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Improving business incubator service performance in China:

The role of networking resources and capabilities

This research analyses the relationships between resources and capabilities in Chinese business incubators to determine the relative importance in enhancing the service performance of incubators. A mixed-method design is used consisting of an in-depth case study and structural equation modelling based on survey data. Incubator managers are advised to invest in infrastructural and external resources and networking capabilities, which are positively correlated with performance. We find that resources relating to government policy, such as funding, may have a negative impact on incubator performance while other integrated service capabilities have little correlation with improved performance.

Keywords: Business Incubator Performance, Business Development, Resource-Based View, China, Structural Equation Modelling.

Introduction

The resource-based view of business (RBV) has been widely adopted over the past few decades to explain competitiveness and heterogeneity in the field of management (Foss & Ishikawa, 2007). The use of this perspective has largely been confined to firms operating in non-service industries, with an early influential application of RBV to services by Bharadwaj, Varadarajan, and Fahy (1993) to understand competitive advantage in service industries. The application of the RBV specifically to services, with intangible outputs and high customer involvement, has been limited and we seek to make a contribution in this area. Under consideration in the present research is the 'business incubator' which provides a service the fledgling firms by providing assistance and support to accelerate client growth (Sung, Gibson, & Kang, 2003). Success requires careful application of the possessed resources, the expansion of capabilities, and interactions within the incubator and also in the wider business network. There is a paucity of research on the use and role of resources and capabilities in incubators and how the possessed resources and capabilities impact on the service performance.

Entrepreneurism is increasingly important in China, generating greater interest in

incubator services (Wang, Yin, Cheng, Lin, & Lu, 2008). As government policy is frequently used as a tool to direct developments (Chen, 2006) it is necessary to understand whether benefits from government policies playing an important role in the success of incubators. The key research question explored is: Which resources and capabilities do Chinese incubators find most useful in improving their service success? The answer will allow incubator directors to invest their energy developing requisite resources and capabilities to improve their success.

The paper commences with an introduction and background for the study provided by a literature review, culminating in development of hypotheses. A short case is presented. Structural equation modelling (SEM) is used to analyse survey data and validate hypotheses. Conclusions are provided and limitations of the study are discussed before outlining areas for future research.

Literature review

RBV is presently the dominant theory that explains interfirm performance differences (Hoopes, Madsen, & Walker, 2003). Resources of a firm "include all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by a firm that enable the firm to conceive of and implement strategies" (Barney, 1991, p. 101). Organisations are repositories of capabilities, knowledge, and resources; RBV seeks to use the combination to explain heterogeneity in firm performance (Barney, 1991, 1996; Conner & Prahalad, 1996; Peteraf, 1993). Each firm builds competencies around resources or capabilities which are rare, valuable, inimitable, and not easily substitutable (Barney, 1991). Firms are able to organise activities and resources in combinations that markets cannot imitate (Conner, 1991; Ghoshal & Moran, 1996; Madhok, 1996; Teece, Pisano, & Shuen, 1997, inter alia), generating superior performance.

Resources can traditionally be categorised into physical capital resources, human capital resources, and organisational capital resources (Barney, 1991, p. 101). Capabilities are a mixture of practices and routines enacted by people (Hoopes et al., 2003). Dell has resources consisting of factories and assembly lines, yet their key capability lies in their implementation, integration, and use of resources that drives and supports their build-to-order capability (Simchi-Levi, Kaminsky, & Simchi-Levi, 2008). Eisenhardt and Martin (2000) describe a dynamic capability as "the processes to integrate, reconfigure, gain and release resources [. . .] Dynamic capabilities thus are the organizational and strategic routines by which firms achieve new resource configurations" (p. 1107). These procedures and routines are "the distinctive ways that things are accomplished" (Teece et al., 1997, p. 528), which evolve over time. Hence, "a dynamic capability is a learned and stable pattern of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness" (Zollo & Winter, 2002, p. 340). The sense of "how we do things" develops and creates an organisation with reduced ambivalence, capable of responding to uncertainties within the environment (Diochon & Anderson, 2011).

The use of the term 'capabilities' in this research is similar to the term 'business processes' as used by Ray, Barney, and Muhanna (2004). Resources are critical as "[a]ctivities, routines, and business processes are the mechanisms through which resources and capabilities get exposed to market processes" (Ray et al., 2004, p. 35), indicating reliance of business performance on the processes (the capabilities), built on resources.

Service resources and capabilities in business incubators

A business incubator is a service provider that serves incubatees (start-up firms) so they graduate after the incubation period (Wang, Lin, Yin, Lu, & Cheng, 2008; Wang, Yin et al., 2008). Incubatees should exit after three to five years, with the graduation rate of incubatees

and the success rate of incubatees providing two indicators of the service performance (Luo & Bian, 2008). However, the incubators also provide many services to external organisations as part of other projects; these successes are also an indicator of success.

Business incubators in China have been set up by the government and are increasingly privately operated. Their measures of service performance are linked to the graduation and success in the development of businesses. Resources influence the performance of the incubator through mediating capabilities (Li, Lin, Wang, Lu, & Yin, 2010), with two important capabilities identified (Wang, Lu, Lin, & Liao, 2010). The first involves the provision of professional services, using resources to provide a nurturing environment for incubatees and giving guidance, a capability we label as the incubator's 'integrated service capability'. The second involves the ability of the incubator to establish and use a network to support the incubatees, providing resources and allowing the firms to draw on this network to improve their development, a capability we label as the incubator's 'operating and networking capability'.

Basic resources are required to provide incubation services. At the most fundamental level this may be provision of land in the form of a technology park (Lalkaka & Abetti, 1999); flexible or prestigious premises; access to services, facilities, and equipment; supportive tenancy arrangements (Lee & Osteryoung, 2004; Reid & Garnsey, 1997); management and accounting assistance; and communications facilities (Vedovello & Godinho, 2003), all of which are recognised as valuable to incubatees. Further resources include services involving government grants and loans, general counselling and mentoring, access to external information and resources, and access to external business people (Abduh, D'Souza, Quazi, & Burley, 2007). These services involve higher levels of dissatisfaction, indicating that incubators developing these services must be careful to provide appropriate resources to improve service performance. Having appropriate infrastructural resources

allows the incubator to develop new methods of supporting incubatees and provides opportunities to expand the incubator network to generate further advantages. To attain acceleration in growth of their client firms, "incubators offer targeted service packages [. . .] [which] comes close to 'turn-key' infrastructure support" (Sung et al., 2003, p. 452), with the objective of giving incubatees competitive advantages. These infrastructure resources represent a broad category of resources, without which it is impossible to provide a full range of services. This gives us the first hypotheses:

H1: The greater the Infrastructural Resources of the incubator, the greater the incubator's Integrated Services Capability.

H2: The greater the Infrastructural Resources of the incubator, the greater the incubator's Operating and Networking capability.

The role of government policy is particularly important in the context of Chinese incubators as government policy can be highly influential, particularly as incubators provide a means for government policy to encourage greater technological innovation (Chen, 2006). Chinese incubators may provide advice on government policy, which is particularly important to client firms as there are many funds and related policies that they need to understand using customised information (Wang, Yin et al., 2008). Funding is a particularly important concern during growth for entrepreneurial clients (Lindelöf & Löfsten, 2002; McAdam & McAdam, 2008; Sun, Ni, & Leung, 2007), so the knowledge of, and ability to, access information on how to secure funding becomes a critical resource to an incubator. Abduh et al. (2007) asserts that assistance to gain government grants/loans was perceived as being the most important counselling-related incubation service and also the service incubatees perceived as being significant but poorly delivered by the incubator. Understanding applicable government policies and the ability to learn of changes and adapt advice given to incubatees represents a significant resource for Chinese incubators. The

ability to influence government policy is also linked to the success of entrepreneurial activities (Lee & Osteryoung, 2004; Sung et al., 2003), as is the role of communicating with incubatees concerning relevant government policies and providing support with taxation issues (Mian, 1996).

Being able to acquire greater support from government policy allows incubators to have greater resources available to undertake activities to support incubatees. Being able to advise clients on the best use of relevant policy or how to work within regulations also allows the incubator to generate greater capabilities. Government policies may be utilised to broaden the incubator's capabilities to network and engage with the wider community. The importance of the government policy resources in creating incubator capabilities provides us with the next two hypotheses:

H3: The greater the Government Policy directed to the incubator, the greater the incubator's Integrated Services capability.

H4: The greater the Government Policy directed to the incubator, the greater the incubator's Operating and Networking capability.

Support in the development of markets and products are key factors in assisting incubatees. However, other determinants of success lie within the incubatees and in their relationship with the incubator (Sun et al., 2007). Many management and new service development (NSD) processes involve multiple factors, including the individual, the external environment, infrastructure, and groups and organisations (Stevens & Dimitriadis, 2005). These factors belong to resources or are resource-related, so services and NSD should focus on the development of resources and the role of resources, and understanding how to combine these into new service offerings using appropriate capabilities.

The ability of incubators to develop new services relies on the support of internal and external resources networks. Froehle and Roth (2007) argue that greater attention in building

capabilities and resources generates success in NSD; service performance is linked to capabilities. Wang et al. (2008) note incubatees' value tangible and infrastructural resources most highly, and also finance, advice on how to use government policies, and help with networking with government officials. It is the provision of networks and external support that incubatees find more valuable than infrastructural support (Mian, 1996). Having greater external support can enable integrated service capabilities and also allow the incubator to learn how to use such resources to better support incubatees to develop and leverage their resources. External support resources are critical in developing capabilities, providing our hypotheses:

H5: The greater the External Support resources of the incubator, the greater the incubator's Integrated Services capability.

H6: The greater the External Support resources of the incubator, the greater the incubator's Operating and Networking capability.

These three fundamental groupings of resources (infrastructural, government policy, and external support resources) form the foundation for capability development, where capabilities impact directly on service performance. The two distinct types of capabilities are the Integrated Service Capabilities and the Operating and Networking Capabilities.

Resource networks

It has been argued by Galaskiewicz and Wasserman (1993) that analysis in management research has shifted from individual actors to relational systems, indicating a shift to focusing on networks of resources and capabilities. Porter (1998) suggests networks are used to access resources and capabilities lying beyond a firm's boundary, with the network becoming critical as the "sources of competitive capabilities can be embedded externally in firms' network resources – their network of bridging ties and linkages to regional institutions"

(McEvily & Zaheer, 1999, p. 1152). Membership of networks and the role and relative location of the focal firm in the network are also important (Gulati, Nohira, & Zaheer, 2000). This has led to the 'relational view' where network routines, network processes, capabilities, and knowledge sharing in the network play increasingly important roles (Dyer & Singh, 1998). Full benefit from networks may require specialised training in understanding the cognitive, emotional, and social learning dimensions (Bergh, Thorgren, & Wincent, 2011), building on cognitive elements of entrepreneurship; cognition acts as an enabler for effective resource combination (Sommer & Haug, 2011).

Service encounters involve interaction between the service organisation, customer, and contact personnel (Cook et al., 2002) with similar interactions within the incubation relationship. Incubatee participation in networks may enhance learning, yet many incubatees' perceive risks in interactions with other entrepreneurs (Bergh et al., 2011), risks that incubators are able to reduce. Greater network interactions will lead to formation of improved incubatee social capital, creating substantial value and improving incubatee performance (Hughes, Ireland, & Morgan, 2007).

Resource networks allow incubators to integrate resource gathering activities over their networks with the intention of becoming a single point of access for incubatees where knowledge and resources can be located. The networks comprise general business networks in local communities such as specialised consulting or advisory services that provide direct support required by incubatees seeking to construct a solid operational platform (Weinberg, Allen, & Schermerhorn, 1991). The importance of resource networks to incubators has attracted increased scholarly attention (Abduh et al., 2007).

Providing value through a resource network requires two key processes: the gathering and aggregating of resources (resource-seeking behaviour) and the promotion of a strategic network (knowledge-seeking behaviour) (Hughes et al., 2007). Value-creation depends on

strong interactions through the network. New organisational forms are emerging that assist incubators to succeed in the development and provision of new services (Buche & Scillitoe, 2007). The incubator can assemble and integrate knowledge and resources from networks and combine these with coaching for incubatees (Hughes et al., 2007; Peters, Rice, & Sundararajan, 2004). Training can improve incubatee entrepreneurial orientation and should focus on dimensions that are weakest in that country to maximise the opportunities for success in venture creation (Lee, Lim, & Pathak, 2011). Culture-specific challenges can guide formulation of specific curricula items supported by external resources; tailored training may be particularly necessary in regions, such as China, where Confucianism is a dominant part of the culture (Lee et al., 2011).

The ability of the incubator to develop strong networks while aggregating and gathering resources, allowing reassembly for NSD, is an important Operating and Networking capability for incubators. This guides the next hypothesis:

H7: The greater the incubator's Operating and Networking Capabilities, the greater the incubator's Service Performance.

The existence of the external linkages is alone inadequate to help an incubator; there must be adequate internal capabilities to translate externally sourced resources or capabilities into capabilities to assist client firms.

Service performance

Edvardsson and Olsson (1996) note that service development effort should attempt to "create the prerequisites for services which the customer perceives have an attractive added value" (p. 141). Service has a lasting effect if the resources provided by resource network can raise incubatee abilities. Team structure, processes, and IT influence the NSD ability; there is a direct relationship between cross-functional team structures and the speed of NSD (Froehle,

Roth, Chase, & Voss, 2000). Some scholars assert that as effective teamwork improves service capabilities, organisations must embed knowledge sharing practices while developing team cultures to achieve NSD performance (Hu, Horng, & Sun, 2009).

The Service Process Analysis (SPA) allows users to match attributes of services to the best underlying processes or delivery channels (Tinnila & Vepsalainen, 1995). The representation improves understanding of relative service positioning and alternate repositioning strategies. Efficient processes are located on the SPA diagonal. Incubator services rely increasingly on professional teams and developing capabilities to formulate customised services (Abduh et al., 2007; Lendner, 2007; Wang, Lin et al., 2008); incubators are shifting from a generic strategy and are improving through rapid NSD designed to facilitate accelerated incubation (Erikson & Gjellan, 2003). As this shift occurs new resources must be developed or sourced and new methods of accomplishing tasks must be devised as new capabilities are generated.

The presence of significant internal support services may have a significant impact on the desired outcome. Investigating the research and development in a university setting, del-Palacio, Sole, and Berbegal (2011) used internal services as an independent variable in linear regression, with the service performance of the university (measured by research performance) as the dependent variable. They assert that in their sample the ability to integrate internal services provided support to enhance overall service performance. Similarly, increased professionalism, internal teams, and organisational structures may support incubators in improving performance. The shifts to delivering targeted and customised incubation services require integrated service capabilities. It is the capability of the incubator to offer Integrated Service Capabilities that drives Service Performance, giving the final hypothesis:

H8: The greater the incubator's Integrated Service Capabilities, the greater the

The role of incubator resources in improving service success

Most service operations management literature investigates firms in business-to-consumer (B2C) scenarios; little emphasis has been placed on business-to-business (B2B) services. In this research our focus is business incubators providing a service to fledgling businesses – a B2B service.

The contention of this research is that business incubators must carefully judge which resources and capabilities are most useful. Based on the literature review the resources possessed by the incubator do not directly impact on the incubator's servicer performance; the relationship is moderated by the presence of Integrated Service and Operations and Networking capabilities (Figure 1). Specific combinations of resources and capabilities are used in NSD which improves the service performance.

Figure 1 The incubator resources and capabilities model

Methodology

After reviewing the literature to understand the relevance of resources in incubator service performance it was decided to use a two phase design. First, an in-depth case study of an incubator was conducted. Second, qualitative and quantitative data were collected at a training event for incubator managers. Using these approaches employs research methodological triangulation (Easterby-Smith, Thorpe, & Lowe, 1991); both quantitative data and qualitative data were collected using survey instruments and interviews, respectively. The approach was utilised as "organizational researchers can improve the accuracy of their judgements by collecting different kinds of data bearing on the same phenomenon" (Jick, 1979, p. 602). Research output is improved as triangulation allows "a more complete, *holistic*, and contextual portrayal of the unit(s) under study" (Jick, 1979, p. 603; emphasis

from original).

The case study presented is based on in-depth examination of an incubator's processes and interviews with key staff. The case study shows how the incubator has used the resources and capabilities successfully and examples can be drawn concerning different aspects of the capabilities and resources to refine the measures used in the survey. Referring to the literature and the case study allowed development of appropriate measures for use in the survey.

The survey was used to analyse the hypothesised relationships to supplement the qualitative case study in a recognised mixed-methods approach (Birkinshaw, 2004). Capabilities and service performance are difficult to measure directly as they are unobservable latent variables. SEM focuses on the relationships amongst these latent variables (constructs). While the constructs are unobservable, the meanings of these constructs may be inferred through measuring indicators (Hair, Black, Babin, & Anderson, 2010). Several indicators are used to form each construct and were derived from the literature and the case study. The resulting survey instrument is available in Appendix I. SEM is a useful tool to investigate a series of relationships where a dependent variable in one relationship becomes an independent variable in the next relationship. The surveys also contained open-ended questions that prompted qualitative answers and responses by the participants.

Case and data presentation

The case study presented in this section was used with the literature to derive a series of constructs for resources and capabilities which were used to inform the SEM analysis.

Case study – NDTISC incubator

Nanshan District Technology Innovation Service Center (NDTISC) is a business incubator established in 1999 to service high-tech start-ups. It is located in Shenzhen, Guangdong

Province, China, and is representative of business incubators in China. NDTISC is a State Level Incubator[1] and has grown rapidly; in 2010 NDTISC had around 600 clients in ten sub-incubators. A variety of services are now offered to incubatees, ranging from preferential rent and the coordination of administration matters during the early period of operation, through to provision of customised services such as specialised training programs, development of social networks, the platform of communication activities and other advanced services as an incubatee is closer to graduation. Many of the new services developed demonstrate increasing emphasis on professional and targeted services.

Different government bodies produce various policies that impact on businesses. These include tax, financial, science and technology, and industrial policies. Understanding the full range of policies and being able to advise incubatees on relevant policies are, and how to best make use of the policies, is an important service provided by incubators in China (Lin, Jian, & Gao, 2003; Luo & Bian, 2008). Presently NDTISC can advise and help incubatees to access free-funds, interest-free or low-interest loans, commercial loans, industry funds, and angel funds. Preferential rent and taxation arrangements assist the incubator in providing a full range of services. The capabilities that NDTISC has developed which are related to these resources include communication activities, policy seminars, training programs, and one-on-one counselling; NDTISC's use of these resources is summarised in Table 1. Such capabilities and resources are aligned with other, similar, non-profit incubators in China and also the basic services provided by the state-established non-profit incubators. In light of the importance of these services to incubatees, government policy becomes an important resource factor for NDTISC.

The incubator must also have access to resources that help incubatees to meet basic

[1] A State Level Incubator is one of a group of incubators that has been assessed to provide professional services to incubatees and is recognised by the government to be successful. The title of State Level Incubator was awarded by the Torch High Technology Industry Development Center of the Ministry of Science & Technology, China.

survival requirements for their development. These resources predominantly include physical facilities but also include the combination of intangible and tangible resources such as IT and related products. NDTISC incorporates and supports widespread use of IT, messaging platforms, and web site technology to communicate with external stakeholders; IT has become a critical infrastructural resource.

Resources and support obtained from the third-party agencies create an external support network for the incubator. The support includes expertise from intermediary institutions, physical space and information from other incubators, received high-tech and R&D personnel from universities, access to scientific research institutes, and acquired production and living resources from surrounding environment. The external support involves resources of professional assistance, skills, knowledge, technology, and management assistance.

NDTISC has established a Patents Information Inquiry Centre (PIIC), a State Intellectual Property (Shenzhen) Trading Centre (SIPTC) in 2008, and the Technology Innovation Resources Sharing Centre (TIRSC) in 2009. These service platforms involve collaboration with external resource owners through a leveraged external resource network that NDTISC uses to improve service performance.

PIIC uses a database connected to the national patents database. Initially, the service was limited to incubatees, but NDTISC soon opened PIIC to external firms. Some firms also provide IT support and patent information to PIIC, showing how NDTISC can collaborate with external parties to improve services.

SIPTC allows 100 projects to be displayed simultaneously with most related intellectual property being tradable through the web-site. NDTISC collaborated with an external specialist in IP trade and related activities. SIPTC is in close proximity to complementary services which also attract many customers, increasing the visibility of

SIPTC. In two years 50 projects have been traded and 20 communications activities have been fostered.

TIRSC was co-established with a partner that has seventy years experience providing technology services for high-tech companies, allowing affordable provision of services. The partner had around 40 employees on the project. TIRSC facilitates the Shenzhen-Hong Kong Technology Innovation Contest, training programmes, and assisting firms to attend the China High-Tech Fair.

Integrated service capabilities largely involve assisting incubatees to work with the Bureau of Industry and Commerce, providing support to understand taxation, patent support, and offering preferential space and rent. These are some of the most fundamental capabilities that NDTISC employs when providing services to their clients. In practice NDTISC has also established and operated its own resource network. An example is the use of space within other organisations to increase total incubation space, or co-operation with enterprises to provide effective operational management support for incubatees, with the help of intermediary organisations to provide professional services. These networks allow NDTISC to improve their service capabilities.

Figure 2 The dynamic model of networking in incubators [adapted from Figure 1 in Lin, Li, Yin, Lu, and Wang (2008)]

There are three groups of actors, including third party stakeholders such as government, professional organisations, and the venture capitalists and their funds (Figure 2). Resources from the network can be gathered by the incubator through networking and provided to incubatees.

Table 1 NDTISC use of Government Policy Resources

Variables and instrument development

Informed by the literature and the NDTISC case study, the different resources,

capabilities, and service performance were refined with a series of questions developed for the survey that would indicate the level of importance of underlying resources or capabilities (Table 2). Government policy had indicating variables relating to technology, funding, taxation and industrially-related policies. External support resources included intermediaries, other incubators, institutes and universities, and the surrounding environment. Infrastructure resources included physical space, technology platforms, and IT support. The Integrated Service Capabilities included government taxation and regulation assistance, intellectual property and patents, and personnel related services. The Operating and Networking Capabilities included technological product transformation, matching of processes, resources gathering, networking, management ability, and NSD. The Service Performance includes the success of businesses, success of projects, and the graduation rate of incubatees. The selection of these indicators was with reference to literature combined and case analysis.

Likert scales were used in the survey to evaluate the respondent's perceived importance of that factor. Responses to questions were given scores of 1, 2, 3, 4, and 5, where 5 indicated strong agreement with the statement.

Table 2 Development of variables in the model

Sampling and quantitative data collection

The "2008 State Training Course for Incubator Directors, China" was held during December 2008 and coordinated by Torch High Technology Industry Development Centre of Ministry of Science and Technology, China.[2] To validate the hypotheses and understand the correlations between the resources, capabilities, and service performance proposed in this research, a survey instrument was used during the periods of the training course (Appendix I

[2] The Torch High Technology Industry Development Center (also called the Torch Center) was founded in October 1989 and is part of the Ministry of Science and Technology in China. It aims to encourage the development and industrialisation of high technology, to promote the continuous development of high-tech industries, and to promote high-tech commercialization, industrialization, and internationalization in China.

includes a translation of the survey). The training involved 153 participants who were asked to complete the survey. 104 responses were received (82 during the training and 22 afterwards) with 96 valid responses remaining after incomplete responses were discarded (63% response rate). There are around 500 incubators spread over the 31 provinces of mainland China.[3] Participants at the training represented 131 incubators in 21 provinces so the 96 valid responses is representative of incubators throughout China.

Test of model structure

During this research confirmatory factor analysis was used to test the structure of the model and to test the classification of elements in the model. SPSS15.0 and AMOS7.0 were used to analyse the survey data, including confirmatory factor analysis and SEM. The correlation matrix was used as input and the maximum likelihood ratio estimation method was used during analysis.

Evaluation of the model fit in SEM reporting is a complex task. The measures may be either *absolute* or *incremental* (Bollen, 1989); indicating, respectively, the degree that the presented model reproduces the sample data and the proportional improvement when the model is compared to a baseline model. It is important to note that fit indices "should not be used in a mechanical decision process for selecting a model" (Browne & Cudeck, 1993, p. 157). Many factors, such as sample size, influence the fit statistics. Measurement of absolute fit using RMR or SRMR may be appropriate for all sample sizes (Shah & Goldstein, 2006); RMSEA tends to over-reject models (Hu & Bentler, 1998). The RMSEA statistic reported, 0.082, is less than 0.1 (indicating moderate fit), although higher than 0.05 (which would indicate good fit), indicating our model has acceptable fit in terms of absolute fit.

For incremental fit, to avoid a small sample bias, Shah and Goldstein recommend the use of CFI, IFI, or normed x^2 (x^2/df), a ratio that "is useful because it corrects for model size"

[3] Based on data from the China Torch Statistical Yearbook, 2009

(Shah & Goldstein, 2006, p. 159). Normed x^2 values of <1.0 indicate over-fitted models; and values >3.0 indicate under-parameterised models (Jöreskog, 1969); our model with a normed x^2 value of 1.64 has acceptable fit. Evaluated in conjunction with the CFI (0.908) and IFI (0.916), both over the suggested level of 0.9 (Bollen, 1989; Hoyle, 1995), indicates that our model has acceptable fit in terms of incremental fit (Table 3).

A model was built based on Figure 1, giving the following path diagram (Figure 3) of inter-correlation between the variables after computed by AMOS7.0 using standardised estimates. All paths shown are significant at the 5% level. The correlations matrix is shown in Table 3 along with the reliability coefficients in excess of 0.7 for each variable, indicating an acceptable level of reliability for early stages of research (Nunnally, 1978).

Figure 3 Summary of findings

The results support the model (Table 4 and Figure 3). Specifically, the data show that the possession of Government Policy, Infrastructural, and External Support Resources are correlated with Integrated Service and the Operating and Networking Capabilities, which are correlated with Service Performance. Based on the standardised path coefficients we see that the correlation is positive for most relationships, the notable exceptions being between Government Policy Resources and Operating and Networking Capabilities and between Integrated Service Capabilities and Service Performance.

Table 3 Correlation matrix, reliability measures, and fit indices of structural equation model (N = 96)

Results and discussions

There are several results from the model that must be addressed. While no hypotheses were rejected in the model, some show correlations that are unexpectedly negative, or are close to zero, indicating little substantive practical significance (though the relationship itself is

shown to be significant at the 5% level). While this model is consistent with the set of hypotheses developed earlier, this does not imply causation (Hoyle & Panter, 1995).

The coefficient between government policy resource and the operating and networking capabilities is -0.20. The implication is that having greater levels of Government Policy Resources is correlated with reduced Operating and Networking Capabilities. There is no clear reason for this surprising result. After some follow-up interviews, we believe that the explanation is that some incubator managers see their *personal* success as related to the resources accumulated by the incubator. If managers feel they have accumulated sufficient resources with government support there is no incentive to seek further support from external networks. The incubator fails to develop their Operating and Networking Capabilities and the performance of the incubator suffers. If this is the case, then the beliefs of the managers and the incentives relating to performance should be considered in future incubator research.

Our findings indicate that the development of Integrated Service Capabilities has a very slight negative correlation to service performance for the indicators (expressed with a coefficient of -0.06). While significant at the 5% level this coefficient is close to zero, indicating little practical significance. Chinese incubators have clearly struggled to leverage their Integrated Service Capabilities to significantly impact on their Service Performance. This finding is similar to those of Abduh et al. (2007), where some professional services offered were not highly valued by the incubatees.

The Infrastructural Resources variable was closely linked to both Integrated Service Capabilities and Operating and Networking Capabilities. The strong positive coefficients (coefficients of 0.40 and 0.55, respectively) are both statistically and practically significant. Similarly, External Support Resources are positively correlated with both capabilities (coefficients of 0.45 and 0.62). When the relationship between Operating and Networking Capabilities and the Service Performance of the incubators is considered (coefficient of 0.45),

these are highlighted as being the most significant resources and capabilities. The ability to derive advantage through an extended network appears to be advanced in the Chinese incubators and is aligned with desires of incubatees outlined by Abduh et al. (2007).

Based on these findings, Chinese incubators that build and accumulate both Infrastructural and External Support Resources find themselves positioned to develop their Operating and Networking Capabilities. These, in turn, can be used to support their incubatee development and improve the incubator's Service Performance. One result from the research is that the provision of grants and financial support, commonly seen as critical to firms (Abduh et al., 2007; Lindelöf & Löfsten, 2002; McAdam & McAdam, 2008; Sun et al., 2007), has little impact on the Service Performance in our model. In fact, through the mediating influence of Operating and Networking Capabilities, it may even have a negative impact.

Analysis of the case study data and subsequent interviews with managers involved in the NDTISC sub-incubators supplemented the SEM analysis. These data are summarised in Table 4 and provide useful support for the SEM findings. Of particular interest is the connection between the Integrated Service Capability and Service Performance; some interviewees noted that there is no connection between these variables. From interviews, the relationship between the Government Policy Resources and the Operating and Networking Capabilities is suggested as being positive, contradicting the SEM results, and requiring further study to understand completely.

Qualitative responses from the questionnaires also provide support for the proposition that external resources and networking capabilities are very important for the Chinese incubators. One incubator director noted that "[t]he management personnel of incubators can be exchanged between two or more incubators, and then they can learn from each other," spreading information and knowledge through the wider network of incubators. Another

respondent noted that "[t]he methods we have used to expand the space of the incubator include: investment by the government, co-operation with private companies, and building a community of incubators and firms," indicating a high level of external involvement. Such external resources are also valuable in supporting development of a 'soft environment' which is intangible and networks can "provide value-added services to technology start-ups, and then to create a conducive atmosphere to innovation and entrepreneurship." Networking capabilities appear to support this soft environment and may play an important role in determining success in Chinese incubators.

Table 4 Summary of verification of correlation among resources, service capability and service performance

Managerial implications

Our study shows that of the effect of the three resources types have different levels of impact on the incubator service performance, of which the effect of External Support Resources is relatively most important. During the pursuit of improved service delivery to incubatees, incubators make use of resource networks and external support, rather than internal resources, to support incubatees. As an example, the NDTISC incubator provided resources to incubatees and also engages in extensive collaborative engagements with a range of external support organisations and networks creating a soft environment.

Resources impact on Service Performance through intermediary capabilities; development of Operating and Networking Capabilities is critical and may be developed through the acquisition and utilisation of Infrastructural and External Support Resources. Incubator managers would therefore be advised to increase their capabilities in operations and networking and construct resources network to help improve Service Performance.

Academic implications

The links between Integrated Service Capabilities and Service Performance was very weak and negative. This is unusual result runs counter to expectations from the literature, where essential internal services are considered a pre-requisite to the successful development of services to support incubatees (Edvardsson & Olsson, 1996; Hu et al., 2009). Instead, our research suggests that the impact of Operating and Networking Capabilities, particularly those involving networking to acquire and deliver resources for incubatees, are of greater importance. Incubator performance is increasingly reliant on External Support Resources rather than internalising resources and capabilities.

Conclusions

The contribution of this paper is the creation and testing of a resource and capability based model to understand the factors that impact on incubator service performance in China. Our research extends the work of RBV scholars by applying this perspective to the study of incubators and establishing the importance of developing appropriate capabilities and acquiring the right types of resources to help incubators prosper.

We find that there is generally a positive link between the presence of resources, the capabilities or processes that are built on these resources, and the overall service performance exhibited by the business incubator. There is one interesting disparity, which is how the findings suggest that government policy resources are inversely related to the operations and networking capabilities of an incubator, a capability that is critical to incubator service performance. That is, the more government policy resources available the less likely the incubator will be to develop the operating and networking capability required for incubator service performance. The external support resource has a strong relationship with the operations and networking capabilities. We also found a weak relationship between the

integrated service capabilities of an incubator and the incubator service performance. This indicates that the operations and networking capabilities are of vital importance to incubators, as are developing external support resources. With this as a guide, it becomes clear that the establishment of networking capabilities to draw on external support resources and infrastructural resources is a critical element in the success of Chinese incubators.

Limitations

One limitation of this research is the sample size and sampling method used to collect survey data. The research displayed a significant response rate due to the sampling methods employed, yet the sample size remains relatively small compared to some studies using SEM. This has been balanced by the two-part methodology, drawing on a case study in conjunction with literature to derive hypotheses grounded in practice. Building on these hypotheses the survey was designed. SEM was used to understand the relative strength of the various relationships. Future research should seek a larger sample size to increase the statistical generalisability of the results. The survey data were gathered during a training event in China. The population being sampled from is, therefore, Chinese incubators; generalisation beyond this sample should be conducted with caution as the population of incubators around the world may have different parameters to the population of Chinese incubators, particular as there are presence of different cultures will impact on entrepreneurialism (Lee et al., 2011; Sommer & Haug, 2011). There is also the potential for self-selection bias, as all attendees at the event may share characteristics which affected their responses.

Future research

Several of the findings are worthy of consideration in future research. The negative relationship between Government Policy Resources and the Operating and Networking Capabilities is interesting as many Chinese incubators are state supported. Investigation of this relationship is challenging and requires in-depth case studies that will allow an

understanding of underlying management dynamics that generate the interesting and counter-intuitive result from this research. A similar study of private incubators may help us understand how they overcome the lack of state-provided resources.

During incubation incubatees play an active role as they receive and use the services provided, influencing the outcome of the service provision. Future research should examine the dynamics of the interactions between incubators and incubatees. The approach would require a longitudinal case study designed to capture the richness of the interactions and to understand the environmental and contextual influences on the development of the relationships and how these impact on service outcomes.

The role of external networks and resources in supporting the Operating and Networking Capabilities are shown to be the most critical relationship in this research. Further studies focused on this relationship need to be conducted using a mixed methods approach to understand how incubators can construct effective external networks and which specific capabilities can be developed to harness the opportunities of the networks. Key variables must be identified to map the dynamics or patterns of behaviours and may result in a survey to establish relative relationship strength with statistically generalisable results.

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Appendix I.

The questionnaire for: "The study to evaluate systems of capabilities and efficiency of technology business incubators"

Dear Director:

In order to improve the service capabilities and the level of service of business incubators, we will conduct a survey on service capabilities, influence factors of service capabilities, service effects (performance) of business incubator. Thank you for your participation.

Shenzhen Association of Business Incubators, Nanshan Technology Venture Service Center, Shenzhen 朗读

Part I

The following is: "The importance of factors like policy, environment, resources to services capabilities of business incubator " Please tick the numbers on the right by "√"		very unimportant	unimportant	normal	important	very important
1	Government's technology policy to support high-tech enterprises	1	2	3	4	5
2	Government's Special funds to support high-tech enterprise	1	2	3	4	5
3	Government's Preferential tax policies to support high-tech enterprises	1	2	3	4	5
4	Development policies of national industrial and industrial structure	1	2	3	4	5
5	The incubator's relationship with Intermediaries (management consulting, investment, legal, finance, etc.)	1	2	3	4	5
6	Establishing incubation network with other incubators	1	2	3	4	5
7	The relationship between the incubator and Universities, research institutes	1	2	3	4	5
8	Social and cultural environment around the incubator	1	2	3	4	5
9	Incubator's facilities capacity (space area, traffic location, etc.)	1	2	3	4	5
10	Professional technology public service platform	1	2	3	4	5
11	Information technology development and the degree of development of social information	1	2	3	4	5

Part II

The following is: "The importance of services capabilities of business incubator to service performance" Please tick the numbers on the right by "√"		very unimportant	unimportant	normal	important	very important
12	Service capabilities of administration, taxation, property	1	2	3	4	5
13	Services capabilities of patents and other intellectual property	1	2	3	4	5
14	Services capabilities of personnel and training	1	2	3	4	5
15	Capabilities of the transaction of technological achievements, trade and advocacy	1	2	3	4	5
16	Process matching (convergence) capability of service providers (business incubator) and service Recipients (incubated firms)	1	2	3	4	5
17	Capabilities of social resources (finance, information, etc.) gathering of business incubator	1	2	3	4	5
18	The ability to establish incubator network	1	2	3	4	5
19	Business incubator's operating capabilities (anticipation, evaluation, implementation, etc.)	1	2	3	4	5
20	Business incubator's capabilities in new service development (and its success rate)	1	2	3	4	5

Part III

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The following is: "The effect of service capabilities of business incubator on the performance of each item." Please tick the numbers on the right by "√"		very little	a little	normal	strong	very strong
21	Success rate of incubated firms	1	2	3	4	5
22	Success rate of incubated projects	1	2	3	4	5
23	Graduation rate of incubated firms	1	2	3	4	5

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Table 1 NDTISC use of Government Policy Resources

Government policy	**How NDTISC uses government policy**	**Capability developed**	**Examples of related services**
Funds	Special funds for incubatees to encourage development. Incubator establishment and funds for the incubator construction. Funding to encourage growth.	Operating and Networking Capabilities (guided by government and professional organisations such as VCs).	Incubation funds, interest-free loans, angel funds, industrialisation funds etc. Establishing new incubators and expanding incubator functions. Direct investment, co-investment with VCs.
Technology policy	Constructing a platform to provide IT. Encouraging activities to provide technology.	Operating and Networking Capabilities (co-operation with other companies). Integrated Service Capabilities (organising activities and deal with operational support).	Establishing a platform of patent inquiry and a trade centre for patent and technology. Technology training and forums and technology policy seminars.
Industry development	Industry development focus and emphasis. Regional economy focus and emphasis. Industry development conditions and advantages.	Operating and Networking Capabilities (guided and supported by government, companies, universities and institutes). Integrated Service Capabilities (Merchants \ attract investment, selecting incubatees).	Developing special industry sub-incubator, such as ICT park, digital and culture industry park/incubator. The alliance of incubators within the district. Providing input into an industry development plan from the government.
Talents, skills, and abilities	Helps incubatees to recruit staff with appropriate talents government support. Organising incubatees to attend Job Fair.	Operating and Networking Capabilities (co-operation with universities). Integrated Service Capabilities (some Job Fairs are organised by the government of China and other countries)	Providing space for incubating firms to advertise the recruitment of talented staff on the website of NDTISC. Supports incubatees to attend China International Talent Exchange Fair.
Physical space	Providing preferential rent arrangements. Co-operating to establish new sub-incubators. Various type of establishment and operation model of sub-incubator. Special industry sub-incubators to support clients Serve firms which are not within the incubator.	Operating and Networking Capabilities (co-operation with companies and government organisations). Integrated Service Capabilities (operational management support)	Rental fees may be reduced by 30-50% for most incubatees. Two sub-incubators were established by government and the other eight sub-incubators were co-established with government and external company support. Four distinct operational models in sub-incubators. Services can also be provided to local non-incubated firms.
Supporting activities	Some activities are directly supported by the government. Some activities are indirectly supported by government and other government organisations.	Operating and Networking Capabilities (co-operation with government and government organisations).	Organising and supporting firms to attend "China high-tech Fair", and the International Interchange Fair. Providing services such as training courses, Investment Clubs, IT Tea club, mentoring, and entrepreneur guidance.

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Table 2 Development of variables in the model

Variables	**Constructs**	**Description**	**Abbreviation**	**Source of the variables and the supporting evidence**
Resources	Government policy	Government policy supporting high-tech enterprises	Tech policy	Luo, et al., 2008; Lin, et al., 2003; Sun et al., 2007
		Funding policy to support high-tech enterprise	Financial	Luo, et al., 2008; Lin, et al., 2003; Sun et al., 2007
		Preferential tax policy to support high-tech enterprises	Tax policy	Luo, et al., 2008; Lin, et al., 2003; Sun et al., 2007
		National industrial structure and industry development policies	Industry	Lin et al., 2003
	External support	Cooperation with intermediary organisations (consulting, investment, legal)	Intermediary	Luo, et al., 2008; The co-operation between NDTISC and intermediary organisations
		Establishment of external networks	Incubation net	Sun et al., 2007
		Coordination between universities, research institutes, and incubators	Institutes	Luo, et al., 2008; Sun et al., 2007
		Socio-cultural environment surrounding incubator	Environment	Luo, et al., 2008; Li, 2006; Sun et al., 2007
	Infrastructure	Physical facilities	Physical	Luo, et al., 2008; Sun et al., 2007
		Professional & technical service platform	Tech. platform	Luo, et al., 2008
		IT development and degree of social information	IT	NDTISC communicates with outside world using IT, message platform and web site.
Service capabilities	Integrated service capability	Industry and commerce, taxation, property service capabilities	Admin. matters	Luo, et al., 2008
		Service providing information about patents and intellectual property	Patent	Enterprises hope to obtain intellectual property right support; NDTISC established a patent information inquiry platform.
		Personnel and training services	Training	Luo, et al., 2008
	Operating and networking capability	Technology transformation of products, transactions, and advocacy	Product trans.	NDTISC established a national Intellectual Property (Shenzhen) Trading Centre
		Matching the incubator process with incubatee.	Process match	Enterprises note there is poor communication between incubates and incubators; demands on services are not matched in form or content
		Gathering social resources	Resource gather	NDTISC services integrate external resources for incubatees.
		Establishment of incubator network	Networking	Li, 2006; Sun et al., 2007
		Incubator management support	Management	Luo et al., 2008; Sun et al., 2007
		Incubator NSD	Service Devel.	NDTISC provides services and engages in NSD. Enterprises note that they cannot obtain the services which they need.
Service performance	Service performance	The success rate of incubation	Firm success	Luo et al., 2008
		The success rate of projects	Project success	NDTISC measures the success of projects as an indicator of success.
		Graduation rate of business	Firm Graduate	There is exit mechanism of incubated business within incubator.

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Table 3 Correlation matrix, reliability measures, and fit indices of structural equation model (N = 96)

Correlation matrix and reliability measures									
		Mean	SD	1	2	3	4	5	6
Resources	1. Government Policy	4.670	.547	***(.801)****					
	2. Fundamental facilities	4.245	.712	.20	***(.738)***				
	3. External support	4.078	.723	.69	.60	***(.736)***			
Capacities	4. Integrated abilities	4.204	.739	.40	.43	.46	***(.821)***		
	5. Operating and networking	4.320	.622	-.18	.52	.62	.58	***(.852)***	
Performance	6. Service performance	3.919	.770	-.12	.22	.26	-.03	.44	***(.822)***
Fit indices									
Model	x^2	df	x^2 / df	RMSEA	RFI	IFI	CFI	NFI	TLI
Final Model	363.417	222	1.64	.082	.825	.916	.908	.798	.871

* Bold bracketed figures on the diagonal are the internal reliability coefficients of these variables represented by Cronbach's alpha (α).

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Table 4 Summary and verification of correlation among resources, capabilities, and service performance

Hypothesised relationship	**Hypothesis**	**SEM Estimate**	**Case study support for relationship**	**Verification from the NDTISC case**
Government Policy Resources -- Integrated Service Capability	H1	0.40	Supported	NDTISC is a government agency, and obtains more government policy support than other incubators. It has a strong relationship with the industry and commerce authorities and the tax agency and is therefore well-placed to help incubated businesses to deal with administrative matters.
Government Policy Resources -- Operating and Networking Capability	H2	0.55	Unclear; contradicts the SEM results	NDTISC obtains many government policy resources and has developed a strong operating and networking capability. The evidence from the NDTISC case contradicts the SEM results.
Infrastructural Resources -- Integrated Service Capability	H3	0.40	Supported	Physical space can provide training space; the establishment of public platform can generate greater trust by government institutions and simplifies handling of administrative matters.
Infrastructural Resources -- Operating and Networking Capability	H4	-0.20	Supported	NDTISC contacts the outside world through the SMS platform and the web site. With the help of a third-party to operate technical platforms they have increase the ability of their networking operations.
External Support Resources -- Integrated Service Capability	H5	0.45	Supported	The outside supports of technology agency, consulting agency, law agency, accounting agency and others have increased the capability of NDTISC to deal the relationships with government, businesses, and the community.
External Support Resources -- Operating and Networking Capability	H6	0.62	Supported	With the aid of external support NDTISC has improved the capability of its own management and external co-ordination, while the external support helps NDTISC to operate networks directly.
Integrated Service Capabilities -- Service Performance	H7	0.45	Not supported	In the interviews with incubatees, some interviewees said that the business, tax, and other administrative capabilities of incubator do not provide them with substantial help.
Operating and Networking Capabilities -- Service Performance	H8	-0.06	Supported	The stronger the operating and networking capabilities, the more resources and capabilities (including technology, business information, capital) can be accumulated to directly support businesses growth to boost service performance.

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Figure 1

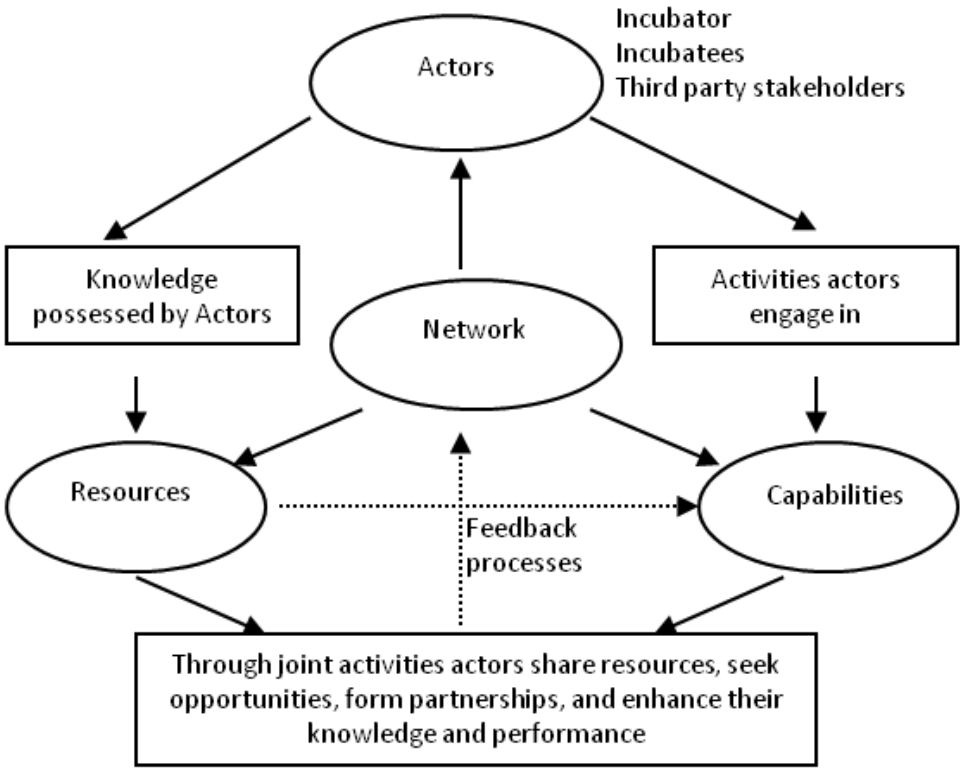

Figure 2

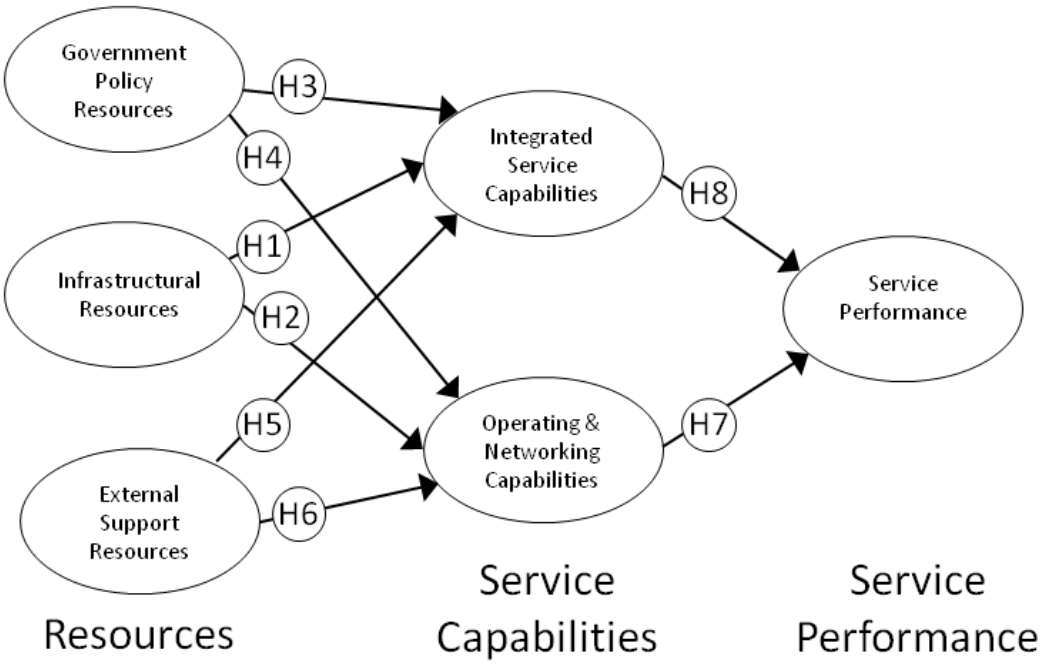

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Figure 3