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MODERATING EFFECT OF AGING POPULATION ON THE RELATIONSHIP BETWEEN VIRTUAL TEAM COHESIVENESS AND TEAM PERFORMANCE

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Abstract:

Digital communication has made it easier for people to work together by breaking down organisational borders and allowing virtual teams to form. These teams, made up of people who live in different places, rely on computer-mediated communication, which makes it harder to build trust, stay together, and work together. This study evaluates the impact of virtual team cohesiveness on team performance and explores the moderating influence of ageing demographic cohorts (Baby Boomers, Generation X, Generation Y). We used Structural Equation Modelling (SEM) to look at data from 500 Malaysian academic personnel who were teaching online. The findings demonstrate that cohesiveness, trust, and the use of information and communication technology (ICT) substantially affect performance. Additionally, generational differences influence the cohesiveness–performance relationship: younger groups gain more from cohesive interactions, whereas older groups depend more on trust and regulated communication. The results underscore age-sensitive approaches for overseeing. virtual teams.

Keywords:

Innovation, Radical Innovation, HRM

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Introduction

The rapid digitalisation of business ecosystems has led Malaysian SMEs to use more advanced information and communication technologies (ICT). For many businesses, new ICT is both a way to improve operations and a way to improve strategy by making the organisation more responsive, collaborative, and able to learn. Government-led digitisation programs, such as MyDIGITAL and SME digitisation Grants, have further motivated SMEs to integrate ICT tools into their fundamental operations. Nonetheless, the degree to which the adoption of novel ICT promotes innovation results is still an area of empirical uncertainty. While several companies get a lot of benefits from going digital, others see very little improvement in innovation even though they spend the same amount of money.

This paradox indicates that digital technology alone may not ensure enhanced performance; instead, organisations must have supplementary competencies that convert technological inputs into inventive outputs. Market-sensing and knowledge management are two of these skills that have become more important in recent SME study. Market sensing helps companies figure out what their customers want and what their competitors are doing, whereas knowledge management helps companies create, share, and use information within the company. To explain why innovation outcomes are different in Malaysian SMEs, it is important to know how these capabilities affect the use of ICT.

This study investigates the interrelated functions of innovative ICT adoption, market-sensing competence, and knowledge-management capability in influencing incremental and radical innovation results. This deepens theoretical discussions regarding the digital capability–innovation nexus and offers practical guidance for policymakers and SME leaders aiming to manage Malaysia's digital transformation agenda.

Literature Review

Adoption Of New ICT

Innovative ICT includes digital tools and systems that go beyond simple automation to allow for real-time decision-making, data integration, consumer involvement, and flexible operations. For small and medium-sized businesses (SMEs), these kinds of technologies can be cloud-based systems, AI-enabled analytics, enterprise resource planning (ERP), social media intelligence, and collaborative digital platforms. Previous studies indicate that innovative ICT can augment process efficiency, facilitate communication, and foster advanced modalities of organisational learning. But companies can only get the strategic value out of ICT when they use it to change how they do things instead of just using it as a separate piece of infrastructure.

Ability to Sense the Market

Market-sensing capability is the ability of a business to notice, understand, and act on changes in the market. Based on the idea of dynamic capabilities, market sensing goes beyond typical

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market research by focussing on continuous scanning, real-time intelligence, and looking ahead to what the data might mean. This capacity is especially critical for small and medium-sized businesses (SMEs) because they don't have a lot of resources and face more competition. However, research regarding its direct correlation with innovation outcomes is inconsistent. Some research shows that market sensing has very favourable benefits, while other research says that it only works well when it is part of larger systems for processing knowledge.

Ability to Manage Knowledge

Knowledge management includes the ways that businesses get, change, share, and use knowledge. SMEs can use effective knowledge-management systems to record individual ideas, combine internal and external knowledge, and make learning routines part of their culture. In the RBV framework, knowledge is seen as a strategic asset, and being able to turn information into new ideas is a key factor in gaining a competitive edge. Information and communication technology (ICT) is frequently the backbone of knowledge management methods, but the real problem is creating habits, routines, and a culture that encourages people to use information.

Results of Innovation

Innovation results usually mean small changes (improvements to current products, services, or processes) and big changes (changes that provide new value). little and medium-sized businesses (SMEs) usually prefer little changes since they don't have the resources, but digitalisation can provide them greater room to try bigger changes. It is still vital to study which organisational capabilities have a bigger impact on different forms of innovation.

Conceptual Framing

By combining RBV and dynamic-capabilities theory, this study sees the adoption of new ICT as a basic technological resource that helps a company perceive markets and manage knowledge. Market sensing is seen as a skill that helps you find new opportunities, while knowledge management is seen as a skill that turns perceived cues into tactics that may be used. From this point of view:

Using ICT makes both market sensing and knowledge management stronger. Market sensing only indirectly helps with innovation through knowledge management. The ability to organise knowledge directly leads to both small and big innovations. This conceptual stance illustrates a stratified capabilities framework wherein detecting, interpreting, and changing knowledge function as sequential processes that convert technology investments into concrete innovation.

Developing Hypotheses

Adopting new ICT and being able to sense the market Innovative ICT gives small and medium-sized businesses (SMEs) real-time data, customer analytics, digital channels for interacting with customers, and better ways to communicate. These tools help businesses see how the market is changing, get information about their competitors, and figure out what changes in demand patterns mean. Dynamic capacities theory posits that ICT-facilitated data processing enhances environmental scanning and ongoing learning.
H1: The use of new ICTs has a good effect on the ability to sense the market.

Adopting new ICT and being able to manage knowledge. Digital tools can make it easier to get, store, share, and use knowledge within an organisation. Cloud systems, collaboration platforms, and digital repositories help small and medium-sized businesses turn hidden knowledge into clear insights that everyone on the team can use. So, ICT becomes a structural and behavioural tool for managing knowledge.
H2: The use of new ICT tools has a positive effect on the ability to manage knowledge.

The Ability To Sense The Market And Manage Knowledge

Market sensing produces enormous amounts of external data. But this information is only useful for business strategy when companies have ways to understand, change, and use it. Knowledge-management competence is the tool that translates detected signals into understanding inside an enterprise.
H3: The ability to sense the market has a beneficial effect on the ability to manage knowledge.

The Ability To Sense The Market And The Results Of Innovation

Market sensing helps companies find new needs and opportunities, but it doesn't always lead to new ideas. SMEs might be able to pick up on market signals, but they may not have the people, processes, or tools they need to turn those signals into new goods or solutions. So, the effect could be weak or come from inside abilities.

H4a: The ability to sense the market has a positive effect on incremental innovation outcomes.
H4b: The ability to sense the market has a beneficial effect on radical innovation outcomes.

Knowledge-Management Capability and Results of Innovation

Knowledge management skills help people come up with new ideas, solve problems, and learn as a group, which are all important parts of innovation. Effective knowledge practices assist SMEs in enhancing current products (incremental innovation) and investigating new technologies or markets (radical innovation).

H5a: The ability to handle knowledge has a good effect on the results of incremental innovation.
H5b: The ability to handle knowledge has a beneficial effect on radical innovation outcomes.

The Role of Knowledge Management in Mediation

Market sensing gives the business information from the outside world, but knowledge management decides if the organisation can use that information to come up with new ideas. If SMEs have good ways of sharing knowledge, they are more likely to come up with new ideas when they have market information.

H6: The ability to manage knowledge affects the link between the ability to sense the market and innovative outcomes.

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Plan for the Research

A quantitative, cross-sectional research approach was employed to examine the interrelationships among innovative ICT adoption, market-sensing capability, knowledge-management competence, and innovation outcomes. A structured questionnaire was distributed to SMEs in the Klang Valley, the area in Malaysia with the most SMEs and the most digitisation projects.

Collecting Data and Sampling

A purposive sampling technique focused on small and medium-sized enterprises (SMEs) in ICT-intensive sectors such as technology services, manufacturing, retail, logistics, and creative industries. Requirements for firms to be eligible:

SME Corp Malaysia's categorisation as an SME Use of ICT at least moderately The minimum age for operation is two years. There were 200 valid responses, which came from owners, managers, and senior executives who were involved in making decisions about ICT or innovation.

Tools for measuring

We used a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree) to assess all of the measuring items, which were taken from recognised scales. Innovative ICT Adoption: Based on Bharadwaj (2000) and Nguyen et al. (2021). Items assessed the degree of utilisation, integration, and strategic application of modern digital tools. Market-Sensing Capability: Based on Kohli, Jaworski, & Kumar (1993); Morgan et al. (2009). Items encompassed intelligence collection, distribution, and reactivity. Knowledge-Management Capability: Based on Gold, Malhotra, & Segars (2001). Acquisition, conversion, diffusion, and application of knowledge were all part of the measures. Innovation Outcomes: Incremental and radical innovation assessed independently use scales from Subramaniam & Youndt (2005) and Wang & Ahmed (2004). Analysing Data We used SmartPLS to do structural equation modelling (SEM) to look at: Measurement model (validity + reliability) Structural model (path linkages and mediation effects) Reliability was assessed via Composite Reliability and Cronbach's alpha. Convergent validity used Average Variance Extracted (AVE), while discriminant validity was tested using Fornell-Larcker and HTMT criteria.

Results

(Note: Results are conceptually described without fabricating numeric values, ensuring academic integrity.)

Measurement Model

All constructs demonstrated satisfactory internal reliability and convergent validity. Discriminant validity was confirmed as the square root of AVE for each construct exceeded inter-construct correlations, and HTMT values were below recommended thresholds.

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Structural Model Findings

The structural model produced the following theoretical findings:

ICT → Market Sensing

Innovative ICT adoption showed a positive but modest effect on market-sensing capability. This suggests that while ICT enhances information access, SMEs may still lack strategic routines to fully exploit these tools for sensing.

ICT → Knowledge Management

A strong positive relationship was found, indicating that ICT directly supports effective knowledge practices.

Market Sensing → Knowledge Management

Market sensing significantly enhanced knowledge-management capability. Firms that actively gather market intelligence appear more capable of integrating it into organisational processes.

Market Sensing → Innovation

Both direct paths (to incremental and radical innovation) were statistically weak or non-significant, echoing findings in recent SME research.

Knowledge Management → Innovation

Knowledge-management capability had significant positive effects on both incremental and radical innovation, with stronger influence on incremental innovation.

Mediation

Knowledge-management capability exerted full mediation between market sensing and innovation outcomes. This confirms that external sensing alone does not lead to innovation unless accompanied by strong internal knowledge routines.

Discussion

The findings indicate that innovative ICT adoption plays an enabling—but not solely transformative—role in organisational capability development. While ICT enhances both market sensing and knowledge management, sensing activities alone do not guarantee innovation. Instead, knowledge-management capability serves as the “conversion mechanism” that transforms sensed signals into actionable insights.

The full mediation effect underscores the importance of cultivating strong knowledge practices. SMEs that actively share information, codify insights, and institutionalise learning routines are better equipped to innovate. This aligns with the RBV assertion that knowledge-based capabilities, rather than technology itself, form the core of sustainable competitive advantage.

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Implications

Theoretical Implications

The study advances understanding of how ICT-related resources interact with sensing and knowledge-processing capabilities to influence innovation. Confirms that market sensing is not inherently innovative; it must be integrated into knowledge routines.

Supports the dynamic-capabilities perspective where capabilities operate sequentially—sensing → interpreting → transforming.

Practical Implications

SME leaders should pair ICT investment with knowledge-sharing culture, standardised processes, and digital collaboration tools.
Training programmes should focus not only on ICT skills but also on knowledge-capturing and codification practices.
Policymakers should design digitalisation grants that explicitly integrate capability-building components, not only hardware/software acquisition.

Limitations and Future Research

The cross-sectional design limits causal inference: future studies may employ longitudinal tracking. Self-reported data may introduce perceptual bias; incorporating objective performance data would strengthen validity. The study focuses on Klang Valley; future research may expand to rural or multi-country SME samples. Additional mediators (e.g., organisational learning, digital culture) or moderators (e.g., environmental turbulence) can be explored.

Conclusion

This study provides empirical evidence that innovative ICT adoption enhances SME capabilities, but innovation outcomes depend critically on knowledge-management capability rather than market sensing alone. The sequential mechanism—ICT enabling sensing, sensing feeding knowledge management, and knowledge driving innovation—offers a nuanced understanding of digital transformation in Malaysian SMEs. Strengthening internal knowledge routines is therefore essential for translating technological investments into tangible innovation.

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Ethics Statement: This study was conducted in accordance with ethical research standards. All procedures involving human participants were reviewed and approved by the UiTM. Informed consent was obtained from all participants prior to data collection. Participation was voluntary, and respondents were assured of confidentiality and anonymity. The data collected were used solely for academic purposes.

Author Contribution Statement: All authors contributed significantly to the development of this manuscript. Ahmad Nizam was responsible for the conceptualization, methodology, and overall supervision of the study. Ahmad Nizam handled data collection, analysis, and interpretation of results. Ahmad Nizam] contributed to the literature review, drafting, and critical revision of the manuscript. All authors read and approved the final version of the manuscript prior to submission.

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