

# Collaborative innovation in the public sector to manage GNSS CORS technology in Thailand

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## Abstract

Organisations require effective access to disruptive technology management including a generation of a culture of continuous innovation. Therefore, the open innovation paradigm has been established as a theoretical base for managing innovation in the enterprises and public sectors. In order to handle the independent ownership and management of GNSS CORS technology complexity in Thailand at the national level, collaborative innovation has arisen for building and refining the creative ideas and sharing internal resources and external knowledge. Moreover, stakeholder theory is deployed to consider the role-plays and the power of each of the partners over an inter-organisational collaboration.

**Keywords:** GNSS CORS, Collaborative innovation, Public sector

## Introduction

Public and private organisations in sectors such as health care, construction and logistics that require satellite data for ensuring target locations are faced with a proliferation of positioning applications. Continuously Operating Reference Stations (CORS) constitutes one of the technologies designed as a supplement to Global Navigation Satellite System (GNSS) signals to improve positioning precision (GPS.GOV, 2017). Effectively implementing this land-based augmentation system has presented difficulties for countries such as Thailand. In particular, independent ownership and management of the GNSS CORS network has led to problems of duplication and overinvestment and the lack of facility sharing has adverse effects on the budgetary requirements of individual CORS users.

To resolve such complications in the management of GNSS CORS technology in Thailand requires the adoption of technological innovation in the public sector. To this

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end, the various Thai government agencies involved have developed a form of collaborative innovation. But this must take account of the different levels of power among the CORS licence holders based on their number of assets and major missions. The present paper analyses key issues surrounding innovation management with respect to GNSS reference networks from the perspective of the open innovation paradigm, with a particular focus on collaborative innovation and stakeholder engagement.

## **Theoretical Background**

### *Open innovation*

The term ‘open innovation’ was coined in 2003 by Chesbrough in his seminal book, since then open innovation has become a term synonymous with modern approaches to innovation (Cassiman and Valentini, 2016). Essentially open innovation means that the innovation process is permeable, meaning that “there are many ways for ideas to flow into the process, and many ways for it to flow out into the market” (Chesbrough, 2006). This understanding that innovation transpires across the boundaries of individual firms and involves many actors linked together in formal and informal innovation activities has resulted in Chesbrough (2003) distinguishing open innovation from the traditional closed model of innovation. Closed innovation is based on the premise that investment in R&D results in technological discoveries that advance into new products and services, which increase profits that are then reinvested into the development of further new technologies, all in a process controlled and managed by a single firm. Conversely, within open innovation this process is opened up with ideas and technologies being developed externally to the firm. What also occurs is the spinout of ideas, technologies and business models from the open innovation activities to other firms who perhaps create new ventures.

Since 2003 a plethora of studies have emerged on the topic of open innovation. While we agree with Huizingh (2011), who highlights that innovation has very rarely been ‘closed’, there is no denying the increased focus on more complex forms of innovating with multiple actors, across organisational boundaries. What we see in the literature is the use of ‘open innovation’ as an umbrella term, with other forms of innovation such as collaborative innovation, network innovation, co-creation, user-driven innovation, crowdsourcing all falling under the broader term of open innovation. While it is not the purpose of our paper to disentangle the knotty conceptual underpinnings of various types of openness within innovation practices, it is important to recognise the shared dimension of these concepts – namely, that innovation takes place with multiple actors and not within the confines of a single organisation.

### *Open innovation in the public sector; collaborative innovation*

While much of the literature in this area has its roots in for-profit organisations there is a growing body of research focusing on the application of these practices of innovation in public sector organisations. There is a recognition that open and collaborative forms of innovation may support an increase in the quality and quantity of innovations in the public sector (Nambisan, 2008; Bommert, 2010), at the same time as helping to remove policy impasses and deadlocks while dealing with ever increasing complex societal problems (Torfing, 2016). It is also known that models of open and collaborative innovation cannot be directly transferred into a public sector setting due to the policy processes and cycles that determine the introduction of new policies (Mergel and Desouza, 2013). However, there is a growing literature on the development of guidelines and frameworks applying

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the principles of open and collaborative innovation into the public sector (e.g. Bloch and Bugge, 2013; Brown and Osborne, 2013; Crosby et al., 2016).

In a related field, collaborative governance is defined as the inclusion of government organisations in formal discussion in order to reach agreement with respect to public policy adoption or how government resources or plans are managed (Ansell and Gash, 2008). Networked government engages all types of organisations (for and not-for profit organisations) and citizens in the system to attain relevant public goals. As a result, the concept of collaborative innovation emphasises that resources should be shared over different organisational boundaries (Moore, 2009; Bommert, 2010). Also, a crossdisciplinary approach is proposed to the collaborative work between governments in which the advanced collaborative innovation hierarchies could strengthen public innovation by instigating stable processes (Sørensen and Torfing, 2011).

### *Stakeholder management*

A key aspect of open and collaborative innovation is the management of stakeholders to engage with innovation. This appears to be more of a challenge in public sector led collaborative innovation where IP issues are less transparent, knowledge is often more tacit and there are inherently more politics at play (Mergel and Desouza, 2013). Furthermore, the literature identifies a key consideration concerning the management of the open and collaborative innovation, which is ‘who’ takes ownership and responsibility for the innovation. This means that the facilitation of the collaboration is of utmost importance in the success of the collaborative innovation (Sørensen and Torfing, 2011); but there is limited theoretical or practical insight into how this facilitation can be done effectively.

A multi-stakeholder partnership (MSP) is an idea in which stakeholders, both governmental players and non-governmental players, make an effort to do something together under a win-win situation, with each actor given a clearly defined role (Simon et al., 2016). When the stakeholder-based process is applied to local government administration, the decision makers are influenced by the stakeholders who are empowered to deploy the power over their organisation (Gomes, 2006). There appears to be an element of power differential that can impact the success of the collaboration; for example, the individual managers’ consideration of power and power-motivated behaviours can impact the success of the innovation (Cankar and Petkovšek, 2013). This can result in power asymmetries that can risk the operation of the collaborative innovation (Sørensen and Torfing, 2011). In order to overcome these power differentials there are traditionally five elements that underpin the collaboration concept; namely:

1. organisation,
2. associateship,
3. interaction process,
4. objective, and
5. temporal attribute.

The task of exploring the stakeholders’ role needs the comprehension of the distinctiveness, the depth, area of interest, distinct portion and logic deducting of players. The requisite conditions are as follows: to obtain the arrangement of the public value that needed to be co-produced; to gain legitimacy and authorisation over the converging and diverging points: and to create the required capability of co-producing the public value, especially delivery and interconnected system capacity with a close attention to the important route, divergent resourcing, and contrasting time frames (Bryson et al., 2017).

### *Initial conceptual framework*

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This demonstrates the complexity of the areas to be considered in the setting up and management of a collaborative innovation network. Figure 1 outlines the initial conceptual framework for our study. It illustrates the key areas of importance and will provide guidance as an analytical framework for our empirical data.



*Figure 1 - Initial conceptual framework*

Our study into the complexity of managing the GNSS CORS system in Thailand aims to analyse how different government agencies are collaborating in terms of data gathering, data management and service distribution. Our study will also evaluate the roles played by prominent owners of GNSS network infrastructure in this collaboration.

## **Research Methodology**

### *Outline of the research design*

An earlier case study of interagency cooperation relating to GNSS reference station administration in Australia has shown the need to make proper allowance for the innovation capability of each participating organisation and to assign the separate key roles (Hausler and Philip, 2013; Higgins, 2008; Roberts et al., 2004; Roberts, 2009). Based on the apparent similarities, we seek to build on the Australian research findings in our own study of GNSS CORS management in Thailand. A central feature of the Australian case was the establishment of ANZLIC as the top government body in Australia and New Zealand responsible for the accessibility and usability of spatial information (ANZLIC, 2019). In Thailand, no less than nine organisations are getting involved in GNSS ground infrastructure technology, including six government agencies and three universities (Rizos and Satirapod, 2011).

Our research design is founded on a realist ontology combined with a multimethodology approach to data gathering, including focus groups, expert interviews and in-depth case studies. In practical terms, this involves focus group interviews with six organisations who own the base stations in Thailand and expert interviews with academics from three universities, supported by simultaneous analysis of the Australian case study documentation. Our approach to data analysis is based on deductive content analysis to derive our research findings. The broad objectives and scope of our study and

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somewhat convoluted nature of the research design lead to a large set of multifarious research data (Stewart et al, 1990).

The data collection phase started in the summer of 2018 and is currently ongoing. Following transcription and translation of the focus group and expert interviews, detailed content analysis is applied, and findings are compared.

#### *Data collection methods*

A focus group is a data collection method that provides large amounts of information on the perspectives and spontaneous body language from of a range of individuals about issues raised in the group interaction (Rabiee, 2004). Primary focus group data were collected from six government and public organisations that control GNSS CORS infrastructure in Thailand. The six focus groups respectively comprise the Royal Thai Survey Department (RTSD), the Department of Lands (DOL), the Department of Public Works and Town & Country Planning (DPT), the Hydro and Agro Informatics Institute (HAIL, a public organisation), the Geo-Informatics and Space Technology Development Agency (GISTDA, a public organisation), and the National Institute of Metrology, Thailand (NIMT, a public agency).

Each of the focus group interviews lasted between one and three hours. They were conducted internally: the participants were invited to discuss a given topic with three to six government officers who came from the same organisation. The detailed composition of each focus group was determined based on selected criteria covering the purposive specification and multidimensional aptitude of the participants. These criteria included, for example, age range, knowledge of the study area as well as other characteristics, organisational responsibility and decision-making power. As they had been carefully selected based on these criteria, the participants were comfortable expressing their ideas to the group members and researcher (Rabiee, 2004). Additionally, some of the participants were assigned as the representatives of their specific department, in order to substitute for any important decision makers who were unavailable for the focus group interviews.

Expert interviews constituted the second data collection method employed in this study. This particular qualitative technique requires skilful participants with a specific interest and expertise in the relevant area of research. Although a powerful technique if applied in the right manner and circumstances, the choice of experts is subject to a number of constraints; in particular, proficiency in the specialised research questions but also limitations in terms of time, availability and accessibility. Such factors tend to put a strict limit on the number of the potential participants (Baker et al., 2012).

Once selected, experts are requested to attend sessions with an interviewer who raises queries relating to specific topics and records the responses (Muskat et al., 2012). In our research design, the experts were two Professors and a Lecturer from three Thai academic institutions; namely, Chulalongkorn University (CU), King Mongkut's Institute of Technology Ladkrabang (KMUTL) and Kasetsart University. They are all professionals in GNSS technology and related fields of research; and they participated in semi-structured interviews lasting between one and two hours.

#### *Data analysis methods*

Data collection was immediately followed by the start of the process of data analysis. Summaries and transcriptions of the focus group and expert interviews, including nonverbal communication as well as the way in which participants used words and the tone of their voice, were made in preparations for the next steps in the analysis (Onwuegbuzie et al., 2009; Stewart et al., 1990). In a qualitative research paradigm, the

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analysis aims to understand the meaning of a situation, rather than its literal truth, according to the purpose of the study. In the context of focus groups, transcribing interview data could yield many similar instances and phrases. There is then a risk that data selection and evaluation could become highly subjective. Therefore, an in-depth analysis of the interview data should be systematic, sequential, verifiable and continuous (Krueger and Casey, 2000; Rabiee, 2004).

Content analysis is a flexible approach that can be applied to quantitative data as well as qualitative data, either in an inductive or deductive investigation. Although its very flexibility and lack of straightforward guidelines for use have sometimes caused problems for researchers applying this analysis method, it is very well suited for delicate and multifaceted context analysis. Moreover, a deductive analysis is capable of testing existing assumptions or differentiating between phenomena relating to dissimilar categories and different times (Elo and Kyngäs, 2008).

Based on our prior theoretical knowledge from the literature review, we have used our initial conceptual framework (in Figure 1) to apply deductive content analysis to the massive set of data from both the focus group interviews and expert interviews. This has been done through a systematic process, in which data consisting of the use of words, tone of voice, gestures, facial expressions and body positions have been examined in connection with the research questions. The quotes have been classified into a 'relevant category' and 'not so relevant category' and duplicate quotes have been grouped as per their similarities. The data preparation step has been repeated until all was in readiness for the data interpretation stage (Rabiee, 2004).

## **Findings**

### *Outline of data analysis*

After the preparation stage, we have analysed our data in accordance with the seven criteria of Krueger (1994) and Rabiee (2004); including actual words used and their meaning, context, internal consistency, frequency or extensiveness of comments, intensity of the comments, specificity of responses, and big ideas.

#### *1. Consider the actual words used and their meaning*

The word most frequently mentioned in the interviews is 'business model', which the participants considered as a framework for the collaboration. The participants seemed to believe that this word constitutes the main guideline for the direction in this collaborative project and that it will influence multifaceted factors of the cooperation, including the policy or regulation that will be adopted accordingly.

#### *2. Consider the context*

The researcher did not ask about the importance of the CORS technology. However, the participants expressed that this technology is necessary to ascertain the quality and ease of their work. Thus, the expansion of GNSS network is required. However, they are taking additional technology into account at the same time, in order to prevent obsolescence of traditional technology effect.

#### *3. Consider the internal consistency*

The individual participants' steadiness in viewpoints and position was firmly retained; the viewpoints of others rarely impacted their individual perspectives. Some changes happened solely when new information emerged from trustworthy members who are directly responsible for the matters related to that information.

#### *4. Consider the frequency or/and extensiveness of comments*

The most frequent words occurred in discussions is 'who', with reference to the context, 'who' means 'which organisation'. The questions about 'who' arose in many

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instances: either who should be the project leader?, who should be the national data centre?, who should manage the central network?, who should process the CORS network?, who should provide the services?, who should take responsible for the marketing strategies?, who should deal with the private sector or foreign countries?, and who else should be able to own the CORS in Thailand?. The participants responded to the question about ‘whether collaboration on GNSS CORS in Thailand should be done’ that ‘everyone (organisations) wants to get involved in this collaboration as it is a great opportunity to gain advantage from the shared infrastructure’. ‘Many of them want to be the leader of an association; however, who is the most appropriate one?’

*5. Consider the intensity of the comments*

This stage has aimed to perceive the profound feelings of the speakers about their comments. When the directors or managers from the prominent organisations stated that they agreed with the collaboration, it means that their organisations would love to join the created community of CORS as important players and could leave the coordination once the conditions are of no further interest. Conversely, the comments from less powerful organisations are thereunder. They have more positive feelings about this collaboration than the powerful ones.

*6. Consider the specificity of responses*

The replies from the members that related to individual experience have been considered as contradictory hypothetical situations. For instance, an officer who graduated from Japan recommended to use the Japanese business model as a guideline of the cooperative project rather than Australian business model; whereas an IT specialist commented about cell-based technology to replace or supplement the CORS technology.

*7. Find the big ideas*

Making provision for overall discussion matters requires a temporary pause to increase the ability to assess the massive amount of resources thoroughly and go through the variety of information efficiently. As a consequence of this step, the big picture of the discussion would be asserted.

*Data interpretation*

A preliminary interpretation of the results by manually comparing and contrasting the interview data can be summarised as follows. First, the comments in respect of the given topics reflect a considerable shift in attitudes towards the collaborative project. There are several issues that the interviewees concerned about listed below.

*1. Whether public collaborative innovation relating to GNSS technology will come into effect?*

The lack of the obliging power of the laws and regulations supporting the actions has decelerated the team forming process. Further, a change of the government could cause unpredictability and uncertainty in the policy of CORS management.

*2. Which government agency (between the one who has the maximum number of the assets and the one who has core responsibility for state surveying) should be the project leader?*

The Royal Thai Survey Department who is responsible for the national mapping was the most frequent mentioned organisation in this point. Nevertheless, the Department of Lands who have the greatest amount of CORS sites in Thailand was named as well.

*3. Which organisation should be the national data centre?*

Should the project leader be the national data centre? If yes, they would be the central unit for the CORS management in Thailand. On the other hand, the national data centre should be able to make profit or make the contract with private sector or foreign countries.

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Therefore, the Royal Thai Survey Department, which is a Special Services Group of Headquarters, Royal Thai Armed Forces, might not be applicable to this aspect.

*4. What should be the shape of the cooperation design?*

As regards the interests of the structure of the cooperation between government organisations, the regulations or an Act of Parliament to permit government authorities to share internal information with other parties had to be granted beforehand. In addition, the restrictions on resource sharing and the relationship between organisations should be clarified.

*5. What business model should be selected?*

They need to judge between Japanese business model and Australian business model (or other business model) which one is the most pertinent to be followed?

*6. What technology should be installed for the overall network configuration?*

Multiple type of hardware and software have been established, the configuration for the central network need to be chosen in advance. Once the data streaming start, the network setting should be ready to go as well.

Second, the interviewees demonstrated the strong desires for concrete out-turns with respect to rational doubts that are mentioned above. The following are crucial needs they pointed out.

*1. Regulations or policies*

They greatly desired the effective regulations or policies for inter-organisational cooperation so that each organisation is allocated a suitable role.

*2. Authority*

An appropriate authority is demanded of each office. In order to the flexibility and possibility in working on this project together, particular authority should be given to specific collaboration members. Therefore, they will know the extent of their legitimate rights in performing tasks or duties and protect them from any charge and trial as the result of proceeding with the plan under the government policies.

## **Contribution**

The ultimate goal of our research is to support the adoption of the policy framework for strengthening the GNSS CORS collaborative innovation in Thailand. This will include the development of a viable business model to formulate budgetary guidance and resolve budgetary issues.

From a theoretical perspective, our research contributes to a better understanding of the roles that each of the stakeholders should play in a collaborative innovation effort, taking account of their different levels of power and interest. Collaborative innovation holds considerable promise in breaking individual policy deadlocks, minimising systemwide investment costs and improving public service quality. However, Bommert's (2010) contention still holds: there is an urgent need for empirical research, typically in the form of in-depth case studies, to substantiate such potential benefits. Our research aims to make an original contribution to fulfilling this need.

## **Conclusion**

The study of GNSS CORS technology management in Thailand is now under way to establish a final stage of analysis and interpretation which are an extremely time-consuming process due to a huge amount of data. After that, we will endeavour to adopt the policy framework for this technology management which require a great thoroughness. Therefore, the relation between the cooperative government organisation and the power of stakeholders should be identified precisely prior to the policy adoption. However, the vital role of political leadership, politicians, and politics that influence



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public value production in the society are greatly significant to take into account (Bryson et al., 2017). As a result, further study would extend to focus on the political power issues that could impact the GNSS CORS collaboration management in Thailand.

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