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A MODEL OF THE DECISION PROCESS FOR GIS ADOPTION AND DIFFUSION IN A GOVERNMENT ENVIRONMENT

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Abstract

The way a government organisation conducts its business can be viewed as a public management system, consisting of a `public production process' in an organisational setting. In this system, many factors interact with one another to make it operate. Accordingly, the decision for the adoption and diffusion of GIS in such a system also will be subject to the influence of these factors. Based on the experience of GIS adoption and utilisation observed in several Australian State government agencies in 1995, seven such factors are identified, namely, GIS paradigm, aligned vision of decision makers, production infrastructure, production process, product mix, organisational setting, and the external environment of the stakeholders. Their relationships are described in a model which confirms the need for alignment between GIS and these factors in a government organisation. It is hoped that the model will contribute to the theoretical understanding of the process of GIS diffusion in a government environment, and as a result, facilitate the planning and management of the process in future.

Introduction

A government organisation functions in the context of two elements: the unique way government conducts its business and the organisational setting. The government business delivery process, also called `public production process' by Alford (1993) , comprises the use of the production infrastructure of a government, by means of a process of production, to generate a product mix to satisfy the needs of the stakeholders and to gain a continual provision of resources. The organisational setting is the formal and informal management environment developed over the years of existence of the organisation. Any introduction of change in a government environment must be studied in the context of these two elements. This paper will examine how these two elements interact in general, and provide a framework to describe the decision process for adoption and diffusion of GIS in a government environment. The paper starts by examining what constitutes the government business delivery process.

Government Business Delivery Process

Disturbed by the success of business management principles in gaining support of government administrators, Moe and Gilmour (1995) reiterate the importance of law-based principles of

public administration in protecting the citizenry from an overbearing, arbitrary, and capricious use of government power. They stress that private and public sectors are inherently different and the entrepreneurial management model is not and cannot be a substitute for political and legal accountability. They call for the recognition of the strengths and responsibilities of each sector. Moe and Gilmour's view echoes the debate about `managerialism' in the Australian public sector in the late 80s as noted by Alford (1993) . This debate centred around whether or not public sector activity should be managed as a productive process just like the private business sector. After reviewing the argument, he concludes that neither party give a proper account of the task and context of public sector management, and puts forward a public management model called `Public Production Process'.

Alford regards public sector activity as a production process made up of four main components: *organisational capabilities*, *production*, *value*, and *environment*. Organisational capabilities refer to the productive capabilities of the organisation such as staff, equipment, buildings etc. Production is the procedures whereby the organisational capabilities and other resources are converted to something of value. Value refers to something of value produced, such as goods, services, market failure remedies, and equity etc. Environment is the citizens and stakeholders for whom the value is produced; and from whom authority and funds (taxes) to conduct the business are received. The public production process is distinct from the private one in four ways. Very briefly, first, public sector managers produce non-market values (also referred by some researchers as public value) in addition to market values. Second, the range of actors in the *environment* is more complex involving stakeholders other than clients and tax-payers. Third, public sector managers use public power, including persuasion, convenience and power itself, in addition to public money as a resource to carry out their tasks. Four, they make use of public power to tap production capabilities from other external organisations through a process called co-production. To portray a clear and coherent set of meanings and to facilitate the following discussions, the four elements are renamed from environment to *stakeholders,* organisational capabilities to *production infrastructure*, production (including co-production) to *production process* and value to *product mix*. For a government organisation, the stakeholders will form its external environment while the remaining three elements will constitute the internal production process within its management environment. Together, they make up the *public management system* of that organisation (Figure 1).

GIS Diffusion in a Goverment Organisation

In this section, we shall try to identify the relationships between GIS and the public management system of a government organisation, and establish what GIS diffusion in this environment entails. There are many definitions of GIS (Maguire, 1991) . Here, GIS in a government environment is viewed as a set of tools (Burrough, 1986) which provide both infrastructure and business application services (Chan & Williamson, 1995) to generate a product mix, based on a GIS paradigm, in a particular organisational setting (Huxhold & Levinsohn, 1995, p. 5) of a public management system. This composite definition is chosen as it allows GIS to be studied in the context of the more complex management environment (refer as the organisational setting below according to the definition by Huxhold and Levinsohn) of a government organisation. It also includes an important element, the GIS paradigm which is the application of fundamental geography, i.e., georeferencing, geocoding, and topology, to organising and using information. In a diffusion study, the GIS paradigm gives GIS a unique identity, distinguishing it from other information technology developments in an organisation.

Rogers (1993) defines diffusion as the process by which an innovation is communicated through certain channels over time among members of a social system. GIS adoption is typically a contingent innovation-decision (Rogers, 1983, p.347) as its adoption decision by an organisation normally precedes that of the individuals owing to the high capital outlay required. As Campbell and Masser (1995, p.5) point out, this type of decision by an organisation involves interaction between complex sets of personal, organisational and cultural interests. Further, adoption does not necessarily lead to successful utilisation resulting in benefits. They suggest that diffusion should be an umbrella concept encompassing the processes of awareness raising, adoption, implementation, routinization and utilisation and an evaluation of the outcomes. The ultimate achievement of GIS diffusion is the embodiment of the technology into the organisation's

business processes (Zwart, 1993) . Therefore the study of GIS diffusion within an organisation will involve study of not just the adoption decision, but a process comprising a whole host of GIS decisions involving adoption, implementation, utilisation, and routinization in order to achieve the required outcomes.

An organisation is a stable system of individuals who work together to achieve common goals through a hierarchy of ranks and a division of labour (Rogers & Agarwala-Rogers, 1976, p.26) . Stability is achieved by a high degree of structure imposed on communication patterns through creation of the formal and informal organisational settings. The formal setting is defined by predetermined goals, prescribed roles, authority structure, and rules and regulations (Rogers, 1983). All of them also broadly define how the internal production process is structured to achieve the organisational goals. Before any major change can be formally adopted and accepted, it must first gain official recognition through the formal setting, e.g., by means of proper justification or feasibility study etc. through prescribed channels.

The informal setting refers to the various kinds of informal practices, norms and social relationships among the members of the organisation (Rogers, 1983). These members, like all other communities of people, have different opinions and values, conflicting priorities and goals. As a result, they compete amongst themselves for power and resources (Handy, 1993, p. 291) . This competition gives rise to organisational political behaviours, which are displayed to attain a goal by "*informal*, rather than formal means of *influence* in the face of potential *conflict*." (Pinto & Azad, 1994) . These behaviours manifest the presence of the informal setting. While the formal setting broadly defines the internal production process, the informal setting decides how and what are actually produced. As a result, any major change will ultimately have to pass the scrutiny of the informal setting in addition before it is fully accepted by the organisation. Likewise, before the bolts and nuts of a GIS can be introduced into a government organisation, in one way or another, the importance of the GIS paradigm in the internal production process must be established in both the formal and informal organisational settings first.

Traditionally, recognition by the formal setting is achieved through justification exercises or feasibility studies. If successful, this is often followed by purchasing and installation of the hardware and software. At this stage, GIS enters into the internal production process as an entity in the production infrastructure. Through a process of data conversion, applications development, and training, GIS may be used to varying degrees to produce the product mix required of the organisation. Often problems arise at this stage in the diffusion process. Though the GIS paradigm may have been accepted in the formal setting, it has not gained the recognition of the informal setting. Unless it has, it will be difficult for GIS to be integrated into the internal production process. As a result, the progress of diffusion may be delayed or even stopped.

In an ideal situation when the GIS paradigm (and thus GIS - see definition at beginning of this section) has been recognised by both the formal and informal settings, the technology will gradually become an integral part of the production infrastructure and production process (Chan & Williamson, 1995) , converting resources to the prescribed product mix. In the diffusion process, the production process may have to be modified, or re-engineered, to make full use of the potential offered by the technology. When users become more proficient with the technology, they can identify more efficient ways of production, or new products that may be more effective in meeting the needs of the stakeholders. This achievement is important as by reducing cost and satisfying the stakeholders, resources will be more likely available to support the business of the organisation. Over time, GIS and its paradigm will diffuse throughout the organisation, becoming more integrated into the internal production process and more transparent to the users. Based on the above discussions, the way factors in the public management system of a government organisation interact during diffusion of GIS can be summarised in Figure 2.

In the model in Figure 2, the public management system comprises the external environment formed by the stakeholders, and three elements of the internal production process (production infrastructure and process, and product mix) which resides in the government organisational setting. The organisational setting is make up of its formal and informal components for which there may be no clear-cut boundary. The entry point for GIS and its paradigm is the production infrastructure. For it to progress to more advanced diffusion stages, it will have to establish itself as an integral part of the internal production process by creating an alignment with the process and with the formal and informal settings through interaction. This alignment is a reciprocal exercise with each party adjusting to the needs of others to achieve the best outcome. GIS diffusion in a government environment is also indirectly affected by the stakeholders' satisfaction towards the product mix and their willingness to support the production process.

Vision and The GIS Decision Model

As pointed out in the last section, the formal and informal settings of an organisation give it not only stability but also significant resistance to change. Under these circumstances, Rogers (1983, p. 349) still observes that innovation is going on all the time in an organisation. What is the driving force behind these innovations? The answer may lie in the difference among people in an organisation as observed by Handy (1993) . People tend to have different personalities, experience, education, needs, and values. These qualities, subject to the influence of the organisational settings, will congeal into their visions, which can be defined as a `*sense of purpose and direction*' (Dunford, 1992) or a `*mental journey from the known to the unknown, creating the future from a montage of current facts, hopes, dreams and dangers and opportunities*' (Hickman & Silva, 1984) . Like people, visions of people in an organisation differ. These visions will drive them, actively or passively, reasonably or maliciously, to attaining goals

which range from gaining resources or power on purely a self-serving basis to that of furthering the organisational goals (Pinto & Azad, 1994) .

A vision can play an important role in the decision process for GIS diffusion. According to Rogers' (1983, p. 165) innovation-decision process model, an innovation decision is preceded by knowledge and persuasion. Knowledge of the innovation, GIS in this case, is affected by prior conditions such as previous practice, felt needs/problems, innovativeness and norm of the social system. It is also affected by the characteristics of the decision-making unit comprising social-economic characteristics, personality variables and communication behaviour. These prior conditions and characteristics of a decision-making unit correspond to its vision developed within the organisational settings, as described in the previous paragraph.

A vision, on taking up the GIS paradigm completes the knowledge stage in Rogers' model. The stage of persuasion is completed when the GIS paradigm is thoroughly evaluated against the vision, based on the perceived characteristics of GIS, such as, access to learning, ease and effects of use, cost, utility etc. (Pinto & Onsrud, 1993) . This is followed by the decision stage, the outcome of which may be acceptance or rejection. Rogers (1983, p. 173) talks about active and passive rejection, involving whether use of the innovation has been considered. However, there can also be active and passive acceptance, involving whether active measures are taken to persuade others to accept the GIS paradigm. Passive acceptance takes place when users accept what is given to them without following up the decision by encouraging others to accept. This often occurs among users who tend to follow what they are told to do and are generally satisfied with what they have achieved. The ambitious and innovative-minded are more inclined to display active acceptance. They develop a vision of making use of GIS to further the goals of the interest groups they belong to. To this end, they are prepared to persuade others, formally or informally, to align with their vision, and will try to overcome any resistance in the course. The higher an interest group is within the hierarchy of an organisation, the more dominant will be its vision, the greater will be the impact of the resulting decisions, and often, the greater will be the resistance encountered. Active acceptance of the GIS paradigm into a vision is therefore the driving force behind diffusion of GIS within an organisation. In the literature, an individual in high position who displays active acceptance of the GIS paradigm often is referred as the champion.

As pointed out by Campbell and Masser (1995, p. 159) , a champion in an organisation may come and go. Under these circumstances, a champion has two important roles to play. First is to get the tangible part of GIS, e.g., data, hardware and software etc. in place. Second is to nurture the acceptance, particularly the active acceptance of the GIS paradigm into the visions of decision making units in the organisation. On the premature departure of the champion, those with the nurtured GIS aligned vision can develop a new driving force, building on what has been achieved by the champion. Over time, it is the combined drive of those with an aligned GIS vision, displaying active acceptance, that sustains the momentum for GIS diffusion in an organisation.

To sum up, the decision for GIS diffusion is a continuous process of decision-making through interaction with the internal production process, the organisational setting, and the external environment of the stakeholders. The whole process starts with the active acceptance of the GIS paradigm into the vision/s of one or more decision making units in an organisation, particularly that of the champion. Subsequently, the GIS aligned vision either becomes the dominant vision or aligns itself with the existing dominant vision. In either case, the outcome is a GIS aligned dominant vision.

Based on the two roles identified for a champion, for GIS diffusion to advance, the GIS aligned dominant vision will have to generate two types of decisions. First are the GIS decisions which directly affect the physical growth of GIS in an organisation. It is this type of decisions that dominated the literature in the past. Second are the ancillary decisions which are made to change the production infrastructure, the production process, the product mix, the organisational setting, and the views of the stakeholders to complement the GIS decisions. This

is to ensure that the development of GIS and the way the public management system functions align with each other to achieve the organisational goals efficiently and effectively. An important side-effect of aligning GIS with the public management system is to make the latter more receptive to the GIS paradigm. As a result, ancillary decisions help to nurture GIS aligned visions among other decision-making units in the organisation, which in turn will maintain the momentum for GIS diffusion. These decisions have to be made through interactions with the rest of the public management system, providing valuable feedback towards the state of GIS diffusion in the organisation. The outcome is the continual flow of resources from the stakeholders in return for the production of the appropriate product mix demanded in an effective and efficient way. This decision process takes time which is an important factor for successful GIS diffusion. The complete decision process of GIS diffusion in a government environment is illustrated in Figure 3.

An opportunity to match the theoretical model described above with actual practice in a government environment arose during a recent visit to several State Government agencies in Australia to study their GIS development. Three cases are documented in the next section. This is followed by a section discussing how the actual experience can illustrate the concepts described, i.e.,

1. Active acceptance of the GIS paradigm into the vision is the driving force behind the decision for GIS diffusion,
2. The need for a GIS aligned dominant vision to sustain the momentum for GIS diffusion. This is achieved by either nurturing minor visions that align with the dominant GIS vision, or aligning the GIS vision with the dominant vision of the organisation.
3. The need for alignment between GIS decisions and ancillary decisions.

To avoid possible embarrassment to the agencies and the staff concerned, the agencies are

identified by a codename respectively: Xcase, Ycase, Zcase. Other than that, as far as the authors can ascertain, the information provided reflects the actual situation.

Cases of GIS Development

Xcase

The first agency is Xcase which is responsible for the supply of mapping data, both paper-based and digital. It has a total staff size of about 400 and a recurrent annual budget of over A$21 million (1992/93). Though staff were already experimenting with digital facilities in 1974, the organisation was not committed to a digital environment and as a result, not much progress was made. In 1985, the present agency was officially established by an amalgamation of two existing Offices, and later was headed by the present Director in 1987. Since 1980/81, there was a continuous scaling down of the budget and staff size of both the present agency and its parent Offices. The agency was located away from the State capital which bred a feeling of isolation. By 1987, the morale of the staff was low and many were disillusioned about their future with the completion of the state-wide cadastral pattern developed from orthophotographs. The new Director, who was conscious of the needs of the agency and its staff, and had experience with GIS, decided to adopt the technology as part of the long term strategy of the agency. At first, there was limited support for the new vision. Many staff, apart from the GIS pioneers, were not familiar with use of computers and could even be considered techno-phobic. Use of information technology in the agency was limited. With the appointment of a supportive business manager, a systematic effort was made to better align the views of managers and staff with the help of GIS pioneers. The effort involved promotion by merit, training staff in the new technologies, and encouraging staff to interact with clients to find out their needs. More significantly, with the help of cost-benefit justifications, politicians were convinced to inject A$30 million for the development of the Statewide digital cadastral database (DCDB). Staff could then see the benefits of change, particularly the adoption of GIS, and so, a vision driven, customer oriented, GIS embracing culture was developed. The GIS is currently providing both infrastructure and business process services to the various business units of the agency.

Ycase

The second agency is Ycase which is responsible for land administration, land registration, and general supply of land ownership data, both paper-based and digital, for about three million legal parcels. It supports the operation of the land market in the State. It has a total staff size of about 700 and an recurrent annual budget of about A$30 million (1994/95). It started examining the use of information technology in the early 1970s and a working Management Information System (MIS) was introduced in 1983. All along, both previous and present Directors of the agency recognise that the system they are running is essentially a GIS, involving both geographic and attribute data albeit the geographic component comprises paper-based maps. In 1988, the Charting Branch received funding to start a pilot GIS project to investigate if providing a computer cadastral map index to the land ownership data was feasible. However, before a full GIS for business application could be developed, the agency needed a Statewide digital cadastral database (DCDB) at graphic accuracy. In the mid-80s, with an interagency agreement, the development of such a database was to be coordinated by a separate body. In the mean time, apart from supporting the development of the DCDB, resources of Ycase were heavily committed to continually introducing new MIS and the associated changes in business processes needed to reduce reliance on manual labour and reduce backlog of data up-dates, and generally to improve services to the public. Therefore, the pilot GIS project progressed slowly over the years.

This does not pose any adverse effect on the project which has been kept as an on-going core agency project since 1988. This has been possible because top management are convinced that

conceptually, the system being run by the agency is essentially a GIS and in the long term, requires an accurate DCDB for both charting and searching of all ownership data and for checking cadastral survey plans. Further, over these year, the agency gained significant management experience and expertise in the introduction of information technology into the agency. A more change-conducive organisational culture had been built up. With the completion of the DCDB by a separate state agency in the last couple of years, arrangement is in place for the two agencies to work together to develop a GIS that serve their needs. In future, when the GIS is mature enough for agency-wide introduction, the achievement of total computerisation and automation of the business delivery process of the agency for both textual and graphical data will be possible.

Zcase

The third agency is Zcase which is responsible for managing 16,900 km of road and the associated traffic systems in the State, with emphasis on road safety and transport efficiency. It has a total staff size of over 8000 and an recurrent annual budget of over A$706 million (1992/93). In the late 1980s, middle and lower management of different business units were increasingly aware of GIS, and their demand to use GIS to provide a graphical interface to query the large management databases grew significantly. In response, the general manager of Information Technology Services justified a case for a corporate licence of a proprietary GIS software with associated training for a small number of people. At that time, the immature technology and difficult commands resulted in great user resistance. A few took on the challenge and became the GIS core group. Three years on, managers separately responsible for assets management and maintenance, route and network planning, road safety and road use, road performance measurement, road funding allocation and environmental management etc. acquired other pc-based GIS products. Though GIS matched the corporate business information needs, there was no consensus on a standard GIS within the agency. In 1991, a management consultant was unable to overcome the problem.

Simultaneously, Zcase's Information Technology policy was being restructured. The officer-in-charge of the exercise saw the value of GIS and fought the case for an integrated GIS at CEO level. Ultimately, an internal cost-benefit justification helped gain approval to set up a team to implement GIS across Zcase. In 1994, a four-member GIS management implementation team was created under the Information Technology Services group to oversee implementation of the selected system corporate-wide. To overcome staff resistance in the process, a value management study was conducted with the help of experts to ensure that all necessary functions were provided to meet end user needs. It gained over 90% support and was found to be a valuable tool to facilitate change.

In early 1995, on the recommendation of one of the directors, the project team was placed under a different section in the agency, within a common geomatic environment of surveying, mapping, and property management. Later, the Chief Executive commissioned a third party evaluation of the implementation of the corporate GIS project, which was found to be a success. The project delivered GIS software, hardware, geographic data, training and applications to users throughout Zcase. Based on the recommendations in the report, the implementation team was given two years to get GIS fully operational and decentralised to regions. It was also required to operate on a self-sufficient basis through provision of services to regions and other clients.

In the mean time, senior management was keen to encourage business units to get quality accredited to ensure that Zcase got value for money from its investment in management and technology. Special badge presentation gatherings were organised to recognise openly the achievement of those who got the status. Senior management was keen to improve the productivity of the agency through conscientious cultural change. The GIS groups in headquarters and in regions are expected to be accredited in time.

Discussion

GIS Aligned Dominant Vision as a Driving Force

In Xcase, the Director's belief in GIS as a means to modernise the agency was the GIS aligned dominant vision, and the constant driving force behind development of the corporate GIS. It took him almost a decade to build an integrated GIS to conduct the agency's core business and became a leader in its field. In the process, being aware of the reluctance of the agency to change, an effort was made to better align the visions of the managers and staff with his dominant vision. It involved promotion by merit, training staff in the new technologies, and encouraging staff to interact with clients to find out their needs. At the time of the study, all managers interviewed were perceived to share a common GIS vision.

In Ycase, owing to data and other administrative and business constraints, GIS using digital spatial data has stayed in the pilot stage since 1988. However, unlike similar project in the private sector which may have been abandoned, the project remains as an on-going core agency project. This is largely due to the support of the present and previous Directors who are convinced that the system the agency used to deliver its products is essentially a GIS, albeit a GIS using a paper-based map base. It is their intention to eventually introduce a modern fully computer-based GIS. This is the GIS aligned dominant vision keeping GIS alive in Ycase.

Currently, those responsible for the GIS pilot project have been working on a demonstration to show staff and clients how GIS using digital base map can make the business delivery process more effective and efficient. Over the years, Ycase has successfully introduced new information technology to streamline the old paper-based operations for textual data. The management expertise developed and the resulting change-conducive organisational setting have prepared the agency for the transition to a GIS-based production process. Capitalising on this achievement and with the support of top management, it is expected that the demonstration can help nurture a strategic GIS aligned vision rapidly to aid smooth diffusion of GIS in the agency.

In Zcase, top management originally had minimal knowledge of and commitment to GIS. Their vision was to boost productivity and to improve product quality. In the course of realising the vision, Information Technology strategy (incorporating GIS) was restructured and a Total Quality Management policy was adopted. Once they were convinced by the GIS advocates that an integrated GIS was essential to core business, and was in-line with their strategic intent, they had provided the financial backing and used various means to ensure the successful introduction of a coordinated corporate GIS. Unlike Xcase and Ycase, GIS aligned vision is not the dominant vision in Zcase. However, it aligned successfully with the current dominant vision, generating a GIS aligned dominant vision, and achieving more advanced GIS diffusion.

Since the introduction of the first proprietary GIS into the agency, the GIS paradigm had spread. More sections in the agency have developed their own GIS based on different pc-based software. This created conflicts when effort was made to introduce a agency-wide GIS software. However, the GIS visions were ultimately aligned through a value management study. Currently, GIS hardware and software have also been introduced into the regional offices and staff are encourage to use the technology with the help of key local advocates. These are also measures to nurture the active acceptance of the GIS paradigm by the regional staff through hands-on experience. In due course, it is expected that an aligned GIS vision will be developed throughout the agency to support the coordinated application of GIS to core business. In a government organisation, introduction of the hardware and software cannot guarantee true advance in GIS diffusion, but a sustained GIS aligned dominant vision can.

Alignment of GIS and Ancillary Decisions

In Xcase, although there was a GIS vision in 1987, the Director was fully aware that the agency was not yet prepared for the technology. Apart from nurturing the visions of staff and building up the GIS, ancillary decisions were made to equip more staff with the new technology, to change the manual and product-oriented way of business delivery to an automated, customer-oriented way, and in general, changing the internal production process. Most important of all, a decision was made to invest in a consultancy justification for a DCDB and to actively lobby government (the stakeholders in Figure 3) to invest in GIS. The result was the injection of A$30 million for the project, providing a great boost in morale and financial support to achieving the GIS vision, and demonstrating the importance of aligning the GIS and ancillary decisions.

In Ycase, though a decision was made by the government to develop a DCDB in support of a GIS in the mid-1980s, the agency was only given a supporting role. However, it needed an accurate cadastral map to carry out its work. Further, there was a pressing need to automate the internal production process to meet the demand of clients. Confronted with these constraints and despite the Director's GIS aligned dominant vision, the GIS and ancillary decisions made have to compromise and align with each other. The outcome was to press ahead with the automation process, and to develop the necessary GIS skills in the agency through pilot projects while waiting for the DCDB to be completed.

In Zcase, in the early phase of development of the GIS, the GIS and ancillary decisions were not aligned resulting in proliferation of pc-based GIS. To remedy this position, when it was decided to introduce an agency-wide GIS, an ancillary decision was made to use a value management study to align the visions of the user groups. A consensus was reached as a result, clearing the way for the smooth introduction of GIS. On the other hand, as GIS was a tool to achieve the agency's dominant vision of quality and productivity improvement, the GIS team will have to abide by the resulting ancillary decisions to get quality management accreditation and to be self-sufficient within two years. This illustrates that alignment between the dominant and GIS visions is a mutual process with both adjusting to each other's needs.

Conclusions

A government organisation is viewed as a public management system comprising an internal production process in an organisational setting, and influenced by the external stakeholders. For diffusion of GIS to advance, it must establish itself as an integral part of the internal production process in alignment with the organisational goal, by gaining the recognition of both the stakeholders and the organisational setting. The GIS adoption and diffusion decision is not a single decision but a series of decisions made through a process of active interaction with the public management system over time. In the process, two types of decisions are made. First are GIS decisions that concern the physical development of GIS, and second are ancillary decisions that concern the complementary change of the public management system to facilitate acceptance of GIS and its paradigm. To maximise the benefits of GIS, the two types of decisions will have to be aligned. The driving force behind the decision for GIS adoption and diffusion is the GIS aligned dominant vision which is a result of the cumulative active acceptance of the GIS paradigm into the visions of decision-making units in an organisation, particularly that of top management.

In short, the decision process for GIS adoption and diffusion in a government environment can be viewed as a process of alignment of the GIS paradigm and visions of the decision-making units with the public management system. The latter comprises production infrastructure, production process, and product mix all within the organisational setting, and under the influence of the external stakeholders.

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