of this area has increased as business, methodological and technological solutions have become more complex. A thorough knowledge of each employee's educational background, work experience, professional development completed during employment, and potential for advancement is an essential complement to decisions on human resource assignments. Coupled with these demands on managers is the need to strengthen their understanding of, and commitment to, the concepts of responsiveness, innovation, self-management and teamwork (Robertson and Gartner 1997). There is wide variation in the extent to which managers have received management education as part of their formal post-secondary education, as indeed there is in management training during employment. The requirement for management education noted by earlier writers, for example Larsson, 1991, Jakobsen, 1997 and Rhind, 1997, is also the plea of this paper. Senior managers must consider whether this is a responsibility of the post-secondary educational programme in geomatics or other discipline, or the individual or department during employment. If it is the last, then assistance might be sought from the civil service, a university, business school or private sector consultant or company.

Training

In this paper training is interpreted to mean:

- Ensuring that the current staff has the necessary theory, practical skills **and** practical experience to function effectively in a restructured organisation performing changed business processes with appropriate technology and to a schedule. This will require a training programme to be designed and implemented, perhaps before but certainly throughout a period of cadastral modernisation.
- Preparing new recruits to function in the same manner.
- Ensuring that where private sector professionals must contribute to the changed business processes, they also are able to function appropriately.
- Encouraging managers and other key personnel to develop a broadened outlook on the business.

Understanding the working of the business process is central to creating an appropriate training programme. Each business process in new or modernised demarcation, surveying, mapping and registration systems must be defined in detail, and be tested and verified under conditions as close to operational as possible. A model registration office and a pilot project are useful for this purpose. The outcome will be a series of detailed process models and sub-models, accompanied by summaries of the steps within each process. The documentation of standard operating procedures (SOPs) for selected processes to guide staff in their work might well be another outcome. However it should be recognised that the literature associates SOPs with bureaucracy, inflexibility, and the stifling of initiative and innovation (see, for example, Obermeyer and Pinto 1994 and Chrisman 1997). Discouraging the last two qualities would run counter to the emphasis in this paper on self-motivation and team building. Although

defining the business process should be viewed as an essential first step, each team should be encouraged to take ownership of the process, and to improve it through innovation.

Closely associated with the above is specifying the classes and levels of staff required to operate each business process, the desirable educational background and work experience for each, and the numbers in each class and level needed to staff each process in each office. Clearly the last must take into account the annual buildup required by a modernisation programme, and the expected annual attrition of staff. The first two aspects are likely to be more contentious due to the risk of drafting excessive specifications. For example, the legislation in Ontario is prescriptive on the duties of the registrar who is responsible for a land registry. Any procedural or legal question on which a registrar concludes that a ruling cannot be made locally is referred to the Director of Titles, who is a lawyer. The outcome is that only three of the current 67 land registrars in Ontario are also lawyers. Careful thought is needed, then, on the respective roles of registrars, managers and lawyers within a single land registry. Similarly the clerks in land registries do not necessarily require training as a legal clerk, though this might be helpful to the individual on entering service. In addition, there is the private or government notary who, in many civil law countries, is effectively the gatekeeper to the registration of legal interests in land. The functions of the notary's office with respect to land transactions must therefore be kept in mind when the business processes of the registry are being designed or re-engineered.

Earlier mention was made of private sector surveyors during discussion of quality assurance. Other technical and professional persons in the private sector may also contribute to a cadastral modernisation programme, and perhaps thereafter. Data collectors, photogrammetrists in private companies, and data entry operators are illustrations. Private lawyers in real estate practices may also 'contribute' to the registration system through the quality of title searches and the documents they prepare for registration. This affects training in two ways. First, the training programme should ensure that private sector professionals understand the terms of contracting out, the standards that are to be met, and their responsibility to assure quality. Second, the programme should assist professionals to understand and apply new technology and methodologies.

Readily accessible and up-to-date HR data and information on current staff in all offices is a sine qua non in the design of a training programme. Yet this is not always available, and may even be difficult to obtain. If organisational restructuring will result in several previously separate organisations being combined, then equally information must be obtained on the other staff complements. Combining workforces may also present risks if there are other established business processes.

There has been some discussion of the types and levels of cadastral training that are required (for example by Dale and McLaughlin 1988; Larsson 1991; McGrath 1992), and for GIS the literature is voluminous. A training programme may consist of several types of learning. The first is **contextual** that enables the beneficiary to understand the setting for the work of the organisation. Illustrations are a course or module on the role of land and property markets in market economies, understanding other cadastral systems and cost recovery. The second is **support** learning in which the individual develops a working base for subsequent functional learning. A simple illustration is one or more courses on computers and computing for novices, operating systems, and software for word processing and spreadsheets. The third is **functional** learning of the technical and practical aspects of business processes necessary for each class and level of staff to function effectively. The underlying concept is the 'need to know'. The number of courses or modules in this group is likely to be large. The fourth is

managerial learning that is intended for all who supervise staff or who have the potential to do so. From the above flow several propositions:

- Though specific learning experiences, courses and modules must be selected for inclusion in a training programme for each class and level of staff, establishing a balance between contextual, support and functional learning is critical.
- The costs of including specific learning experiences, courses and modules in a training programme are not trivial and must be valued.
- The tangible and intangible benefits likely to be gained from a specific mix of learning experiences, courses and modules must be assessed when planning the programme and all courses and modules must be evaluated by the participants.

In general terms much can be achieved in carefully designed and well executed training courses and modules of one to three days' duration. Correspondingly more can be managed in the less frequent courses of up to ten days' length. The possibility of a specific course or module that lasts weeks is not excluded, though any such proposal should be examined with care.

There is still a serious lack of experience with computers and computing which is potentially detrimental to cadastral modernisation. Specifically there appears to be a tendency for the staffing of IT functions such as systems analysis, software development, system management, database administration and a help desk to be underestimated. This applies also to the training that IT staff may require. These situations may be attributable to senior managers not understanding the skills, capacities and limitations of the current IT staff; the detail and complexity of computerisation; and the importance of textual databases being updated continuously. The risks in such underestimation are considerable, and thus managers should ensure they seek the best advice possible.

There is general agreement that because of language and cost, training should be delivered by domestic trainers wherever possible. This does not exclude the possibility of these trainers being taught by expatriate specialists where there is insufficient local expertise. There are, however, differing views on the contributions that vendors might make to a training programme. Kalensky and Latham (1998) represent the view that vendors have an important contribution to make, whilst Hearnshaw (1983) noted that the effectiveness of courses offered by vendors is not always impressive. The author believes that provided the content of training and contractual obligations are defined precisely, and that delivery is monitored and evaluated, vendors can provide appropriate training and should be asked to do so where their expertise is not matched locally.

The locations of training will depend on local circumstances. There are arguments that favour centralised training, including the desirability of a single mockup registration office in which specific business processes are practised though there are associated costs in transportation and accommodation of participants. However a **virtual** office can now be achieved using web technology at a single or multiple locations. This principle may also be applied to other aspects of teaching and learning, for example in the recording and processing of electronic field survey data, and data capture by digitisation. Thus training can be freed from centralisation to a greater extent than before without risk to uniformity of content and delivery.

Appropriate training should be provided when cadastral modernisation is being planned, during implementation and, dependent on staff attrition and subsequent changes in business processes, after the project is completed. Integration of training with the procurement, delivery and installation of instruments, hardware and software is critical; and the advantage of having vendor training in two phases should be noted – at

time of delivery, and some weeks later when working experience has been gained. These measures will avoid the undesirability of training before project implementation in a single intensive burst (Eason 1993); and will reflect the principle of 'just in time' delivery noted by Coleman (1998). Overall there is a strong case for the preparation of a master training forecast and plan. This will cover the whole period of cadastral modernisation, specify the types and lengths of courses and modules to be offered, identify the numbers of current and future staff to be trained in each course and module, and project the costs of the programme. It should be subject to continuous updating.

Education

Post-secondary educational institutions have the potential to play an important role in cadastral modernisation. This includes not only programmes that produce graduates in subjects directly related to the cadastre, e.g. cadastral surveys, land management, surveys and mapping, and remote sensing, but also in information technology and management education. Not infrequently insufficient attention is paid in cadastral modernisation to realising the potential. There are, however, three principal constraints that must be considered and resolved if geomatics or related departments in post-secondary institutions are to fulfil their potential.

The first is human resources. Though teaching staff in the post-secondary institutions of emerging economies are highly educated, often they have been deprived of experience with current methodologies and technologies. This applies to satellite geodesy, electronic surveying, digital mapping with special reference to analytical and softcopy photogrammetry, image processing in remote sensing, GIS and the contributions of database management methodology to property registration. The teaching staff in emerging economies share with their counterparts in developed economies a general lack of formal education in business, marketing and management. Correcting these deficiencies may occur, first, through a donor's offer of places in formal postgraduate degree or diploma programmes abroad. Though such generosity is to be welcomed, it is important that the proposed educational programme is wholly relevant to cadastral modernisation. It can be expected that strengthening management education will be achieved locally as business schools are established and expanded. There are infrequent offerings of the second possibility, custom designed courses, due to the costs of designing and offering such a course for a small number of participants. The third possibility is a study leave financed by a fellowship. This offers considerable potential for learning and benefits to future teaching provided that the host allocates sufficient time to the visitor. Finally, although there is a long tradition of technical staff being attached for short periods to public sector production agencies, this has not been the case with private sector companies. It is a device that merits attention.

The second constraint is the educational curriculum. Significant changes in the design of geomatics curricula have occurred during the past ten years. Present circumstances are forcing a further, and arguably more fundamental, review of geomatics education. This is due partially to evolving technology that enable a greater variety of professionals, technicians and members of the general public to manipulate spatial data effectively without the intervention of geomatics personnel. It is also affected by the market driven emphasis on re-engineering business processes (Coleman 1998), and the premium this places on graduates with strong analytical and communication skills. The ability to assess, integrate and manage disparate data sets remains a partially fulfilled challenge; whilst the development, implementation and management of national and international spatial data infrastructures constitutes a challenge for the new century. The current imperative is not to fine-tune curriculum design within what Coleman has termed a 'zero sum' academic environment; but rather to engage in

fundamental analysis of what the marketplace for spatial information in the next century will contain, and what it will require of geomatics and other professionals.

Physical resources are the third constraint. In many cases post-secondary institutions in emerging economies are sadly lacking in modern survey instruments, modern Windows and UNIX-based computing, and appropriate software used in positioning and surveying systems, analytical and softcopy photogrammetry, and textual and graphic databases. These tools are, however, being procured for operational use in government agencies and the private sector as part of cadastral modernisation programmes financed by lenders and donors. The public and private sector organisations are the future employers of graduates of post-secondary programmes; and as several writers have pointed out, employers prefer to recruit graduates who have the necessary theoretical knowledge and preferably some working experience with modern methods and technology. There is a case, then, for including in a loan, credit or grant application provision for appropriate strengthening of the physical resources of relevant post-secondary educational institutions. It has been suggested that practical experience of working with modern instruments, software and methods could better be achieved by placing students in public and private sector organisations in which new instruments and software have been installed. Though this is desirable as an interim measure, it is not a long-term solution because of conflicting priorities in production and learning. Nor is arranging practical work with visiting consultants a continuing solution. However, joint programmes of technical cooperation with foreign universities can make a useful contribution and should be encouraged.

There is a further element of strengthening post-secondary education that deserves closer attention. This is the capacity for research, particularly applied research that may support a cadastral modernisation programme. For example, the forthcoming high resolution satellite sensors are designed to capture panchromatic data of 1 m ground resolution or better, and multispectral data of 4 m resolution or better. The data offer considerable potential for the production of dense DEMs, topographic maps at scale 1:2500 or smaller, perhaps the capture of selected parcel boundaries, and the regular monitoring of agricultural production for property assessment and other purposes. Local knowledge and field checks are an integral part of the necessary research. A university or college might be commissioned to undertake the research under the sponsorship of the responsible agency and with funding from the grant, loan or credit. An alternative is a joint programme with a foreign institution that has access to research funding.

Post-secondary educational institutions might also be considered as a resource in planning a training programme, and perhaps in teaching selected courses or modules. Feasibility will depend on several factors. The first is the subject matter, theoretical, practical or both and, associated with this, the academic preparation and practical experience of the teaching staff. Given the emphasis on relatively short, full time courses when training existing or newly recruited staff, the willingness of academic staff to adopt appropriate teaching methods is a second factor. A third is the adequacy of physical resources if teaching is to be undertaken in the post-secondary institution. And finally, but by no means the least, is the ability of academic staff to deliver training on time and at an agreed price.

Conclusions

External changes that prompt cadastral modernisation, and the many internal changes that modernisation brings about, affect almost every aspect of the human resources of public sector cadastral organisations. Neither the private sector nor the post-secondary educational sector is completely free from the effects of change in the public sector. Yet change brings not only challenges, but many opportunities - to restructure the organisation and in the process encourage the participation of employees, to examine critically and ensure all business processes are relevant, to persuade employees to commit themselves to the organisation and heighten their motivation. It is also an opportunity to develop and implement a context sensitive, pertinent and timely training programme that allows local expertise to be utilised to the maximum and facilitates the professional development of staff. And, in the process, it is an opportunity to strengthen post-secondary educational institutions so that they may contribute positively to a national programme of modernisation.

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