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**Performance of exploitative and explorative innovation in a
collaborative public sector: Effects from digitisation of governance
infrastructure on collaborative innovation**

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**Performance of Exploitative and Explorative Innovation in a
Collaborative Public Sector:
Effects from Digitisation of Governance Infrastructure on Collaborative
Innovation**

Hirofumi Hirata

Abstract

Collaborative innovation (CI), which seeks to innovate in the private sector and other public institutions, plays a vital role in the public sector. This study examines the organisational performance of municipalities collaborating with higher tiers of government (upward collaboration), local stakeholders (inward collaboration), and peers (outward collaboration) through exploitative and explorative innovation. Based on several types of collaboration and innovation, the effect of digitisation is assessed using a Structural Equation Model (SEM). The model is tested using 405 responses to questionnaires from Japanese cities. This study uncovers the relationships between organisational performance, CI, and digital government.

Keywords:

Collaborative innovation, digital government, exploitative innovation, explorative innovation, human-machine interaction.

1 Introduction

According to Torfing (2019), the public sector faces a shortage of public resources (e.g., finances and personnel), the role demanded by citizens is increasing, and the search for innovative solutions in the public sector is necessary. Under these circumstances, Collaborative Innovation (CI), which seeks innovation by working with the private sector and other public institutions, is vital in promoting innovation in the public sector. Through fieldwork, Lindsay et al. (2021) found that existing administrative services in Scotland improved through collaboration among multiple stakeholders, including public administration. However, few quantitative empirical studies have been conducted to enhance the external validity of such results, especially for local governments in Japan.

In Japan, inter-municipal cooperation (IMC) is common. An IMC framework is a policy stipulated in the Local Autonomy Law that allows multiple local governments to establish a corporate body to implement IMC (Baba & Asami, 2020). In August 2015, the Minister of Internal Affairs and Communications' Notice 'Points to Keep in Mind Concerning the Promotion of Reform of Local Administrative Services' (Ministry of Internal Affairs and Communications 2015) requested each local public body to promote business reform from the perspective of providing administrative services efficiently and effectively amid the still severe local fiscal situation. In response, each local public body has worked towards administrative reforms, such as outsourcing and business process reengineering (BPR). By incorporating CI, as Torfing (2019) advocated, in implementing administrative reforms, new administrative reform initiatives may be implemented, and efficient and effective administrative services may be promoted.

Moreover, digitisation has significantly affected the CI in the public sector. However, only a limited number of local governments have implemented CI. This study proposes to determine the contribution of CI to organisational performance in local governments. Specifically, this study quantitatively analyses the impact of survey research on organisational performance as a non-financial impact. Another purpose is to explore the effects of digitisation on CI quantitatively.

2 Literature Review and Hypothesis Development

2.1 Collaborative Innovation and Performance

According to Barrutia and Echebarria (2023), CI is one of the most effective instruments for knowledge development in the public sector because it allows learning from and implementing collaboration among partners. However, Torfing (2016) states that innovation in the public sector does not always yield good results. Therefore, examining the impact of CI and the conditions under which CI can generate positive results for public

institutions is useful.

Chen et al. (2023) classify innovation in administrative services into six categories based on Bason (2010) and others: management, service, mission, policy, partner, and citizens. According to Torfing (2019), CI initiatives in Denmark have led to innovation and crime reduction, but in the context of administrative reforms, in August 2015, the Minister of Internal Affairs and Communications issued a notice stating that ‘administrative reforms should be carried out in an efficient and effective manner’ (Ministry of Internal Affairs and Communications, August 2015, p. 3). Since administrative reform aims to provide administrative services efficiently and effectively, this study measures the impact of CI on organisational performance, which cannot be measured using financial items.

Many management accounting studies have used Van de Ven and Ferry's (1980) seven items: (1) productivity; (2) quality or accuracy of work produced; (3) number of innovations, process improvements, or new ideas; (4) reputation for work excellence; (5) attainment of production or service-level goals; (6) efficiency of operations; and (7) morale of unit personnel. This choice reflects the fact that in government organisations, outcomes cannot be measured using financial items such as sales and profit indicators. Verbeeten and Speklé (2015) measured organisational performance in a survey of Dutch municipalities and found that these items captured organisational performance indicators. Various factors negatively correlate with financial items, such as the net debt ratio, net debt per resident, and net debt change per resident, indicating that organisational performance indicators are reliable. Therefore, this study uses Verbeeten and Speklé's (2015) organisational performance indicators.

2.2 Types of Collaboration and Innovation

Based on a survey of Spanish local governments, Barrutia and Echebarria (2019) measured forms of collaboration as upward, inward, and outward, based on the typology proposed by Agranoff (2014). Upward collaboration is defined as collaboration with higher tiers of government (HTG), such as the central or broader local government. Inward collaboration is defined as collaboration with local stakeholders, and outward collaboration is the collaboration among local governments (e.g., inter-municipal collaboration). This study adopts these definitions.

Furthermore, from the perspective of the resource-based view of the firm (Barney, 1991; Wernerfelt, 1984), Barrutia and Echebarria (2019) developed indicators of exploitative and explorative innovation based on the three forms of collaboration described above and a survey conducted by Jansen, Van Den Bosch, and Volberda (2006) for the European financial services industry. This study uses these parameters. Additionally, based on survey data,

Barrutia and Echebarria (2019) demonstrated that exploitative innovation occurred in upward collaboration, and exploratory innovation occurred in inward and outward collaboration, as shown in Figure 1. Upward collaboration tends to focus on easy, low-risk changes using common knowledge for small innovations. It may not effectively leverage new, bottom-up ideas despite tools such as virtual platforms facilitating knowledge sharing. Inward and outward collaborations involve forming ties with stakeholders and peer municipalities to access shared knowledge, particularly useful in the absence of networks. Networks facilitate efficient knowledge exchange and reduce the need for direct interactions to achieve straightforward innovation. However, the expenses associated with inward collaboration and the relative simplicity of adopting improvements have already been tested and have gained consensus in the public sector. However, inward collaboration does not directly affect exploitative innovation. Regarding outward collaboration, complex and uncertain projects require solid and direct relationships to transfer unique knowledge, as seen in the varied success of door-to-door waste collection in Spanish municipalities, which is significantly influenced by local management practices.

This study extends the relationship between collaboration and innovation to investigate the link between innovation generated in collaboration and organisational performance.

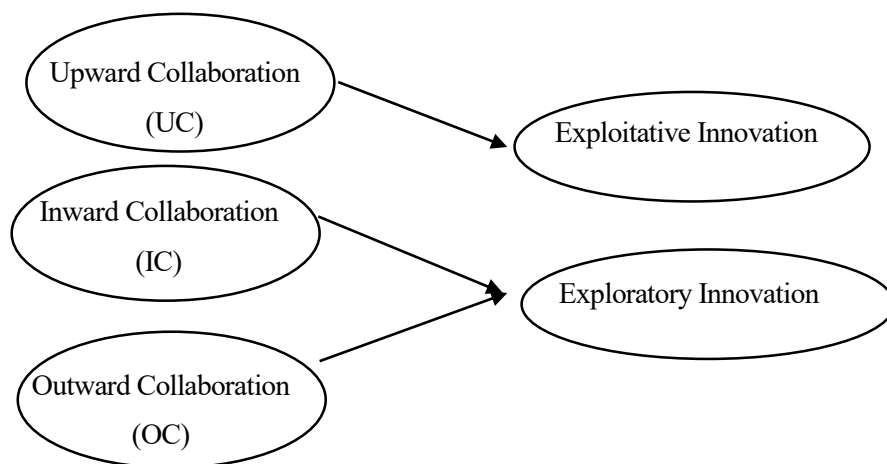


Figure 1. Relationship between various forms of collaboration and innovation (source: Barrutia and Echebarria, 2019).

2.3 Innovation Effects on Performance

Noda (2023) conducted a survey study and found that upward collaboration contributed to financial efficiency, while outward collaboration contributed to problem-

solving in local governments.¹ This result suggests that the various forms of collaboration also affect organisational performance. Therefore, in the relationship between CI and organisational performance, each collaboration can be viewed as directly affecting organisational performance and indirectly impacting innovation. This result extends the relationship proposed by Barrutia and Echebarria (2019). Hence, the following hypotheses are proposed:

H1: Upward collaboration directly and indirectly affects organisational performance through exploitative innovation.

H2: Inward collaboration directly affects organisational performance and indirect effects through exploratory innovation.

H3: Outward collaboration directly affects organisational performance and indirect effects through exploratory innovation.

Figure 2 portrays the proposed relationship between collaboration, innovation, and organisational performance.

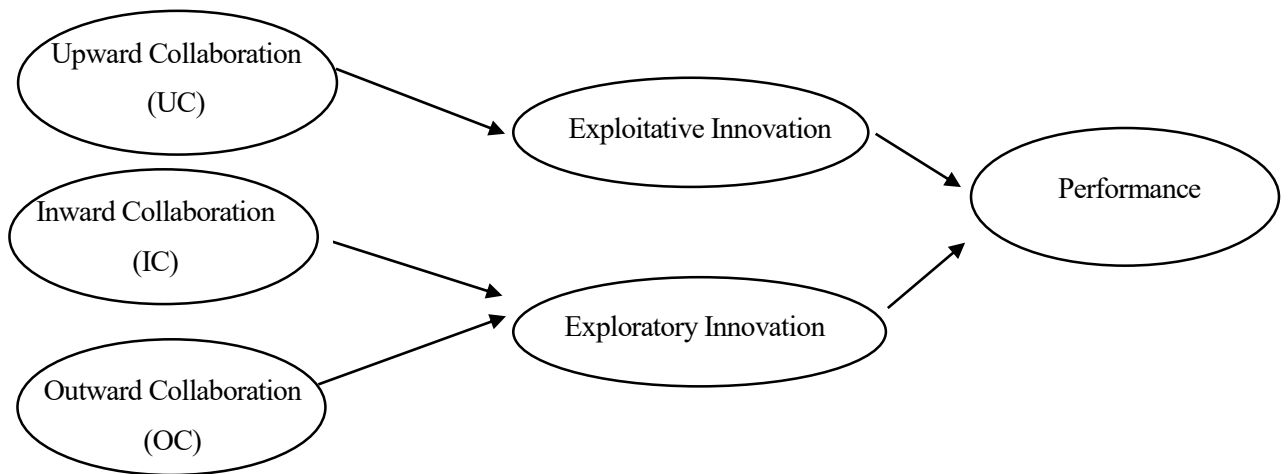


Figure 2. Relationship between Collaboration, Innovation, and Organisational Performance (source: Barrutia and Echebarria, 2019, with author's additions).

2.4. Digitisation of Governance Infrastructure

Interest in how digital technologies affect citizen-government relationships has surged recently. However, the effects of digitisation are opaque in the collaborative governance

¹ Noda (2023) refers to upward collaboration as vertical relationships and outward collaboration as horizontal relationships.

field. Digital technologies do not always lead to collaboration (Lember et al., 2019). A few studies have linked CI and digitisation. A noticeable study by Kattel et al. (2020) shows how information and communication technology (ICT) enhances coordination and collaboration, leading to innovation in the public sector. As a result, the public sector has become more dependent on machine-to-machine (m2m) networks such as public databases and computer-based automation.

Kattel et al. (2020) illustrate how technology and automation have shaped CI using examples of the Estonian government's implementation, including the introduction of a new value-added tax and an e-residency programme. They describe the elements which enhance CI in digitisation as m2m networks, information systems infrastructure capability (ISIC), and information systems human resources capability (ISHRC). However, their theoretical contribution is to 'a limited extent to in the specific case per se' (Kattel et al., 2020, p. 1669). Therefore, it is essential to confirm the external validity of this study. This study uses parameters that are developed by Aydiner et. al (2019).

M2m networks may be of several types owing to multiple actors. In other words, the common digital platforms vary between HTG and municipalities. Thus, this study classified m2m interactions into upward m2m interaction and outward m2m interaction. The upward direction indicates the relationship between HTG and a municipality, whereas the outward direction designates the relationship between municipalities. In addition, innovation types are closely related to the public sector organisation layer; thus, upward relationships are connected to exploitative innovation, while outward relationships are related to explorative innovation. Hence, the following hypotheses are proposed:

H4: Upward m2m interactions positively affect exploitative innovation through upward collaboration.

H5: Outwards m2m interactions positively affect explorative innovation through outward collaboration.

H6a: ISIC positively affects exploitative innovation through upward collaboration.

H6b: ISIC positively affects explorative innovation through outward collaboration.

H7a: ISHRC positively affects exploitative innovation through upward collaboration.

H7b: ISHRC positively affects explorative innovation through outward collaboration.

Figure 3 portrays the relationships among digitisation, collaboration, and innovation.

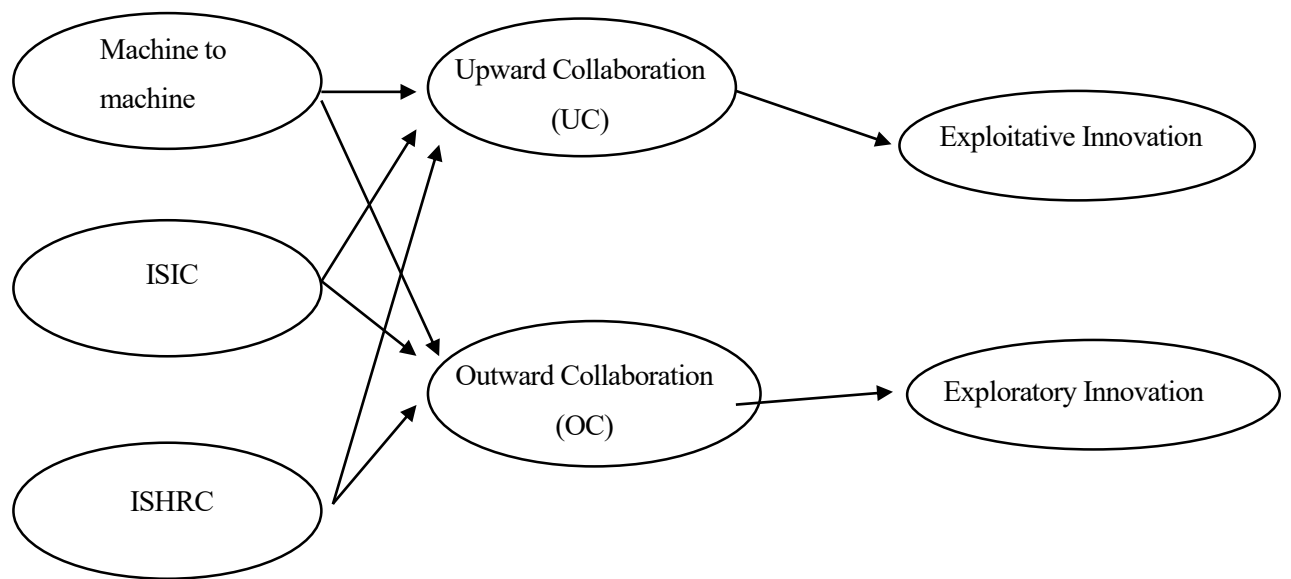


Figure 3: Relationship among digitisation, collaboration, and innovation

3 Data and Methods

Data for the structured equation model (SEM) analysis were collected through a mail questionnaire survey conducted in 2024 for all 792 cities (government-designated cities, core cities, special municipalities, and other cities) in Japan's local governments. Responses could also be sent electronically. Before sending the questionnaire, two practitioners working in city halls and two management accounting researchers with expertise in public organisations were asked to check the content and revise the questionnaire to ensure the appropriateness of the wording and question items. The questionnaire was sent with a self-addressed, stamped envelope requesting that the person responsible for management in the departments involved in administrative reform (e.g., Administrative Management Division and General Policy Division) responded to the questionnaire. Regarding the incentives for responding to the questionnaire, the survey specified that a report on the analysis results would be sent to those who wished to receive it. To improve response rates, a reminder letter was sent before the deadline. The number of responding organisations was 405 (response rate: 51.14%). The respondents were generally section managers or higher-ranked personnel in the departments to which the questionnaires were sent.

4 Results

4.1 Organisational Performance

Questions 1–34 are rated on a 7-point Likert scale, with ‘1’ being ‘completely disagree’ and ‘7’ being ‘completely agree.’ Questions 1–9 are as follows: ‘Please circle your

level of agreement with the extent to which the following statements represent activities related to administrative reform in your city over the past three years.’ Items 29–34 are prefaced with the question, ‘Please circle your level of agreement with the extent to which the following statements describe your city’s administrative reform-related accomplishments over the past three years.’ Questions 35–41 are also rated on a 7-point Likert scale, with ‘1’ being ‘far below average’ and ‘7’ being ‘far above average.’ They similarly ask, ‘How do you rate the performance of your unit relative to other, comparable units (*) on each of the following dimensions? (*) Assumes departments in the public but perhaps also in the private sector.’

Table 1 Constructs and Questions

Upward Collaboration (UC)

	Item	Scale	Mean	Std
1	The frequency of interaction with HTG is high. (Note) any type of interaction, such as a conference call, meeting, and so on.	1–7	3.06	1.32
2	The intensity of interaction with HTG is high. (Note) degrees of detailed information exchange and cooperation.	1–7	3.04	1.34
3	We have a fluid relationship with HTG representatives.	1–7	3.33	1.32

(Cronbach’s alpha =0.94)

Inward Collaboration (IC)

	Item	Scale	Mean	Std
4	The frequency of meetings with local stakeholders is high.	1–7	3.23	1.47
5	The variety of local stakeholders with whom we interact is high. (Note) any type of interaction, such as telephone calls, meetings, and so on.	1–7	3.41	1.55

(Cronbach’s alpha =0.94)

Outward Collaboration (OC)

	Item	Scale	Mean	Std
6	The frequency of meetings with other municipality representatives is high.	1–7	3.11	1.38

7	The number of municipalities with whom we interact is high. (Note) any type of interaction, such as telephone calls, meetings, and so on.	1–7	3.2	1.39
8	The intensity of our interaction with other municipalities is high. (Note) degrees of detailed information exchange and cooperation.	1–7	3.21	1.38
9	We have a fluid relationship with other municipality representatives.	1–7	3.65	1.36

(Cronbach's alpha =0.95)

Exploitative Innovation

	Item	Scale	Mean	Std
29	We regularly implement small adaptations to our existing service.	1–7	4.63	1.14
30	We frequently refine the provision of existing services.	1–7	4.27	1.24
31	We are well known for regularly improving the provision efficiency of our existing services.	1–7	3.45	1.21

(Cronbach's alpha =0.86)

Explorative Innovation

	Item	Scale	Mean	Std
32	We are well known for experimenting with new services and operations.	1–7	3.44	1.24
33	We lead the way in introducing innovations that require brand-new competencies.	1–7	3.32	1.33
34	We constantly consider introducing innovations that go beyond what is usual in a municipality.	1–7	3.47	1.32

(Cronbach's alpha =0.87)

Organisational Performance (OP)

	Item	Scale	Mean	Std
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35	The amount of work and/or the number of products produced in your unit.	1–7	4.37	0.86
36	The accuracy of work produced in your unit and/or the quality of the goods delivered.	1–7	4.43	0.83
37	The number of innovations, process improvements, or new ideas implemented by your unit	1–7	4.3	1.03
38	The reputation for work excellence of your unit	1–7	4.15	0.80
39	The attainment of production or service level goals of your unit	1–7	4.31	0.80
40	The efficiency of operations without your unit	1–7	4.3	0.89
41	The morale of unit personnel	1–7	4.53	0.99

(Cronbach's alpha =0.92)

Table 2 Descriptive statistics and correlations

Variable	Mean	Std	1	2	3	4	5	6
1. UC	0	1.24	1					
2. IC	0	1.43	0.54	1				
3. OC	0	1.26	0.72	0.57	1			
4. Exploitative Innovation	0	0.91	0.47	0.38	0.42	1		
5. Explorative Innovation	0	0.88	0.46	0.39	0.48	0.66	1	
6. OP	0	0.68	0.27	0.23	0.35	0.4	0.45	1

A structural analysis of Hypotheses 1–3 was conducted to confirm the relationship between latent variables, and the results are shown in Table 3. These results confirm the indirect effect of upward collaboration on organisational performance through exploitation. We also confirm the direct impact of upward collaboration on organisational performance. However, we cannot confirm the indirect effect of inward collaboration on organisational performance through explorative innovation. Outward collaboration has also been confirmed to indirectly impact organisational performance through explorative innovation. We also confirm the direct effect of outward collaboration on organisational performance.

Table 3 Structural model estimation

H1	Estimate	z-value	p-value
UC→Exploitative Innovation	0.318***	8.021	0
Exploitative Innovation →OP	0.250***	5.748	0

UC→OP	0.055*	1.796	0.072
$\chi^2=235.288$; d.f.=62 ; CFI=0.956 ; TLI=0.945 ; RMSEA=0.084; SRMR=0.046			

(Note) CFI: Comparative Fit Index, TLI: Tucker-Lewis Index, RMSEA: Root Mean Square Error of Approximation, SRMR: Standardised Root Mean Square Residual

H2	Estimate	z-value	p-value
IC→Explorative Innovation	0.235***	6.359	0
Explorative Innovation →OP	0.302***	6.688	0
IC→OP	0.041	1.571	0.116
$\chi^2=234.900$; d.f.=51; CFI=0.946; TLI=0.931; RMSEA=0.095; SRMR= 0.044			

H3	Estimate	z-value	p-value
OC→Explorative Innovation	0.336***	8.630	0.00
Explorative Innovation →OP	0.257***	5.589	0.00
OC→OP	0.110***	3.565	0.00
$\chi^2=291.029$; d.f.=74; CFI=0.953; TLI=0.942; RMSEA=0.086; SRMR= 0.046			

***p <.01, **p<.05, p*<.10.

4.2 Effects of the Digitisation of Governance Infrastructure

Questions 10–28 are also rated on a 7-point Likert scale, with ‘1’ being ‘completely disagree’ and ‘7’ being ‘completely agree.’ Participants were asked, ‘ Please rate your level of agreement with the extent to which the following statements represent DX as it relates to administrative reform in your city over the past three years.’

Table 4 Constructs and Questions

Upward Machine-to-Machine Interactions (UMMI)

	Item	Scale	Mean	Std
10	Systems in use are jointly cloud-based with HTG	1 – 7	1.97	1.27
11	The system in use is standardised with HTG	1 – 7	1.83	1.12
12	The system has been improved through customisation in a joint cloud with HTG	1 – 7	1.76	1.13

(Cronbach's alpha =0.89)

Outward Machine-to-Machine Interactions (OMMI)

	Item	Scale	Mean	Std
13	The system in use is jointly cloud computing with other municipalities.	1 – 7	3.04	2.02
14	The system in use is standardised with other municipalities.	1 – 7	2.43	1.66
15	The system has been improved through customisation in a joint cloud with other municipalities.	1 – 7	2.35	1.59

(Cronbach's alpha =0.85)

Information Systems Infrastructure Capability (ISIC)

	Item	Scale	Mean	Std
16	Our information systems (IS) infrastructure is suitable for developing customised software applications when needed.	1 – 7	2.94	1.36
17	Our IS infrastructure can respond quickly to requests from internal and external customers.	1 – 7	3.41	1.39
18	The capacity of our network infrastructure is fully competent to meet our organisation's needs.	1 – 7	3.99	1.32
19	Our organisation's data can be shared with internal and external units of the organisation.	1 – 7	2.90	1.42
20	Our IS infrastructure is highly secure to protect our company from intruders and hackers.	1 – 7	5.67	1.06
21	Our IS infrastructure provides fast and flexible operations for internet-based systems.	1 – 7	3.81	1.48

(Cronbach's alpha =0.70)

Information Systems Human Resources Capability (ISHRC)

	Item	Scale	Mean	Std
22	Our IS staff has adequate knowledge of computer-based systems.	1 – 7	4.24	1.24
23	Our company seeks a high degree of computer-based technical expertise from IS department/unit employees.	1 – 7	4.31	1.39

24	Our IS staff can learn quickly and apply new technologies as they become available.	1 – 7	4.27	1.18
25	Our IS staff has the skills and knowledge to manage projects in our current business environment.	1 – 7	4.13	1.21
26	Our IS staff can work closely and efficiently with our employees and customers.	1 – 7	4.56	1.13
27	Our IS staff is capable of rapidly discovering potential problems in the systems.	1 – 7	3.96	1.29
28	Our IS staff is capable of quickly maintaining the system whenever a failure occurs.	1 – 7	4.29	1.28

(Cronbach's alpha =0.90)

Table 5 Descriptive statistics and correlations

Variable	Mean	Std	1	2	3	4	5	6	7	8
1. UMMI	0	0.98	1							
2. OMMI	0	1.46	0.54	1						
3. ISIC	0	0.59	0.1	0.15	1					
4. ISHRC	0	0.94	0.15	0.11	0.65	1				
5. UC	0	1.23	0.18	0.08	0.11	0.07	1			
6. OC	0	1.25	0.20	0.18	0.13	0.12	0.72	1		
7. Exploitative Innovation	0	0.90	0.11	0.06	0.24	0.22	0.46	0.43	1	
8. Explorative Innovation	0	0.91	0.15	0.11	0.21	0.23	0.45	0.48	0.80	1

A structural analysis of Hypotheses 4–7 was conducted to confirm the relationship between each latent variable. The results are shown in Table 6. H6a, H6b, and 7b are supported.

Table 6 Structural model estimation

H4	Estimate	z-value	p-value
UMMI→UC	0.220***	3.419	0.001
UC→Exploitative Innovation	0.310***	7.647	0.000
UMMI→ Exploitative Innovation	0.013	0.276	0.783
$\chi^2=33.351$; d.f.=24 ; CFI=0.996 ; TLI=0.994 ; RMSEA=0.031; SRMR=0.036			

(Note) CFI: Comparative Fit Index, TLI: Tucker-Lewis Index, RMSEA: Root Mean Square Error of Approximation, SRMR: Standardised Root Mean Square Residual

H5	Estimate	z-value	p-value
OMMI→OC	0.128***	2.953	0.003
OC→Explorative Innovation	0.319***	8.043	0.000
OMMI→Explorative Innovation	0.011	0.356	0.721
$\chi^2=57.356$; d.f.=32 ; CFI=0.991 ; TLI=0.988 ; RMSEA=0.045; SRMR=0.039			

H6a	Estimate	z-value	p-value
ISIC→UC	0.188*	1.694	0.09
UC→Exploitative Innovation	0.305***	7.636	0.00
ISIC→ Exploitative Innovation	0.235***	2.785	0.005
$\chi^2=106.879$; d.f.=51 ; CFI=0.975 ; TLI=0.968 ; RMSEA=0.053; SRMR=0.048			

H6b	Estimate	z-value	p-value
ISIC→OC	0.219**	2.010	0.044
OC→Explorative Innovation	0.307***	7.889	0.000
ISIC→Explorative Innovation	0.170**	2.252	0.024
$\chi^2=109.217$; d.f.=62 ; CFI=0.983 ; TLI=0.979 ; RMSEA=0.044; SRMR=0.039			

H7a	Estimate	z-value	p-value
ISHRC→UC	0.086	1.246	0.213
UC→Exploitative Innovation	0.309***	7.788	0.000
ISHRC→ Exploitative Innovation	0.175***	3.424	0.001
$\chi^2=141.639$; d.f.=62 ; CFI=0.977 ; TLI=0.972 ; RMSEA=0.057; SRMR=0.036			

H7b	Estimate	z-value	p-value
ISHRC→OC	0.149**	2.111	0.035
OC→Explorative Innovation	0.304***	7.939	0.000
ISHRC→Explorative Innovation	0.159***	3.269	0.001
$\chi^2=191.447$; d.f.=74 ; CFI=0.972 ; TLI=0.965 ; RMSEA=0.063; SRMR=0.038			

***p <.01, **p<.05, p*<.10.

5 Discussion

5.1 Performance

For non-financial items, we extend Barrutia and Echebarria's (2019) model to show the impact of CI as an indirect effect of each form of collaboration on organisational

performance through innovation.

Barrutia and Echebarria (2019) cited the lack of some sort of innovation outcome as a challenge. While local governments in Japan are implementing efforts to improve organisational performance through administrative reforms, the fact that organisational performance can be shown as an outcome of innovation should contribute to future CI research development.

This study overlaps with previous survey research. However, since it focuses on the perceptions of those responsible for management in departments in charge of administrative reform in the city, some degree of bias is inevitable.

In addition, as Barrutia and Echebarria (2019) pointed out, although the survey simplified collaboration as upward/inward/outward, many more collaborative efforts may be undertaken, which were not captured in this study. However, the present survey did not consider these factors.

Despite these limitations, this study's relationship with organisational performance as an outcome of CI contributes to the body of knowledge on collaboration and innovation in the public sector.

5.2 Digitisation

Based on the results of SEM, a few ICT elements of CI advocated by Kattel et al. (2020) are supported. The IS infrastructure is the basis for enhancing upward and outward collaboration and innovation. IS human resources also play a vital role in implementing outward collaboration and exploratory innovation.

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