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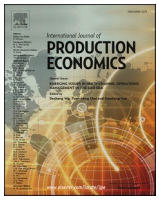

Revisiting the relationship between environmental and financial performance: The moderating role of ambidexterity in logistics

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ABSTRACT

Research has shown the need for business organizations to be ambidextrous, which means they should possess the ability to simultaneously exploit existing competencies and explore novel opportunities for improved organizational performance. Past evidence suggests that corporate environmental and financial performance may benefit from well-organized logistics operations. Meanwhile, the causality between the performances has been continuously debated, and the role of ambidexterity in the relationship is largely unexplored. We argue that ambidexterity in logistics operations enhances the link between environmental and financial performance. Using longitudinal data from Finnish manufacturing and trading firms, we applied regression analysis to test a theory-driven moderation model. Our findings indicate that ambidexterity in logistics operations affects the strength of the virtuous cycle between environmental and financial performance. Notably, the stronger the explorative orientation in logistics in a firm, the more enhanced the link between their environmental and financial performances. Overall, firms may find it challenging for their available resources to be employed for environmental and financial sustainability unless they are ambidextrous. Financial resources and environmental investments are necessary conditions but not sufficient for performance improvements in themselves; they need to be coupled with a desire to seek new, innovative solutions rather than just exploit existing practices. Combining exploitative and explorative orientations in logistics helps businesses meet divergent stakeholder expectations and translate their resources into performance. To this end, logistics operations should be organized to support organizational performance through an active search for new solutions as well as investments to develop both existing and new logistics practices.

1. Introduction

"*It's fairly intuitive that never exploring is no way to live. But it's also worth mentioning that never exploiting can be every bit as bad*" (Christian and Griffiths, 2017, p. 32). Settling for the safe and sound may be a guarantee of comfort and pose less of a risk, but it leads to the following questions: What if the grass is once again greener on the other side? When should one stop exploring? In this context, organizational ambidexterity, in general, refers to the ability to simultaneously exploit existing competencies and explore novel opportunities (O'Reilly and Tushman, 2008; Partanen et al., 2020). Specifically, Im and Rai (2008, p. 1281) defined exploitation as "*the use and refinement of existing knowledge*" and exploration as "*the pursuit of new knowledge and opportunities*." Organizations need to maintain a balance between exploitative and explorative activities to prosper (March, 1991). However, this is no simple task because the activities may be contradictory, emanating organizational tensions and raising the question of how these should be managed (Andriopoulos and Lewis, 2009).

Accordingly, researchers in the field of supply chain management (SCM) have investigated the proper modes of organizing activities for improved organizational performance. Studies in this context underline a need to develop dynamic capabilities that increase organizations' potential for configuring assets to adapt to changing business environments (Beske, 2012; Sabahi and Parast, 2020). In practice, this configuration is undertaken in exploitation and exploration activities (O'Reilly and Tushman, 2008), and may occur within the functional domain of a supply chain (Partanen et al., 2020). Moreover, SCM needs to leverage both current supply chain competencies and seek new knowledge and ideas in supply relationships (Kristal et al., 2010; Rojo-Gallego-Burin et al., 2020). Ambidexterity in supply chain processes, operations, and

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practices is a key component, among others, in enhancing organizational performance (Kilpi et al., 2018; Zhao et al., 2021).

However, ambidexterity, as such, is not exhaustive in terms of explaining performance. Instead, researchers should account for the interplay between various system variables and investigate how organizational factors are configured in relation to each other (Wilden et al., 2016). Similarly, there has been a call for holistic views within the continuing debate on the relationship between different types of organizational performance, particularly corporate environmental performance (CEP) and corporate financial performance (CFP). Here, studies showed mixed evidence of the causality between CEP and CFP, suggesting that the relationship may be better explained when various contingencies are considered (Endrikat et al., 2014; Hang et al., 2019). As for ambidexterity, organizational practices lay the foundation for environmentally sustainable cooperation between firms and further, CEP and CFP (Fang and Zhang, 2018; Agyabeng-Mensah et al., 2020). Nevertheless, the possible enabling or repressing role of ambidexterity in relation to practices or performances has not yet been considered.

In this paper, we make a novel contribution by proposing that ambidexterity in logistics operations plays a moderating role in (i.e., affects the strength of) the relationship between CEP and CFP. Within the SCM domain, logistics plays an important role in linking the two through the integration of various functions and the alignment of resources that already exist in the firm's supply chain network. Specifically, logistics is responsible for organizing the flow of goods through the supply chain, including operations related to, for example, transportation, warehousing, inventory management, and reverse logistics, and it may produce up to 75% of a firm's carbon footprint (Dey et al., 2011). Further, it may also help in economizing environmental efforts by improving efficiency, lowering costs, minimizing energy and resource consumption, and reducing waste generation (Zhu et al., 2012; Jørsfeldt et al., 2016).

Besides identifying ambidexterity in logistics operations as a boundary condition in facilitating the performance relationship and thus enriching the related theorizing (Goldsby et al., 2013), our study makes several further contributions regarding the CEP–CFP relationship. Given that there are relatively few studies that consider a *virtuous cycle* between these performances (Endrikat et al., 2014; Testa & D'Amato, 2017), we suggest that superior CFP allows firms to make investments in CEP, which in turn results in improved CFP. Moreover, many of the previous empirical studies have relied on the simultaneous measurement of CEP and CFP, which does not allow for the establishment of causal linkages but only mere associations (Endrikat et al., 2014). In this research, primary survey data on environmental performance are combined with secondary multi-year data comprising financial reports to test a set of causal hypotheses. The timespan of the longitudinal design was five years, from 2014 to 2018. We performed our empirical analysis on a sample of 146 Finnish firms in manufacturing and trading, including those within various size categories from small to large, as measured using turnover.

2. Theoretical background and hypotheses

2.1. Combining organizational attributes for performance

It is important for logistics and SCM researchers to identify the boundary conditions under which the examined relationships exist (Goldsby et al., 2013). From the perspective of a contingency approach, organizational performance outcomes depend on how well various intra- and inter-organizational structures and processes are aligned with one another (Lawrence and Lorsch, 1967). This alignment is supported by organizational processes that are related to the coordination or integration of activities, learning, and the transformation of assets in the face of change (Teece et al., 1997). Following a metaphor by Wilden et al. (2016), an organization is a house supported by these processes embedded in its pillars. With organizational strategy as the roof, operational capabilities as the joists, and enablers of dynamic capabilities as the foundations, they all contribute to the performance, or market value of the house.

While performance in itself may be viewed as a result of the successful bundling of organizational practices (Flynn et al., 2010; Rojo--Gallego-Burin et al., 2020), studies on the CEP–CFP relationship suggest there is a need to consider the factors in interaction with these performances. In particular, it was stated that improving the alignment between logistics and other functional areas of a firm has potential performance-related benefits (van Hoek et al., 2008). Accordingly, previous studies showed linkages between performance in logistics and CEP or CFP (Green et al., 2008; Laari et al., 2018). The importance of logistics is further underlined in how it is often understood to subsume or even substitute for the term "SCM" among practitioners (Halldórsson et al., 2008; Sweeney et al., 2018). In this manner, logistics includes not only management activities but also coordination and collaboration with channel partners (CSCMP, 2013). However, it is better suited to describe the operations of an individual organization than inter-firm-focused SCM (see Cooper et al., 1997).

When logistics is important for interorganizational performance, ambidexterity is useful in describing the way organizational structures and processes are matched to their environment (i.e., how the house survives through environmental turbulence; Wilden et al., 2016). In this context, the mutually supportive exploitative and explorative processes help organizations understand and capitalize on both existing and new markets (Cao et al., 2009). Further, Weiss and Kanbach (2021) combined organizational ambidexterity and dynamic capability logics in an integrated framework emphasizing how both structural and contextual approaches to ambidexterity may help foster simultaneous exploitation and exploration. According to the structural view, ambidexterity is achieved in interlinkages between organizational units for exploration and exploitation (O'Reilly and Tushman, 2008). Meanwhile, the contextual view posits that ambidexterity is derived from individual organizational actors thinking and acting in ways that enable the joint pursuit of related activities (Andriopoulos and Lewis, 2009; Patel et al., 2013).

Ambidexterity in a business process or function taps into both the structural and contextual views, directing attention from the sources of ambidexterity to where it becomes visible. Ojha et al. (2018) argued that ambidexterity in supply chain processes is achieved when business units tackle exploitative and explorative SCM practices simultaneously to stay competitive. Further, Kilpi et al. (2018) focused on ambidexterity in the purchasing and supply management function based on the exploitative and explorative orientations in the function. In this vein, logistics operations are important for their boundary spanning role that connects structural units and people together and may so exhibit ambidextrous characteristics.

2.2. Research hypotheses

2.2.1. Effect of CFP on CEP

The link between CEP and CFP has been widely debated in the literature. First, good environmental performance could be understood as a product of prior financial performance (Testa & D'Amato, 2017). The *organizational slack perspective* suggests that some firms have a surplus of financial resources that can be allocated to improving environmental performance (Waddock and Graves, 1997; Alexopoulos et al., 2018). Specifically, slack resources are excess resources accumulated by a firm to produce a given level of organizational output, such as labor, machinery, or opportunity costs (Nohria and Gulati, 1996). In this study, we follow the example of studies that consider financial slack resources as a measure of excess within an organization (Leyva-de la Hiz et al., 2018).

Researchers have stated that managers consider investments in environmental performance if there are enough financial resources (Testa & D'Amato, 2017; Alexopoulos et al., 2018). Even though a firm

may be committed to sustainability, there are inherent tensions between financial and non-financial performance, and companies differ in terms of how these tensions are resolved (Haffar and Searcy, 2019). Moreover, firms with limited financial slack may face a conflict between short-term profits and long-term sustainability (Staudenmeyer et al., 2002; Wang et al., 2016), whereas slack resources play a positive and stabilizing function and promote experimentation with different opportunities (Vanacker et al., 2017). Further, excess resources can be used to develop environmental innovations or test potential green market segments (Bowen, 2003). Thus, firms that do not have excess resources are less capable of improving CEP.

Stakeholders will not value a firm's efforts in environmental management if it does not meet their basic financial needs (Wang and Qian, 2011; Koh et al., 2014). If a firm is in financial distress, they expect it to improve the state of business operations instead of spending resources on sustainability causes. For example, liquidity constraints have been found to limit investments in pollution reduction (Earnhart and Lizal, 2006). In particular, in the early stages, firms face uncertainty regarding cash flows and costs, and hence are less likely to be concerned with corporate social responsibility (CSR) activities (Al-Hadi et al., 2019). With regards to solvency, investors may regard a firm with a high debt-to-equity ratio as too risky to invest in, which may disturb CSR activities (Choi and Lee, 2018).

Following the view that financial slack resources are represented in financial performance (Bradley et al., 2011), the first hypothesis is posited as follows:

H1. The prior level of CFP is positively associated with CEP.

2.2.2. *Effect of CEP on CFP*

Previous literature seems to be dominated by examinations of the causal relationship between CEP and CFP, leading to a win-win situation. According to the *good management perspective,* CEP can provide a competitive advantage that can translate into superior CFP (Porter and van der Linde, 1995; Hart, 1995). The basic assumption behind this logic is grounded in a combination of the resource-based view (RBV) and instrumental stakeholder theory. Specifically, the former maintains that CEP could be a valuable resource that improves CFP through cost reductions, product and process innovation, and improved company image, leading to higher sales and profit over time (Barney, 1991; Hart, 1995; Dangelico and Pontrandolfo, 2015).

On the other hand, instrumental stakeholder theory provides another theoretical angle by suggesting that environmental management can improve stakeholder relationships (Davis, 1973; Orlitzky et al., 2003; Molina-Azorín et al., 2009). By meeting stakeholders' environmental expectations, firms can acquire numerous sources of competitive advantage, such as reputations or long-term relationships with suppliers and customers (Endrikat et al., 2014). However, this assertion is contradicted by the proponents of neoclassical economic theory as they claim that investments in environmental issues violate firms' responsibility to create value for shareholders due to increasing costs (Friedman, 2002). However, it is widely accepted today that firms can obtain benefits from environmental performance (Wang et al., 2016).

Hence, the following hypothesis is formulated:

H2. The prior level of CEP is positively associated with CFP.

2.2.3. *The moderating role of ambidexterity in logistics operations*

Offering sustainable products or services is not possible without considering sustainability through the supply chain (Russo and Schena, 2021). Supply chain exploitation focuses on the traditional aspects of SCM, such as clearly defined and measurable targets, refinement of existing skills, and overall efficiency (Ojha et al., 2018; Partanen et al., 2020). This can lead to incremental innovation, which requires small changes to existing products and processes (Sahi et al., 2020). Further, an incremental but continued accumulation of knowledge in more environmentally friendly solutions can help firms identify regular opportunities to improve financial performance (Ramanathan, 2018). Therefore, exploitative orientation in logistics can minimize the additional costs associated with environmental practices.

Nevertheless, while companies' reliance on an exploitative orientation may improve their performance in the short term, they may fail to adapt to unexpected changes (Tamayo-Torres et al., 2017). Therefore, they also need capabilities to adapt to changes in their business environments (Ojha et al., 2018). New ideas and solutions can be identified through supply chain exploration, which is characterized by innovation, learning and uncertainty (Partanen et al., 2020). However, the benefits of exploration may be uncertain, far off in the future, and threaten current organizational structures (Sahi et al., 2020). Thus, the involvement of the logistics function is necessary to achieve these green process innovations, in particular, within production and logistics operations (Wong et al., 2020).

Additionally, attitudinal aspects may also play a part here as the way a firm approaches logistics is related to how it achieves its various goals. For instance, the extent to which members of the supply chain view it as an integrated entity is positively related to firm performance (Hult et al., 2008). Moreover, based on the RBV, Gligor et al. (2016) argued that resources can be leveraged for higher performance by adopting a supply chain orientation, which is a strategic choice to manage SCM-related activities. Accordingly, firms adopt different learning orientations depending on how they are oriented toward exploitation or exploration (Dasí et al., 2015), and organizational learning may be understood as a capability related to a positive link between CEP and CFP (Trumpp and Guenther, 2017).

The optimization of logistics can reduce adverse impacts on the environment and improve profitability (Agyabeng-Mensah et al., 2020). Accordingly, efficiency and innovation in logistics activities and operations are required to reduce emissions and resource consumption (Wong et al., 2020). However, the attainment of these attributes is complicated by the context of sustainability due to which it may be necessary to pursue seemingly contrasting objectives simultaneously (Haffar and Searcy, 2019; Nunes et al., 2020). In this context, we argue that ambidexterity in logistics operations is necessary to configure the relationship between CFP and CEP and put forth the third hypothesis. It is threefold as exploitation and exploration may require segregated efforts in the organization and either drive out or facilitate each other depending on how they are managed (Andriopoulos and Lewis, 2009). A theoretical model based on the hypotheses is shown in Fig. 1.

H3a. Exploitative orientation in logistics enhances the positive association between CEP and CFP.

H3b. Explorative orientation in logistics enhances the positive association between CEP and CFP.

H3c. Ambidexterity in logistics operations enhances the positive association between CEP and CFP.

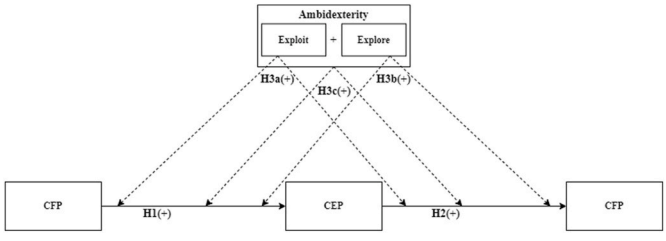

Fig. 1. A theoretical model of the relationships between CFP, CEP, and ambidexterity in logistics operations.

3. Methods

3.1. Data collection

Three measurement points were used in the longitudinal research design: (1) CFP data from 2014 to 2015 (Time 1, t_1); (2) CEP and ambidexterity survey data from 2016 (Time 2, t_2); and (3) CFP data from 2017 to 2018 (Time 3, t_3). Fig. 2 depicts the data-handling process.

The survey data was gathered via an online questionnaire as part of the national Finland State of Logistics Survey 2016). The sample frame comprised all nonstudent members of the Finnish Association of Purchasing and Logistics as well as members of the Finnish Transport and Logistics Association and those from the Federation of Finnish Enterprises who are active in the industries covered in the survey. The student members were excluded because they were not representative of firms dealing with issues in logistics and firm performance. Next, the questionnaire was pre-tested by academic researchers and selected industry experts from the participating associations. The final questionnaire was emailed to 22,946 people. The total number of responses was 1146 and the overall response rate was 5.0%. The survey covers a large proportion of the main industries, measured as a share of turnover, and the response rate of the survey is well in line with that reported in other surveys of a similar scale in the field of logistics (Wagner and Kemmerling, 2010).

Non-response bias was assessed in an independent samples *t*-test that compared early and late respondents (Armstrong and Overton, 1977). The two groups were compared across the measured variables, which revealed no statistically significant differences at $p < .05$ and indicated that non-response bias was not a concern. The content and substantive validity of the CEP and ambidexterity measures were addressed with reference to previous studies on scale development and using discussions about the individual items among members of the research group (Dunn et al., 1994).

The CFP measures were obtained from the Voitto+ database containing financial data from approximately 100,000 Finnish firms based on business identity codes. When we combined the financial data with the 1,146 survey answers, we ended up with 533 cases with available data on all measured concepts. Furthermore, all the CFP measures were not available at all four time points (2014 and 2015 for Time 1; 2017 and 2018 for Time 3), and after excluding responses with more than 25% missing variable data, we proceeded with 146 cases. 24.7% of the firms were small (with an annual turnover below €10m, as per the EU recommendation 2003/361; N = 36), 21.2% were medium-sized (turnover of €10–50m; N = 31), and 54.1% were large (turnover over €50m; N = 79). The largest subindustries included other specialized wholesale (N = 14), the manufacture of chemicals and chemical products (N = 12), and the manufacture of fabricated metal products (N = 10). Firms of varying sizes were included for a comprehensive view on the relationships studied, thus acknowledging how firm size is sometimes used to proxy firm-specific characteristics like performance

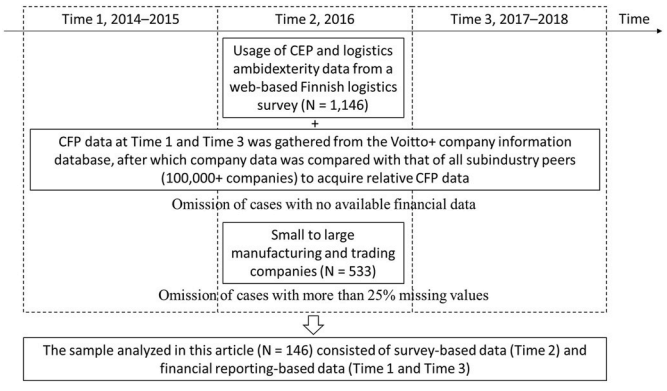

Fig. 2. Dataset and procedures used in this study.

(Endrikat et al., 2014).

Finally, we divided the dataset into two categories, based on the firms' industry category (manufacturing or trading) for missing data analysis. After Little's missing completely at random test (Little and Rubin, 2002), the missing value patterns were found to be random ($p = .517$ for manufacturing and $p = .333$ for trading). Then, we proceeded to impute 93 missing values (49 and 44, respectively)—2.6% of the final sample—using the expectation-maximization algorithm. Hence, the pooled sample used in this study comprised 146 firms in total.

3.2. Measures

In this study, there are three measured concepts: CEP, ambidexterity in logistics operations, and CFP. Specifically, outcome-based environmental performance is measured as the reduction of a firm's negative impacts on the natural environment. Here, the CEP measures were adapted from Laari et al. (2016), and each item was designed using a five-point Likert scale, in which 1 corresponds to "strongly disagree" and 5 to "strongly agree."

Ambidexterity was measured with items developed in line with previous research in the supply chain context (Azadegan and Dooley, 2010; Kristal et al., 2010). Here, the construct usually comprises a duality expressed as exploitation/exploration, each of which measures a specific orientation that an organization is disposed to adopt when faced with organizational issues (Birkinshaw and Gupta, 2013). In this context, respondents were asked to evaluate whether logistics and the development thereof in their organization were based on the intensification of current operations (i.e., exploitative orientation in logistics) or challenging these through seizing novel opportunities (explorative orientation in logistics). Here, it should be noted that comparable scales have been more recently employed by, for instance, Kilpi et al. (2018) and Partanen et al. (2020).

Further, ambidexterity in logistics operations was operationalized as the sum of the two dimensions, as has been done in previous research (Patel et al., 2013). In their meta-analytic review, Junni et al. (2013) found such combined ambidexterity to be positively associated with organizational performance. Furthermore, as noted by Venugopal et al. (2020), small firms, such as those included in our sample, may not have the resources necessary for finding an optimal balance between exploitation and exploration and may thus benefit more from a combined approach to ambidexterity.

Many of the previous studies have utilized market-based financial performance measures but using them requires firms to be publicly listed. As this is not the case for all the sample firms, we used accounting-based measures between 2014 and 2018. Additionally, it is argued that combining profitability, solvency, and liquidity factors provides the most useful standpoint for performance measurement across industries and sectors (Lan, 2012; Shaked and Altman, 2016; Huang and Wang, 2017). Moreover, the factor categories help avoid the selection of overlapping ratios and provide a concise but comprehensive set of quantitative factors that can signal noteworthy warning signs and superior performance (Chen and Shimerda, 1981; Waqas and Md-Rus, 2018). Here, reviewing these factors together provides the most representative picture of a company's relative position and helps in understanding the interrelations of different ratios (Dananti et al., 2017). Thus, we employ the following: 1) return on assets (ROA) to measure profitability; 2) gearing to measure solvency; and 3) quick ratio to measure liquidity.

The raw financial performance measures were normalized by comparing the sample firms to those in the respective subindustry in the database to provide each firm a rank (with zero assigned to the firm with the lowest value). The resulting rank was subsequently divided by the number of firms in the industry to obtain the final value for each measure. Thus, the used CFP measures are the average of a company's yearly values during Time 1 or Time 3. Meanwhile, previous research (e.g., Töyli et al., 2008; Laari et al., 2018) suggests that the normalization of

performance measures in relation to peers from the same industry reduces the impact of between-industry variance in logistics operations, cost structures, and competition on the analysis of the associations of interest. Consistently, we further controlled for the effect of industry (manufacturing or trading) on the dependent variables. The measures are described in Table 1.

3.3. Analysis

We conducted confirmatory factor analyses (CFA) to evaluate the validity and reliability of the CEP and ambidexterity scales. To this end, we examined the average variance extracted (AVE) and construct reliability (CR) values as well as the heterotrait-monotrait (HTMT) ratios of correlations for discriminant validity. The fit of the CFA model was assessed with the Tucker-Lewis index (TLI), comparative fit index (CFI), and root mean square error of approximation (RMSEA) (Schreiber et al., 2010).

Hypotheses were then tested with moderated regression analyses using the PROCESS 3.5 macro for SPSS as described by Hayes (2018). However, before proceeding to moderated regression, we tested for H1 and H2 in unconditional terms by estimating the regression model in Eq. (1). As Hair et al. (2010) noted, it may be useful for discussion to compare the results of such an estimation to the simultaneous entry of all variables, including the moderation term, when the effect of X has previously been tested in the former manner.

$$Y = b_0 + b_1X + b_2W + b_3C + e \quad (1)$$

The relationship between CFP at Time 1 and CEP at Time 2 was examined by defining Eq. (1) so that the estimate for CEP (Y) is based on the intercept b_0, the coefficient for CFP (X), b_1, the coefficient for ambidexterity in logistics operations, b_2, and the coefficient for industry (C), b_3. Next, to study the relationship between CEP at Time 2 and CFP at Time 3, CFP was redefined as Y and CEP as X. The error term is denoted by e.

Next, the variables and interaction term were simultaneously entered, and H3 was tested with estimations of moderated linear regression models based on Eq. (2).

$$Y = b_0 + b_1X + b_2W + b_3XW + b_4C + e \quad (2)$$

The terms in Eq. (2) otherwise remain the same as in Eq. (1), but b_3 is the coefficient for the product of X and W, and b_4 is the coefficient for C. The model was used to study both the relationship between CFP at Time 1 and CEP at Time 2, contingent on ambidexterity in logistics operations at Time 2, and the relationship between CEP at Time 2 and CFP at Time 3, contingent on ambidexterity in logistics operations at Time 2, by redefining the terms in the latter case. To improve the sensitivity of the ambidexterity measure, the models were also estimated by substituting ambidexterity in logistics operations (later Ambidexterity) with either the exploitative orientation in logistics (Exploit) or explorative orientation in logistics (Explore).

Table 1
Applied measures and their descriptions.

Research construct or item	Description
Corporate environmental performance[a]	*Average of responses on the items below on a scale from 1 to 5*
CEP1	Carbon dioxide emissions considering the volume of production have decreased
CEP2	Waste considering the volume of production/sales[b] has decreased
CEP3	Energy consumption considering the volume of production/sales has decreased
CEP4	Water consumption considering the volume of production has decreased
CEP5	Consumption for hazardous materials considering the volume of production has decreased
CEP6	Compared to our competitors, we have been a forerunner in environmental issues
Exploit	*Average of responses on the items below on a scale from 1 to 5*
EXPLOIT1	Continuous increasing of performance is the foundation of our logistics performance
EXPLOIT2	We continuously better the technologies and systems already in use in our logistics
EXPLOIT3	We actively develop the processes and practices in use to achieve increased logistics performance
EXPLOIT4	Identifying and removing inefficient practices is an essential function of developing our logistics
Explore	*Average of responses on the items below on a scale from 1 to 5*
EXPLORE1	Utilizing new and innovative practices is the foundation of our logistics performance
EXPLORE2	We continuously explore new ideas and practices to better our logistics performance
EXPLORE3	We often produce creative ideas that challenge the customary practices in our logistics
EXPLORE4	We actively utilize new technologies and systems in our logistics
Ambidexterity	*Exploit + Explore (scale from 2 to 10)*
Corporate financial performance	*Average of the industry percentile ranks in sample in t_1 or t_3 (scale from 0 to 1)*
Return on Assets (ROA)	(result before extraordinary items + costs of liabilities (12 months))/((balance sheet total of the newest balance sheet + balance sheet total of the previous balance sheet)/2)
Gearing	(interest-bearing liabilities - cash and marketable securities)/equity
Quick Ratio (QR)	current assets/(short term debts-advances received)
Control variable	*Dummy coding to represent the categorical data*
Industry	(1) Manufacturing or (2) trading

[a] Items CEP1–CEP5 represent firms in manufauring, while CEP2, CEP3, and CEP6 represent those in trading.

[b] Production refers to firms in manufacturing, while sales refers to those in trading (regarding items CEP2 and CEP3).

4. Results

Table 2 depicts the results of the CFA that was done separately for manufacturing and trading companies because partly different items were used depending on the industry. Within manufacturing, environmental management may improve a company's environmental performance by lowering wastes, effluents, and emissions in the production process (Hartmann and Vachon, 2018). However, the production-related issues did not apply to trading companies as such and were therefore modified to suit the context or excluded. The items excluded are marked with hyphens in Table 2.

Table 2
Confirmatory factor analysis results.

Items	Manufacturing	Trading
	AVE/CR Loading	AVE/CR Loading
Corporate environmental performance	0.54/0.85	0.52/0.76
- CEP1	0.70	–
- CEP2	0.81	0.73
- CEP3	0.75	0.88
- CEP4	0.68	–
- CEP5	0.71	–
- CEP6	–	0.51
Exploit	**0.52/0.81**	**0.65/0.88**
- EXPLOIT1	0.75	0.75
- EXPLOIT2	0.71	0.81
- EXPLOIT3	0.75	0.81
- EXPLOIT4	0.68	0.86
Explore	**0.55/0.83**	**0.61/0.86**
- EXPLORE1	0.70	0.81
- EXPLORE2	0.79	0.86
- EXPLORE3	0.77	0.73
- EXPLORE4	0.71	0.72

The CFA supported the hypothesized factor structure. All the factor loadings were statistically significant at the $p < .01$ level, and the AVE and CR values were above the suggested thresholds (>0.50 and >0.70, respectively) (Fornell and Larcker, 1981; Hair et al., 2010). Meanwhile, the AVE values over 0.50 also indicate discriminant validity among the constructs (Patel et al., 2013). This validity was further supported by the HTMT ratios remaining under a suggested threshold of 0.85 (see Table 3) (Henseler et al., 2015).

The fit statistics for manufacturing were TLI = 0.893, CFI = 0.915, and RMSEA = 0.087; for trading, TLI = 0.985, CFI = 0.989, and RMSEA = 0.037. As the TLI and RMSEA were below the suggested threshold of 0.90 (Lei and Wu, 2007) for manufacturing, we proceeded to compare the three-factor models with one-factor models to test whether the former fits the data better. Here, the fit statistics for the one-factor models were TLI = 0.479, CFI = 0.566, and RMSEA = 0.191 for manufacturing, and TLI = 0.719, CFI = 0.775, and RMSEA = 0.162 for trading. Thus, the three-factor model fit was better and deemed eligible.

Descriptive statistics are shown in Table 3. On the construct level, the CEP was significantly correlated with ambidexterity-related variables. Explore was also related to Gearing at Time 3 at the $p < .05$ level. Among the financial performance measures, most of the intercorrelations were statistically significant.

Next, we used the regression analyses to examine the main effects among the CFP–>CEP and CEP–>CFP relationships. Contrary to H1, none of the proposed CFP measures (ROA, Gearing, QR) at Time 1 significantly impacted CEP at Time 2, when the interaction between ambidexterity in logistics operations and CFP was not included as a predictor variable. The respective coefficients were $\beta = .030$ ($p = .909$) for ROA, $\beta = -0.353$ ($p = .206$) for Gearing, and $\beta = 0.050$ ($p = .852$) for QR. Similarly, not being strongly supportive of H2, CEP at Time 2 only impacted Gearing at Time 3 with $\beta = -0.046$ ($p = .090$), whereas it did not impact ROA ($\beta = -0.018$, $p = .475$) or QR at Time 3 ($\beta = 0.015$, $p = .562$) without the moderation term.

Meanwhile, partial support for H1 and H2 was provided when ambidexterity in logistics operations was included in the model as a moderator. Supportive of H1, ROA at Time 1 was significantly related to CEP at Time 2 at the $p < .10$ level when the relationship was moderated by Explore or Ambidexterity. QR at Time 1 predicted CEP at Time 2 at $p < .10$ when moderated by Exploit. As for H2, CEP at Time 2 was related to ROA and Gearing at Time 3 at $p < .05$ and $p < .10$, respectively, when the relationship was moderated by Explore. Likewise, the effect of CEP was significant on ROA when the focal relationship was moderated by Ambidexterity at $p < .10$. Detailed results of the simultaneous regression analyses are available in Appendix 1.

H3 was partially supported. Between Time 1 and Time 2, the CFP and ambidexterity measures were related to CEP in five of the model estimations. CEP at Time 2 was predicted by the following interactions: Exploit and Gearing or QR at the $p < .10$ level (supportive of H3a); Explore and ROA at $p < .05$ (H3b); and Ambidexterity and ROA or Gearing at $p < .10$ (H3c). Between Time 2 and Time 3, the CEP and ambidexterity measures were related to CFP in four of the model estimations. First, when only the explore-dimension of ambidexterity was included in the model, the interaction of Explore and CEP predicted ROA and Gearing at the $p < .05$ level (supportive of H3b). Secondly, the interaction of Ambidexterity and CEP predicted ROA and QR at $p < .10$ (supportive of H3c).

Then, we conducted simple slopes analyses to study the relationships between CEP and CFP contingent on the explorative orientation in logistics, which was related to the strongest coefficients among the ambidexterity-related interaction terms. Here, we used the Johnson-Neyman technique to solve for values of the moderator variable for which the effect of X on Y is significant (see Carden et al., 2017). We found statistical significance among the CFP–CEP–CFP relationships, especially when the firms scored either low (approx. <2; e.g., ROA–>CEP, CEP–>ROA) or high (approx. >4; e.g., ROA–>CEP, Gearing–>CEP, CEP–>Gearing) in Explore. The moderation effects are visualized in Fig. 3. As a general inference, the slopes imply that the stronger the explorative orientation in logistics, the more enhanced the link between a firm's CEP and CFP.

Regarding the overall model fit, F-tests for regression models predicting ROA or QR in Time 3 with CEP and ambidexterity measures in Time 2 did not provide support for rejecting the H_0 that the models with independent variables fit the data better than an intercept-only model. Although these sets of coefficients were not jointly statistically significant, it should not be interpreted as compromising the support for our hypotheses, where the main effects and interaction terms were significant separately (Woolridge, 2012).

A graphical illustration of the study model and results is shown in Fig. 4. Here, it should be noted the provided coefficients are based on separate estimations of the regression model (e.g., the moderator variables were not simultaneously introduced into the model).

Finally, we used a heteroskedasticity-consistent standard error (HCSE) estimator to alleviate concerns related to possible violations of the ordinary least squares model assumption of homoskedasticity, which states that the variance of regression standard errors is constant (Hayes and Cai, 2007). Here, we applied the HC3 (Davidson–MacKinnon) estimator that is preferred over others due to the results of, for instance, Cribari-Neto et al. (2005). Notably, the link between ROA at Time 1 and CEP at Time 2 in the Explore condition weakened (increases of coefficient p-values to $p = .121$ for ROA and $p = .086$ for the interaction term). Meanwhile, the link between CEP at Time 2 and ROA at Time 3 in the Explore-condition strengthened (decreases of p-values to $p = .007$ for CEP and $p = .010$ for the interaction term). The previously outlined results regarding the CFP–>CEP link assuming homoskedasticity of residual variance should thus be taken with a bit of caution, whereas the validity of the results regarding the CEP–>CFP link is further supported by the HCSE test.

Table 3
Variable means, standard deviations, intercorrelations, and HTMT results.

	M	SD	1	2	3	4	5	6	7	8	9	10
1. Corporate environmental performance	3.801	0.628	*1.0*	0.346/ 0.231	0.359/ 0.233							
2. Exploit	3.725	0.783	.233**	*1.0*	0.668/ 0.788							
3. Explore	3.230	0.799	.250**	.613***	*1.0*							
4. Ambidexterity	6.956	1.421	.263**	.896***	.900***	*1.0*						
5. ROA, t1	0.599	0.190	.005	-.036	-.022	-.032	*1.0*					
6. ROA, t3	0.594	0.173	-.059	-.090	-.010	-.056	.774***	*1.0*				
7. Gearing, t1	0.656	0.178	-.081	.046	.122	.093	-.245**	-.102	*1.0*			
8. Gearing, t3	0.630	0.193	-.098	.118	.164*	.157	-.089	-.119	.770***	*1.0*		
9. QR, t1	0.473	0.184	.022	-.009	-.005	-.008	.246**	.183*	-.480***	-.400***	*1.0*	
10. QR, t3	0.445	0.183	.049	-.044	-.032	-.042	.085	.103	-.404***	-.395***	.789***	*1.0*

On columns labeled 1–10: Interconstruct correlations squared (below the diagonal); HTMT ratios (above the diagonal, the values for "Manufacturing"/"Trading"). *p < .05, **p < .01, ***p < .001; two-tailed.

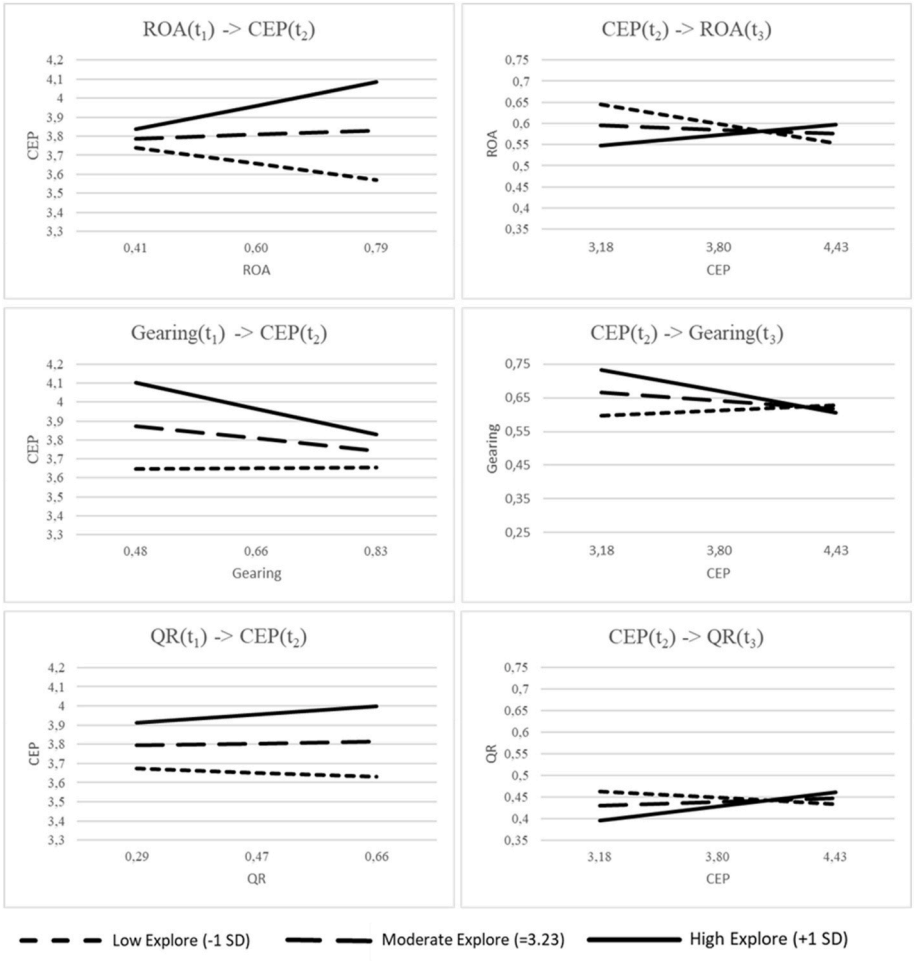

Fig. 3. Visual representations of the relationships between CFP, CEP, and Explore.

5. Discussion and conclusions

5.1. Theoretical implications

In this study, we introduced ambidexterity in logistics operations as a moderator of the CEP–CFP relationship. While many previous studies have overlooked the role of various contingencies in the focal relationship (Endrikat et al., 2014), our analysis revealed a more complex view. More specifically, the discrepancy between the findings in the existing literature may be partly explained by competing perspectives and causal directions. We tested causal hypotheses based on a virtuous cycle view which suggests the relationship between the two variables is bidirectional, i.e., CFP–>CEP–>CFP. We performed our empirical analysis on a longitudinal sample of 146 Finnish manufacturing and trading firms. Notably, we used a unique combination of survey and multi-year financial data from financial reports to study firms ranging from small to large corporations. We further contribute to the debate around the most appropriate CFP measures by measuring it in non-listed firms (Endrikat et al., 2014; Guenther and Hoppe, 2014). We also measured it as a three-dimensional construct to provide a comprehensive overview of superior relative performance. Thus, the results are able to provide a more holistic picture as compared to the majority of prior studies that focused on large publicly listed companies (Torugsa et al., 2012). Further, the results also suggest that CEP is a stronger predictor of CFP than vice versa.

Here, it is important to note that ambidexterity in logistics operations seems to be a significant factor in enhancing the proposed virtuous cycle of the CEP–CFP, as the results were less conclusive when its moderating influence was not considered. By ambidexterity in logistics operations, we refer to the simultaneous act of exploiting existing competences and exploring new opportunities in logistics management and collaboration with supply chain partners from the perspective of a single focal firm. Our results extend the ambidexterity discussion to a novel context and underscore the need to combine exploitative and explorative activities. Moreover, firms primarily perform exploitative activities (Table 3), whereas increased exploration balances these tendencies and facilitates the achievement of a beneficial performance outcome. As per the categorization by Weiss and Kanbach (2021), logistics falls into the category of "interlinked-ambidextrous," where exploration and exploitation contribute to the organization's potential for renewal of competitive advantage. To this end, logistics and ambidexterity are catalysts for enhancing other performance-generating operations within an organization.

Thus, ambidexterity in logistics operations provides an explanation for the existence of financial slack leading to a better CEP and a high level of CEP leading to improved CFP. The sole existence of slack may allow firms to satisfice with a sub-optimal solution while not actively searching for more advanced environmental solutions (Bowen, 2003). Moreover, many of the firms in our sample were SMEs, which represent a context where owners/managers are not always well-informed about the environmental impact of their firm and thus have challenges in employing financial resources to achieve environmental objectives (Gadenne et al., 2009). The explorative orientation in logistics may, in turn, influence how resources are used. Here, it is possible that these forward-looking companies are able to see the benefits of sustainability efforts in the long run to the point where resource-constrained firms may

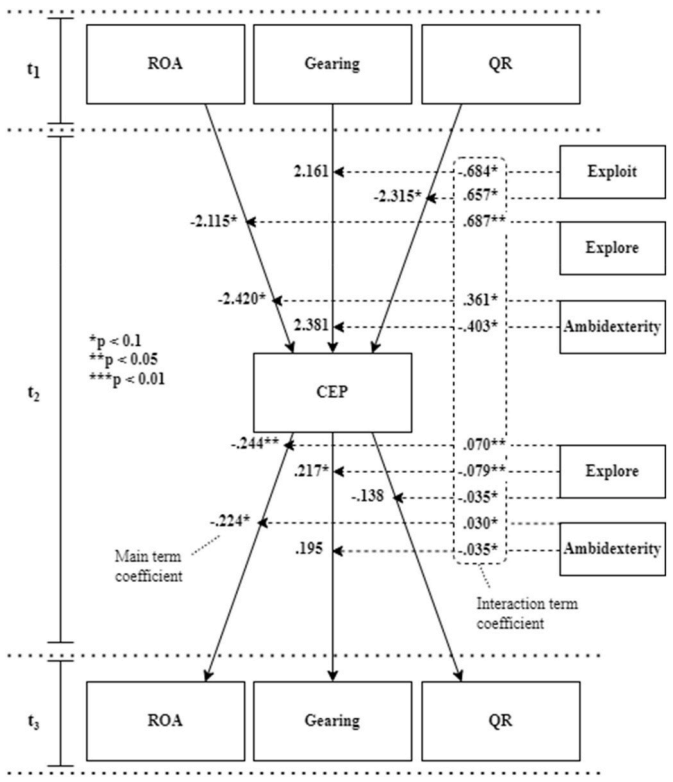

Fig. 4. Graphical illustration of the results (showing associations with $p < .10$ and the main effects related to the interaction term with $p < .10$).

be able to improve their performance with the help of ambidextrous logistics operations. As such, this creates a challenge that requires solving. Even though our results indicated that these firms would benefit from ambidextrous logistics operations, they may lack the resources to invest in them. Thus, to solving this issue would require improved knowledge from both inside the firm as well as their funding sources to secure the path towards a more ambidextrous approach.

Additionally, the results point to how ambidexterity may help organizations solve possible tensions related to their simultaneous pursuit of environmental and financial sustainability. Corporate sustainability logics are reflected in attempts to resolve tensions emanating from competing expectations across performance areas and stakeholders (Haffar and Searcy, 2019). We confirm Hahn et al.'s (2016) statement that combined ambidextrous activities are relevant in terms of performance in social matters and environments with stakeholder pressures. In particular, the explorative orientation in logistics may help organizations to perform well along every dimension of sustainability by supporting the exploitation of their still evolving resource bases. The simultaneous promotion of an innovative mindset in multiple domains, such as logistics or environmental performance, may provide firms with synergistic benefits in their ability to meet stakeholder expectations for organizational performance.

Therefore, developing capabilities to drive ambidexterity in logistics operations is an essential ingredient in the pursuit of a virtuous cycle between CEP and CFP. In a recent study by Vastola et al. (2017), the positive link between CEP and CFP weakened when the firm's cultural environment was inclined toward the avoidance of uncertainty. Based on such findings, it should be noted that firms should not be content with treating logistics as a matter of "business as usual" but embrace uncertainty as a possibility. In this context, explorative activities have positive performance implications notwithstanding the related risks. Nevertheless, other factors related to ambidexterity in logistics operations should not be disregarded. It may be very expensive for smaller firms to pursue exploitation and exploration because of the lack of scope, skills and leverage in supply chain relationships (Partanen et al., 2020).

5.2. Managerial implications

The moderating role of ambidexterity can be interpreted in such a way that excess resources alone are not enough to initiate a positive cycle between the performances, but rather that the resources should also be used to seek new solutions in addition to just exploiting the existing ways of operating. Thus, firms should pay attention to how they are oriented towards logistics and/or SCM—that is, whether they are prone to exploiting their existing logistics capabilities or utilize, produce, and explore new ideas and practices as well. Adopting an explorative orientation in logistics, especially, may prove beneficial when combined with CFP or CEP. An explorative approach to organizational issues may facilitate the accumulation of environmental awareness and provide impetus to environmentally friendly outcomes (see Gadenne et al., 2009; Dasí et al., 2015). This approach is fostered through actions such as investments in new technologies for improving logistics operations.

Furthermore, while the optimization of supply chains has increased efficiencies, the global COVID-19 pandemic has emphasized the shortcomings of the current system. Sabahi and Parast (2020) highlighted that innovative firms are more resilient to supply chain disruptions. Given that the number and intensity of climate shocks caused by global warming are likely to increase, there is a growing need to rethink logistics processes and practices (Sarkis et al., 2020). Hence, managers should ensure that the organizational climate is open and encourages the sharing of ideas in terms of ways to develop existing and new logistics practices, and consequently strengthen the relationship between CEP and CFP.

With regard to managerial practices, Ojha et al. (2018), for example, put forth that a propitious organizational environment for ambidexterity may be facilitated by transformational leadership. Following this notion, to ensure that exploitation and exploration occur, logistics managers should be able to articulate a vision to follow, embody models of appropriate behavior, and support other organizational members. Meanwhile, Patel et al. (2013) emphasized the importance of human resource management systems that encourage employees to actively monitor their environments and explore new opportunities. Our results indicate that it would be fruitful to direct such efforts towards managers and employees in charge of logistics for organizations to realize the benefits from the ambidextrous capabilities of their workforce.

5.3. Limitations and future research

One limitation of this research is the restricted geographic coverage of the sample. Although there are benefits associated with relying on data from a single country (e.g., no need to control for between-country differences or the possibility of gathering a unique dataset of comprehensive financial reporting data from a large number of SMEs), the results are limited in their generalizability. Hence, future studies could extend the scope of the analysis to geographically broader samples. Another limitation stems from the measurement of CEP, since the measures rely on the subjective assessment of the survey respondents. Objective environmental, social and governance (ESG) data is available for a growing number of typically large publicly listed firms, which future research could examine in parallel with perceptual measures. However, such data does not yet exist for smaller companies on a large scale. Furthermore, given that the focus here was on the relationship between environmental and financial performance, adding the analysis of social performance would be a natural next step.

The findings would further benefit from replications of the applied research design. The time period of our study was five years, but considering that environmental practices may be time-consuming to develop and capitalize on, even longer study periods could be well-grounded. For example, it would be interesting to see how the global

outbreak of the COVID-19 pandemic, which has had a devastating financial impact on many industries, has affected environmental performance. Finally, larger samples with a more detailed industry division would better reflect different tiers in the supply chain and elucidate the role of inter-firm action in the linkage between CFP, CEP, and ambidexterity in logistics operations.

Appendix 1

Results of the simultaneous regression analyses

		From Time 1 to Time 2			From Time 2 to Time 3		
		Y = CEP, C = Industry			X = CEP; C = Industry		
		X = ROA	Gearing	QR	Y = ROA	Gearing	QR
W = Exploit	Regression model	Coeff.; SE	Coeff.; SE	Coeff.; SE	Coeff.; SE	Coeff.; SE	Coeff.; SE
		t; p	t; p	t; p	t; p	t; p	t; p
	b_0	4.437; .761	2.079; .977	4.548; .667	1.193; .405	.044; .443	1.093; .428
		5.828; .000***	2.128; .035**	6.820; .000***	2.947; .004***	.099; .921	2.554; .012**
	b_1X	−1.685; 1.252	2.161; 1.482	−2.315; 1.320	-.156; .110	.115; .120	-.162; .116
		−1.346; .181	1.458; .147	−1.754; .082*	−1.422; .157	.952; .343	−1.393; .166
	b_2W	-.084; .204	.646; .267	-.117; .177	-.131; .108	.204; .118	-.182; .114
		-.412; .681	2.418; .017**	-.661; .510	−1.223; .224	1.734; .085*	−1.605; .111
	b_3XW	.465; .334	-.684; .394	.657; .359	.037; .029	-.043; .032	.047; .031
		1.391; .166	−1.737; .085*	1.829; .070*	1.262; .209	−1.345; .181	1.546; .124
	b_4C	-.262; .108	-.315; .108	-.280; .106	-.026; .032	-.001; .035	-.021; .033
		−2.427; .017	−2.926; .004***	−2.633; .009***	-.832; .407	-.030; .976	-.617; .538
	Summary	R^2 = .107	R^2 = .124	R^2 = .116	R^2 = .020	R^2 = .058	R^2 = .024
		MSE = .363	MSE = .356	MSE = .359	MSE = .030	MSE = .036	MSE = .034
		F (4, 141) = 4.208	F (4, 141) = 4.981	F (4, 141) = 4.604	F (4, 141) = .719	F (4, 141) = 2.170	F (4, 141) = .869
		p = .003***	p = .001***	p = .002***	p = .581	p = .076*	p = .485
W = Explore	b_0	4.776; .684	2.738; .745	3.846; .593	1.596; .394	-.303; .436	1.030; .423
		6.984; .000***	3.672; .000***	6.482; .000***	4.050; .000***	-.697; .487	2.435; .016**
	b_1X	−2.115; 1.075	1.224; 1.102	-.637; 1.079	-.244; .104	.217; .115	-.138; .112
		−1.968; .051*	1.110; .269	-.590; .556	−2.347; .020**	1.891; .061*	−1.232; .220
	b_2W	-.220; .211	.520; .233	.089; .175	-.284; .119	.338; .132	-.191; .128
		−1.040; .300	2.236; .027**	.508; .612	−2.376; .012**	2.560; .012**	−1.488; .139
	b_3XW	.687; .334	-.494; .345	.216; .327	.070; .031	−0.079; .034	.047; .033
		2.059; .041**	−1.432; .154	.660; .511	2.264; .025**	−2.310; .022**	1.403; .163
	b_4C	-.242; .106	-.278; .106	-.270; .107	-.023; .031	.001; .034	-.021; .033
		−2.280; .024**	−2.620; .010**	−2.527; .013**	-.735; .463	.021; .983	-.620; .536
	Summary	R^2 = .130	R^2 = .124	R^2 = .106	R^2 = .049	R^2 = .067	R^2 = .023
		MSE = .353	MSE = .356	MSE = .363	MSE = .029	MSE = .036	MSE = .034
		F (4, 141) = 5.249	F (4, 141) = 4.967	F (4, 141) = 4.195	F (4, 141) = 1.813	F (4, 141) = 2.519	F (4, 141) = .816
		p = .001***	p = .001***	p = .003***	p = .130	p = .044**	p = .517
W = Ambidexterity	b_0	4.753; .809	1.811; .987	4.146: .682	1.485; .432	-.266; .473	1.166; .459
		5.876; .000***	1.836; .069*	6.078; .000***	3.438; .001***	-.562; .575	2.539; .012**
	b_1X	−2.420; 1.303	2.381; 1.495	−1.664; 1.295	-.224; .116	.195; .127	-.176; .124
		−1.858; .065*	1.592; .114	−1.285; .201	−1.927; .056*	1.536; .127	−1.423; .157
	b_2W	-.097; .117	.385; .145	-.003; .096	-.115; .061	.155; .067	-.109; .065
		-.826; .410	2.648; .009***	-.031; .976	−1.866; .064*	2.306; .023**	−1.665; .098*
	b_3XW	.361; .188	-.403; .216	.253; .187	.030; .016	-.035; .018	.027; .017
		1.920; .057*	−1.860; .065*	1.354; .178	1.817; .071*	−1.938; .055*	1.580; .116
	b_4C	-.246; .106	-.304; .106	-.276; .106	-.024; .031	-.002; .034	-.020; .033
		−2.318; .022**	−2.875; .005***	−2.610; .010**	-.760; .448	-.046; .964	-.598; .551
	Summary	R^2 = .135	R^2 = .144	R^2 = .124	R^2 = .033	R^2 = .070	R^2 = .026
		MSE = .351	MSE = .348	MSE = .356	MSE = .030	MSE = .036	MSE = .034
		F (4, 141) = 5.515	F (4, 141) = 5.910	F (4, 141) = 4.999	F (4, 141) = 1.196	F (4, 141) = 2.660	F (4, 141) = .941
		p = .000***	p = .000***	p = .001***	p = .315	p = .035**	p = .442

From Time 1 to Time 2: CEP = b_0 + b_1CFP + b_2Ambidexterity + b_3CFP*Ambidexterity + b_4Industry + e.
From Time 2 to Time 3: CFP = b_0 + b_1CEP + b_2Ambidexterity + b_3CEP*Ambidexterity + b_4Industry + e.
*p < .1, **p < .05, ***p < .01.

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