

Organizational Innovation Culture, Digitalization and Perceived Food Safety Control Performance in a Malaysian Public Regulatory Agency

Shanmugam Supramaniam¹, Gazi Md Nurul Islam²

¹Food Safety and Quality Division, Ministry of Health Malaysia

²Universiti Tun Abdul Razak, Kuala Lumpur, Malaysia

DOI: <https://doi.org/10.47772/IJRISS.2026.100900181>

Received: 16 September 2026; Accepted: 21 September 2026; Published: 05 October 2026

ABSTRACT

Food safety regulatory agencies must respond to changing risks while maintaining consistent statutory controls. This study examines Organizational Innovation Culture (OIC) and Digitalization Initiatives as two focal predictors of perceived Food Safety Control Performance (FSCP) among 211 Food Technology Officers in Malaysia's Food Safety and Quality Division (FSQD), Ministry of Health Malaysia (MOH). The cross-sectional questionnaire included 10 retained OIC items, five separate digitalization items, and 12 performance items. In the thesis PLS-SEM model, transformational leadership was also included as an adjustment predictor. OIC was positively associated with perceived performance ($\beta = 0.265$, $p < .001$), while the digitalization path was positive but not statistically significant ($\beta = 0.084$, $p = .212$). The three-predictor model explained 73.6% of variation in perceived performance ($R^2 = 0.736$); this figure cannot be attributed to the two focal predictors alone. The findings suggest that innovation culture merits attention in regulatory practice, while the distinct contribution of digitalization needs further study.

Keywords: Organizational Innovation Culture; Digitalization Initiatives; Food Safety Control Performance; Resource-Based View; Public Sector; Malaysia.

INTRODUCTION

Food safety remains a major global public health priority because unsafe food threatens human health, undermines consumer confidence, disrupts international trade, and imposes substantial economic costs (WHO, 2022; FAO & WHO, 2022). Increasing globalization, technological advancement, and the growing complexity of food supply chains have intensified the challenges faced by regulatory authorities in controlling food safety hazards while ensuring effective enforcement, transparency, and public trust (Ekici & Dümen, 2019; Nayak & Waterson, 2019). Consequently, strengthening food safety governance requires not only comprehensive legislation but also organizational capabilities that enable regulatory agencies to respond effectively to emerging risks and strengthen regulatory performance (Hobbs & Goddard, 2015).

In Malaysia, food safety governance is administered by the Food Safety and Quality Division (FSQD), Ministry of Health (MOH), through the Food Act 1983, Food Regulations 1985, and Food Hygiene Regulations 2009. This regulatory framework is supported by nationally recognised food safety assurance programmes, including Hazard Analysis and Critical Control Point (HACCP), Good Manufacturing Practice (GMP), and *Makanan Selamat Tanggungjawab Industri* (MeSTI).

Food safety enforcement remains an important part of these regulatory efforts. According to the Ministry of Health Malaysia Annual Report (2024), 107,951 food premises were inspected nationwide, resulting in 2,472 temporary closures due to hygiene related noncompliance. During the same period, 48,637 notices were issued under Section 32B of the Food Act 1983, 39,884 compounds were offered, and approximately RM12.55 million was collected in compound payments. These figures reflect the continued occurrence of food safety violations requiring regulatory intervention.

These regulatory activities highlight that effective food safety governance depends not only on legislation, technical standards, and enforcement mechanisms but also on the internal capabilities of regulatory organizations. Public regulatory agencies operate within increasingly dynamic environments that require organizational learning, knowledge sharing, collaboration, adaptability, and continuous improvement to maintain effective regulatory performance (Barney, 1991; OECD, 2017).

Among these capabilities, Organizational Innovation Culture promotes continuous learning, creativity, knowledge sharing, collaboration, and continuous improvement, thereby supporting organizational adaptability and performance (Martins & Terblanche, 2003; Dobni, 2008; Damanpour & Schneider, 2009). Although Organizational Innovation Culture has been widely examined across different organizational settings, empirical evidence within public food safety regulatory agencies remains limited. Existing food safety research has predominantly focused on technical and operational aspects of food safety, including food hygiene, HACCP implementation, food safety management systems, and regulatory control, with comparatively less attention given to the internal organizational capabilities of government agencies responsible for implementing and enforcing food safety legislation (Ropkins & Beck, 2000; Nayak & Waterson, 2019; Grau-Noguer et al., 2023).

Guided by the Resource-Based View (RBV), this study examines whether Organizational Innovation Culture and Digitalization Initiatives are associated with officers' perceptions of Food Safety Control Performance in the FSQD, MOH. They are considered as distinct constructs because a supportive culture and the use of digital systems may relate differently to perceived performance.

LITERATURE REVIEW

Organizational Innovation Culture (OIC) has emerged as a strategic organizational capability that enables organizations to respond effectively to dynamic operating environments while sustaining long-term performance. Unlike technological innovation, which primarily focuses on the adoption of new products or technologies, OIC reflects the shared values, beliefs, norms, and behaviours that encourage continuous learning, creativity, knowledge sharing, collaboration, and continuous improvement throughout the organization (Martins & Terblanche, 2003; Dobni, 2008). These cultural attributes shape how employees generate ideas, exchange knowledge, solve organizational problems, and adapt to environmental change.

Innovation culture can help public organizations review established processes, exchange ideas and improve coordination (Damanpour & Schneider, 2009). In a regulatory agency, these practices must operate within statutory duties and established procedures.

Within the Resource-Based View (RBV), innovation culture represents an intangible organizational resource that is valuable, difficult to imitate, and embedded within organizational routines and relationships (Barney, 1991). Organizational culture evolves through accumulated experience, shared learning, leadership practices, and employee interactions. Consequently, organizations with strong innovation cultures develop capabilities for organizational learning, knowledge integration, and adaptive decision-making that support organizational performance over time (Peteraf, 1993).

Although OIC has been extensively examined in manufacturing, healthcare, education, and service organizations, increasing attention has been given to its relevance in highly regulated public-sector environments. Within public organizations, innovation involves strengthening organizational capability to improve institutional responsiveness and evidence-based decision-making while maintaining accountability and legislative compliance (OECD, 2017; De Vries et al., 2016). Accordingly, this study conceptualises OIC as an organizational capability characterised by continuous learning, collaboration, knowledge sharing, employee creativity, openness to change, and continuous improvement.

Organizational Innovation Culture in Public Sector Organizations

Innovation has traditionally been associated with private-sector organizations pursuing competitive advantage and financial performance. However, public-sector organizations increasingly operate in environments characterised by rapid technological change, rising citizen expectations, fiscal constraints, and complex policy challenges, requiring them to become more adaptive, collaborative, and knowledge-driven (OECD, 2017).

Consequently, innovation has evolved from being viewed primarily as technological advancement to becoming an organizational capability that enhances institutional effectiveness, public value creation, and service quality (De Vries et al., 2016).

Unlike private organizations, public agencies function within formal legislative frameworks, bureaucratic structures, and extensive accountability requirements. These characteristics may reduce organizational flexibility but simultaneously increase the importance of innovation culture because public organizations must improve organizational processes while maintaining transparency, consistency, and regulatory compliance. Innovation therefore becomes a mechanism for improving organizational capability rather than reducing regulatory control.

Previous studies demonstrate that OIC positively influences employee engagement, organizational commitment, service quality, organizational learning, and institutional performance (Martins & Terblanche, 2003; Damanpour & Schneider, 2009). Organizations that encourage collaborative problem solving, knowledge sharing, and continuous learning are better equipped to respond to uncertainty, implement policy changes, and improve organizational effectiveness. These capabilities are particularly important within regulatory agencies responsible for protecting public health, where decision making involves balancing legislative compliance with emerging scientific evidence and evolving public expectations.

Within Malaysia, empirical research examining OIC in regulatory agencies remains limited. Existing studies have largely focused on administrative reforms, digital transformation, and public service delivery, with comparatively little attention given to how innovation culture influences regulatory performance in specialised enforcement agencies such as the Food Safety and Quality Division (FSQD). Examining OIC within the FSQD therefore provides an opportunity to extend public-sector innovation literature into the context of food safety governance.

Organizational Innovation Culture in Food Safety Governance

Food safety governance has become increasingly complex as globalization, technological advancement, changing consumer expectations, and emerging biological, chemical, and physical hazards continue to reshape modern food systems (Nayak & Waterson, 2019; Liu et al., 2020). Regulatory agencies are no longer responsible solely for enforcing legislation but are also expected to undertake risk assessment, surveillance, crisis management, stakeholder engagement, policy development, and international collaboration. These responsibilities require organizational capabilities that enable continuous learning, adaptability, knowledge integration, and effective coordination.

Although legislative frameworks, regulatory standards, and food safety management systems remain fundamental components of food safety governance, regulatory effectiveness also depends on the ability of organizations to interpret emerging scientific evidence, coordinate enforcement activities, respond rapidly to incidents, and continuously improve organizational processes (Hobbs & Goddard, 2015). Within this context, OIC provides an important mechanism for strengthening regulatory effectiveness by encouraging organizational learning, knowledge sharing, collaborative problem-solving, and evidence-based decision-making (Martins & Terblanche, 2003; Dobni, 2008).

For Malaysia's FSQD, regulatory responsibilities extend across headquarters, state health departments, and district health offices, requiring effective communication, consistent interpretation of legislation, and coordinated enforcement activities. Knowledge generated at one organizational level must therefore be effectively shared and translated into consistent regulatory practices throughout the organization. An organizational culture that encourages collaboration and continuous learning can enhance regulatory consistency, organizational responsiveness, and the capacity to address emerging food safety challenges.

Importantly, innovation within food safety governance should not be interpreted as deregulation or reduced compliance. Instead, it represents the continuous enhancement of organizational capability while maintaining legislative integrity, transparency, and public accountability. OIC therefore complements existing regulatory systems by supporting continuous improvement in the implementation and coordination of regulatory responsibilities.

Organizational Innovation Culture and Food Safety Control Performance

Organizational performance has long been recognised as an important outcome of organizational culture because culture influences how employees collaborate, share knowledge, solve problems, and respond to organizational challenges. Previous studies demonstrate that organizations characterised by strong innovation cultures achieve higher levels of operational effectiveness, service quality, organizational learning, and long-term performance (Martins & Terblanche, 2003; Dobni, 2008; Damanpour & Schneider, 2009).

Within public-sector organizations, performance extends beyond financial outcomes to encompass service quality, policy implementation, accountability, stakeholder confidence, and institutional effectiveness (OECD, 2017). For regulatory agencies, organizational performance is reflected in the consistent enforcement of legislation, timely regulatory response, effective risk management, interagency coordination, and protection of public health. Improving regulatory performance therefore requires not only technical expertise and legislative authority but also organizational capabilities that facilitate learning, collaboration, and adaptive decision-making.

Innovation culture may help officers exchange knowledge, identify difficulties in established procedures and coordinate across units. These practices offer a reason to examine its relationship with perceived performance, although the present study does not test the practices as separate mechanisms.

The RBV provides a theoretical explanation for this relationship. According to Barney (1991), sustainable organizational performance is derived from resources and capabilities that are valuable, rare, inimitable, and organizationally embedded. OIC reflects these characteristics because it evolves through accumulated organizational experience, shared learning, leadership practices, and collaborative relationships that cannot be easily replicated (Peteraf, 1993). As an intangible organizational capability, innovation culture enables regulatory agencies to utilise organizational knowledge more effectively, improve regulatory processes, and adapt to emerging demands.

Although the positive relationship between OIC and organizational performance has been demonstrated across manufacturing, healthcare, education, and service industries, empirical evidence within public food safety regulatory agencies remains limited. Existing food safety research has predominantly concentrated on food hygiene practices, HACCP implementation, food safety management systems, technical competency, and consumer behaviour, with comparatively little attention directed towards the organizational capabilities of regulatory institutions themselves. This limits understanding of how internal organizational factors contribute to regulatory effectiveness and sustainable food safety governance.

Digitalization Initiatives and Regulatory Performance

Digitalization may support regulatory work through electronic records, shared data and more timely communication between offices (Grau-Noguer et al., 2023). Its benefits may depend on system usability, training and fit with established procedures. It is therefore useful to assess digitalization separately from a culture that encourages innovation, even though the two may be closely related.

RESEARCH GAP

Although OIC has attracted considerable attention in the quality management and organizational behaviour literature, existing empirical evidence remains concentrated within manufacturing, healthcare, education, and private sector organizations, where innovation is primarily examined as a driver of competitive advantage, operational efficiency, and financial performance (Martins & Terblanche, 2003; Dobni, 2008; Damanpour & Schneider, 2009). Comparatively little research has investigated whether similar organizational capabilities contribute to regulatory effectiveness in public sector organizations operating under statutory responsibilities, bureaucratic structures, and high levels of public accountability. This limitation restricts current understanding of how innovation culture influences organizational performance in regulatory environments where success is measured by governance effectiveness rather than commercial outcomes.

A second gap exists within the food safety literature. Previous studies have predominantly focused on technical

and operational aspects of food safety, including food hygiene practices, HACCP implementation, food safety management systems, compliance behaviour, food handler knowledge, and consumer awareness (Ropkins & Beck, 2000; Nayak & Waterson, 2019; Grau-Noguer et al., 2023). While these studies have substantially improved understanding of food safety management, they provide limited insight into the internal organizational capabilities that enable regulatory agencies to implement food safety legislation effectively. Consequently, the influence of Organizational Innovation Culture on regulatory performance remains insufficiently understood.

Within Malaysia, food safety research has similarly concentrated on external stakeholders, particularly food manufacturers, food premises, and consumers, with comparatively limited attention given to the organizational environment of the FSQD, the country's principal food safety regulatory authority. Given FSQD's central responsibility for policy implementation, surveillance, inspection, auditing, and enforcement, understanding how internal organizational capabilities influence Food Safety Control Performance represents an important but underexplored area of research. Addressing this gap is particularly relevant as regulatory agencies face increasingly complex food systems, evolving international standards, and growing public expectations for effective food safety governance.

A further theoretical gap concerns the application of the RBV within public food safety governance. Although RBV has been widely used to explain organizational performance in private sector organizations, relatively few studies have conceptualised Organizational Innovation Culture as a strategic organizational capability that enhances regulatory effectiveness in public sector institutions (Barney, 1991; Peteraf, 1993). Existing food safety studies have largely emphasised regulatory compliance and technical controls, while providing limited theoretical explanation of how intangible organizational capabilities, such as continuous learning, knowledge sharing, collaboration, and continuous improvement, contribute to sustainable regulatory performance.

Evidence about the internal capabilities of public food safety regulators remains limited. This paper examines innovation culture and digitalization together because the latter may be experienced as part of wider innovation efforts, yet may have a different association with performance. The focal relationships are assessed using the existing thesis model, with leadership included as an adjustment predictor.

HYPOTHESIS DEVELOPMENT

Innovation culture can support learning, coordination and continuous improvement in regulatory work (Martins & Terblanche, 2003; Dobni, 2008). The Resource-Based View suggests that such organizational capabilities may be associated with performance. The first hypothesis concerns officers' assessments of performance in the FSQD.

H1: Organizational Innovation Culture is positively associated with perceived Food Safety Control Performance.

Digitalization can support information management and coordination across administrative levels, but a direct relationship with perceived performance should be tested rather than assumed. The second hypothesis addresses this distinct construct.

H2: Digitalization Initiatives are positively associated with perceived Food Safety Control Performance.

METHODOLOGY

Research Design

This study used a cross-sectional questionnaire to examine two focal predictors, OIC and Digitalization Initiatives, in relation to perceived FSCP. The reported PLS-SEM coefficients were estimated in the thesis model, which also included transformational leadership. Leadership is retained here as an adjustment predictor; the model is not an independently estimated two-predictor model.

Study Population and Sampling

The target population comprised permanent Food Technology Officers employed by the FSQD, MOH. These officers are responsible for food safety inspection, auditing, enforcement, policy implementation, and program-

me coordination at headquarters, state health departments, and district health offices.

The study identified 342 eligible officers involved in food safety auditing and regulatory functions and used a census-based approach to invite eligible officers across organizational levels. A total of 211 usable questionnaires were obtained, equivalent to 61.7% of the stated eligible population. Respondents were not selected through stratified random sampling.

Research Instrument

Data were collected using a structured questionnaire in English and Malay. The broader study covered leadership, innovation culture, digitalization and organizational performance. This paper presents the two focal constructs, innovation culture and digitalization, while retaining leadership in the reported model as an adjustment predictor. Items were informed by relevant literature and refined after pilot testing for the FSQD context.

The final PLS-SEM measurement summary treats OIC as a 10-item construct: five innovation orientation items and five resource allocation items. Digitalization Initiatives are measured separately by five items. This distinction is important because the original questionnaire grouped all 15 items together as innovation related items before the measurement model was refined.

Perceived FSCP was measured using 12 items addressing officers' assessments of food safety control, service satisfaction, working relationships, management, innovation capability, social responsibility, reputation, compliance, and crisis management. This broad measure reflects a public-sector view of performance encompassing organizational capacity and service delivery as well as regulatory activity (Boyne, 2002). Accordingly, the results describe perceived organizational performance, not independently verified inspection results or public-health outcomes. Responses were recorded on a five-point agreement scale.

Table 1. Measurement of Study Variables

Construct	Number of Items	Measurement Dimensions
Organizational Innovation Culture (retained indicators)	10	Innovation orientation (5 items) and resource allocation (5 items).
Digitalization Initiatives	5	Separate digitalization items; reported as a distinct construct in the refined PLS model
Food Safety Control Performance	12	Food safety control performance, service satisfaction, teamwork, organizational management, innovation capability, social responsibility, reputation, food safety compliance, crisis management, and overall regulatory performance

Data Collection

Participation was voluntary, and respondents were informed of the purpose of the study and assured that their responses would remain anonymous and confidential. The questionnaires were distributed electronically to Food Technology Officers across Malaysia. Completed responses were screened for completeness, missing values, and response consistency prior to analysis. Missing data were minimal and were handled using mean substitution in accordance with the data preparation procedures adopted in the study.

Data Analysis

PLS-SEM was conducted in RStudio using the *semnir* package. The analysis reported here comes from the thesis model, in which OIC, Digitalization Initiatives and transformational leadership were simultaneous predictors of perceived FSCP. Leadership is shown as an adjustment predictor to preserve the meaning of the published paths. Estimating a model with only the two focal predictors would require the original data and new model output.

The measurement model was assessed using Cronbach's alpha and composite reliability for internal consistency,

average variance extracted (AVE) and outer loadings for convergent validity, and the heterotrait–monotrait ratio (HTMT) for discriminant validity. The reported construct-level figures are drawn from the thesis PLS summary. The separate CFA described in the thesis had poor overall fit, so its estimates are not combined with the PLS results.

The structural paths were assessed using 5,000 bootstrap resamples. Standardized path coefficients (β), t-values, p-values and 95% confidence intervals were used to assess H1 and H2. The model R^2 describes all three predictors together, including leadership; it is not an estimate for a new two-predictor model.

Common Method Bias

All constructs were rated by the same officers at the same time. In the thesis, Harman’s single-factor diagnostic found that the first factor accounted for less than 50% of variance. This check does not eliminate possible common-method influences.

In addition, procedural measures were incorporated during questionnaire administration to minimise potential method-related bias. Participation was voluntary, respondents were assured of anonymity and confidentiality, and the questionnaire items were presented using clear and straightforward instructions. These measures were intended to reduce evaluation apprehension and potential response bias.

RESULTS

Respondent Profile

The analysis included 211 of 342 eligible officers (61.7%). Respondents were based at headquarters (n = 55), state health departments (n = 30) and district health offices (n = 126). These groups are described to show organizational coverage; this paper does not claim statistically tested differences in the OIC–performance relationship between levels.

The respondents represented different employment grades, years of service, and administrative levels. Most respondents (77.25%) had more than ten years of professional experience in food safety regulation, indicating that the study largely captured the perspectives of experienced regulatory officers with substantial practical and organizational knowledge. In terms of administrative placement, 59.72% of respondents were based at district health offices, 26.07% at headquarters, and 14.22% at state health departments.

Table 2: Demographic and Professional Profile of Respondents

Variable	Category	n	Percentage (%)
Administrative Level	Headquarters	55	26.07
	State Health Departments	30	14.22
	District Health Offices	126	59.72
Grade	C41–C44	155	73.46
	C45–C48	37	17.54
	C49–C54	19	9.01
Years of Service	≤5 years	7	3.32
	6–10 years	41	19.43
	>10 years	163	77.25

Descriptive Statistics

The thesis reports mean of 3.935 (SD = 0.648) for its original 15-item innovation-related composite, 3.983 (SD = 0.733) for the five digitalization items, and 4.172 (SD = 0.696) for perceived performance. The original 15-

item mean should not be treated as the mean of the final 10-item OIC measure, which was not separately verified from the available tables.

Table 3: Descriptive Statistics of Study Constructs

Construct	Mean	Standard Deviation
Original 15-item innovation grouping*	3.935	0.648
Digitalization Initiatives	3.983	0.733
Food Safety Control Performance	4.172	0.696

*The innovation grouping mean is from the original 15-item questionnaire composite; it is not a verified descriptive mean for the retained 10-item OIC construct.

Assessment of the Measurement Model

The thesis PLS summary reports satisfactory construct-level reliability for retained OIC (10 items; $\alpha = 0.89$, CR = 0.91, AVE = 0.58), Digitalization Initiatives (5 items; $\alpha = 0.87$, CR = 0.90, AVE = 0.56) and perceived FSCP (12 items; $\alpha = 0.92$, CR = 0.93, AVE = 0.64). The reported outer loading ranges were 0.71–0.89, 0.73–0.88 and 0.75–0.91, respectively. HTMT was 0.79 for OIC and digitalization, 0.75 for OIC and performance, and 0.71 for digitalization and performance. These values come from the refined PLS summary; an earlier CFA in the thesis reported poor overall fit and should not be used as independent confirmation of the final measurement structure.

Table 4: Reliability and Convergent Validity of Study Constructs

Note. Values are from the refined PLS measurement summary in the thesis. Digitalization is measured separately from the retained 10-item OIC construct. The earlier four-factor CFA had poor global fit and is not presented as validation of this PLS measurement model.

Construct	Items	Cronbach's alpha	Composite reliability	AVE
Organizational Innovation Culture	10	0.89	0.91	0.58
Digitalization Initiatives	5	0.87	0.90	0.56
Perceived Food Safety Control Performance	12	0.92	0.93	0.64

Structural Model Assessment

The thesis structural model included OIC, Digitalization Initiatives and transformational leadership as simultaneous predictors of perceived performance. Leadership is included here as an adjustment predictor. The reported R^2 of 0.736 describes the combined three-predictor model; the thesis does not report R^2 for a model containing only OIC and digitalization.

Hypothesis Testing

In the three-predictor PLS-SEM model, OIC was positively associated with perceived performance after adjustment for leadership and digitalization ($\beta = 0.265$, $t = 3.64$, $p < .001$, 95% CI [0.135, 0.419]); H1 was supported. Digitalization showed a positive but statistically non-significant adjusted path ($\beta = 0.084$, $t = 1.29$, $p = .212$, 95% CI [−0.052, 0.204]); H2 was not supported. The thesis reports positive bivariate correlations with performance for OIC ($r = 0.765$) and digitalization ($r = 0.652$), both $p < .001$. Thus, the non-significant adjusted digitalization path should not be interpreted as evidence of a negative relationship.

Table 5: Structural Model Results (Adjusted Associations)

Role	Predictor : perceived FSCP	β	t-value	p-value	95% CI
Focal H1	Innovation Culture : perceived performance	0.265	3.64	< .001	[0.135, 0.419]
Focal H2	Digitalization : perceived performance	0.084	1.29	.212	[−0.052, 0.204]

Adjustment	Leadership performance	:	perceived	0.581	9.00	< .001	[0.454, 0.707]
------------	------------------------	---	-----------	-------	------	--------	----------------

Interpretation of Findings

Officers who reported a stronger innovation culture also tended to rate performance more favourably, even after the other predictors were included. Digitalization was positively correlated with perceived performance before adjustment, but its distinct adjusted association was not statistically significant. OIC and digitalization were strongly correlated in the thesis ($r = 0.871$), which makes their separate contributions harder to interpret.

DISCUSSION

Organizational Innovation Culture as a Strategic Capability for Public-Sector Regulatory Performance

The two focal predictors showed different adjusted results: innovation culture retained a positive association with perceived performance, while digitalization did not show a statistically significant distinct path. Both findings concern officers' survey responses and should not be interpreted as changes in recorded inspection or public health outcomes.

Public regulatory agencies are evaluated through public health protection, consistent implementation of legislation, service quality and accountability. In this setting, the observed association suggests that innovation culture may be relevant to officers' assessments of regulatory performance. Whether changes in culture lead to better governance requires evidence beyond this survey.

The Resource-Based View offers a theoretical account in which shared learning and collaborative routines may be useful institutional resources. The present association is consistent with that account, but the study did not test whether such resources were rare, difficult to imitate or responsible for changes in regulatory outcomes.

Organizational Learning, Knowledge Sharing, and Continuous Improvement in Public Food Safety Governance

The OIC measure examined innovation orientation and resource allocation for innovation. Officers who perceive greater openness to new ideas may be more willing to discuss inspection challenges and consider improvements to established procedures. Time, training and other resources may also enable them to exchange experience across units. These are plausible explanations for the observed association with perceived performance; the study did not test them as separate pathways.

Food safety officers must respond to emerging hazards, complex supply chains and changing regulatory requirements. Professional learning and the exchange of inspection experience may help them keep their practices current and interpret requirements consistently. Within the FSQD, communication between headquarters, state health departments and district health offices may be particularly useful for coordinating responses to recurring enforcement problems.

Continuous improvement could also help teams identify inspection difficulties, refine internal procedures and share corrective practices while maintaining statutory requirements. The present survey did not establish whether these activities changed regulatory decisions or outcomes. Future research should examine actual knowledge exchange, consistency of inspection decisions, incident response and independently recorded regulatory results.

Theoretical and Empirical Contributions

This study adds evidence from a public food safety regulatory agency to research on innovation culture and organizational performance. The focus on officers' assessments of performance extends the setting in which this association has been examined, while the design limits conclusions about objective regulatory effectiveness.

The Resource-Based View provides a framework for considering innovation culture and digital capability as organizational resources. In this survey, the adjusted OIC path was significant while the distinct digitalization path was not. The analysis did not test whether either resource caused a change in regulatory outcomes.

The findings are relevant to quality management because they bring organizational culture into the discussion of continuous improvement in regulatory institutions. More direct measures of changes in procedures and results would be needed to test whether the proposed link operates in practice.

The study also contributes to public administration literature by highlighting that innovation and regulatory compliance need not be mutually exclusive. Within a regulatory environment, Organizational Innovation Culture may support organizational learning, interdepartmental collaboration, communication, and evidence-based decision-making while maintaining legislative integrity, transparency, and public accountability.

The paper draws attention to the internal organizational environment of a public regulatory agency, whereas much food safety research examines food handlers, industry compliance and technical systems. Its evidence concerns a statistical association in officers' survey responses; future work should connect such responses with independently recorded regulatory results.

Innovation culture was associated with more favourable officer assessments of organizational performance after adjustment for digitalization and leadership. Digitalization had a positive bivariate relationship with perceived performance but no statistically significant adjusted path. The results invite further study of how these closely related constructs function in regulatory work.

Digitalization and Performance

Digitalization was positively correlated with perceived performance but was not a statistically significant distinct predictor once innovation culture and leadership were included ($\beta = 0.084$, $p = .212$). The measures of OIC and digitalization were closely correlated ($r = 0.871$). This pattern warrants careful interpretation because it does not show that digital tools lack value; it shows that the available model did not identify a distinct adjusted association in this sample.

Practical Recommendations

The findings highlight opportunities to further support structured exchanges of inspection experience between headquarters, state and district offices, provide time for reviewing recurring operational problems, and document procedural improvements. These are proposals for practice based on the study context; their effects should be evaluated with recorded indicators.

Digital initiatives would benefit from attention to staff training, system usability, reliable access and feedback from frontline officers. The present results do not show a significant distinct digitalization path after accounting for innovation culture and leadership. Agencies should therefore assess whether changes in digital tools improve inspection timeliness, information quality and coordination in practice.

Future evaluations could compare administrative levels and examine whether organizational learning, digital readiness and resources account for differences in perceived and recorded performance.

LIMITATIONS AND FUTURE RESEARCH

The study was cross-sectional and drew on self-reported responses from Food Technology Officers in one Malaysian agency. The design does not establish causal order, and the findings reflect the views of the officers surveyed rather than those of laboratory staff, industry, other regulators or consumers. Perceived FSCP is broader than independently verified inspection or compliance outcomes. The same-source measures may share response influences despite the Harman diagnostic result.

The two focal predictors were examined using paths from a broader thesis model that also adjusted for leadership. The R^2 of 0.736 belongs to that three-predictor model. Because the original data were not reanalysed for this paper, no distinct two-predictor coefficients or R^2 are claimed. OIC and digitalization were highly correlated ($r = 0.871$), which limits the interpretation of their distinct adjusted associations.

Future research could estimate the two-predictor model directly, repeat measurements over time, and link questionnaire responses with recorded inspection results and incident response measures. Separate data sources

and perspectives from other stakeholder groups would strengthen the assessment of regulatory performance.

CONCLUSION

In this study of 211 Food Technology Officers, OIC was positively associated with perceived FSCP after adjustment for digitalization and leadership ($\beta = 0.265$, $p < .001$). Digitalization was positively correlated with performance but had no statistically significant distinct path in the adjusted model ($\beta = 0.084$, $p = .212$). The findings support attention to organizational learning and measured implementation of digital tools within the FSQD.

REFERENCES

1. Barney, J. B. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99–120.
2. Boyne, G. A. (2002). Concepts and indicators of local authority performance: An evaluation of the statutory frameworks in England and Wales. *Public Money & Management*, 22(2), 17–24.
3. Crossan, M. M., & Apaydin, M. (2010). A multi-dimensional framework of organizational innovation: A systematic review of the literature. *Journal of Management Studies*, 47(6), 1154–1191.
4. Damanpour, F., & Schneider, M. (2009). Characteristics of innovation and innovation adoption in public organizations: Assessing the role of managers. *Journal of Public Administration Research and Theory*, 19(3), 495–522.
5. De Vries, H., Bekkers, V., & Tummers, L. (2016). Innovation in the public sector: A systematic review and future research agenda. *Public Administration*, 94(1), 146–166.
6. Dobni, C. B. (2008). Measuring innovation culture in organizations: The development of a generalized innovation culture construct using exploratory factor analysis. *European Journal of Innovation Management*, 11(4), 539–559.
7. Ekici, G., & Dümen, E. (2019). *Escherichia coli* and food safety. *The Veterinary Quarterly*, 39(1), 215–223.
8. Food and Agriculture Organization of the United Nations. (2021). Trade and food safety standards: Digital technologies for trade and food safety. FAO.
9. Food and Agriculture Organization of the United Nations, & World Health Organization. (2022). Food safety: A right for everyone. FAO & WHO.
10. Grau-Noguer, E., Suppi, R., Rodríguez-Sanz, M., Serratosa, J., Bolao, A., Lundén, J., Hau, P., Melo de Vasconcelos, F., Åberg, R., Blomgren, C., Lambert, M., Leppik, K., Vågsholm, I., Kautto, A. H., Lueckl, J., Abeln-Richter, S., Kamphausen, R., Bammens, E., Georgiades, F., . . . Portaña, S. (2023). Digitalization and official food safety inspections at retail establishments. *Food Control*, 154, Article 109950.
11. Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2022). A primer on partial least squares structural equation modeling (PLS-SEM) (3rd ed.). Sage.
12. Hobbs, J. E., & Goddard, E. (2015). Consumers and trust. *Food Policy*, 52, 71–74.
13. Liu, P., Kerr, W. A., & Hobbs, J. E. (2020). Food safety governance and regulation. *Food Policy*, 95, 101931.
14. Martins, E. C., & Terblanche, F. (2003). Building organisational culture that stimulates creativity and innovation. *European Journal of Innovation Management*, 6(1), 64–74.
15. Ministry of Health Malaysia. (2024). Annual report 2024. Ministry of Health Malaysia.
16. Nayak, R., & Waterson, P. (2019). Global food safety as a complex adaptive system: Key concepts and future prospects. *Trends in Food Science & Technology*, 91, 409–425.
<https://doi.org/10.1016/j.tifs.2019.07.040>
17. Organisation for Economic Co-operation and Development. (2017). Innovation skills and leadership in the public sector. OECD Publishing.
18. Peteraf, M. A. (1993). The cornerstones of competitive advantage: A resource-based view. *Strategic Management Journal*, 14(3), 179–191.
19. Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). Free Press.
20. Ropkins, K., & Beck, A. J. (2000). Evaluation of worldwide approaches to the use of HACCP to control food safety. *Trends in Food Science & Technology*, 11(1–2), 10–21.

21. World Health Organization. (2022). Global strategy for food safety 2022–2030: Towards stronger food safety systems and global cooperation. World Health Organization.