# Ambidextrous Innovation Capabilities, Antecedents and Performance

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***Abstract*--R&D intensive firms have faced many kinds of innovation dilemmas which firms have to develop both radical innovation to tap new opportunities and incremental innovation to enhance existing capabilities. The designed organizational structure allows to excel at both conflicting modes of innovation can be termed as organizational ambidexterity. However, how R&D intensive firms deal with various kinds of innovation dilemmas strategically still remain understudied. Based on the schools of organizational learning, strategic management, organizational design, and innovation studies, the study develops a notion of ambidextrous innovation capabilities (AIC) and AIC scale. AIC is formed by three dimensions: commitment, searching, learning and structure ambidexterity. And elaborates antecedents into three dimensions: corporate entrepreneurship, creative support and contingency reward. This paper proposes two hypotheses addressing the relationships between AIC and performance, antecedents and AIC. The survey generated 718 usable questionnaires responses in 68 BUs from 32 firms. The results show that AIC is positively associated with performance and antecedents are positively associated with AIC. In the future work, the paper concludes that the development of AIC could overcome innovation dilemmas, in turn enhance the performance. Firms could apply the proposed instrument to diagnose the condition of AIC in order to achieve higher performance.**

## I. INTRODUCTION

As competition has become increasingly fierce and product life-cycles is shortening [1], firms are facing difficult decisions in articulating innovation strategies, in particularly regarding dilemmas of innovation [27,28]. The accelerated rate of technological progress and complexity is constantly challenging existing strategies and organizational structures [25,48]. Previous research on innovation discussed innovation dilemmas such as short term vs. long term commitment [109], open vs. closed innovation dilemma [21,22], and aligned and adaptable structure dilemma [41,109], etc. Meanwhile, literature in organization has developed a theory of organization ambidexterity that responds to conflicting demands within organizations. The term *ambidexterity* is used as an archetype to describe an innovative capability to perform seemingly conflicting dilemmas or pursue disparate things simultaneously [69,109].

We argue that organisational ambidextrous capabilities to overcome innovation dilemmas are valuable innovation capabilities for firms to achieve better performance. We develop the concept of "ambidextrous innovation capabilities" (AICs) and further argue that in order to explain the complexity of innovation, a multi-dimensional construct of AICs, taking into account of innovation process, and their antecedents must be considered simultaneously. The paper contributes to the existing literature in the following aspects. Although literature in innovation pointed out problems resulted from innovation dilemmas, few placed emphasis on organisational solutions and their antecedents to these dilemmas. Similarly, despite literature in organization developed a theory of organizational ambidexterity to respond to conflicting demands within organizations, few addressed solutions to overcome the various innovation dilemmas simultaneously. Drawing from an original survey of R&D intensive firms, this paper investigates R&D intensive firms' ambidextrous organisational practices and their contributions in resolving dilemmas of innovation. The contribution of this paper therefore lies in the advancement of our understanding in organisational capabilities and their antecedents for an ambidextrous organisation that manages the various innovation dilemmas effectively and enhances firm performance. The results show that business units' AICs are positively associated with their performance. The study also identifies important antecedents such as creative support, corporate entrepreneurship and contingent rewards have positive impacts on business units' a AICs. This paper is organized as follows. The concepts of AICs and antecedents of organisational ambidexterity are developed in Section 2 and Section 3.The survey, the data and analysis are detailed in Section 4. Section 5 outlines the discussion. Finally, conclusion is presented in Section 6.

## II. THEORETICAL BACKGROUND

### *A. Ambidextrous innovation capabilities (AICs)*

Innovation capabilities are a set of firms' characteristics that facilitate and support innovation [14]. Scholars in innovation management have long regarded firms' innovation capabilities as key drivers for firm growth and performance. The contribution of innovation capabilities to growth and performance are realized through their ability to capture value from innovation. Such competences are significant for firms' performance in the market and the essential quality of such competences lies in their appeared causal ambiguity [88] difficult for competitors to imitate [86,104]. A wide range of studies have reported that strategy

[56,72], creativity [101], and project management [49,81], organizational capabilities [18] contribute to innovation.

In particular, recent research in organizational studies suggested organizational ambidexterity is a key quality for firms to perform better and be sustainable in industries where technology life cycles are short and uncertainty is high. Indeed, Firms often seek to be organisationally ambidextrous as they often encounter conflicting demands for resources [34,41,47,69,87]. Ref. [105] found that ambidextrous companies enjoy lower risks and lower exit rates.

Ambidextrous companies are also found to be positively associated with growth or performance [5,41,47,69,116]. Combining exploration and exploitation in knowledge searching results in a high rate of product innovations [58] and radical innovations [18]. Ref. [83] suggested that ambidextrous organisations tend to be more able to achieve their goals. Using R&D-related excess returns, ref. [84] showed that such returns for ambidextrous organisations not only persist for three to five years but also show little sign of diminishing.

This suggests that while existing literature in innovation discusses innovation capabilities and literature in organisational studies stresses the significance of organisational ambidexterity to innovation and performance, a core concept that interlinks the two schools of literature has been the AICs that function as innovation capabilities. We referred to such capabilities as AICs. In particular, ref. [109] defined organizational ambidexterity as "t*he ability to simultaneously pursue both incremental and discontinuous innovation…from hosting multiple contradictory structures, processes, and cultures within the same firm."* Because it particularly supports and facilitates innovation, we suggest that it is close to concept of AICs that we wish to develop. While ref. [109] highlighted the sets of contradictory capabilities to simultaneously pursue incremental and radical innovations, it might not be sufficient to address the complexity of innovation. Apart from incremental vs. radical innovation dilemma faced by innovators, research on innovation has explored other types of innovation dilemmas such as open vs. closed innovation dilemma [21,22] and aligned vs. adaptable innovation dilemma [41]. We thus argue that a multi-dimensional concept of ambidextrous innovation capabilities (AICs) that is a construct of firms' several dual innovative capabilities [4,20,23] would serve better to explain the complexity of innovation. The multi-dimensional concept of AICs is also more likely to qualify the quality of innovation capabilities in that they could create higher barriers to imitation. Based on the concept of combinative capabilities [60], firms combine different capabilities to maximize barriers to imitation. The ability to utilize different capabilities in different areas and domains would also involve routines [76] and coordination [61]. They are types of organizational capabilities that are tacit in nature and this helps to create causal ambiguity [88]. Competitors as outsiders therefore would not be able to figure out exactly what elements contribute the success of the focal firms and thus they are unable to duplicate the successful formula.

The concept of AICs takes a process view of innovation and acknowledges that innovation process is characterised with strategic planning, idea generation, idea screening, concept development and testing, business analysis, formation of the cross-functional team, product or service design, testing and pilot runs, marketing tests and commercialization [3,93]. For instance, at the stage of strategic planning, innovative firms could emphasize both long-term and short-term commitment [41] to overcome the incremental vs. radical dilemma; at the stage of implementation, innovative firms could emphasize both the mechanical and organic structure [37,41,109] to overcome the aligned and adaptable dilemma. These multi-dimensional aspects of AICs are based on arguments outlined above, ambidextrous commitment, searching, learning and structure that are able to conduct multiple dual innovation activities are expected to be perform better. This leads to the following hypothesis:

*H1: The greater ambidextrous innovation capabilities, the greater the performance is likely to be.*

*B. Antecedents and AICs*

Environmental conditions represent an important factor that affects firms' innovative capability [40,106,112]. Ref. [87] proposed that theory of innovation ambidexterity requires to consider simultaneous effects of contextual, structural and leadership characteristics in achieving ambidextrous innovation capabilities [18]. Ref. [41] suggested that the solutions of sustaining organizational ambidexterity can be both achieved through a top-down, structural ambidexterity way, and through a bottom-up, contextual ambidexterity approach. Studies on contextual ambidexterity and structural ambidexterity have also proposed that leadership is a critical factor in enabling innovation ambidexterity [18] .

Indeed, Ref. [41] suggested that organizational attributes shape individual and collective behaviours that in turn shape business-unit capacity. Organizations may develop ambidexterity through inter-organizational context such as creative support, corporate entrepreneurship, and contingent rewards [41,65]. Building on these arguments, this paper addresses these three antecedents that are relevant to enable contextual ambidexterity, structural ambidexterity and effective leadership and serve as antecedents. The three antecedents are outlined further below.

As few studies have empirically brought contextual ambidexterity, structural ambidexterity and effective leadership together to assess ambidexterity theory, this paper's contribution lies not only in the assessment of the antecedents of the three types of ambidexterity simultaneously, but also in uncovering the relationship between these antecedents and the AICs.

**1) Creative Support as contextual antecedent**

Ref.[54] found in their research that, if an organization could continuously transform itself and provide with definite vision and mission, it might reinforce its own competitiveness and thereby improve its performance. Ref.[41] focused on how organizations can create a supportive context in which individuals wear 'two hats' and make their own informed judgments about how they should allocate their time to meet the conflicting demands. It is manifested in the behaviour of hundreds of individual in the ways described above and in the unwritten routines that develop in organizations[41]. Contextual ambidexterity is referred to as an organizational capability that simultaneously demonstrates exploration and exploitation across an entire company [41]. Organizational scholars have acknowledged the importance of simultaneously balancing seemingly contradictory tensions [35,38,44,62,67,75]. Contextual antecedent is a set of processes or systems that encourage individuals to make their own judgments about conflicting demands to accomplish organisational contextual ambidexterity [34,73,109].

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*H2a: Creative support is positively associated with ambidextrous innovation capabilities*

**2) Corporate Entrepreneurship as structural antecedent**

Structural antecedents advocate a spatial separation of ambidexterity innovation into separate business units to be coordinated by integration mechanisms, task partitioning, temporal separation, and leadership [1,39,51,87,109]. The spatial separation acts as an efficient mechanism to stimulate organizational performance especially when environments were characterized by long periods of stability and disrupted by discontinuous change [109]. Thus structural differentiation could help ambidextrous organizations to maintain different competencies that might address conflicting demands [42]. However, inter unit coordination among units with different objectives could be very challenging [1,41,79]. One solution to this is to design an additional corporate structure that can balance the primary structure's shortcomings and support non routine tasks and innovation [43]. Corporate entrepreneurship could offer a solution to maintain a company's existing business and cope with emerging disruptive innovation [11]. Ref. [115] defines corporate entrepreneurship as *"the process by which teams within an established company conceive, foster, launch and manage a new business that is distinct from the parent company but leverages the parent's assets, market position, capabilities or other resources."*

The existence of corporate entrepreneurship helps organizations to maintain different competencies that address inconsistent demands [42]. Corporate entrepreneurship within organisations presents an ideal solution to support ambidextrous innovation. This leads to the following hypothesis:

*H2b: Corporate entrepreneurship is positively associated with ambidextrous innovation capabilities.*

**3) Contingent Rewards as leadership antecedent**

Contingent rewards refer to monetary incentives and recognition [95]. Ref. [83,41], ref. [41]and [109] suggested that supportive leaders, flexible managers and an aligned top management team are important antecedents underpinning any form of ambidexterity [18]. Transformational leadership and the development of a learning culture, characterized by psychological safety, openness to diverse opinions, and participation in decision making, promote ambidexterity at the team level [77]. While in an ambidextrous organisation, the exploration units may be small and decentralized with loose cultures and processes, the exploitation units may be larger and more centralized with tight cultures and processes [7], ref. [8] suggested that leaders play the role as facilitator to provide contextual support to members within the organization with diversified objectives.

To encourage team members to accomplish seemly opposite objectives and reduce conflicts, team contingent rewards could foster cooperation and create commitment to organisational goals [10]. Team contingent rewards could create an outcome interdependency among senior team members [96,114] and encourage them to achieve integrative value through identifying ways to use shared resources across exploratory and exploitative units [98]. According to [46], "leadership is the process of influencing others to understand and agree about what needs to be done and how it can be

done effectively, and the process of facilitating individual and collective efforts to accomplish the shared objectives" (p. 7). Therefore, this antecedent is so called *contingency rewards* leadership. Furthermore, team contingent rewards reduce interpersonal competition and facilitate negotiation and mutual adjustment necessary for exploratory and exploitative units to coexist [85]. Research showed that in ambidextrous organizations, executives use contingent rewards to transcend their unit's direct interests and achieve integrative value across exploratory and exploitative units (e.g. [98]). This leads to the following hypothesis:

*H2c: Contingent rewards are positively associated with ambidextrous innovation capabilities*

This paper identifies three antecedents of ambidextrous innovation capabilities. Contextual support is used as an antecedent of contextual ambidexterity. Corporate entrepreneurship is used as an antecedent of structural ambidexterity. Contingency reward is used as an antecedent of effective leadership to achieve ambidexterity. We hypothesise that these antecedents are positively associated with AICs. We also hypothesise that AICs are positively associated with performance. The overall framework is illustrated as Figure 1.

## III. METHODS

*A. Participants*

We target the participants are that R&D-intensive firms are characterized by a high rate of technological development and change, investment decisions are subjected to a number of complex issues relating to forecasting, understanding market conditions, and assessing industry evolution [59,99]. Thus R&D organizations have become multi-hierarchy, matrix-oriented, and complicated structures. R&D organizational structure has multiple-level R&D activities such as corporate R&D, business unit (BU) R&D, and functional R&D. A corporate R&D is the highest level and emphasizes innovation. A BU R&D is a medium level and focuses on both innovation and efficiency [108].

We lasted about 2.5 years for a total of 718 responses in 68 BUs from 32 firms. Innovation resources resulting from R&D input are also consistent with the relationships of organizational ambidexterity [98]. A cover letter explained the general nature of the research and provided assurances of anonymity and confidentiality. Most of our respondents sealed their surveys in envelopes provided and returned it to the authors. All measures originally in English used in the pilot and the two field studies were translated into Chinese and back-translated by two bilinguals following the procedures recommended by [12].

The paper collected the data using a comprehensive survey, and all items required five-point Likert-style responses, ranging from 1 ("strongly disagree") to 5 ("strongly agree"). To deal with potential problems associated with single-informant bias and common method bias, the research separated the measurement of the independent and dependent variables and collected data through multiple respondents. The ultimate respondents are consisted of 645 non-administrators and 73 administrators. The administrators served as senior R&D managers /BU heads/ CTO (VP) at the BU or departments offices in each firms. There were 559 male respondents (91% of the respondents).

*B. Measures*

***1) Performance***

The dependent variable - performance has four items requiring senior and middle management respondents to reflect on performance over the last three years, follows the work of [41]. (1) "This business unit is achieving its full potential", (2) "People at my level are satisfied with the level of business unit performance", (3) "This business unit does a good job of satisfying our customers", and (4) "This business unit gives me the opportunity and encouragement to do the best work I am capable of" [.84]. Principal component analysis demonstrated that all items loaded on a single factor having an eigenvalue of 2.56 and accounting for 65 percent of the variance. Internal reliability was high (α=.80).

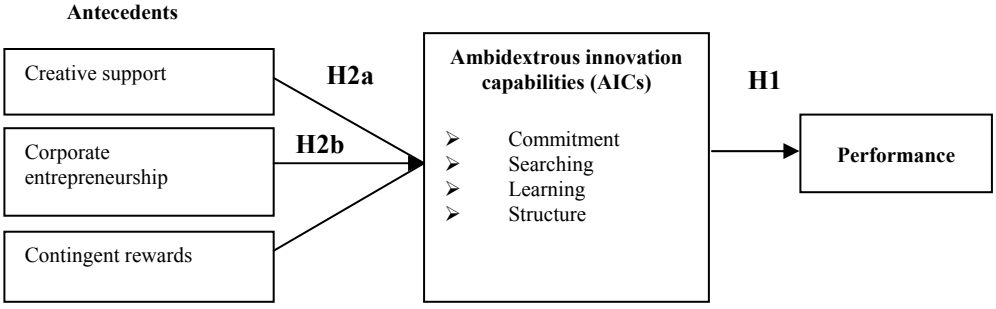


Figure 1 AICs, the antecedents and performance

***2) Ambidextrous innovative capabilities.***

Although the research conceptualizes ambidexterity as a multidimensional construct comprised of capabilities of ambidextrous innovative (that is, as commitment, learning and structure ambidexterity). The ambidextrous commitment and searching capabilities measures following those scholars are comprised of 6 items (e.g. Resource committed in development activities, etc.) [2]. The ambidextrous searching capabilities measures following those scholars are comprised of 5 items (e.g. External information exchange, etc.). The measures of ambidextrous learning and structural capabilities are comprised of 14 items (e.g. We frequently refine the provision of existing products and services, etc.) [47] and 6 items (e.g. Formalization, Stratification, etc.). And the Cronbach's α =.89, .73,.84 and .73, respectively).

***3) Antecedents***

The research will measure the antecedents by developing multi-item scales to represent the contextual antecedent of discipline, stretch, support, and trust identified by [87]. We use the factor "Creative support" be developed for contextual**.** The other factory referred to "Corporate entrepreneurial**",** represent a combination of the items will be developed for spatial separation and parallel structure**.** Finally, the leadership antecedent was measured with items adapted from [5,97,69]. The third factor representing a combination of the items developed for top management team explicit management of the balance and shift resource to support, are referred to as "Contingency reward". It represents the content of the items in this antecedents construct. There were 6 items to assess "Creative support" (e.g. A supportive environment in members' initiatives and entrepreneurship, etc.), and 6 items for "corporate entrepreneurship" (e.g. Availability of corporate fund, etc.) and 6 items for "contingency reward" (e.g. Leadership teams might successfully manage the contradictions that arise from structural separation in ambidextrous organizations, etc.) at the antecedents.

***4) Control variables***

Accounting for the heterogeneity of the sample, the study will be under control of the researcher by consideration of R&D and business unit size. The following variables— BU age, BU size, — were used as control variables. Ref.[30] have illustrated the role of small companies over the life cycle of the technology. They also showed that firm size does influence the innovation strategy and value capturing ability of firms on new technology. The study gives more control to firm size and age, as they have been found to influence firm growth [16,57,90,103].

***5) Confirmatory factor analysis (CFA)***

Using maximum likelihood estimation in LISREL [55], confirmatory factor analysis (CFA) investigated the items' factor structure because the items were derived in accordance with a priori typological scheme. This study conducted CFA to verify the proposed three–factor structure of innovation ambidexterity, including "Creative support", "corporate entrepreneurship" and "contingency reward" with acceptable Cronbach's α (0.88, 0.85 and 0.87, respectively). The overall chi-square test of model fit is statistically significant ($\chi 2$ (459) = 952.3, $p < .001$). The root mean square error of approximation (RMSEA) is .07 and the standardized RMR is .07. The normed fit index (NFI) is .91, non-normed fit index (NNFI) was .94, and the comparative fit index (CFI) was .95. The statistical significance of each estimated parameter is also assessed by respective t-values, and is found to be significant ($p < .05$). The completely standardized solution indicates the convergent validity of all measures is acceptable.

***6) Data Analysis***

This study constructed separate questionnaires to gather data for the independent (i.e., creative support, corporate entrepreneurship and contingency reward) and dependent variables (i.e., ambidexterity innovation capabilities and business performance) in order to avoid self-report and self-evaluation that can result in common method bias. To mitigate the potential problem of self-report bias, the senior managers filled out the questions about both business and innovation performance. To test the hypotheses, multiple regression analyses were performed to test the hypotheses. The issues used SPSS to estimate the hypotheses. First, the study included the control variables (i.e., BU size and BU age) to examine the AICs have three dimensions: commitment, searching, learning and structure ambidexterity capabilities. Subsequently, the results examined the relationships of the AICs, performance and antecedents. Average inter-rater agreement score ($\gamma$wg) was .70 for ambidextrous innovation capabilities, .70 for corporate entrepreneurship, .80 for creative support, .71 for contingent rewards leadership, which were well above the cut-off value of 0.70. The ICC(1) and ICC(2) values, were .19 and .71 for ambidextrous innovation capabilities, .16 and .68 for creative support,.11 and .70 for corporate entrepreneurship, .14 and .71 for contingent rewards leadership were obtained. Accordingly, aggregation was justified for these variables, and provided substantial support for the scales.

## IV. RESULTS

The means, standard deviations, and pairwise correlations for the variables in this study are listed in the Table 1. Since significant correlations were found among a number of the variables, the thesis further investigated potential multicollinearity using variance inflation factors (VIFs). The maximum VIF obtained in any of the models for substantive variables was substantially below the rule-of-thumb cut off of 2 for regression models (O'Brien, 2007) [80]. Therefore, multicollinearity was not considered an important issue for

these results. At the antecedents, the corporate entrepreneurship variable is significant and positively related to creative support (.383, p< .01), strategic alignment (.594, p< .01) and AIC (.705, P < .01). The creative support is significant and positively related to strategic alignment (.383, p< .01), AIC (.523, p< .01). The strategic alignment is significant and positively related to AIC (.786, p< .01) and performance (.344, p<. 01). The AICs variables is significantly related to performance (.419, p<. 01). Since significant correlations were found among a number of the variables, the paper further investigated potential multicollinearity using variance inflation factors (VIFs). The maximum VIF obtained in any of the models for substantive variables was substantially below the rule-of-thumb cut off of 2 for regression models (O'Brien, 2007) [80]. Therefore, multicollinearity was not considered an important issue for these results.

This research tested the hypotheses using hierarchical regressions and all the variables are presented in Table 2. Hypothesis 1 predicted that AICs is positively related to performance are presented. As depicted in model 2 (β = .425, p < .001), thus supporting Hypothesis 1. And, the coefficient for creative support in model 3 is positive and statistically significant with AICs (β =.325, p < .001), thus supporting H2a. The coefficient for corporate entrepreneurship is positive and statistically significant with AICs (β =.208, p < .01), thus supporting H2b. Finally, the coefficient for contingency reward is positive and statistically significant with AICs (β =.501, p < .001), thus supporting H2c.

## V. DISCUSSIONS

The discussions of those tests aim to propose a holistic framework addressing the ambidexterity issue and antecedents. The AICs include commitment, learning and structure ambidexterity. The paper findings also provide additional insight into the debate about the value of achieving high levels of incremental and radical innovation, versus a balance between the two, and achieving both simultaneously versus sequentially. Within the context of R&D intensive firms' BUs it appears that achieving simultaneously high levels of both types of innovation has a significant impact on BU's performance.

The empirical results highlight how leveraging innovation dilemmas and ambidextrous innovation capabilities are systematically related to innovation capacities in business unit level. The corporate entrepreneurship, creative support, and contingency reward are acting as the critical antecedents of ambidextrous innovation.

In this paper, the theoretical implications for the organizational ambidexterity are explored to examine the boundary conditions of innovation dilemmas. Firms are seeking to balance the innovation dilemmas in decision making since they usually encounter increasing conflicting demands of resources [13,34,41,47,69,87].

The AICs include commitment, learning and structure ambidexterity. Organization ambidexterity was defined as the ability of firms to pursue and synchronize short-term efficiency and long-term innovation, exploratory and

TABLE 1 DESCRIPTIVE STATISTICS AND CORRELATIONS

| Variables | Mean | S.D. | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|---|
| 1.BU size | 11.40 | 6.07 | | | | | | |
| 2. BU age | 47.49 | 40.65 | .021 | | | | | |
| 3.Corporate entrepreneurship | 10.75 | 1.16 | .072 | -.016 | | | | |
| 4.Creative support | 11.81 | .99 | .122 | -.128 | .383** | | | |
| 5.Contingency reward | 22.62 | 1.89 | .109 | .121 | .594** | .383** | | |
| 6.AICs | 67.32 | 4.58 | .151 | .089 | .705** | .523** | .786** | |
| 7. Performance | 33.33 | 7.93 | .076 | .221 | .212 | .233 | .344** | .419** |

N = 68 (Business units). $^{+}p < .10$; * $p < .05$; ** $p < .01$; two-tailed tests

TABLE 2 RESULTS OF REGRESSION ANALYSIS

| Variables | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| | Performance | Performance | AIC |
| BU size | -.072 | -.140 | .048 |
| BU age | .219$^{+}$ | .182 | .061 |
| AIC | **3.2.1** | .425***(H1) | 4 |
| Creative support | | | .325*** **(H2a)** |
| Corporate entrepreneurial | | | .208 ** **(H2b)** |
| Contingency reward | | | .501*** **(H2c)** |
| Δ $R^2$ | .054 | .175 | .149 |
| $R^2$ | .054 | .229 | .745 |
| Adjusted $R^2$ | .024 | .192*** | .724*** |
| ANOVA F | 1.821 | 6.231*** | 36.154*** |

A. For all models, N = 68. Standardized coefficients are shown.

B. Ambidexterity innovation capacities (AIC) is the multiplicative interaction of commitment, searching, learning and structure ambidexterity; $^{+}p \leq .10$; * $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$

exploitative innovation, organism and mechanism simultaneously [4,21,22,41,47,98,109]. The revisited methodology seemingly ought to be better for radical and incremental innovation strategy formulation.

Although prior research has focused on investigating the separate effects of tangible and intangible and formal and informal assets [66] on generating innovations, the paper argue below that in order to generate ambidexterity innovation, organizations need to bundle assets together in ways that will generate high levels of radical innovation and incremental innovation simultaneously. The paper develops a notion of AICs capacity that is formed by three dimensions: Commitment, learning, and structure ambidexterity.

The results provide some intriguing insights into how firms may be able to foster higher firm performance by using ambidextrous innovation capabilities (i.e., the attainment of high level of both incremental and radical innovations). Many scholars have also explicitly cited the need for additional researches that examine the effects of innovation dilemmas [34,41,47,69,87]. Ambidextrous innovation capabilities combine effects of incremental and radical innovation [47].

By observing the above systematic process theory and integrating the perspective of organizational ambidexterity, the AICs focus on the literature with regard to process theory addressing short-term (incremental) and long-term (radical) strategies [32,51,109] applied in motivation phases. The second invention phases extend and deliberate on explorative and exploitative learning [4]. And it is this combinative effect among these bundled resources and capabilities that enables the simultaneous pursuit of explorative and exploitative activities that lead to simultaneously generating multiple types of innovation including incremental and radical [45]. Finally, the theorization and labelling phases involves alignment and adaptability in organizational structure [41,67].

The results of the present study indicated that antecedents of AIC in those R&D intensives firms stimulated ambidextrous innovation capabilities for the business units. And the antecedents of AIC concern three factors: Corporate entrepreneurship, creative support, and contingency reward. For a comprehensive construct validation of the new scale, two studies were carried out. For one, the findings are in support with the contention that developing a concurrent function of antecedents is critical to create cross-unit synergies, and thereby organizational ambidexterity [65,69,107]. Second, when AICs pattern and performance are high, AICs will be satisfactory. This finding suggested that AICs capacity between internal and external would bring the R&D intensive firms to higher performance. This finding echoed [9] suggestion that considering three processes to be the separate and complement approaches in managing strategic contradictions. This is also similar to the finding of [87], a dual type allows both discrete orientations and fit across dimensions at the business unit (BU) level.

Additionally, antecedents that are not equivalent to AIC provide a defined approach for R&D workers to mitigate the conflict tasks. The finding is consistent with the results of [17] study arguing that structural ambidexterity and contextual ambidexterity complementarily support ambidextrous innovation activities. Of particular note, structural ambidexterity plays an important role in the initial stage of R&D activities, whereas the importance of contextual ambidexterity is greater in later stages. Maintaining close relationships with customers may lead to risk aversion, detraction from an organization's exploration and innovation capabilities (e.g., [29]. This is coupled with structural adaptation theory [6,53], a theoretical framework suggesting that groups experience more difficulty in adopting a cooperative mind-set toward (past) competitors than in shifting from a cooperative to a competitive mind-set. Thus, the present study suggests that BU exchanging a member with a competing group may have difficulty harvesting the innovation benefits typically (i.e., under non-competitive conditions) associated with membership change [26,78,117].

It suggests that those firms that are able to achieve high levels of both incremental and radical innovation by effectively bundle the appropriate set of capabilities will have a substantial competitive advantage, while those firms that are less capable of doing so will find themselves at distinct competitive disadvantage. The study further verifies that corporate entrepreneurship, creative support, and contingency reward as critical antecedents persuading BU leaders to pursue AICs. Specifically, cooperation and leadership have a stronger influence than contextual and structural in stimulating AIC among BU.

## VI. CONCLUSIONS

The present study designed an an AICs scale which was served to explore the relationships between current AIC and performance, and those between current AICs and antecedents. Furthermore, the notion of AICs was established according to three key factors: Commitment, learning and structure ambidexterity. The research results also suggested that firms seeking to reach close relationships with customers may face risk aversion, which may decrease organization's exploration and innovation capabilities (e.g., [29]).

AIC is a holistic framework addressing the ambidexterity issue. Ref. [86] defined capabilities as the cumulative results of an organization's overall learning, particularly a learning on how to coordinate production technologies dispersed throughout different locations and how to integrate diverse technologies. In other words, capabilities involve an organization's operating systems and delivery of values.

Support for our first hypothesis, which proposed that there would be a positive relationship between a higher level of innovation ambidexterity and business performance, lends support to prior research on managing apparent paradoxes such as managing exploitative and exploratory activities [67],

as well as prior research on managing ambidexterity [41,45]. Based on what this paper have found, it appears that greater business performance results from managing ambidextrously, investment in current products through exploitative activities, while at the same time creating a sustainable market position for the future through exploratory activities.

In addition, support for those hypotheses (H2a~H2c) that bundled capabilities would lead to higher AICs suggest that a bundle of capabilities provides a significant advantage over a collection of capabilities, even when those capabilities are complementary [45]. Apparently, it is the result of the bundling process that provides the ability to effectively foster multiple and conflicting activities simultaneously. Thus, while earlier studies have suggested that ambidexterity arises from valuable resources and core capabilities [36,104], this paper advances our knowledge of the relationship among resources, capabilities and innovation ambidexterity by suggesting that generating higher innovation ambidexterity requires that all three antecedents work together for a synergistic effect.

The main contribution of the present study is to involve relevant theory delineating distinct dimensions of ambidextrous organization in integrating three capabilities. More importantly, this thesis achieved its primary endpoint — demonstrating that R&D intensive firms maintaining ambidextrous organizations will align the administrators with the dual goal of aliment and maintain adaptive capability. Ultimately, the top managers should put into practice systems that allow supportive leadership to emerge, which in turn will motivate R&D engineers to achieve and maintain the dual innovation capabilities.

Indeed, the present study suggests "the BU levers" managers need to pull in order to overcome the dilemmas and competition that arise in developing two different types of innovations. Building an entrepreneurial culture appears to have an impact on developing not only radical new products, but also on incremental ones. Managing the dilemmas that crop up in organizations has been a source of fascination, as well as consternation, for management researchers for many years [70]. Moreover, AIC is critical for R&D intensive firms to leverage the impacts of AIC antecedents on BU performance.

The findings also provided top managers with some practical implications. The cooperation, contextual, structural, and leadership antecedents may facilitate the management of relationships between AICs and performance of technology-related firms. As such, organizations should routinely assess and monitor both two ends through the AICs. The implications for management and policymakers are formulated as follows. Ref. [113] proposed that ambidexterity yields long-term pay-outs rather than the short-term maximization of profits. This suggests that even generic resources are conserved rather than placed at risk when the potential benefits of risk taking are less salient, as is the case in an opportunity-laden environment. Ref. [87] also argued that ambidexterity studies should consider multiple performance dimensions.

Furthermore, as suggested by [87], environmental dynamism is found to moderate the relationship between organizational ambidexterity and outcome. This research has also been an attempt to take a peek inside the black box of relationships among a firm's capabilities, innovation ambidexterity, and performance. The paper was conducted by examining the possibility that ambidextrous innovation capability that plays an important role between antecedents with performance. The findings also suggest that this set of capabilities enable the organization to acquire information from sources that are both internal and external to the firm.

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