Journal of Management Studies 41:6 September 2004
0022-2380

Exploring Exploration Orientation and its Determinants: Some Empirical Evidence*

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ABSTRACT Adopting an information-process perspective, this article conceptualizes exploration orientation in terms of scope of information acquisition. In line with this conceptualization, a multidimensional operational measure of exploration orientation is developed and its internal consistency established. The measure appears to have nomological validity in that it behaves as predicted with measures of variables hypothesized to be related to exploration orientation. Consistent with the emerging co-evolution framework, environmental pressures as well as managerial intentions are found to influence an organization's exploration behaviour. Specifically, empirical results indicate that more environmental dynamism, a stronger organization mission, a prospector orientation and larger slack resources are associated with a greater exploration orientation. Implications, shortcomings and future research directions are discussed.

INTRODUCTION

There is growing interest in the role of knowledge in creating and sustaining competitive advantage. This has placed exploration firmly at the centre of researchers' agenda, because the extent to which an organization engages in exploration is thought to influence learning, knowledge generation, innovation and performance. Given this importance of exploration to organizational well being, one would expect to find a tradition of systematic research, cumulative theory building and a related set of empirical findings in the literature. This sadly is not the case. Although some important conceptual work (Lewin et al., 1999; March, 1991) has appeared over the years, empirical research has conspicuously lagged behind.

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Some recent contributions notwithstanding (McGrath, 2001; Rosenkopf and Nerkar, 2001), there is little by way of empirically validated understanding of the factors affecting exploration and how differences in exploration relate to performance. More fundamentally, there is no generally accepted measure of exploration orientation that could be used for testing substantive hypotheses in different research contexts. The present study seeks to fill some of the gaps evident in the literature.

Approaching exploration from an information-processes perspective (Huber and Daft, 1987), we advance a multidimensional instrument to measure exploration orientation (i.e., the level of exploration in an organization). The instrument is anchored in the argument that exploration orientation is in a key fashion about information-acquisition scope. Scale reliability and unidimensionality properties are ascertained and the instrument is used to test an initial set of hypotheses regarding factors affecting exploration orientation. The hypotheses testing is motivated in part by the necessity of establishing nomological validity of the exploration measure. Any definite proof of the degree to which a measure corresponds to a construct must ultimately come from determining how well that measure fits lawfully into some theoretical network of expected relations (Nunnally, 1967; Venkatraman and Grant, 1986). This study represents the first stage of a multi-phase project. In other research, we intend to expand our structural model to also examine the performance consequences of differences in exploration orientation. The study achieves two goals. First, it helps build a foundation for systematic empirical research into exploration by providing a measurement instrument. Future scholars could use the instrument to operationalize exploration in their specific research contexts, which should foster aggregation and comparison of findings. Or indeed, if deemed desirable, future scholars could attempt to further extend the instrument developed and tested here to cover additional construct facets. Second, the study contributes to extant literature by identifying and verifying some important antecedent conditions affecting exploration levels.

In the theory section below, we first conceptually anchor our research in the emerging co-evolution framework. This reflects our belief that organization behaviour and strategy represent the combined result of environmental effects and managerial intentions. Therefore, exploration orientation is modelled as a joint function of both. We then focus on the domain of exploration-orientation construct. Three key dimensions of the construct are identified in the form of supply-side, demand-side and geographic information-acquisition scope. Next, we advance our arguments and hypotheses with regard to antecedents of exploration orientation. The methodology section provides details of our sample, data collection procedures and measurement instruments. This is followed by a presentation of our analysis and results. Lastly, we discuss our research and formulate tentative conclusions.

THEORETICAL BACKGROUND

Co-evolution and Exploration Orientation

The co-evolutionary perspective is emerging as an important organizing framework for inquiring into organizational conduct and outcomes as a joint function of managerial efforts and selection pressures imposed by the environment (Lewin and Volberda, 1999; Volberda and Lewin, 2003). This is in contrast to prior perspectives in which the focus has been on firm-level adaptation either as a function of managerial intentions (e.g., strategic choice theory) or as a function of population-level selection–variation–retention processes with managerial intentions playing little if any role in the adaptation process (e.g., organization ecology theories). A central idea of the co-evolution framework is that organizations and their environments co-evolve by a process characterized by multidirectional influences among an organization, its environment and other interacting organizational populations (Baum, 1999; McKelvey, 1997). Adaptation is specifically viewed to take place through idiosyncratic exploration and exploitation processes at the organization level. These processes are linked to environmental changes at the population level (Lewin et al., 1999). Further, both exploration and exploitation are deemed critical from the viewpoint of organizational survival and prosperity (March, 1991).

Observation suggests that organizations may not be equally exploration oriented. Cognitive psychologists in fact report that organizations in a variety of industries exhibit competitive myopia – a tendency not to engage in exploration by disregarding new but distant developments. Instead of exploration, these organizations monitor and react incrementally to the actions of a small group of similar competitors (Porac and Thomas, 1994). Such myopia has been held responsible for not only various instances of organizational failure but also decline of whole industries (Levitt, 1960; Porac and Thomas, 1994). An under-emphasis on exploration is also indicated by empirical studies rooted in population ecology and evolutionary theory. In contrast to this, there is contradictory evidence available that some organizations are quite exploration oriented. Management and popular literature report companies such as 3M, Hewlett Packard, General Electric and Motorola that have been able to maintain an enduring focus on exploration resulting in successive series of successful innovations and sustained competitive advantage. Volberda (1998) indicates that some companies seem to have developed structures and cultures promoting high levels of exploration. A similar picture of exploration orientation emerges from the literature on innovation (e.g. Brown and Eisenhardt, 1997) and strategic types (e.g. Miles and Snow, 1978) in which prospector organizations show a non-stop tendency towards proactive, experimental behaviour.

If some organizations are more inclined towards exploration and others less, the question arises why? Answering this is crucial not only from the perspective of

augmenting academic knowledge but also from the standpoint of advising practice. Below we develop and test hypotheses regarding potential environmental and organizational determinants of exploration orientation. First however, we focus on the conceptual domain of exploration-orientation in order to develop a suitable measurement scheme for the construct. So far, in the absence of a reliable measure of exploration, substantive research has had to rely on different ad hoc indicators of exploration. For example, while McGrath (2001) measures exploration by using a multi-item scale with its focus on newness manifested in a project, Rosenkopf and Nerkar (2001) use patents in the optical-disc industry to assess exploration and its impact. The usage of different indicators is problematic in that it makes it difficult to compare findings of different studies. Against this backdrop, we propose a multidimensional measure of exploration orientation.

Information Acquisition and Exploration Orientation

Ideas and expressions often used to illuminate the nature of exploration include search, variation, experimentation, flexibility, innovation and risk-taking (Lewin et al., 1999; March, 1991). The essence of exploration has been characterized as pursuit of new knowledge and boundary-spanning search for discovery of new approaches to technologies, businesses, processes or products (Levinthal and March, 1993; McGrath, 2001). Implicitly knit into the notion of exploration is the idea of greater or lesser scope of external information acquisition. Clearly, the presence or absence of search efforts implies that information from the external environment is respectively sought or not sought to be brought into the boundary of the organization. This centrality of information acquisition to exploration is evident in several theoretical perspectives. It is framed as the importance of gaining fresh information to improve present and future returns in rational-choice models (Radner and Rothschild, 1975); as target or aspiration-dependent collection of information in bounded-rationality models (Simon, 1955); as absorption of external information in models of learning and innovation (Levinthal and March, 1993); and as quest for new routines or practices to increase survival odds in evolutionary models (Nelson and Winter, 1982). In view of this, it makes intuitive sense to explicitly conceptualize exploration in terms of information-acquisition actions. Following our argument, one could then say that the broader the scope of external-information acquisition the more exploration oriented the organization and the narrower such scope the less exploration oriented the organization.

Our emphasis on information-acquisition scope is consistent with recent strategy research in which a distinction is drawn between local and boundary-spanning search. Building on March and Simon (1958) and Nelson and Winter (1982), Stuart and Podolny (1996) define local search as the behaviour of a firm to search for solutions in the neighbourhood of its current expertise or knowledge. Martin and Mitchell (1998) show that local search leads incumbents to introduce

designs that are similar to those incorporated in their existing products. Rosenkopf and Nerkar (2001) argue that by indulging in local search a firm focuses on similar technology, creates incremental innovations and becomes more expert in its current domain. This enables the firm to build so-called 'first-order competences' over time. While these competences may lead to competitive advantage, the snag is that environment change could turn them into competency-traps (Levitt and March, 1988) or core-rigidities (Leonard-Barton, 1992). In contrast to local search or local exploration, Rosenkopf and Nerkar (2001) portray boundary-spanning exploration to be based on obtainment of knowledge from beyond local organizational and technological domains. This latter type of exploration is surmised to lead to 'second-order competences' or the ability of a firm to create new knowledge through recombination of knowledge across domains.

Our conceptualization of exploration orientation follows the above-summarized literature. It however extends extant literature by focusing systematically on scope of search along not only the supply-side of competition (production facilities, technologies and products are illustrative of supply-side aspects), but also the demand (customer needs, customer groups and substitutes are illustrative of demand-side aspects) and spatial (different geographic regions or markets represent the spatial aspect) facets of competition. Accordingly, exploration orientation is regarded as a construct with three integral dimensions: supply-side information-acquisition (SSIA), demand-side information-acquisition (DSIA) and geographic information-acquisition (GIA). An organization of course may be more or less exploration oriented with reference to each dimension. To illustrate, one organization may be comparatively less exploration oriented on the geographic dimension, which would manifest itself in a narrow information-acquisition scope centring on monitoring of customer, product and process developments in served geographic regions only. In contrast, a competitor may be relatively more exploration oriented on the geographic dimension, which would be visible in a broader information-acquisition scope such that changes in the served geographic regions as well as regions not currently served are monitored. As organizations may be more or less exploration oriented on each dimension, clearly all three must be jointly considered for assessing the overall degree of exploration orientation.

Although emphasis above has been on interpreting exploration orientation in terms of information acquisition, it needs to be recognized that exploration as conceived in this study and in prior work is also in an important way about pursuit of knowledge, experimentation and risk-taking. The explicit focus on information acquisition is justified however because bringing in of external information would appear central to knowledge pursuit and experimentation. Moreover, information acquisition, especially when it is broad in scope, entails risk inasmuch as the outcomes of resource commitments to it are uncertain, distant and often negative (see March, 1991). From a measure-development viewpoint, the information focus is helpful as it provides a parsimonious foundation to operationalize exploration.

Importantly, the focus permits us to develop a measure that does not unnecessarily overlap with measures of conceptually related constructs such as strategic orientation and innovation, which often include items pertaining to experimentation and risk-taking. This lessens the danger that any significant effect found between exploration and related constructs may be a methodological artefact due to overlapping items rather than a true relationship. We leave it to future work to ascertain whether an operational measure of exploration should be expanded to also explicitly include knowledge, experimentation and risk-taking items.

Determinants of Exploration Orientation

Environmental dynamism. Much of organization theory on environment concentrates on its dynamism feature, which is usually defined as the degree of unpredictability of environment change (Dess and Beard, 1984). Scholars observe that a general outcome of increased dynamism is higher managerial uncertainty (Dess and Beard, 1984; Duncan, 1972). This is argued to induce more extensive information search with a view to lessen uncertainty and to manipulate the environment (Daft and Weick, 1984; Dutton et al., 1983). Uncertainty is arguably reduced when information search proceeds beyond data acquisition and starts providing interpretations (Elenkov, 1997). The preceding suggests that higher levels of dynamism are likely to lead to a relatively greater exploration orientation. Organizations would want to diminish uncertainty by expanding the scope of information acquisition and gathering more boundary-spanning data in order to come up with new and timely approaches to deal with external developments. Indeed, the more dynamic the environment and hence more severe the environment selection regime, the more important for an organization to have a greater exploration orientation in order to adapt effectively. As such, the following hypothesis:

> *Hypothesis 1*: The greater the environmental dynamism, the greater the exploration orientation of an organization.

Organization mission. Besides the environment, managerial intentions matter too. A key construct in this context is organization mission, defined as organization-wide shared agreement on the vision, business domain and competencies of an organization (cf. Campbell and Yeung, 1991; Sidhu, 2003). Learning literature suggests that organization mission affects exploration because of its positive influence on information processes. Arguably, it provides the necessary groundwork capable of sustaining greater exploration. Slater and Narver (1995) indicate that organizations guided by a shared vision are able to continuously engage in acquisition of boundary-spanning information, which facilitates single and double-loop learning. In contrast, in organizations without a shared vision, expansive information search is likely to prove difficult to implement. Fiol (1994) states: 'learning in organiza-

tions entails not only the acquisition of diverse information, but the ability to share common understanding to exploit it'. Plausibly, a strong organization mission functions as an effective collective context that can enable the increased information acquisition implied by a greater exploration orientation. In contrast, divergent and conflicting interpretations about the organization, its direction and its environment are likely to hinder execution of organized actions to gain large amounts of diverse information. At best, lack of a strong organization mission may lead to localized ad-hoc and haphazard actions, which would not be in the true spirit of exploration. At worst, and perhaps more likely, it may lead to explicit internal disagreements that obstruct the strategy process. In view of this, a stronger mission is expected to be associated with a relatively greater exploration orientation and lack of a strong mission to a relatively weaker exploration orientation. Therefore, the following hypothesis:

Hypothesis 2: The stronger the organization mission, the greater the exploration orientation.

Strategic orientation. Scholars argue that managerial experiences locked in organizational routines affect organizational actions (Lant and Mezias, 1992; March, 1981). Building on this, one can argue that strategic orientation is likely to affect exploration orientation. Miles and Snow (1978) advanced a typology comprising four generic strategic orientations. The typology identifies prospector, defender, analyser and reactor organizations based on key differences with regard to strategy, structure and process routines. The four strategic types are considered as fairly stable. Importantly, in contrast to the other types, prospector organizations are characterized as having a broad and expanding product-market domain due to continuous innovation (Conant et al., 1990). Given their externally-directed innovation-centred routines, it would be logical to think that prospectors have a strong exploration orientation. Indeed, prospectors have been suggested to engage in elaborate and aggressive information-acquisition (Miles and Snow, 1978). Further, they have been noted for their drive to search for and experiment with new opportunities (Hambrick, 1983; Shortell and Zajac, 1990). This in contrast to defender, analyser and reactor types who are likely to be less exploration oriented. Given this, the following hypothesis:

Hypothesis 3: A greater prospector orientation is positively related to a greater exploration orientation.

Technology. In addition to mission and strategy, technology may be expected to have a bearing on exploration orientation. The flexibility aspect of technology has received substantial academic attention. Inflexible core technologies because of greater vulnerability are likely to be associated with increased environment-

scanning scope and frequency to create early awareness about threatening changes (Yasai-Ardekani and Haug, 1997). Early awareness is vital as inflexible technologies often involve capital intensive, highly automated, specialized equipment that limits the range and variability of output and leaves an organization highly exposed in the event of unforeseen demand or supply disruptions (Bettis, 1981). Building on this, one would anticipate that organizations with inflexible technologies have a greater exploration orientation. Information search and acquisition actions are likely to extend beyond local, served product-markets into non-local, related product-markets. This places inflexible-technology organizations on a better footing to spot and respond to key threats. Importantly, exploration may reveal new uses of the technology, which ensure its consistent use and recovery of sunk costs. Where technology is difficult to adapt to new uses, organizations may try to find a way out by experimenting with new business processes, new customer segments and new geographic markets. The argument is in conformance with prospect theory (Kahneman and Tversky, 1979), which argues that organizations are likely to take riskier actions when faced with the prospect of losses. Since the loss prospect is higher with inflexible technologies, these are likely to engender higher levels of risk-taking and exploration as concerned organizations look for ways to protect and recoup investments:

> *Hypothesis 4*: The greater the inflexibility of technology, the greater the exploration orientation.

Slack resources. Resources are important in that they provide organizations means to act in ways not possible for organizations weaker in resources. Available resources in the form of slack may confer a strategic advantage as they buffer organizations from external shocks (Meyer, 1982), make possible adaptive responses (Cyert and March, 1963) and facilitate slack search, experimentation and learning (Hedberg, 1981; Levinthal and March, 1981). Slack is often conceptualized as absorbed/unavailable or unabsorbed/available (cf. Bourgeois, 1981; Singh, 1986; Wiseman and Bromiley, 1996). Whereas unabsorbed slack corresponds to excess uncommitted liquid resources in organizations, absorbed slack may be viewed as excess costs, staff and salaries (Singh, 1986; Williamson, 1964). Much attention has been paid to the impact of slack resources on risk-taking (Moses, 1992; Singh, 1986) and innovation (Greenhalgh, 1983; Nohria and Gulati, 1996).

Extant work indicates that slack resources may affect exploration inasmuch as they condition information search, experimentation and risk-taking. Here we specifically argue that absorbed slack in the form of excess monetary and human resources allocated to environment-monitoring will shape exploration orientation. With reference to monetary resources, a larger environment-monitoring budget is likely to facilitate exploration. It gives firms latitude to acquire more and diverse competitive information including information from beyond the boundaries of

served product-markets. In contrast, in firms with fewer monetary resources for information search, focus is likely to be first and foremost on monitoring, making sense of and responding to the contingencies of the direct environment rather than on acquiring information from non-local product-markets and getting involved in uncertain, experimental projects. With regard to human resources, or the number of people formally committed to information gathering, a greater number may be expected to foster exploration and a smaller number to impede it. The fewer the people officially responsible for environment search, the more difficult it would be for them to engage in extensive search in a comprehensive or meaningful fashion due to time and cognitive limits. Although it is easily imagined that greater monetary and human resources would be conducive to intensive search, note that our argument here is that they foster extensive boundary-spanning search. Accordingly, the following hypotheses:

Hypothesis 5: The larger the environment-monitoring budget, the greater the exploration orientation.

Hypothesis 6: The larger the formal environment-monitoring staff, the greater the exploration orientation.

METHODOLOGY

Sample and Procedures

Data were collected in two waves from companies belonging to the Dutch metal and electrical engineering sector, which encompasses six two-digit level industrial activity areas if the SIC scheme is adopted. The two-stage procedure was followed in order to separate the measure-purification phase from the hypotheses-testing phase. Following Churchill (1979), the first data sample was used for examining internal consistency of the exploration measure. Based on the examination, the measure was re-specified leading to a scale with strong reliability and unidimensionality properties. The internal consistency of the re-specified measure was then cross-validated using the second data sample.

The same pre-tested questionnaire was used for both data-collection rounds. The key-informant approach was followed with managing directors being targeted as respondents. Further, the cover letter accompanying the questionnaire explained that it was critical that the respondent be a member of the top management team (TMT) in case the managing director was unable to participate. Strategy literature suggests TMT members to be suitable respondents for measurement of organizational-level constructs (e.g. Conant et al., 1990). Five hundred and 800 questionnaires were sent out respectively for the first and second data-collection rounds. Companies were selected from an alphabetically ordered list of 1400 com-

panies provided by FME-CWM (Dutch trade association of metal and electrical engineering companies). The selection was random. Every third company on the list was selected for the first round. From the list of remaining companies, the first 850 companies were selected for the second round. The respondents were allowed three weeks to return the questionnaire. This notwithstanding, if no response was received from a company within ten days, a reminder letter was sent. A final reminder letter was sent immediately after the elapse of the three-week period. These procedures led to response rates of 17 per cent (n = 85) and 18.23 per cent (n = 155).

Variables

Multi-item instruments were used to operationalize exploration orientation, environmental dynamism and organization mission. In all three cases, individual items were measured on seven-point Likert scales anchored at 'strongly disagree' and 'strongly agree'. While sample items are reported below, the complete instruments are available from the authors on request.

Exploration orientation. Exploration orientation was initially operationalized with the help of 23 items, with nine items for the SSIA dimension, eight items for the DSIA dimension and six items for the GIA dimension of the construct. For all three construct dimensions, the items sought to determine relative exploration orientation in terms of breath/narrowness (i.e., scope) of information acquisition. For example, with reference to the SSIA dimension, two of the items to measure supply-side information-acquisition scope were: 'we are well aware of technological and technical developments within our industry' and 'a careful watch is kept on industries that are technologically related to ours'. With reference to DSIA dimension, two of the items were: 'little information is gathered on product preferences of customer groups that we do not currently serve' and 'we know well the product and process innovation efforts of our customers'. With reference to GIA dimension, two of the items were: 'we are knowledgeable about all important opportunities in the geographic regions in which we operate' and 'we are well informed about the price and quality aspects of products in neighbouring geographic regions'.

Environmental dynamism. A condensed version of Miller's (1987) four-item instrument was used. We relied on only three items because of pragmatic concerns relating to questionnaire length. These obliged us to edit extant instruments such that items that could be deemed redundant were excluded. Having carefully reasoned that based on theoretical grounds the three items would be sufficient to measure dynamism, one item was left out. Cronbach's reliability coefficient was 0.77.

Organization mission. A 15-item instrument was used to gauge the degree of organization-wide shared agreement on the vision, business domain and competencies of the organization. As examples of items on the instrument: 'the organization leader has lucidly articulated a vision'; 'there is total consensus among marketing, production and R&D departments on the organization's business domain'; and 'a lot of effort is made to ensure that organization competencies are known at all hierarchical levels'. The scale had a reliability coefficient of 0.92.

Strategic orientation. A self-typing paragraph instrument was used. The validity of the instrument has been tested previously and found reasonable (James and Hatten, 1995; Shortell and Zajac, 1990). The paragraph descriptions were from James and Hatten (1995). Further, a ten-point constant-sum scale procedure was adopted. This required subjects to allocate a total of ten points to the prospector, analyser, defender and reactor descriptions of strategic types depending on how closely their organization matched each of the descriptions. The points allocated to the 'prospector' description were used as the prospector-orientation score.

Technology inflexibility. In the spirit of Miller and Cardinal (1994), technology inflexibility was operationalized in terms of capital intensity. It was measured by asking respondents to indicate the ratio of production equipment to total assets. It is worth observing here that with new technologies it is often human assets rather than fixed assets that result in inflexibility. In line with the theoretical treatment however, reliance on the fixed-asset ratio indicator echoes our specific interest in technology inflexibility rather than human-assets inflexibility in this study. The two may conceivably lead to different sets of organizational actions in response to external events. Further, the focus seemed appropriate in light of the surveyed industries such as primary metals, metal products and industrial machinery in which specialized capital-intensive production equipment is a significant factor.

Environment-monitoring resources. The size of environment-monitoring budget was measured by asking respondents to indicate the amount of money spent in the previous year on monitoring the environment. Respondents could select from 11 class intervals ranging from 'less than 10,000 guilders' to 'more than 100,000 guilders'. The size of formal environment-monitoring staff was measured by asking respondents to indicate the number of people formally responsible for collecting and analysing external information.

Organization size. The natural log of employees was included in the regression model as a covariate to control for the possibility that absolute measures of environment-monitoring resources do not merely operate as surrogates for organization size.

DATA ANALYSIS AND RESULTS

Exploration Orientation Measure

The first data set was used for purifying the initial exploration-orientation instrument. Due to space considerations, we do not report the details of the purification procedure. We limit ourselves here to observing that a second-order confirmatory factor analysis (with each of the three identified dimensions of exploration being specified as first-order factors) of the first data set suggested reduction of the initial 23-item scale to a more parsimonious16-item scale, with six items each for the SSIA and DSIA dimensions and four items for the GIA dimension. Further, validation results obtained with the second data set are summarized in Table I. The reliability coefficients for the SSIA, DSIA and GIA dimensions are all satisfactory. Further, the fit results for the first-order SSIA, DSIA and GIA dimensions of exploration orientation can be considered good. None of the three chi-square values is significant at the 5% level. Further, the goodness-of-fit index (GFI) and incremental-fit index (IFI) values are in the high nineties. Also, the normed chi-square values are at the desired level. These results indicate that the scales for the individual dimensions of exploration construct achieve unidimensionality. As the scales measure the first-order dimensions of exploration orientation, following established practice (e.g. Spreitzer, 1995; Zou and Cavusgil 2002), exploration orientation scores were computed as the unweighted sum of dimension scores. The greater the overall score the more exploration oriented an organization and the lower the score the less exploration oriented the organization.

Determinants of Exploration Orientation

Hypotheses 1–6 were tested by estimating the following regression equation:

$$Y_1 = \alpha_1 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_7 X_7 + \varepsilon_1$$

Table I. Exploration orientation – reliability and CFA model-fit results

Dimension	*Items/indicators*	*Reliability*	*CFA results*				
			χ^2_{df}	*p-value*	χ^2/df	*GFI*	*IFI*
1. SSIA	6	0.79	$13.99_{(9)}$	0.12	1.55	0.96	0.97
2. DSIA	6	0.79	$14.94_{(9)}$	0.09	1.66	0.98	1.00
3. GIA	4	0.76	$5.69_{(2)}$	0.06	2.85	0.98	0.96

Table II. Results of regression analysis

	Dependent variable			
	Exploration orientation			
Independent variables	***b***	**s.e.**	***β***	***t***
Dynamism	0.11	0.05	0.17	2.21**
Organization mission	0.25	0.07	0.28	3.53***
Prospector orientation	0.06	0.03	0.16	2.07**
Technology inflexibility	–0.45	0.28	–0.13	–1.63
Environment-monitoring budget	0.05	0.03	0.15	1.69*
Formal environment-monitoring staff	0.08	0.03	0.18	2.14**
Organization size	–0.03	0.09	–0.03	–0.32
Intercept	2.71	0.48		5.67***
Adjusted R^2			0.31	
F-statistic			7.60***	
N			122	

***p < 0.01; **p < 0.05; *p < 0.10.

where Y_1 denotes exploration orientation and X_1 to X_7 correspond respectively to environment dynamism, organization mission, prospector orientation, technology inflexibility, size of environment-monitoring budget, formal environment-monitoring staff and organization size. Further, α and ε symbolize the constant and error terms.

Estimation results shown in Table II indicate that, as hypothesized, higher environmental dynamism is linked to a stronger exploration orientation and lower dynamism to a weaker exploration orientation. The results also indicate that organization mission has a positive influence on exploration orientation. The stronger the mission the stronger the exploration orientation and the weaker the mission the weaker the exploration orientation. Further, consistent with expectations, a stronger prospector orientation appears to engender a stronger exploration orientation. Contrary to expectations however, support is not found for the hypothesis that greater technology inflexibility leads to a stronger exploration orientation. Moreover, the sign of the technology-exploration relation, though not significant, is negative. This would appear to hint in the direction of stronger exploration orientation in the event of technology flexibility rather than technology inflexibility. Further, results support the hypotheses connecting absorbed slack resources to exploration orientation. Monetary as well as human resources are found to be positively related to exploration orientation, although the effect of the former is only marginally significant. Finally, organization size included as a control variable is not found to be related to exploration orientation.

DISCUSSION

The initial results pertaining to the exploration-orientation scale are quite encouraging. Using two data sets from the same population, we were able to distil a parsimonious set of 16 items from an original group of 23. The measure covers all three key identified dimensions of the construct. Importantly, the measure displays internal consistency, i.e., it is both reliable and unidimensional. This fosters confidence in the usage of the measure in hypothesis-testing research. In this study, focus was on developing and testing hypotheses pertaining to the composite exploration-orientation construct. Towards this end, scores for the individual first-order SSIA, DSIA and GIA dimensions of exploration orientation were summed to arrive at the overall score for the construct (e.g. Spreitzer 1995; Zou and Cavusgil, 2002). Future scholars could expand on this and examine how environmental and organizational variables impact on the individual dimensions of exploration orientation identified in this study. One promising line of research, for example, would be to determine what contextual conditions lead an organization to lay a relatively greater or lesser emphasis on each of the three facets of exploration. For instance, how does technological uncertainty influence organizational choices regarding supply-side exploration versus geographic exploration? Distinctive features of the exploration measure advanced here are a continuous interval level of measurement, an organization-level focus and determination of exploration orientation at the current point in time. Additionally, the measure is based on a set of items that are quite general. This facilitates measure usage in different contexts, allowing aggregation and comparison of findings. The measure could be readily employed for instance in future co-evolution research seeking to ascertain whether exploration orientation is a relatively stable factor or whether it is liable to change over time. It could further be used for testing factors hypothesized to be responsible for constant/varying levels of exploration orientation. Such work is likely to provide useful insights into the possibilities of synchronizing exploration levels to match environmental conditions, say, through affecting cultural change in the organization. A key relation that could be tested with the current instrument is between exploration and performance. For example, as literature on problem-motivated search would suggest, does satisfactory past performance lead to a lower organizational emphasis on exploration? Also, what impact does exploration have on organization learning, innovation and performance?

This study may be said to have established initial nomological validity of the exploration measure. Consistent with the co-evolutionary perspective, substantive results obtained with the measure suggest that environment as well as managerial intentions seem to exert a significant influence on whether an organization is more or less exploration oriented. This research focused on dynamism as the variable representing environmental pressure and organization mission, strategic orientation, technology inflexibility and absorbed slack as the variables representing man-

agerial intentions. Our findings support the thesis that if dynamism as often conceived and as operationalized here is a function of changing customer preferences, shorter product life-spans, greater rate of technology change and larger R&D expenses, the higher uncertainty generated by dynamism is likely to lead to expanded information search. This finding should however be verified in future by employing an objective measure of dynamism. Reliance on an objective measure such as average industry R&D spending would of course raise the issue of whether an organization's exploration orientation is better regarded to be affected by managerial assessments of the particular environment facing the organization or whether it is due to industry-wide characteristics. If the particular environment facing an organization is the more appropriate antecedent of exploration behaviour, a problem with measures such as R&D spending is that more detailed within-industry data may not be available. Interestingly, we found that exploration orientation was on average positively related to dynamism. It remains possible however that while some organizations may have a relatively high exploration orientation when environments are stable, others may have a relatively low exploration orientation when environments are dynamic. Future work that examines the impact of this behaviour on adaptation effectiveness would enrich the literature.

With reference to the mission–exploration finding, one could argue that a strong exploitation-centred mission may work against greater exploration, especially if an organization is doing well. This possibility would have made it difficult to find support for our hypothesis. While lack of data on mission content prevented direct testing of the impact of content on exploration, in our view the strong support for the hypothesis suggests that the missions of organizations in our data set were not focused on exploitation (say, of current technologies and capabilities), or at the least they were not wholly focused on exploitation. This not because of some systematic bias in data gathering but because missions customarily have a future-oriented, long-term, direction-setting component. Such a component envisions a desirable future state of the organization and typically it reflects an aspiration that goes beyond the exploitation of current technologies and capabilities. That is to say, mission statements typically include a vital exploration-centred part. However, an exploration-centred part cannot automatically be assumed to represent widespread agreement on the mission due to potential intra-organizational divergences of opinion. Given this, the relation that we sought to investigate and we believe to have measured is between higher/lower levels of mission-related agreement and exploration orientation. As reasoned before, a higher level of shared agreement would enable greater scope of information search and it plausibly initiates a climate allowing concerted and coherent experimentation. This argument is consistent with the behavioural view of innovation. In March and Simon's (1958) framework, innovative activity is instigated due to failure to reach some aspiration level. Inasmuch as there is some collective aspiration level (as captured by the orga-

nization mission construct) towards which the organization aims but has not currently achieved, we would expect a greater exploration orientation. On the other hand, absence of aspiration (say, due to good financial performance in the past) would dampen exploratory behaviour. With regard to the last, we consider it unlikely that a company profitably exploiting its niche would explicitly formulate a mission and seek earnestly to create a high shared agreement on it. Rather, successful in the past it is likely to stay its course. From a construct measurement viewpoint such an organization would score low on our mission scale and from a substantive angle we would expect it to score low on the exploration-orientation scale. Hence, the strong support for our hypothesis. In future work however, it would be useful to study the independent and interaction effects of mission content and shared agreement on exploration.

Given the nature of prospector-type organizations, it is not surprising that we found a positive relation between prospector orientation and exploratory behaviour. However, correspondence between measures of these constructs in the theoretically predicted direction lends extra credence to the exploration instrument developed above. Conspicuously, this study failed to find a stronger exploration orientation on account of technology inflexibility. Although the parameter is not significant in the model, intriguingly, the sign of the parameter is negative. This goes against our theory-based expectation and hints that technologically flexible firms may in fact be more exploration oriented. An explanation could be that exploration is inhibited because technologically inflexible firms are strategically committed to a niche, which can be sustained by continual refinement and cost reductions. Also, technologically flexible firms may be more search and experimentation oriented because of the potential to shift their productive assets easily and profitably into new areas. Bringing in the earlier discussion relating to organization mission, the effect of technology flexibility on exploration orientation may indeed be stronger if there is a gap between current achievements and aspiration levels. Future research should investigate this. We also found that exploration orientation is shaped by absorbed slack in the form of monetary and human resources committed to environment monitoring. While commitment of a larger budget and staff to environment monitoring is of course a matter of managerial intent, the current study suggests that such intent ultimately has a bearing on whether information search is more localized or extensive. Whereas a smaller budget and staff exert pressures towards localized search, more resources allow boundary-spanning search by furnishing the means necessary for such search.

Limitations and Conclusion

Some potential and actual limitations of this study must be noted. A potential limitation relates to the use of perceptual scales to measure some of the variables. This entails the possibility that our findings may have been on account of some common

affective component underlying the scales rather than a true relationship. As a case in point, items in the exploration orientation and organization mission scales by including expressions such as 'closely monitor', 'finger on the pulse', 'lucidly articulated' and 'consensus' could be said to have inadvertently evoked a common affective component associated with how well a respondent believes the organization is doing. However, extreme care was taken in designing the survey questionnaire to avert bias. For example, clear instructions were given to respondents to provide answers that reflected the actual situation. Moreover, the perceptual scales did not follow one another directly in the questionnaire. In view of the steps taken, although we are inclined to believe that we were able to solicit objective responses which only indicate the level of the specific variable being measured, the possibility of an affective component cannot be definitely ruled out. As such, caution must be exercised when considering the findings of this study. Methodological triangulation in future research in the form of multiple measurements of variables would enable the drawing of more definitive conclusions about the causal relations reported here.

Another limitation relates to the sampling population. Data collection was confined to the Dutch metal and electrical engineering sector. Companies in this sector are principally industrial product and service companies in the business-to-business market. Therefore, the results obtained here cannot be generalized to a non-industrial, consumer-product companies context. Future research should test whether the present measurement and substantive findings also hold in other contexts. A further data collection connected limitation of this research relates to the key-informant procedure. Multiple-informants permit examination of inter-informant response consistency. Although our reliance on single informants reflects practical contingencies and the need to first arrive at a list of acceptable indicators of exploration construct before proceeding to investigate inter-informant response consistency, future research must cross-validate our results through a multiple-informant approach. A final limitation relates to the absence of longitudinal data, because of which causality cannot be clearly established. The cross-sectional data meant that only a static model could be tested. In terms of our desire to determine nomological validity of the exploration-orientation measure, only concurrent validity can be said to have been ascertained, not predictive validity. It is worth noting in this context that our use of the expression 'antecedents' is because of theoretical cause-effect logic. Future research could verify causality empirically using longitudinal data and lagged models.

Despite its limitations, we believe that this study has made progress towards addressing important gaps in the literature. It advances a multidimensional operational measure of exploration orientation centring on the idea of supply-side, demand-side and geographic information acquisition. The scales for all three dimensions of the construct are reliable and unidimensional. Further, the measure appears to possess nomological validity in that it relates as expected to measures

of theoretically connected constructs. In this context, this work finds preliminary evidence that environmental dynamism, organization mission, prospector orientation and absorbed slack in the form of monetary and human resources committed to environment-monitoring are positively associated with exploration orientation. Through proposing and validating an instrument to measure exploration orientation, the present study contributes to the development of a foundation for systematic empirical research into exploration behaviour. The instrument could be easily employed in future studies of co-evolution. Although this initial research concentrated on direct, one-way environmental and managerial effects, in future studies the instrument could be used to examine indirect effects and multidirectional causalities as organizations, industries and environments co-evolve.

NOTE

*The authors would like to thank Prof. Arie Lewin and three anonymous reviewers for their valuable comments and suggestions that helped improve this manuscript.

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