# “Impact of external stimuli and management control systems on radical innovation and startup performance”


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# IMPACT OF EXTERNAL STIMULI AND MANAGEMENT CONTROL SYSTEMS ON RADICAL INNOVATION AND STARTUP PERFORMANCE

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## Abstract

The rapidly changing business environment and fierce competition necessitate startups to innovate continuously. External stimuli such as market trends, technological advancements, and competition are critical in influencing a startup's ability to innovate and enhance performance. This study aims to explore the role of these external stimuli, along with management control systems, specifically diagnostic and interactive systems, in promoting radical innovations and improving startup performance. A quantitative approach using partial least squares structural equation modeling (PLS-SEM) was applied to data collected from 250 startup managers in Indonesia. The results show that external stimuli significantly influence diagnostic ($p < 0.001$, $t = 3.647$) and interactive control systems ($p < 0.001$, $t = 5.452$). Diagnostic and interactive systems positively affect radical innovation ($p < 0.001$, $t = 3.362$). Radical innovation significantly enhances performance ($p < 0.001$, $t = 3.453$). Such evidence shows that external stimuli and control systems should be aligned to facilitate radical innovation and increase startup performance. The study offers valuable information for managers on how to achieve operational control but retain strategic flexibility in rapidly changing situations. The findings present both theoretical and practical contributions to strategic management and innovation processes in startup companies.

**Keywords** environment, management control system, innovation, performance, PLS-SEM, technology, market competition, Indonesia

**JEL Classification** 031, 032, M13



**Conflict of interest statement:**
Author(s) reported no conflict of interest

## INTRODUCTION

The startup environment is characterized by rapid technological changes, growing market demands, and fierce competition. This dynamic condition puts considerable pressure on startups to maintain high performance and competitiveness. To thrive in such an environment, radical innovation combined with an effective management control system becomes essential (Wang et al., 2020). Radical innovation (i.e., transformative changes in products, processes, or business models) is necessary for startups to stay ahead of competitors and meet changing customer needs. However, achieving this requires more than just creative ideas. Startups must also implement a robust management control system that provides flexibility to drive innovation while ensuring operational efficiency.

The integration of management control systems and external stimuli, such as market trends, technological advancements, and competition, plays a crucial role in facilitating radical innovation (Luiz & Beuren, 2023). In particular, diagnostic control systems and interactive control systems provide complementary approaches to managing startup performance. While diagnostic control systems focus on operational efficiency and performance monitoring against predefined goals, interactive control systems encourage creativity, collaboration, and responsiveness to external changes (Su et al., 2015). Although the individual impact of these factors on startup performance has been discussed in the literature, their combined effects in promoting radical innovation and improving startup performance are still less explored.

# 1. LITERATURE REVIEW AND HYPOTHESES

## 1.1. External stimuli and innovation in startups

The external environment plays a crucial role in shaping the startup's strategic decisions and innovative capacity. External stimuli, such as market trends, technological advancements, and competition, significantly affect a company's ability to innovate and remain competitive (Severo & De Guimarães, 2022). By their very nature, startups operate in a dynamic and often volatile environment, requiring them to be agile and responsive to external changes (Bresciani et al., 2023). The ability to effectively utilize these external stimuli can lead to the development of radical innovations, that is, major shifts that can disrupt the market and create a competitive advantage for organizations (Hanandeh et al., 2024).

Contingency theory suggests that organizations must align their strategies and structures with the external environment to achieve optimal performance (Kim et al., 2016). This alignment is crucial for startups, which need to adapt quickly to changing market conditions. Therefore, understanding how external stimuli affect the innovation process and how startups can use these factors to their advantage is a key area of interest in innovation research.

Some studies related to the external influence of this stimulus produce contradictory results (research gap). Luiz and Beuren (2023), Bernd and Beuren (2022) showed a significant negative effect of the stimulus environment on the use of management control systems on product innovation and process innovation. Meanwhile, Frezatti et al. (2017) and Bresciani et al. (2023) discovered that companies that thrive in a high uncertainty and dynamic environment will tend to increase the use of management control systems.

## 1.2. Management control system and radical innovation

A management control system is essential to ensure that a startup can achieve its strategic goals while maintaining the flexibility to innovate (Janka, 2021). Diagnostic control systems and interactive control systems are the two main types (Frezatti et al., 2017) that play different roles in driving innovation.

A diagnostic control system is used to monitor and evaluate the performance of an organization or company by measuring the achievement of preset goals (Mariano-Hernández et al., 2021). This system controls existing processes and provides information to managers or leaders of the organization on the extent to which targets or operational standards are being achieved. Typically, such a system includes a variety of key performance indicators (KPIs) that are used to evaluate operational efficiency and effectiveness (Müller-Stewens et al., 2020). The purpose of the diagnostic control system is to ensure that the organization is running according to the plans and strategies set, as well as to identify problems if the performance does not meet expectations. They are more focused on controlling and reporting results.

An interactive control system focuses on the process of active communication and interaction between managers and members of the organization to respond to the challenges and opportunities that exist in a dynamic environment (Su et al., 2015). In contrast to the diagnostic control system, which is more passive and structured, the interactive control system encourages active involvement in decision-making, strategy adjustment, and handling evolving problems. These systems are used to explore new ideas, monitor changes in the market, and respond to changing needs (Ismail & Sudrajat, 2012). They support organizational innovation and adaptation by involving more flexible


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and dynamic information-based decision-making (Dzvinchuk et al., 2021). An example of an interactive control system is regular meetings with the team to respond to feedback and new issues that arise in the field

Diagnostic control systems are focused on monitoring and controlling performance against predetermined objectives, ensuring that operations remain efficient and on track (Müller-Stewens, 2020). They provide a stable foundation for managing routine activities and tracking progress, which is crucial for startups that need to maintain operational efficiency while innovating (Wang et al., 2020). However, diagnostic control systems alone may not be enough to support radical innovation, as it is often seen as rigid and focused on short-term goals (Hallioui et al., 2022).

In contrast, interactive control systems encourage creativity, learning, and collaboration within organizations. Encouraging strategic dialogue and involving multiple stakeholders in decision-making facilitates a more flexible and responsive approach to innovation (Bastian et al., 2024). Interactive control systems are invaluable for startups involved in radical innovation, as they allow for rapid adaptation to external changes and encourage the generation of new ideas (Piliang et al., 2023). The integration of diagnostic and interactive control systems creates an environment conducive to radical innovation by combining the benefits of efficiency monitoring with the flexibility necessary for creative breakthroughs (Bellora-Bienengräber et al., 2022).

Wang et al. (2021), Lill and Wald (2021), and Endenich et al. (2022) state that the existence of a control management system provides limitations in creating innovation in the organization. Meanwhile, Bernd and Beuren (2022), Pan Fagerlin and Lövstål (2020), and Barros (2019) stated that the design of management control systems positively triggers organizations in interaction, thus giving rise to innovative ideas.

## 1.3. Radical innovation and startup performance

Radical innovation is a type of innovation that produces major and fundamental changes in an industry or market (Barba-Aragón & Jiménez-Jiménez, 2020). These innovations create breakthroughs that are very different from previous technologies or products, often by introducing new concepts that have never existed before. Radical innovation can change the way people work, interact, or use products and services (Wang et al., 2020). Examples of radical innovation are the invention of the Internet, smartphones, and electric vehicles, which not only changed the industry in which they were introduced but also changed the social behavior and lifestyle of society at large (T.T. Le & P.B. Le, 2023). Radical innovation often involves high risk, but it also offers great profit potential because it can dominate the market or create new markets that do not yet exist (Thneibat, 2021). The literature suggests that radical innovation can provide startups with a substantial competitive advantage, allowing them to differentiate themselves and expand their market share. However, successful radical innovation requires a supportive organizational structure, including an appropriate management control system that encourages learning exploration, and risk-taking (Li et al., 2019).

Companies that manage radical innovations effectively tend to improve their competitiveness and performance over time (Yang et al., 2021). By fostering an environment that supports radical innovation, startups can achieve long-term success, increased profitability, and improved market position (Bulut et al., 2022). In addition, organizations that implement diagnostic and interactive control systems are better equipped to manage the uncertainties and risks associated with radical innovation, which ultimately leads to improved performance (Wang et al., 2020).

The literature highlights the important role of external stimuli and management control systems in generating radical innovations and improving startup performance. However, there is still a need for more research to explore how these factors interact and contribute to startup success, especially in emerging markets like Indonesia (Piliang et al., 2025). This study examines the role of external stimuli and management control systems in encouraging radical innovation and improving startup performance in Indonesia (Figure 1).

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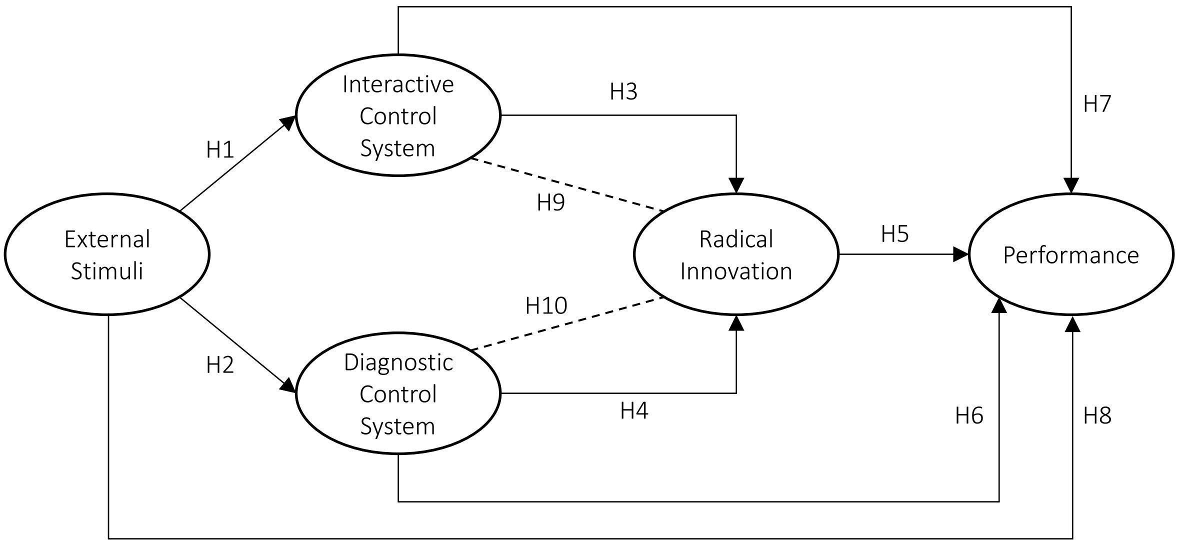


**Figure 1.** Research framework

By applying contingency theory, which argues that organizational strategies and structures should be aligned with external environmental factors, this study aims to uncover how different management control systems drive innovation and improve startup performance. The hypotheses raised in this study are:

*H1: External stimuli positively influence the use of an interactive control system.*

*H2: External stimuli positively influence the use of a diagnostic control system.*

*H3: Interactive control systems positively influence radical innovation.*

*H4: Diagnostic control systems positively influence radical innovation.*

*H5: Radical innovation significantly enhances startup performance.*

*H6: Diagnostic control systems contribute to the improved performance.*

*H7: Interactive control systems contribute to the improved performance.*

*H8: External stimuli positively influence startup performance.*

*H9: Radical innovation mediates the relationship between interactive control systems and performance.*

*H10: Radical innovation mediates the relationship between diagnostic control systems and performance.*

## 2. METHODOLOGY

This paper utilizes a quantitative approach, collecting data through online and offline surveys (Appendix A). The sample consists of 250 middle- and upper-level managers from various startup sectors in Indonesia, including coffee shops, fashion, and finance startups. Data were analyzed using partial least squares structural equation modeling (PLS-SEM), a technique suitable for exploring complex relationships between variables. PLS is often used as an alternative to estimating models of relationships between latent constructs and indicators (Hair et al., 2022). The data collection period was from January to March 2023. The research methodology focuses on using both diagnostic and interactive control systems as key factors in promoting radical innovation and improving startup performance. This study uses a 10-point measurement scale.

Table 1 shows the data collection results. As many as 60% answered through Google Forms (an online survey), and 40% answered directly.



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**Table 1.** Data collection

| Types of Data Collection | Respondents | Percentage |
|---|---|---|
| Live Interview | 100 | 40% |
| Questionnaire Distribution Through G-Form | 150 | 60% |
| Total | 250 | 100% |

**Table 2.** Respondent data profile

| Types of business | Respondents | Percentage |
|---|---|---|
| Coffee Shop Startup | 105 | 42% |
| Fashion Startup | 85 | 34% |
| Finance Startup | 60 | 24% |
| Total | 250 | 100% |

Table 2 shows that the respondents belong to the startup industry in the field. As many as 42% are from the coffee shops sector, 34% from fashion startups, and 24% come from finance. The demographic attributes of respondents are depicted in Table 3. From Table 3, the gender distribution was 80% female and 20% male.

**Table 3.** Demographics of respondents

| Characteristics | Value | Percentage |
|---|---|---|
| Gender | Male | 20% |
| | Female | 80% |
| Age | 19 | 5% |
| | 20 | 10% |
| | 21 | 20% |
| | >21 | 65% |
| Frequency of use of technology or digital devices for learning | Infrequently | 3% |
| | Occasional | 5% |
| | Often | 30% |
| | Always | 62% |

Following PLS-SEM, the study analyzed average variance extracted (AVE), composite reliability (CR), and *t*-values. AVE is used to measure the validity of convergence in the context of SEM and PLS approaches. It indicates the extent of the variance explained by the latent construct in the indicator. If AVE ≥ 0.50, the construct has good convergence validity, which means that the latent construct explains more than 50% of the variance of its indicator. Conversely, if AVE < 0.50, convergent validity is lacking. Next, composite reliability measures the internal consistency of a latent construct. CR is more accurate than Cronbach's alpha because it considers the contribution of each indicator. A good CR score is: CR > 0.7 of adequate reliability, CR > 0.8 of excellent reliability. CR < 0.7, reliability is considered low. Furthermore, after obtaining the path coefficient, a significance test was carried out using the t-value obtained from bootstrapping. The *t*-value is compared to the critical value (e.g., for a significance level of 5%, $t > 1.960$). The relationship is statistically significant if the $p$-value $< 0.05$ or $t > 1.96$. Otherwise, the relationship is considered insignificant.

## 3. RESULTS

According to the PLS-SEM approach, the loading factor is a key parameter that determines the strength of the relationship between the indicator and latent variable (Ringle et al., 2023). It assesses the validity of the measurement in the PLS-SEM model. The loading factor is the regression coefficient that connects the indicator and its latent variable. This means that the loading value can explain more variation in latent variables. A loading factor ≥ 0.7 means that the indicator has a strong relationship with the latent variable and is considered valid, a 0.5–0.7 value means that medium loading if the latent variable has adequate composite reliability, and < 0.5 means low loading; usually the indicator is then omitted because it fails to account for latent variables adequately.

Figure 2 shows that external variables such as stimuli, diagnostic use, interactive use, radical innovation, and organizational performance have an external loading value above 0.7. This implies high loading, a strong relationship between the indicator and the latent variable, and the model is thus valid.

**Table 4.** Average variance extracted, composite reliability, and Cronbach's alpha

| Construct | Extracted Average Variance (AVE) | Composite Reliability (CR) | Alfa Cronbach (CA) |
|---|---|---|---|
| Diagnostic Use | 0.937 | 0.990 | 0.989 |
| External stimuli | 0.964 | 0.994 | 0.992 |
| Interactive Use | 0.954 | 0.990 | 0.988 |
| Performance | 0.900 | 0.973 | 0.964 |
| Radical Innovation | 0.958 | 0993 | 0.991 |

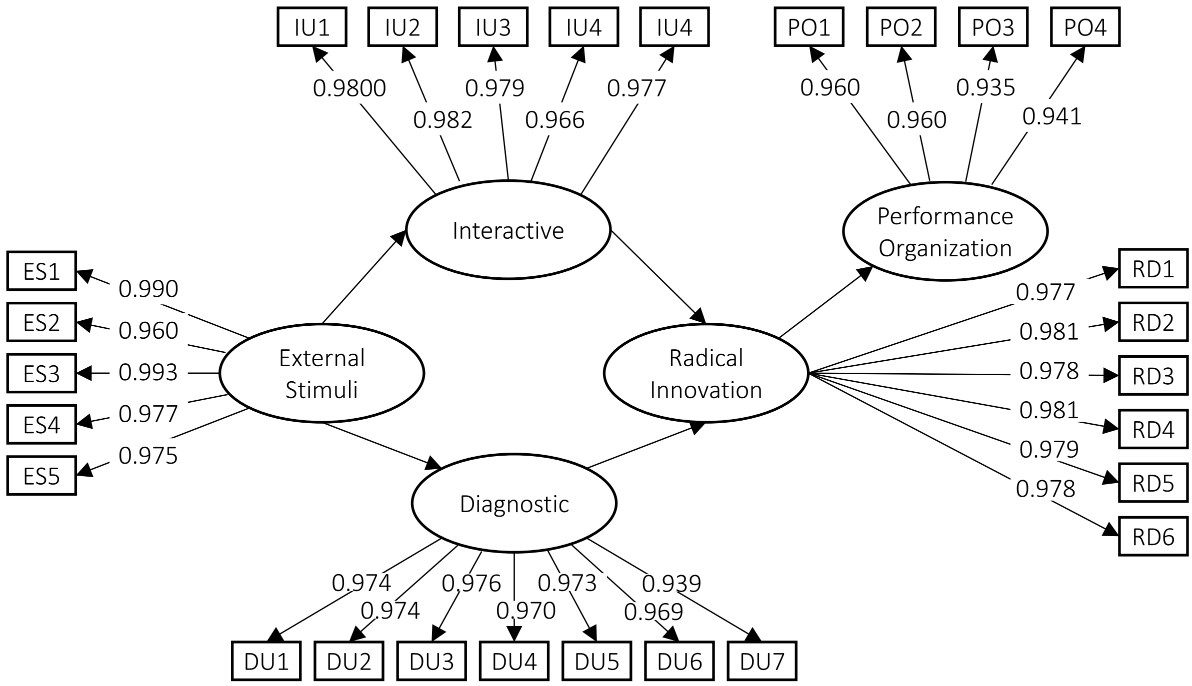


**Figure 2.** Factor loading

Next, Table 4 shows the values of AVE, CR, and Cronbach's alpha. Each latent variable during the study was defined as mean-variance (AVE) (Shmueli et al., 2019). The paper excludes all indicators with a load below the value of 0.40. Following the Fornell–Lacker criterion used to examine the validity of the differentiator (Ringle et al., 2023), the square root of the AVE for any latent variable goes beyond the correlation between the latent variables in the vertical and horizontal directions. The latent variables were checked using the heterotrait-monotrait ratio criterion, and it was established that all latent variables exceeded the threshold value of 0.85. In addition, the model fit index's standard mean root square residue is 0.080. The variance inflation factor in the resilience test (Hair et al., 2022) determines the existence of multicollinearity between the variables.

**Table 5.** Discriminant validity according to the Fornell–Larcker criterion

| Variable | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Diagnostic Usage | 0.968 | | | | |
| External stimuli | 0.279 | 0.982 | | | |
| Interactive Use | 0.301 | 0.375 | 0.977 | | |
| Performance | 0.499 | 0.376 | 0.419 | 0.949 | |
| Radical Innovation | 0.546 | 0.348 | 0.395 | 0.557 | 0.979 |

In the case of the cross-loading test, as shown in Table 5, all variable items showed a high correlation value greater than 0.7. To test the hypotheses, the *p*-value between the variables is determined. If the *p*-value is less than 0.5 and the *t*-value is below 1.950, the hypothesis is accepted (Hair et al., 2019).

The analysis through PLS-SEM confirms the relationships between the variables as hypothesized. External stimuli significantly influence both diagnostic ($p < 0.001$) and interactive control systems ($p < 0.001$). Furthermore, both control systems positively affect radical innovation ($p < 0.001$), which in turn significantly enhances performance ($p < 0.001$). The study also confirms that diagnostic and interactive systems contribute to improved performance, with both playing distinct roles in fostering operational efficiency and creativity.

Table 6 proves that external stimuli significantly influence diagnostic ($p < 0.001$, $t = 3.647$) and interactive control systems ($p < 0.001$, $t = 5.452$). Diagnostic and interactive systems positively affect radical innovation ($p < 0.001$ for both). Radical innovation significantly enhances performance ($p < 0.001$, $t = 3.453$).


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**Table 6.** Model validation results

| Path | Sample Means (M) | Standard Deviation (STDEV) | T Statistics (\|O/STDEV\|) | P value | Result |
|---|---|---|---|---|---|
| External Stimuli → Interactive Use | 0.377 | 0.069 | 5.452 | 0.000 | H1 Accepted |
| External Stimuli → Diagnostic Use | 0.285 | 0.076 | 3.647 | 0.000 | H2 Accepted |
| Interactive Use → Radical Innovation | 0.246 | 0.075 | 3.362 | 0.000 | H3 Accepted |
| Diagnostic Uses → Radical Innovation | 0.468 | 0.080 | 5.900 | 0.000 | H4 Accepted |
| Radical Innovation → Performance | 0.304 | 0.090 | 3.453 | 0.000 | H5 Accepted |
| Diagnostic Usage → Performance | 0.241 | 0.085 | 2.801 | 0.003 | H6 Accepted |
| Interactive Usage → Performance | 0.176 | 0.071 | 2.431 | 0.008 | H7 Accepted |
| External Stimuli → Performance | 0.141 | 0.068 | 2.000 | 0.023 | H8 Accepted |
| Interactive use → Radical Innovation → Performance | 0.076 | 0.036 | 2.204 | 0.014 | H9 Accepted |
| Diagnostic Uses → Radical Innovation → Performance | 0.142 | 0.049 | 2.957 | 0.002 | H10 Accepted |

# 4. DISCUSSION

The findings provide valuable insights into how external factors and management control systems affect radical innovation and organizational performance. External stimuli significantly affect the interactive control system. The positive and statistically significant relationship between external stimuli and interactive control systems, as indicated by a $p$-value of 0.000 and a $t$-value of 5.452, accepts H1. These findings confirm that external stimuli, such as market trends, technological advancements, and competition, have a strong influence on the adoption and application of internal control systems in startups. Such systems promote creativity and flexibility, allowing startups to adapt quickly to external changes, which is essential in driving radical innovation. This is different from Luiz and Beuren (2023), who stated that the environment has a negative influence on the use of the management control system. However, this result confirms the findings by T.T. Le and P.B. Le (2023), as an interactive control system facilitates dialogue and strategic collaboration, enabling organizations to innovate and stay competitive in a rapidly changing environment.

External stimuli positively affected the use of diagnostic control systems, as reflected by the $p$-value of 0.000 and the $t$-value of 3.647, accepting H2. Diagnostic control systems, which focus on monitoring performance and operational efficiency, are affected by external changes that affect the organization's strategic goals and objectives. This evidence is contrary to the results of Bernd and Beuren (2022), which stated that the environment does not affect the control and innovation process in the company. These findings are in line with Wang et al. (2020), who suggested that diagnostic control systems must adapt based on information from the external environment, such as shifts in market conditions or regulatory changes. For example, startups facing an economic downturn can adjust their revenue targets through diagnostic control systems to be more in line with market realities.

Interactive control systems positively influence radical innovation. Their significant effect on radical innovation ($p$-value = 0.000, $t$-value = 3.362) favors H3. These results underscore the role of interactive control systems in encouraging radical innovation by fostering an environment conducive to creative thinking and collaborative decision-making. The results are contrary to Endenich (2022), who stated that the management control system has a negative influence on the innovation process.

This paper supports Bastian et al. (2024), stating that interactive control systems encourage participatory decision-making and facilitate responsiveness to external changes, essential for generating innovative solutions. These findings confirm that interactive systems are essential for startups that want to implement major innovations in products or services.

Diagnostic control systems positively influence radical innovations, with a $p$-value of 0.000 and a $t$-value of 5.900, supporting H4. This evidence contrasts Lill and Wald (2021), who discovered that the boundary control system has a negative influence on the creation of innovation due to restrictions on freedom. Although diagnostic control systems have traditionally been used for operational control, this study shows that they also play an important role in supporting radical innovation. By tracking performance against predetermined goals, diagnostic control systems can ensure that innovative initiatives remain aligned with the overall strategic direction of the organization (Fazlan & Zulkarnain, 2023). These findings suggest that diagnostic control systems may seem rigid but can provide a stable foundation for innovative projects.

Radical innovation improves organizational performance; H5 is confirmed with a *p*-value of 0.000 and a *t*-value of 3.453. These results are consistent with Lyu et al. (2020), who showed that radical innovation provides startups with a competitive advantage, improves their effectiveness, and creates opportunities for market expansion. Radical innovation allows startups to differentiate themselves in the market, leading to increased market share, improved reputation, and long-term growth.

Diagnostic control systems positively affect performance (*p*-value = 0.003, *t*-value = 2.801), supporting H6. This suggests that diagnostic control systems, by focusing on monitoring and tracking performance, contribute to the overall success of startups. As pointed out by Shurafa and Mohamed (2018), a diagnostic control system ensures that the organization's operations are aligned with its strategic objectives. By providing timely feedback and enabling corrective action, they help startups stay on track and meet performance targets, especially in a fast-paced and competitive environment.

The interactive control system positively affected the performance; H7 is supported by a *p*-value of 0.008 and a *t*-value of 2.431. The role of interactive control systems in fostering collaboration and adaptability in startups contributes to better decision-making and faster response to external changes. As Dzvinchuk et al. (2021) point out, startups operating in unpredictable environments can leverage interactive control systems to innovate and stay competitive. By using interactive control systems to monitor performance and drive innovation, startups can achieve better operational efficiency and faster growth.

External stimuli directly affect organizational performance, with a *p*-value of 0.023 and a *t*-value of 2.000, accepting H8. External factors such as market dynamics, technological advancements, and competition directly impact a startup's ability to improve its performance. By effectively responding to these external stimuli, startups can strengthen their market position and build resilience to external shocks (Bastian et al., 2024).

Radical innovation mediates the relationship between interactive control systems and performance with the significant indirect effect of interactive control systems on performance through radical innovation (*p*-value = 0.014, *t*-value = 2.204), confirming H9. These findings highlight the importance of interactive control systems in facilitating innovation, which in turn leads to improved performance. Interactive control systems help startups generate new ideas and solutions, while radical innovations allow them to improve their market offerings and increase competitiveness.

Radical innovation mediates the relationship between diagnostic control systems and performance, and the mediating effect of radical innovation in the relationship between diagnostic control systems and performance (*p*-value = 0.002, *t*-value = 2.957) favors H10. These results emphasize the role of radical innovation in improving the effectiveness of diagnostic control systems. By aligning diagnostic control systems with radical innovation efforts, startups can improve their performance and adapt to market demand more effectively (Thneibat & Sweis, 2023).

The findings of this study have theoretical and practical implications. From a theoretical point of view, this paper contributes to understanding how management control systems (both diagnostic and interactive) facilitate radical innovation and improve startup performance. It expands on contingency theory by showing how external stimuli affect the adoption and effectiveness of different control systems. Practically, the study provides valuable insights for startup managers, emphasizing the importance of integrating diagnostic and interactive control systems to drive innovation and improve performance. Managers must pay attention to external factors, such as market trends and competition, and utilize control systems to align organizational strategies with these changes. By doing so, startups can increase their agility, drive innovation, and ensure long-term success.


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## CONCLUSION

This study investigates the interplay between external stimuli, management control systems (both diagnostic and interactive), and radical innovation in enhancing startup performance. The paper emphasizes the importance of three key elements (external stimuli, management control systems, and radical innovation) in driving both operational and strategic improvements in startup performance. The findings confirm that external stimuli, such as technological changes, market shifts, and competitive pressures, play a critical role in shaping the management control systems within startups. These control systems, once established, provide the framework necessary to drive radical innovation. This innovation, in turn, leads to significant improvements in organizational performance, both in the short and long term. The ability of startups to leverage radical innovation can result in increased market share, enhanced operational efficiency, and overall company growth, depending on the industry in which they operate.

However, to successfully implement radical innovation, startups must be adaptable, able to respond to an ever-changing environment, and willing to take calculated risks. This study underscores the need for startups to focus on environmental adaptability, develop effective management control systems, and foster radical innovation to achieve sustainable growth and competitive advantage. By aligning these three components, startups can ensure both operational excellence and long-term success.

This analysis also highlights the critical role of external influences and management control systems in promoting innovation and improving startup performance. Policymakers and business leaders should recognize the importance of fostering an environment conducive to innovation, which is vital for staying competitive in today's dynamic market. Future research could expand on these findings by exploring other forms of innovation, such as green or open innovation, particularly in larger organizations.

## AUTHOR CONTRIBUTIONS

Conceptualization: Arfah Piliang.
Data curation: Arfah Piliang, Meutia.
Formal analysis: Meutia.
Investigation: Arfah Piliang, Elvin Bastian.
Methodology: Arfah Piliang.
Project administration: Meutia, Munawar Muchlish.
Resources: Elvin Bastian, Munawar Muchlish.
Validation: Elvin Bastian.
Visualization: Munawar Muchlish.
Writing – original draft: Arfah Piliang.
Writing – review & editing: Meutia, Elvin Bastian, Munawar Muchlish.

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# APPENDIX A

**Table A1.** Questionnaire items

| Variable | Indicators | Source |
|---|---|---|
| External stimuli | Driving global restructuring/structural change. | Frezatti et al. (2017) |
| | The rise of the country and the decline of the market. | |
| | Economic and social threats to society. | |
| | Sacrifice of unavailable resources. | |
| | Competitor actions against the product. | |
| | Equipped to cope with the increasing level of business competition. | |
| Interactive Use | A proper understanding of innovation is considered necessary among top management. | Henri (2006), Frezatti et al. (2017) |
| | Managerial levels pay regular and constant attention to the concept of innovation and its discussion. | |
| | The information generated by the catalyst system is analyzed and/or debated in meetings with higher or lower officials and colleagues. | |
| | The system creates constant questions and then discussions about what information is available, what is expected, and what to do. | |
| | Projects based on innovation will be evaluated even after execution. | |
| Diagnostic Usage | The company officially develops the strategic master plan. | Frezatti et al. (2017), Baird et al. (2019) |
| | Organizational operations are carried out on an annual volumetric plan. | |
| | The budget is consistent and flows from the strategic planning process. | |
| | Pre-existing rolling forecasts require building projections to provide pre-existing financial results. | |
| | The capital budget consists of existing investment project plans. | |
| | Company has budget control management. | |
| | Executive variable remuneration depends, among other things, on individual performance that can be controlled through budget control. | |
| Radical Innovation | Develop new offerings to break through barriers and provide new services and products. | Piliang et al. (2023), Frezatti et al. (2017) |
| | New advanced technology is a more creation-oriented invention. | |
| | The level of uncertainty (exploration) is relatively high. | |
| | Sources of innovation, mainly individuals and line managers. | |
| | Start with a transparent informal process and rules. | |
| | An emerging strategic plan to pair itself with a newly developed invention. | |
| Performance | General effectiveness of the entity. | Frare et al. (2022), Ismail (2015) |
| | Balance sheet commercial perspective. | |
| | Market share for significant commodities over competitors. | |
| | Its operating efficiency and productivity ratio. | |


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