POLICY BASED SOLUTIONS OF COMPATIBLE SOFTWARE FOR BUILDING OF CADASTRAL DATABASE FOR UNIFYING LAND ADMINISTRATION IN VIETNAM

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Abstract:

The 2013 Law on Land was promulgated and entered to power. The Law provides revised articles and new amendments of main contents in activities of surveys and evaluation of land resources to settle shortages the 2003 Land Law did not provide detail regulations for Ministry of Natural Resource and Environment (MONRE) had approved the project "Strengthening the land administration and land database" which will be implemented from 2017 to 2020.

However, actually, Vietnam is using numerous software for land administration but they are not compatible among themselves. Therefore, the effectiveness of land administration works remains limited in many aspects. This paper provides a study of existing status of software technology policies for cadastral database and an analysis of existing shortages which have common reasons from incompatibility of these software.

This paper, targeting the settlement of problems raising from practical activities, proposes policy solutions for building of compatible software to unify the land administration activities in Vietnam.

Keywords: *Technology policy; Compatible software technology; Cadastral database; Land administration.*

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1. Introduction

Technology policies for the system of software for processing of cadastral database play important roles in management of cadastral database. But in practice, these policies exhibit many shortages in aspects of both theoretical and practical nature. One example of that: Vietnam is using many software for land administration activities which have yet many limitations and cannot produce the desired effects.

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The above noted situation causes difficulties to administration works and wastes of resources (human resources, finance resources, technological resources and etc.). Therefore, it is needed to build conceptual and practical backgrounds for building of compatible software technology policies for processing of cadastral databases to enhance effectiveness of land administration activities.

2. Basic notions

Technology policies were the focused center on studies by many scientists. There are works, among them, to deal directly with the term of "technology policies". But there are also many works which do not deal directly with this term but remain to be considered as initiators of this term.

According to evaluations by *Hoyningen-Huene Paul* (1993), it is possible to consider Thomas Samuel Kuhn as founder of technology policy related studies[2]. In his work "*The Structure of Scientific Revolutions*" [3] Kuhn first dealt with the term "*paradigm*" according to interpretation of which the science is purely products of thinking minds. This point of view by Kuhn in fact rejects the philosophical concepts of positivism.

A brief notice: there exist many different concepts in translating the term *paradigm* into Vietnamese. Actually, in Vietnam, there exist a few Vietnamese translated versions of the English original work *The Structure of Scientific Revolutions* by Thomas Samuel Kuhn. *Nguyen Quang A*[4] provides a translation of this term into Vietnamese. *Vu Cao Dam* (2011), in his work "*Course of Policy Science*", agrees with this translation by Nguyen Quang A. And, in this paper, I use this Vietnamese translation of the term.

Originally, Thomas Kuhn raised two aspects related to paradigm. First, *paradigm* is related to basic knowledge of theoretical nature which is largely accepted by leading scientists in certain science field. This basic knowledge of theoretical nature is dealt in textbooks of the field. Second, *paradigm* is related to standard situations and ways to solve problems.

Software technology policies were not dealt directly by researchers abroad. They deal with that by the term "software mamangement policies". In fact,

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[2] Hoyningen-Huene, Paul (1993) provided an evaluation of roles of the founder of studies for technology polices: *"Technology policy is distinct from science studies but both claim Thomas Samuel Kuhn as a founder, while technology policy recognizes the importance of Vannevar Bush".*

[3] Kuhn, T.S. (1962) *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press. ISBN 0-226-45808-3

[4] See: Nguyen Quang A. Vietnamese translation of *The Structure of Scientific Revolutions* by Thomas Kuhn. Translated version was provided from website *minhtrietviet.net* (updated on 19th August 2016)

this term deals with management policies of automation process which applies rules based on working and warning procedures: (i) to keep management policies on right tracks to realize the defined objectives; and (ii) to warn managers that the rectification of old policies and the issuance of new policies might break out the structure already shaped by previous policies. From another side, the term "software technology policy" could be interpreted as software development policies. Birrell N.D. called them as policies to turn needs of consumers or policy objectives of managers to a software product *(Birrell, N.D, 1985)*.

So, software technology policies of compatible cadastral database on basis of *paradigm* concepts by Thomas Kuhn should be understood in two aspects. First, they are theoretical backgrounds and need to be used, in practice, in unified ways for land administration sector. Second, software technology policies of compatible cadastral database are able to prevent shortages in land administration activities which originate from the use of different cadastral database software.

In the land administration sector, the system of land information and land database hold a particularly important position because they contain systemized software for purpose of management and exploitation of information in land administration process.

The system of land information includes many components, namely: technical and technological infrastructure of land information, system of administration of software, systemized software, application software and national land database.

Land database is a set of data which are organized and arranged in such a way to permit access, exploitation, management and upgrading through electronic devices.

National land database include many components, namely: database of legal regulation documents on land administration, *cadastral database*, database of fundamental land surveys, master plan database, land use plans, land price database, statistic database, land inventories and etc.

Therefore, *cadastral database* in this paper is understood as a component of national land database.

3. Overseas experiences of building of land administration software

Overseas scientists pay attentions to recover shortages in land administration works coming from use of different software. The paper entitled "*Soil database management software development for optimizing land resource information utilization to support national food security"* by

Rizatus Shofiyati, Saefoel Bachri and Muhrizal Sarwani (2011) dealt with it, since the first start of development of land resources database where a big volume of digital data and super data was collected and created. There exist some application software of land database for management of a big volume of data, for example: Side & Horizon (SHDE4), Soil Sample Analysis (SSA) and others. There are also database of soil physics and database of chemical assets from surface soil to underground layers of soil which contain soil data, climate data, surface soil conditions and other parameters necessary for land classification. Management software of land resource database are still based on the DOS admin system and are independent. The fact that this system remains independent leads to low efficient use of the information system of agricultural land resources. The solution for this shortage requires reviews and development of new database software which would be compatible to development of information technology. This paper provides an explanation on development of an interactive information system of agricultural land resources for optimization of use of land resource data and for higher efficiency of land administration activities.

Researches by *W.B. Labiosa, W.M. Forney, A.M. Esnard, et al. (2013)* provide a detail presentation of an *ecosystem portfolio model* as a test model to integrate ecological matters with socio-economic information and related values to make management decisions. Ecosystem Portfolio Model (EPM) uses a framework of multi-standard evaluation of scenarios, Geo Information System for land analysis and use, and sensible land change models (including spacial factors) to describe changes of values in ecosystems in connection to covering canopy rates of lands and living quality level of local communities. Parameters in basic models can be changed through interfaces permitting users to offer supports to make simultaneous exploration of scientific problems and sub-groups of priorities for related sides. The researches applied in prototype projects in South Florida showed changes in the total values of the ecosystem including global view and sub-units of the model, bio-diversified potentials and land ecology recovering capabilities of the area including high rising seawater situations. All of these parameters were compared to the land use scenarios of this area by 2050 and this assessment gives backgrounds to make suitable management solutions.

Overseas published researches show that the land administration practice requires a review and development of new database softwares to keep pace with development of information technologies to optimize use of land resource data and to enhance effectiveness of land administration activities. At the same time, overseas made researches also show clearly the needs to

have integrated tools for evaluation of multi-indicator scenarios to set up land use plans in urbanized areas. The study and application of external experiences would lead to solutions proposed for enhancement of land administration effectiveness in Vietnam.

4. Cadastral database software actually in use in Vietnam

4.1. Architectural models

Cadastral database software actually in use in Vietnam are divided into two architectural types including:

- Client-Server architectural models: previous generations of software such as ViLIS 2.0, ELIS, TMV.LIS, SouthLIS, DongNaiLIS, VGIS and some others;
- Web based multi-layer architectural models: new generations of software such as VietLIS, ViLIS 3.0, ELIS Cloud and TMV.LIS 2.0.

4.2. Graphic technologies

Cadastral database software mainly uses the following graphic technologies:

- ArcGIS technological platform offered by ESRI Company (USA): this software is used largely in 60/63 provinces/cities in Vietnam. This software uses ArcGIS Engine libraries as graphic platform for presentation, display and redaction of maps, and spacial management. This group includes software ViLIS, ELIS, TMV.LIS, SouthLIS and LandInfo;
- GeoNuris technological platform offered by JungdoUIT (South Korea): VietLIS software actually uses GeoNuris technologies for presentation, display and redaction of maps, and spacial management. However, Vietnam actually has no experiences and detail assessment of effectiveness of use, price, costs and possibilities of extended connections between large technological platforms of the world such as ArcGIS (ESRI), GeoMedia (Hexagon Geospatial) GeoNuris (JungdoUIT) and open source code platforms such as MapServer, GeoServer and others;
- Open source code platforms: they are mainly under development and test stages which include software TMV.LIS 2.0, ELIS and ViLIS.

4.3. Brief development history

- ViLIS software were developed since 1997. The first version of these software is Famis-Caddb software which get implemented since 1999. The ViLIS 1.0 version was developed during 2001-2005 years and the ViLIS 2.0 version has been developed since 2005;
- ELIS software were developed since 2005;
- TMV.LIS software were developed since 2008;
- SouthLIS software were developed since 2013;
- VietLIS software were developed since early 2014.

4.4. Functional systems and potentials of use

Actually, from view of functional systems, ViLIS software keep the first position in provision of user supporting functions. However, interfaces were not designed accordingly which cause certain difficulties in use.

VietLIS software, since being developed later, are equipped with more sophistic structure, scientific arrangement and user friendly interfaces. However, its functions are not so fully provided as ViLIS and ELIS can do. At the same time, these software were not proven through practical operation then cannot provide exact and detail evaluation evidences.

4.5. Evaluation works for software

It is a reality that cadastral database software were introduced to use even not having been yet approved by any scientific council, commented by managers or evaluated in term of quality by local authorities, and, then, difficult to be sure to meet technological standards. In practice of use, these cadastral database software exhibit certain shortages and disadvantages.

4.6. Rules of test, maintenance and trial operation

Rules of test, R&D works, warranty and maintenance service did not get yet attentions from managers and then this situation leads to many limitations of these technological products.

A global evaluation states: *the software have different disadvantages but, in majority of cases, they can meet only requirements put to land database at local level. There is no software to meet indicators for requirements to be unified and compatible to become a national land information system.*

5. Policy solutions for compatible software technologies to build up cadastral database

Technological compatibility was in center of attentions by many overseas researchers. *Begoña Garcia Mariñoso (2001)* started studies of matters of technological compatibility and technological incompatibility where the basic considerations for selection of compatible technologies are based on certain components including natural resources, human resources, economic, environmental, cultural, social factors and others. Compatible technologies have to be also the ones to meet objectives of socio-economic development and requirements of natural environment and social environment.

However, the term "suitable" *and* "compatible" *used in technological sectors have some particular meanings different from daily use of these terms. Every technology itself always seems to be suitable at the time moment it appears. However, during S&T development process, the technologies coming from different sources, appearing in the same sector and being developed in different stages may become incompatible each with other. The problems here are related to:*

- Selection of suitable technologies: The solution of choice made for a single technology while other technologies (said to be unsuitable) being rejected is very high cost and does not meet practice of actions, particularly the one of poor countries;
- Selection of compatible technologies: The integration of technologies in such directions which do not lead to conflict and make outputs of compatible technologies meet the requirements of previous technologies.

According to *Neil Gandal (2002)*, the selection of compatible technologies should be based on consideration of the following indicators:

- Prerequisite indicator: Outputs have to meet requirements of technological effectiveness which means that the quality of outputs of technologies under consideration should not be lower than the ones made by previous technologies;
- Satisfaction of harmonic relations between technologies and environment aspects (natural and social): Environment friendly technologies, savings of human resources and no internal disturbances of technological staffs;
- Saving of financial resources;

- Low impacts from crisis in material and energy supplies, saved consumption of natural resources, low consumption of energy and material, possible use of renewable energy sources;
- Lowest limits of time-outs, even for case of selection of the most suitable technologies (refusal of remaining technologies) or for case of integration of technologies to get compatible options for their use.

In case of software technologies, in order to meet compatible indicators, it is necessary to check the following aspects: functions to meet fully requirements, good efficiency, possibilities of easy maintenance, credibility and acceptance by users, with following details:

- Possibilities of easy maintenance: software need to be adjustable and extendable to meet changing demands;
- Credibility: High level of exactness and confidentiality of information and operation;
- Efficiency: Use of software not causing waste of resources of the system;
- Acceptance by users: Easy understood and operated by users, and compatible to other systems;
- Development of techniques to build software to solve problems of incompatibility between operational environment and infrastructure of information techniques;
- Possibility of transfer: abilities of technologies to meet the indicator of easy use, even for case of users with middle qualification level in concerned fields of selected technologies.

6. Tests of models of compatible technology solutions for the system of cadastral database

Solutions to be considered as feasible need to meet fully two factors of being “unified” and “compatible”. The “unified being” feature of solutions is reflected through close connections between solutions to build software. The “compatible being” feature is reflected through feasibility of solutions. The proposed solutions need to meet right requirements to be selected as standardized system of software technologies to build cadastral database.

6.1. Test of model for ViLIS software for urbanized land administration (case of Ho Chi Minh City)

ViLIS 2.0 software were applied to build land administration database in Ho Chi Minh City. The objectives of the project were to establish legal status of every land piece and related land use rights in fast, compact and

transparent way on basis of a unified land administration database which is integrated from database of standardized cadastral maps and cadastral data under management.

The implementation of ViLIS software in Ho Chi Minh City has gained the following main results:

- The contents of land administration database, upon completion, are able to meet specific technical specification required by MONRE;
- Outputs of land administration activities by district governments are well controlled, regularly operated and effectively used which permit to meet requirements of State administration activities of lands in localities;
- ViLIS software, having been implemented, provide not only good supports for building of land administration database but also direct supports for professional works and administrative reform works in field of land administration;
- Conducted programs help to form teams of professional staffs which gain capabilities and qualification to meet demands of IT related works and modernization of State administration duties;
- Conducted programs also help to enhance effectiveness of administrative reforms and to enhance accessibility of population to land information sources.

The test of the model shows that land administration software can meet indicators of compatibility of cadastral database with land information systems, give contributions to administrative reforms and, particularly, enhance accessibility to population to land information systems by organizations and individuals which have needs of land use.

6.2. Test of model for ViLIS software to be used as provincial centralized cadastral database (case of Vinh Long Province)

Vinh Long Province is one of 9 provinces to conduct the pilot project "Modernization of the Vietnam system of land administration" (VLAP). The VLAP Project uses ViLIS software to establish the system of cadastral database including reviews and adjustments to meet local specific conditions.

The VLAP Project made investments to upgrade ViLIS software from 0.1 version to 2.0 version to meet two targets:

- To become the software of unified use in VLAP provinces to build land database according to technical specifications for cadastral database;

- To become the software to provide unified administration and operation of cadastral database (information sources of cadastral sector) for regular activities of land administration in the VLAP provinces.

In Vinh Long Province, provincial cadastral database are stored, managed and upgraded according to the concentrated database model. In this model, there exists an unique cadastral database stored in the provincial office of registration of land use rights. Offices of registration of land use fights at district level would need to make direct access to cadastral database of the provincial office of registration of land use rights through large networks between province and district levels.

The advantages of the centralized database model is to secure the unique status of cadastral database independently from decentralization of data upgrading operations of offices of registration of land use rights at province and district levels.

We need to note the centralized cadastral database model was implemented successfully in Vinh Long Province.

The tests conducted in Vinh Long Province show that the model can meet requirements to centralized cadastral database independently from decentralization of data upgrading operations by offices of registration of land use rights at province and district levels. From another side, it meets through-passing requirements to specific data transmission networks and establishment of links between decentralized services of local land administration activities.

6.3. Evaluation of ViLIS software through pilot models

6.3.1. Advantages of ViLIS software

The advantages of ViLIS software as a land information system are seen clearly through its capabilities to meet duties related to activities of State administration of lands including:

- Tools to support the building of land administration database;
- Supports for filing of registration application and issuance of certificates of land use rights, upgrading of changes, establishment and management of cadastral files;
- Management of stores and links of digitalized legal files;
- Realization of procedures and formalities of land transactions;
- Supports for administrative reforms which provides inter-links between the three levels;

- Provision of links with electronic government information gates of cities and districts;

ViLIS software permit to realize the whole software based process of land transaction, to support directly administration works of leading bodies and to enhance work effectiveness of staffs.

6.3.2. Possibilities to propagate models of application of ViLIS softwares

Practical surveys show that 61/63 provinces/cities of Vietnam are using land information software which come from various sources (Gia Lai Province and Dak Nong Province do not make yet any choice of software), namely:

- ViLIS 2.0 software: being implemented in 44 provinces;
- ELIS software: being implemented in 11 provinces;
- TMV.LIS software: being implemented in 4 provinces (Bac Kan, Thanh Hoa, Thua Thien Hue and Quang Nam);
- SouthLIS software: being implemented in Duc Trong District, Lam Dong Province;
- VietLIS software: being implemented in 2 localities (Tu Son Town, Bac Ninh Province and Hai Chau District, Da Nang City);
- LandInfo software: being tested in Hai Ba Trung District, Hanoi;
- VGIS software: being tested in Tu Liem District (former), Hanoi;
- DongNaiLIS software: being developed and implemented by related services of Dong Nai Province.

So, actually we have 44 provinces, making the greatest share among users, to implement the use of VILIS software. This leads to many advantages in propagation of use of these software including low costs for their propagation.

Briefly, the two pilot models meet well indicators of technological compatibility and, at the same time, meet well requirements of theoretical concepts, namely: technological effectiveness, good connection between technologies and environment aspects, no internal disturbances of technological staffs, saving of finance resources, no time-outs during selection of suitable technologies.

From another side, the two pilot models show certain credibility rate of exactness and confidentiality of information, high effectiveness (use of software does not cause waste of resources of the system) and, most

particularly, acceptance by practical operation of administration services (easy use, compatibility with existing systems, possibilities to meet requirements of unified land administration procedures over the whole country). Therefore, these models can be propagated largely in land administration sectors.

7. Conclusions

The paper has dealt with a proposal of technological policy solutions, unified and compatible, in the system of cadastral database software to enhance effectiveness of land administration activities in the national scale where the central attentions are focused on building of indicators for data structure, unified and compatible software, contents of data structures in the system of cadastral database and solutions for human resources for operation of unified and compatible technology policies in the system of cadastral database software.

In addition to efforts to build unified and compatible technology policies, it is necessary to implement works for completion of:

- Legal documents;
- Designing of data structures;
- Financial investment policies;
- Policies for training of high quality and high qualification human resources for policy making and policy implementing services from central level to local level;
- Policies for operation management of functional organizations from central level to local level.

The pilot projects conducted in Ho Chi Minh City and Vinh Long Province show the policies for development of the system of software technologies offer chances to get unified and compatible technologies to build better cadastral database. The solutions the paper proposes should get attentions from S&T managers.

Other topics which were not dealt with in this paper due to limited size of a research paper are policies for financial investment and training activities to get high quality human resources for implementation of solutions for compatible software technology policies to build up cadastral database for unified land administration in Vietnam./.

REFERENCES

In Vietnamese:

1. Vu Cao Dam. (2010) *Course of policy sciences.* Hanoi National University Publishing House
2. Nguyen Quang A. Vietnamese translation of the work *The Structure of Scientific Revolutions* by Thomas Kuhn.
3. Documents related to cadastral database software.

In English:

4. Kuhn, T.S. (1962) *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press, ISBN 0-226-45808-3
5. Birrell, N.D. (1985) *A Practical Handbook for Software Development*. Cambridge University Press. ISBN 0-521-25462-0.
6. Hoyningen-Huene, Paul. (1993) *Reconstructing Scientific Revolutions: Thomas S. Kuhn's Philosophy of Science*. Chicago: University of Chicago Press.1993
7. Begoña Garcia Mariñoso. (2001) *Technological incompatibility, endogenous switching costs and lock in.* The Journal of Industrial Economics, Vol.49, No.3, pp. 281-298.
8. Neil Gandal. (2002) *Compatibility, Standardization, & Network Effects: Some Policy Implications.* Oxford Review of Economic Policy, 18 (1), pp. 80-91
9. Rizatus Shofiyati, Saefoel Bachri, Muhrizal Sarwani. (2011) *Soil database management software development for optimizing land resource information utilization to support national food security*. Journal of Geographic Information System, Vol.3 (3), p.211 (6). ISSN: 2151-1950.
10. W.B. Labiosa, W.M. Forney, A.M. Esnard, et al. (2013) *An integrated multi-criteria scenario evaluation web tool for participatory land-use planning in urbanized areas: The Ecosystem Portfolio Model*. Environmental Modeling and Software, Vol.41, p.210 (13). ISSN: 1364-8152.