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A SEQUENTIAL MODEL OF INNOVATION STRATEGY—COMPANY NON-FINANCIAL PERFORMANCE LINKS

Wakhid Slamet Ciptono*

This study extends the prior research (Zahra and Das 1993) by examining the association between a company's innovation strategy and its non-financial performance in the upstream and downstream strategic business units (SBUs) of oil and gas companies. The sequential model suggests a causal sequence among six dimensions of innovation strategy (leadership orientation, process innovation, product/service innovation, external innovation source, internal innovation source, and investment) that may lead to higher company non-financial performance (productivity and operational reliability). The study distributed a questionnaire (by mail, e-mailed web system, and focus group discussion) to three levels of managers (top, middle, and first-line) of 49 oil and gas companies with 140 SBUs in Indonesia. These qualified samples fell into 47 upstream (supply-chain) companies with 132 SBUs, and 2 downstream (demand-chain) companies with 8 SBUs. A total of 1,332 individual usable questionnaires were returned thus qualified for analysis, representing an effective response rate of 50.19 percent.

The researcher conducts structural equation modeling (SEM) and hierarchical multiple regression analysis to assess the goodness-of-fit between the research models and the sample data and to test whether innovation strategy mediates the impact of leadership orientation on company non-financial performance. SEM reveals

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that the models have met goodness-of-fit criteria, thus the interpretation of the sequential models fits with the data. The results of SEM and hierarchical multiple regression: (1) support the importance of innovation strategy as a determinant of company non-financial performance, (2) suggest that the sequential model is appropriate for examining the relationships between six dimensions of innovation strategy and company non-financial performance, and (3) show that the sequential model provides additional insights into the indirect contribution of the individual dimensions of innovation strategy (partially mediators) to company non-financial performance —productivity or operational reliability.

The findings provide empirical evidence extending the previous model of Zahra and Das. These findings also provide a basis for useful recommendations to upstream and downstream SBU managers attempting to implement a sequential model of innovation strategy —company non-financial performance links. This study shows that upstream SBUs rely on external innovation sources. They will acquire innovation policies through business partnership development (such as Joint Operation Body for Enhanced Oil Recovery or JOB-EOR, Joint Operation Body for Production Sharing Contract or JOB-PSC); licensing agreements (Technical Assistance Contract or TAC, Consortium Cooperation System); or acquisition with other firms (Joint Operating Contract or JOC). In contrast, downstream SBUs emphasize on generating internal innovation sources to develop their own in-house R&D efforts. The downstream SBUs should make extensive policies of internal innovation sources in their attempts to control the distribution of oil-based fuel and transmission of natural gas for domestic and international markets effectively. Both policies would enhance understanding and ultimately contribute to the improvement of company financial performance —sales, net profit margin, return on assets.

Keywords: company non-financial performance; sequential model six dimensions of innovation strategy

Introduction

Technological innovation is the most critical factor in the oil and gas industry, especially for increasing the oil and gas production (the level of productivity) in the upstream sector, and for improving operational reliability in the downstream sector. Technological innovation includes exploring, refining, extending products, processes, technologies of oil and gas in the upstream sector (supply-chain activities); and shipping and harbor, distribution, and marketing network in the downstream sector (demand-chain activities). The innovation is categorized into different types, such as radical versus incremental innovation. Different types of innovation require different kinds of underlying soft skills (knowledge) and have different impacts on the industry's competitors and customers relationships (Schilling 2005).

Radical innovation is an innovation that is very new and different from prior solutions (i.e., exploring new oil and gas fields in both onshore as well as offshore with enhanced oil recovery or EOR). On the other hand, incremental innovation is an innovation that makes a relatively minor change from or adjustment to existing practices (i.e., developing the existing oil and gas well). Such innovations can improve the global standing of Indonesia's oil and gas companies and help them regain their status as world-class companies. By using new technology, creating and commercializing or marketing new products, and adopting innovative manufacturing processes, Indonesia's oil and gas industry can effectively solve their competitive problems (Swamidass 1986).

Numerous studies of innovation have found recurring patterns in how new technologies (i.e., enhanced oil recovery or EOR) emerge, evolve, are adopted, and are displaced by other technologies. From the various studies of success and failure in innovation, it is possible to construct a sequential model of innovation strategy –company performance links for effective innovation management. A number of models for auditing innovation have been developed in recent years, providing a framework against which to assess performance in innovation management. For Zahra and Das's purposes in exploring innovation strategy –company performance links model– it would be helpful to build the sequential model and use it to focus attention on key aspects of the innovation management challenge about potential for change (Zahra and Das 1993).

Indonesia's oil and gas companies realize that in order to meet the future challenges of discovering new reserves and new alternative energy (e.g., coal and geothermal), they have to develop an integrative approach to innovation strategy (Hakim 1996). This strategy defines the oil and gas companies' goals in pursuing innovation by delineating both the ends (what to innovate) and the means (how to achieve it). Integrating the diverse activities that lead the creation, empowerment, development, and commercialization of immediate and market products and technologies enables the oil and gas company to maximize its payoff from innovation efforts.

Indonesia's oil and gas companies have already implemented TQM program to achieve their vision to be recognized as world-class companies committed to operational excellence. Although TQM program has been and will continue to be a vital part of business operations, companies must fundamentally rethink their ways of conducting business and have the courage to implement innovation strategy necessary to sharpen their competitive advantage by differentiating their products and creating value to customers. In addition, the oil and gas managers should gain benefits from the interaction between quality and innovation via an empirical study of the link between innovation strategy and company performance (the Government of Republic of Indonesia 2003; Rossetto and Franceschini 1995).

In this paper, the author extends the prior research (Zahra and Das 1993). The differences between Zahra and Das's study and this research are:

1. Zahra and Das (1993) mailed a questionnaire to Presidents (or the highest ranking executives) of 513 manufacturing companies (customer and industrial goods group) throughout the United States. They received 149 complete responses, for a response rate of 31.9 percent. This study distributed a questionnaire (by mail, e-mailed web system, and focus group discussion) to three levels of managers (top, middle, and first-line) of 49 oil and gas companies with 140 SBUs in Indonesia. The use of multiple informants help both the validity and the reliability of the study. Each qualified sample of 140 SBUs received 20 questionnaires. Totally, 2,800 questionnaires were distributed to the participating oil and gas companies in qualified samples of 140 SBUs. A total of 1,332 individual usable questionnaires were returned thus qualified for analysis, representing an effective response rate of 50.19 percent. Of these, 354 were from high level managers, 447 from middle level managers, and 531 from first-line managers. These qualified samples fell into 47 upstream (supply-chain) companies with 132 SBUs (1,188 respondent managers: 343 top level managers, 415 middle level managers, and 430 first-line managers); and 2 downstream (demand-chain) companies with 8 SBUs (144 respondent managers: 11 top level managers, 32 middle level managers, and 101 first-line managers). According to Bryman and Bell (2003), the typical response rate for a research survey is of the order of 15-20 percent.
2. Zahra and Das develop two research models: simultaneous and sequential models of innovation strategy—company financial performance links. They compare responding firms in sales, size, number of employees, and Standard Industrial Classification (SIC), using multivariate analysis of variance. This study develops a sequential model of innovation strategy—company non-financial performance links for upstream and downstream SBUs. These SBUs, which differ in concerns about company non-financial intensity, provide an interesting setting to examine the association between innovation strategy and company non-financial performance

(productivity and operational reliability).

In their research implications, Zahra and Das suggest that future research be needed to extend their study by employing alternative analytical techniques (structural equation modeling or SEM, hierarchical multiple regression) to establish the validity of their findings. For instance, researchers may explore AMOS and SPSS as two alternative analytical frameworks for testing the sequential model. They also recommend that future research measure a firm's relative emphasis on internal or external innovation orientations. This information may help in validating empirical indicators of innovation strategy.

Considering the Zahra and Das's suggestions, this study wants to examine the association between a company's innovation strategy and its non-financial performance in the upstream and downstream strategic business units (SBUs) of oil and gas companies. Overall, the study aims to contribute to the literature in two ways: (1) to show that innovation strategy makes a significant difference in company non-financial performance, comparing between upstream and downstream sectors; and (2) to introduce the sequential model that explores the association between innovation strategy and company non-financial performance that oil and gas managers in upstream and downstream sectors can use to establish an effective innovation strategy.

The remainder of the paper is organized as follows. In the next section, the author reviews the dimensions of innovation strategy followed by company non-financial performance. Next, the author explains the modeling innovation strategy and company non-financial performance links for both upstream and downstream sectors. Subsequently, the author discusses the research method of the study. Afterwards, the author presents the empirical results, followed by discussion and implications of the findings in last section.

Dimensions of Innovation Strategy

Leadership Orientation

According to Porter, innovation is a new way of doing things that is commercialized. The process of innovation cannot be separated from a firm's strategic and competitive context (Afuah 2003). In the early 1980s, Michael Porter made three major contributions to the analysis of innovation in corporate strategy: (1) by explicitly linking technology to the five forces driving industry competition, (2) by choosing among a number of generic strategies that must be made by the firm (Tidd et al. 2005), and (3) by deciding between two market strategies —leadership or followership. According to Porter (1980), there are five forces driving industry competition, each of which generates opportunities and threats: relation with suppliers, relation with buyers, new entrants, substitute products, and competitive rivalry among established firms. Porter (1985) also describes four generic market strategies that firms must choose: overall cost leadership, product differentiation, cost focus, and differentiation focus. Finally, according to Porter, firms must also decide between two market strategies:

1. Innovation leadership orientation — where firms aim at being the first to market (a first-to-market orientation), based on technological leadership. This requires a strong corporate commitment to creativity and risk-taking, with close linkages both to major sources of relevant new knowledge and to the needs and responses of customers.
2. Innovation followership orientation —where firms aim at being late to market (a second-to-the-market or late-entrant or imitator orientation), based on imitating (learning) from the experience of technological leaders. This requires a strong commitment to competitor analysis and intelligence, to reverse engineering (i.e., testing, evaluating and taking to pieces competitors' products, in order to understand how they work, how they are made and why they appeal to customers), and to cost cutting and learning in manufacturing (Tidd et al. 2005).

The lesson from the most innovative companies is that leadership is the critical factor in creating and sustaining successful innovation (Davila et al. 2006). In addition, leadership orientation provides the essential contribution/incentive for innovation. There are three initial activities that the leadership orientation should undertake to set the context to any change in innovation:

1. Leadership must define the innovation strategy (innovation directions and decisions) and link it to the business strategy;
2. Innovation must be aligned with the company business strategy, including selection of the innovation strategy; and
3. Leadership must define who will benefit from improved innovations.

Leadership needs to ensure that innovation is an integral part of the company's business mentality. Indeed, innovation culture of a company is such an important part of the business mentality. Leadership sometimes includes an assessment of the innovation climate to determine employees' perceptions of how well innovation is ingrained in the business mentality. Understanding the perceptions of innovation across the organization and the cultural norms associated with innovation can be critical to understanding the obstacles to innovation. Typically, an innovation climate survey diagnostic is used across and throughout all levels of the organization—top, middle, and low level of management (Davila et al. 2006).

A formal innovation strategy allows a firm to simultaneously consider product and process innovations. This is important because process innovations are sometimes tied to product innovations as a new product cannot be manufactured without breakthroughs in process (Thurow 1992 in Zahra and Das 1993). Consequently, Finkin (1983) suggests that product development and manufacturing process development function best when they are integrated. Also, as industries and markets mature, innovation efforts tend to shift from creating products to cost-reducing process innovations (Khan and Manopichetwattana 1989). Porter (1985) states that firms may value a great deal in the combination of product and process innovations they emphasize. Zahra and Das (1993) conclude that it is important to examine the association between the firm's innovation leadership orientation and its innovation portfolio—types and sources of innovation.

Types and Sources of Innovation

These dimensions refer to the combination (portfolio) of innovations a firm pursues or generates over time. Similar to Zahra and Das, this study has not considered innovations in other related business applications, such as information technology and innovative organizational designs. Instead, the author focuses on product and process innovations —a focus that is consistent with the results of a survey of manufacturing managers that conclude that both process and product innovations are important to a company's business strategy (Schroeder et al. 1986 in Zahra and Das 1993). Further, the extensive reviews of the literatures by Anderson et al. (1989) in Zahra and Das (1993) show that manufacturing managerial choices usually center on product and process technologies.

Based on the above explanations, this study considers four types of innovation (the 4Ps of innovation portfolio) in order to develop a sequential model:

1. Product and Service Innovation — changes in products or services which a company offers. Product innovation results in the creation and introduction of radically novel products or modifications in existing ones (Krubasik 1988; Pale 1988 in Zahra and Das 1993). Researchers like Gupta and Wilemon (1990) state that product innovation can be risky. They suggest that poor definition of product requirements, technological uncertainty, lack of senior management support, lack of resources, and poor project management implementation can handicap new product development efforts. However, Gupta and Willemon advise that by overcoming these critical problems, companies can reduce the operational risks associated with new products and, in fact, create a sustainable competitive advantage in their marketplace (Zahra and Das 1993). Product and service innovation are increasingly about differentiation through customization to meet the particular needs of specific users. Product and service innovation also affects product and service quality,

but has a greater effect on reputation (brand image) and value or innovativeness (Tidd et al. 2005).

2. Process Innovation—changes in the ways in which they are created and delivered. Process innovation leads to new methods of operations by producing new manufacturing technologies or improving existing ones (Leonard-Barton 1991). They can also help companies achieve economies of scale or scope that can be used to lower costs and prices. An integrative innovation strategy allows the firms to simultaneously consider product and process innovations. This is important because process innovation is sometimes tied to product innovation as often a new product cannot be manufactured without breakthroughs in process (Thurow 1992). Process innovation tends to focus increasingly on driving out cost (cost leadership) and improving productivity in the supply-chain (SC Process Innovation) and demand-chain (DC Process Innovation) activities. Process innovation also helps improve relative quality and reduce costs, thereby improving the relative value of the product and service (Tidd et al. 2005).

   Together, product/service innovation and process innovation drive growth in market share through increasing the productivity level and operational reliability (Tidd et al. 2005). To accelerate the integration (combination) of product/service and process innovations, Gold (1987) and Tidd et al. (2005) suggest that companies need both the sources of innovation —Paradigm Innovation or Internal Sources of Innovation and Position Innovation or External Sources of Innovation.

3. Paradigm Innovation or Internal Sources of Innovation —changes in the underlying mental models of inhouse R&D efforts to generate product and process innovations.
4. Position Innovation or External Sources of Innovation —changes in the context of purchasing, licensing agreements, acquisition of other firms, joint-ventures with suppliers, customers, and other firms.

Zahra and Das argue that companies emphasize different sources of innovation. For instance, a study of new-venture firms in the computer and communication equipment industry (McDougall et al. 1992) shows that corporate-sponsored ventures emphasize patented technology and product development. In contrast, new ventures sponsored by independent entrepreneurs use external sources, such as public domain technology, and do not emphasize product development.

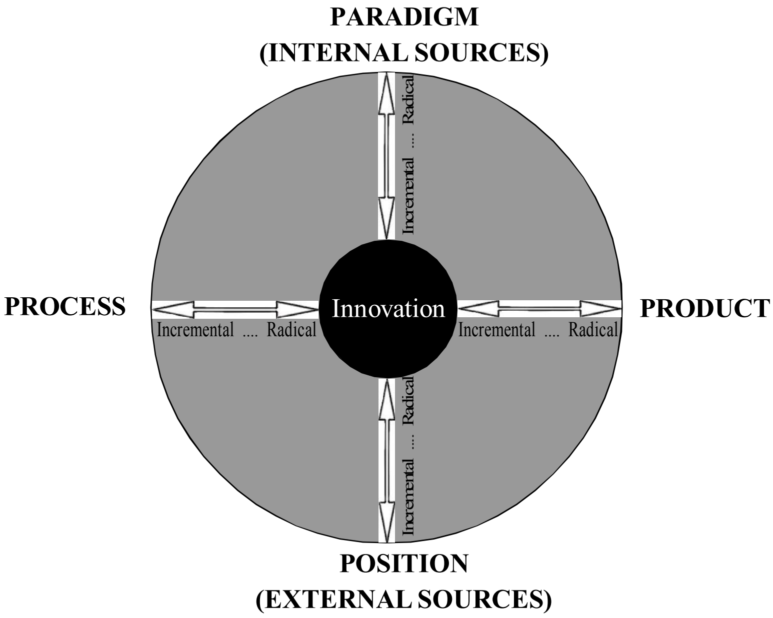
Each of 4Ps of innovation can take place along an axis running from incremental through to radical change; the area indicated by the circle in Figure 1 is the potential innovation space within a company can operate. The ways in which a company approaches incremental —"doing what companies do better" (the continuous innovation approach) will differ from those used occasionally to handle a radical step change— "new to the world" (the radical innovation approach) in product/ process or paradigm/position.

Studies of incremental/continuous innovations suggest that the cumulative gains in efficiency are often much greater over time than those which come from occasional radical innovations. More recent experience of deploying lean and agile operations in manufacturing and services, and increasingly between as well as within enterprises, underlines furthers the huge scope for such continuous innovation (Womack and Jones 1996). The challenge seems to be to develop ways of managing innovation not only under 'steady-state' but also under the highly uncertain, rapidly evolving and changing conditions resulting from discontinuity. This discontinuous condition helps us understand why established organizations need to deal with discontinuous or radical innovation (Tidd et al. 2005).

Investment

According to Tidd et al. (2005), the real test of innovation success is not a one-off success in the short term but sustained growth through continuous innovation and adaptation. In their terms, success relates to the overall innovation process and its ability to contribute consistently to growth. In addition, innovation is an investment— its use to help shape and improve the company's ability to innovate consistently. Investment in innovation efforts requires technical resources and

Figure 1. **Types of Innovation (Four P's of Innovation Space)**



Source: Tidd et al. (2005):13

managerial capabilities over time in an integrated way.

Investment decision for the innovation implementation is the current commitment of resources for a period of time in the expectation of receiving future benefits of innovation —return on innovation (e.g., lump sum of cash or income/return stream) that will be greater than current outlay (Brigham and Ehrhordt 2005).

Based on Zahra and Das's study, the dimension of investment in innovation embodies the financial, technological, and human capital investments associated with manufacturing innovation activities (Thompson and Ewer 1989; Leong et al. 1990). Financial investments include spending on R&D projects and purchasing innovations developed elsewhere. Technological investments are expenditures on infrastructure equipment and basic facilities required for innovation (Betz 1987; Thurow 1992). Human capital investments include salaries, training and development (T&D), and other costs associated with developing dynamic capability of staff (Kamm 1987; Tidd et al. 2005).

Theoretically, there are many different potential links among the six innovation strategy dimensions, and it is important to focus on the fit among the dimensions. One must effectively match (seek consistency in) one's choices among the innovation strategy dimensions. Choices in these dimensions should be compatible, thus reinforcing and supporting one another (Venkatraman 1989). Fit reduces the misuse of resources and enables a firm to attain high performance levels (both financial and non-financial performances).

Company Non-Financial Performance

It is leadership's responsibility to make benefits from improved innovations very clear to the company's stakeholders who are the targets for value creation —economic value-added (EVA) and market value-added (MVA). Innovation always focuses on maintaining or increasing company performance (financial and non-financial performances) by delivering the value of company innovation strategy to the stakeholders (Davila et al. 2006). A company innovation strategy helps the company sharpen its competitive advantage by differentiating its products and creating value to customers (Porter 1985 in Zahra and Das 1993). When the new product or process is different from existing ones, the company's advantage is protected from imitation by competitors. A company can use innovative products to protect its markets or target new niches, thereby achieving superior company financial performance (sales and profit) over its rivals (Butler 1988; West 1992 in Zahra and Das 1993).

Porter (1996) returns to the subject of strategy in the mid-1990s. He finally recognizes the importance of fit (i.e., coherence and balance) between operational effectiveness (doing things better) and innovation strategy (doing things that others cannot do). The innovation model in the oil and gas industry is called an integrated innovation value-added chain –a system integration and extensive networking (Afuah 2003 and Tidd et al. 2005). An interactive model sees innovation as a multi-actor process which requires high levels of integration at both upstream with key suppliers and downstream with demanding and active customers, and of emphasis on linkages and alliances. Within the area of linkages and alliances, developing close and rich interaction with markets, with suppliers and other organizational players, is of critical importance (Tidd et al. 2005).

The author separates upstream SBUs and downstream SBUs, but consider them mutually influencing, an integrated innovation value-added chain in the oil and gas industry. It focuses on what the innovation contributes to the competitiveness and capabilities of a firm's suppliers (supply-chain or upstream SBUs), customers (demand-chain or downstream SBUs), and complementary innovators between upstream and downstream. This study observes that operational effectiveness is always essential in developing oil and gas business based on the implementation of innovation value-added chain. Most of SBUs in Indonesia's oil and gas industry do not rely much on financial performance. They are being cost centers. Operational effectiveness (company non-financial performance) is necessary for oil and gas company survival, which will always be a source of sustainable competitive advantage. Hakim (1996) argues that most upstream SBUs are more concerned about the number of reserves they have (the level of productivity or cost efficiency in crude, oil, gas, and geothermal), while downstream SBUs are more concerned over operational reliability (the ability of oil and gas stations to distribute and ensure adequate oil and gas needed by the society on time, on specification, and on cost). According to Tidd et al. (2005), there is strong evidence for connecting innovation with company performance. They argue for a strategically focused innovation as part of balanced scorecard of company performance measurement. In addition, if the company non-financial performance is excellent, then innovation may be sufficient to gain better company financial performance, leading to business success.

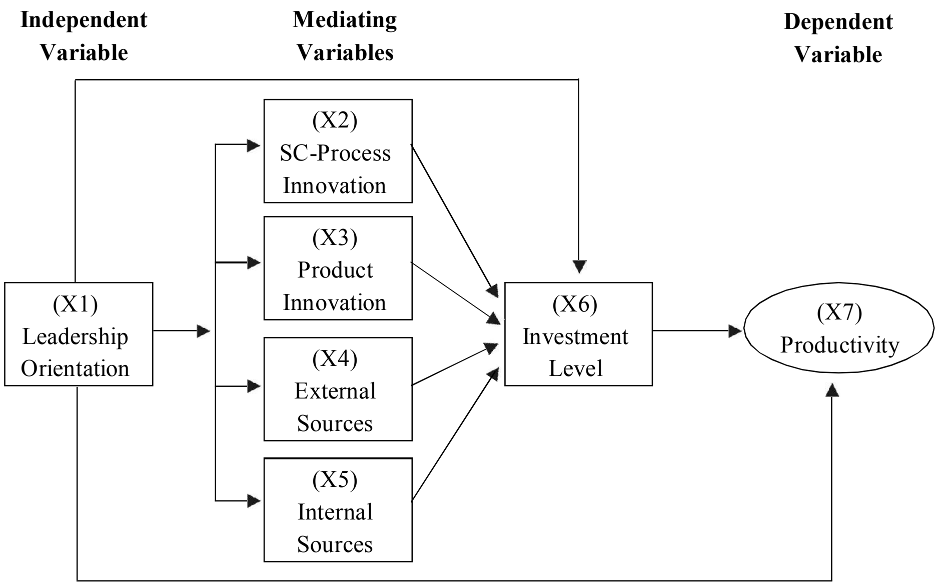
Modeling Innovation Strategy and Company Non-Financial Performance Links

Sequential Model

Researchers like Ettlie (1983); Ettlie et al. (1984); and Kamm (1987) suggest two possible approaches to the association model between the dimensions of a company's innovation strategy and the company financial performance (Zahra and Das 1993). In the first approach, innovation strategy dimensions are assumed to influence company performance directly and simultaneously (a simultaneous model of innovation strategy –company financial performance links). The second approach suggests a logical sequence among innovation strategy variables (a sequential model of innovation strategy –company financial performance links). Hence, the association between certain innovation strategy dimensions and company performance may be indirect; that is, the effect of one dimension may be mediated by the influence of another dimension.

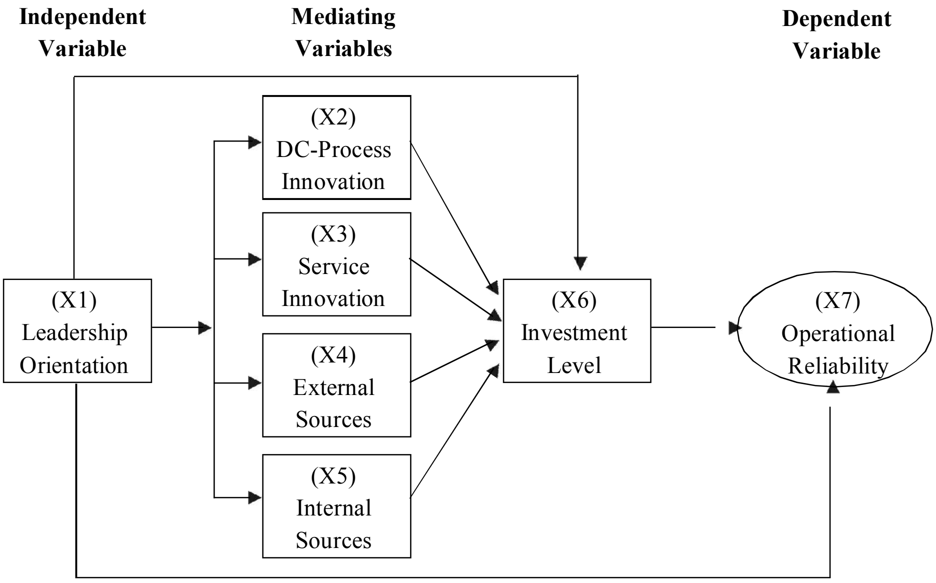
This study posits that a logical sequence may exist among the four innovation strategy dimensions (Porter 1985), reflecting an ordered set of relationships among them –as mediating variables. Certain choices (e.g., leadership orientation –as an independent variable) must precede others (e.g., level of investment –as a mediating variable). The sequential model also acknowledges the potential indirect influence of some innovation strategy dimensions on company non-financial performance (i.e., productivity and operational reliability). Even though a variable may not influence non-financial performance directly, it may still influence other important dimensions that, in turn, affect the company non-financial performance. This occurs because innovation strategy dimensions may depend on one another, as depicted in Figure 2 and Figure 3.

Figure 2. **A Sequential Model of Innovation Strategy —Company Non-Financial Performance Links (The Hypothesized Model) for Upstream SBUs**



SC = Supply-Chain

Figure 3. **A Sequential Model of Innovation Strategy—Company Non-Financial Performance Links (The Hypothesized Model) for Down-stream SBUs**



DC = Demand-Chain

To describe the logical framework of the sequential models in this study, the author follows the sequence already used by Zahra and Das. Figure 2 and Figure 3 show the sequential models and the hypothesized order of relationships among the dimensions of innovation strategy. The rationale for sequencing the variables in the order shown is based on theory. The logical starting point in Figure 2 and Figure 3 is the oil and gas company's choice of its intended innovation leadership position. The firm makes this choice based on its chosen external environment, its competitive strategy, its strengths and weaknesses, and the availability of resources—its opportunities and threats (Porter 1985 in Zahra and Das 1993),

Once they choose an innovation leadership orientation, oil and gas managers then address two issues. First, what type of innovation will the firm emphasize? For the manufacturing function (i.e., oil and gas companies—upstream and downstream functions), they should select a portfolio of product and process innovations. They will need to consider the firm's competitive strategy, market definition, and customer profile. They can then articulate the extent of the companies' (upstream or downstream SBUs) emphasis on process and product innovations.

Next, oil and gas managers (upstream or downstream SBUs) must address the second question: Which sources should the company use in developing or securing upstream or downstream SBU innovations? They will base their selection of innovation sources on the company's planned leadership position. If the company pursues a first-to-the-market orientation, it will rely heavily on internal sources in generating its process and product ideas (Porter 1980 and 1985). A company that follows a second-to-the-market orientation will use both internal and external sources (Burgelmann and Sayles 1986 in Zahra and Das 1993). A late-entrant, imitator firm will use external sources extensively in developing its product and process and then rely on its internal facilities to improve these innovations.

The managers' choices of the types (process and product) and sources (internal and external) of innovation determine the levels of investments. Leadership orientation will also influence the level of company investment in innovation. A first-to-the-market orientation requires significant investments in both theoretical and applied research, employment of highly skilled researchers and staff, development of information systems that can scan the environment to identify important opportunities, and maintenance of state-of-the-art facilities.

Firms adopting a second-to-the-market or late-entrant orientation face quite different situations. Companies that adopt either of these orientations will require different skills and resources that may not call for such high levels of investment.

Corporate investment in manufacturing innovation is expected to have a positive direct effect on company performance (i.e., company non-financial performance –productivity and operational reliability). Leadership orientation also has a direct influence on company non-financial performance (productivity and operational reliability). Growing evidence shows that pioneers (first movers) improve their operational productivity if they implement their innovation strategies efficiently and effectively (Porter 1985; Butler 1988 in Zahra and Das 1993).

The author employs structural relations and structural equation modeling (SEM) to examine the sequential association between innovation strategy and company non-financial performance. Structural relations enable researchers to examine the effects of selected variables on other variables of interest. It helps them identify direct and indirect effects in a complex system of variables, and allows them to include mediating variables in the analysis easily (Swamidass and Newell 1987). Structural relations are useful when the theory is not highly refined; insights from path analysis can be useful in trimming and refining theoretical models. Because the theoretical relationships among the current variables are not very well understood in Indonesia's oil and gas industry, the author considers path analysis appropriate. SEM provides a straight for-ward method of dealing with multiple relationships simultaneously and comprehensively for determining the goodness-of-fit measures of the sequential model (Bentler 1990; Hair et al. 2006).

The author also conducts a hierarchical multiple regression analysis as a statistical tool to test whether four Ps of innovation (product, process, paradigm, position) and investment mediate the impact of leadership orientation on company non-financial performance (productivity and operational reliability). In addition, the author follows Baron and Kenny's procedures (three stages) for testing the mediating effects:

(1) The first stage is to determine a significant relationship between the independent and the dependent variable;

(2) The second stage is to test a significant relationship between the mediators (four Ps of dimensions of innovation strategy and investment level) and the dependent variable (company non-financial performance) controlling for the independent variable (leadership orientation); and

(3) The third stage is to reveal the relationship between the independent variable and the dependent variable, decreasing or becoming non-significant when the mediators are added to the step (Baron and Kenny 1986; Dorenbosch et al. 2005; James and Brett 1984).

Hypotheses Development

The research frameworks (Figure 2 and Figure 3) which identify an eleven-stage-path analysis delineate the factors involved in the association among seven research constructs for upstream and downstream SBUs. On the basis of a review on the diffusion of distinctive innovation strategy literatures, the author posits seven quantitative-deductive research hypotheses to test the link between six dimensions of innovation strategy and company non-financial performance (productivity and operational reliability).

1. H1: Leadership orientation has a direct and significant effect on company non-financial performance (productivity or operational reliability).
2. H2a-d: Leadership orientation has direct and significant effects on Process, Product, External and Internal Sources of Innovation.
3. H3: Leadership orientation has a direct and significant effect on investment level.
4. H4a-d: Process, Product, External and Internal Sources of Innovation have direct and significant effects on investment level.
5. H5: Investment level has a direct and significant effect on company non-financial performance (productivity or operational reliability).

6. H6: Leadership orientation has an indirect and significant effect on investment level through its direct effect on product, process, external and internal sources of innovation.
7. H7: Leadership orientation has indirect and significant effects on company non-financial performance (productivity or operational reliability) through its direct effect on product, process, external and internal sources of innovation, and investment level.

Research Method

Sampling Technique

Empirical data for this survey (a cross-sectional study) were collected from 49 oil and gas companies in Indonesia; containing 140 strategic business units (SBUs). 47 of which are privately owned and two of which are in the public sector (state-owned) companies. The primary unit of analysis for empirical validation was the individual Strategic Business Unit (SBU) level. The SBU organizational structure was chosen in this study because of three reasons. *First*, Indonesia's oil and gas companies have realized that SBUs allow corporate management to delegate authority for the strategic management of distinct business entities –the SBUs (Hakim 1996; Pearce and Robinson 2005). In addition, the SBUs are cost centers, which facilitate accurate assessment of operational effectiveness (productivity and operational reliability). *The second* important reason of choosing the SBU as unit of analysis was that the advantage of the SBUs is to meet the increased coordination and decision-making requirements that result from increased diversity and size (Pearce and Robinson 2005). *Third*, the SBU is the level of implementation for most quality and innovation management programs. Furthermore, studies have shown (e.g., Curkovic et al. 2000) that quality-innovation investments vary between plants or SBUs within the same firm, indicating that a more aggregated unit of analysis, such as the parent firm level, would likely obscure important differences.

A multiple informant sampling unit (stratified random sampling) was used to ensure a balanced view of the relationships among the research constructs, and to collect data from the most informed respondents on different level of management (top, middle, low level of management) (Bryman and Bell 2003).

An assessment of non response bias was made using the extrapolation approach recommended by Armstrong (1979). Each individual questionnaire type (top, middle, and first-line managers) was categorized by the date the completed questionnaire was received. Tests revealed no significant differences between early responders (the first wave of responses; n = 442) and late responders (the second wave of responses; n = 890) on any of the constructs. As indicated by CFI (the comparative fit index) of 0.990 for the research model, the multi-group models represent excellent rate for the data. Accordingly, non-response bias is unlikely to be present in this data (Hoyle 1995; Morgan and Piercy 1998).

Measures

The author measured the dimensions of innovation strategy using indices developed from three level managers' responses to multiple items. The author selected items corresponding to each index based on theory. In addition, the author ran a principal component analysis to determine if the 28 innovation items fell into their respective theoretic dimensions (Zahra and Das 1993). The results supported the separation of the 28 items into the six dimensions shown in the Appendix. The Appendix shows the measures and items. This study develops six dimensions of innovation strategy (X1 through X6): Leadership Orientation (X1), Process Innovation (X2), Product Innovation (X3), External Innovation Source or Position Innovation (X4), Internal Innovation Source or Paradigm Innovation (X5), Investment Level (X6), and two company nonfinancial performances (X7) —productivity and operational reliability.

Analysis and Results

The software programs AMOS 5.0 and SPSS 12.0 were used to the quantitative data analysis. AMOS facilitates the specification process by automatically incorporating the estimation of standardized path coefficients, variances by default for all research (independent, mediating, dependent) variables, and goodness-of-fit measures (Byrne 2001; Arbukle and Wothke 1999; and Anderson and Gerbing 1988). SPSS facilitates reliability analysis, factor analysis, factor loadings, inter-correlations, and the three steps of hierarchical multiple regression process by determining the *R*-Square Change, *F*-Change, and Standard Coefficients Beta for each step (Bryman and Cramer 1997; Coakes and Steed 2003).

Interpretation of Results

To interpret the results of the study, the author used some statistical tools: instrument reliability, factor analysis, inter-correlations, path analysis, structural equation modeling (SEM), hierarchical multiple regression analysis, and decomposition of path variance.

Instrument Reliability

In determining the reliability of the multi-item scale, item to total correlations and coefficient alpha were calculated. The results of the reliability analysis for the critical items of 28 innovation items are outlined in Table 1. The scale purification was not carried out because all items have item-total correlations of higher than 0.50. No such innovation items were eliminated. Also, the standardized item alpha for critical items of innovation items is 0.8996, reliabilities of 0.70 or

Table 1. Reliability Analysis Scale

Innovation Items	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
X1	101.9775	193.0702	0.5244	0.8957
X2	102.2878	187.7164	0.5654	0.8965
X3	102.3651	189.8756	0.5857	0.8943
X4	102.0383	191.3602	0..6462	0.8941
X5	101. 9752	190.3310	0.6597	0.8937
X6	101.9797	191.2951	0.6562	0.8940
X7	102.0654	189.9664	0.6728	0.8934
X8	102.6702	188.0438	0.6580	0.9074
X9	102.5199	189.9310	0.6507	0.8936
X10	102.2036	190.3653	0.6574	0.8937
X11	102.2720	190.0373	0.5403	0.9002
X12	102.6364	190.9429	0.5677	0.8947
X13	102.3434	191.2768	0.5164	0.9006
X14	103.1758	194.4879	0.5009	0.8997
X15	102.6206	191.7093	0.5831	0.8948
X16	102.3794	189.7093	0.6100	0.8940
X17	102.3328	188.9591	0.5673	0.8996
X18	102.5748	189.7844	0.6408	0.8937
X19	102.2434	191.4760	0.6635	0.8940
X20	102.2908	190.4395	0.6359	0.9002
X21	102.4756	188.0586	0.5866	0.8991
X22	102.2885	191.6851	0.6402	0.8943
X23	102.2141	192.0932	0.6267	0.8945
X24	102.2194	190.1428	0.6750	0.8935
x25	102.2487	189.5945	0.5472	0.9001
X26	102.3434	192.0046	0.6060	0.8947
X27	102.2284	193.1523	0.5961	0.8951
X28	102.3772	193.2080	0.5948	0.8960

Alpha = 0.8996

higher will suffice. These confirm the reliability of the relationships items.

Factor Analysis

The author measured the dimensions of innovation strategy using indices developed from SBU managers' responses to multiple items. Zahra and Das selected items corresponding to each index based on theory. In addition, the author ran a principal component analysis to determine if the 28 innovation items (X1-X28) fell into their respective theoretic dimensions. To interpret the dimensions, it is necessary to group the innovation items that have high loadings in the same dimensions. One strategy is to shorten

Table 2. **The Result of Principal Component Analysis: Innovation Dimensions**

Rotated Component Matrix						
Innovation Items	**Innovation Strategy Dimensions**					
	1	**2**	**3**	**4**	**5**	**6**
X1	**0.769**	0.273	0.075	0.322	-0.061	0.098
X2	**0.764**	0.291	0.054	0.273	-0.004	0.126
X3	**0.721**	0.048	0.266	0.059	0.061	0.287
X4	**0.704**	0.301	0.107	0.282	0.058	0.109
X5	**0.666**	0.280	0.145	0.267	0.057	0.107
X6	**0.664**	0.180	0.247	-0.018	0.331	0.058
X7	0.355	**0.707**	0.241	-0.070	0.307	0.112
X8	0.190	**0.657**	0.121	0.257	0.069	0.185
X9	0.174	**0.640**	0.225	0.246	0.091	0.082
X10	0.157	**0.639**	0.121	0.099	0.137	0.171
X11	0.277	0.278	**0.630**	0.157	-0.006	0.181
X12	0.223	0.228	**0.630**	0.157	0.046	0.133
X13	0.347	-0.006	**0.617**	0.199	-0.011	0.121
X14	0.099	0.389	**0.611**	-0.013	0.022	0.146
X15	0.195	0.236	**0.562**	0.230	0.237	0.206
X16	0.305	0.249	0.225	**0.683**	-0.010	0.213
X17	0.239	0.187	0.121	**0.623**	-0.244	0.268
X18	0.255	0.140	0.309	**0.618**	-0.016	0.138
X19	0.051	0.231	0.384	**0.601**	0.200	0.149
X20	0.053	0.229	0.319	0.200	**0.674**	0.010
X21	0.195	0.052	0.068	0.142	**0.663**	0.112
X22	0.149	0.247	0.414	0.281	**0.602**	0.017
X23	0.305	-0.047	0.097	0.030	**0.551**	0.038
X24	0.306	0.126	-0.009	0.012	0.137	**0.683**
X25	0.035	0.135	0.252	0.380	0.352	**0.648**
X26	0.099	0.256	0.155	0.265	-0.121	**0.612**
X27	0.216	0.363	0.190	0.287	0.036	**0.567**
X28	0.016	0.187	0.314	0.038	0.107	**0.552**

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization

Table 3. **Total Variance Explained**

Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Total	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
17.9155	35.831	35.831	7.9235	15.847	15.847
3.108	6.216	42.047	6.8955	13.791	29.638
2.7135	5.427	47.474	5.2735	10.547	40.185
2.1675	4.335	51.809	4.9665	9.933	50.117
1.906	3.812	55.622	2.7525	5.505	55.622
1.410	2.820	58.442	1.410	2.820	58.442

(in ascending order) the matrix of factor loadings so that items with high loadings on the same factor appear together. Thus, as depicted in Table 2, only the strong factor loadings (e" 0.5 in absolute value, shown in bold) are considered to simplify the interpretation process. A good rule of thumb is that standardized loading estimate should be 0.5 or higher, and ideally 0.7 or higher (Tamimi 1985; Hair et al. 2006).

The results support the separation of the 28 items into six dimensions shown in Table 2. Six dimensions of innovation strategy are as follows: (1) Leadership Orientation (X1- X6); (2) Process Innovation (X7- X10); (3) Product (Service) Innovation (X11-X15); (4) External Innovation Source (X16- X19); (5) Internal Innovation Source (X20- X23); and (6) Investment Level (X24- X28). The Appendix shows the innovation strategy dimensions and items.

A thorough investigation of Table 3 indicates that the six innovation strategy dimensions are meaningful and account for 58.442 percent of the total variation among the 28 innovation items. The six innovation strategy dimensions are leadership orientation, process innovation, product (service) innovation, external innovation source, internal innovation source, and investment level. It is interesting to note that the first factor "leadership orientation" accounts for 35.831 percent of the total variation among the 28 innovation items. This clearly reinforces the importance of leadership orientation in adapting a first-to the-market posture that is conductive to gain a competitive edge (Zahra and Das 1993).

Inter-Correlations

Table 4 presents the means, standard deviations, and inter-correlations among the dimensions of innovation strategy. Cronbach coefficients (α) for the innovation strategy measures are shown at the diagonal path of Table 4. Because all measures have α of 0.80 or above, the author concludes that they are reliable. All of the correlations among the innovation strategy vari-

Table 4. **Means, Standard Deviations, and Intercorrelations among Dimensions of Innovation Strategy**

Six Dimensions of Innovation Strategy	X1	X2	X3	X4	X5	X6	Mean	SD
X1— Leadership Orientation (LO)	**0.85**						3.03	0.44
X2— Process Innovation (SCPI/DCPI)	0.70	**0.88**					2.65	0.39
X3— Product/Service Innovation (PI/SI)	0.61	0.67	**0.86**				3.50	0.52
X4— External Source/ Position Innovation (ES)	0.59	0.59	0.59	**0.80**			3.06	0.52
X5— Internal Source/ Paradigm Innovation (IS)	0.58	0.64	0.60	0.64	**0.89**		2.91	0.44
X6— Investment Level (INV)	0.54	0.40	0.36	0.36	0.32	**0.87**	2.75	0.48

Cronbach coefficient α at the diagonal. All correlations are significant at $p < 0.001$.

ables (X1- X6) are positive, suggesting that innovation strategy dimensions (leadership orientation, process innovation, product innovation, external sources or position innovation, internal sources or paradigm innovation, and investment level) reinforce one another.

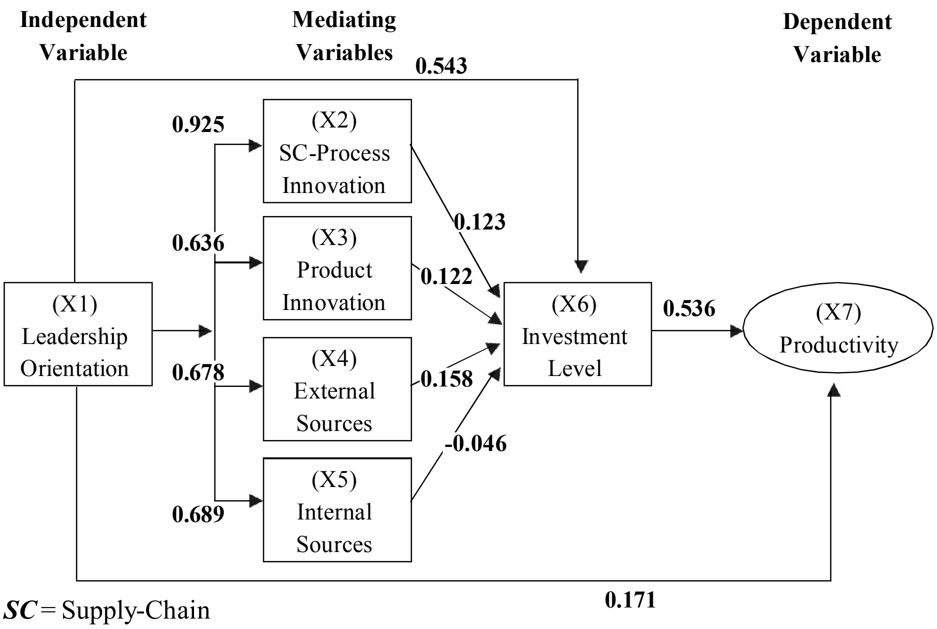
Structural Relation Results

In testing the sequential model, the author uses structural relations. In addition, in this study, measurement errors are low—as judged by the reliability coefficients, which exceed 0.80—favoring the use of path analysis (Li 1976; Asher 1976). Figure 4 and Figure 5 present the results of path analysis from the regression runs. The path models are significant at $p < 0.001$, with R^2 of 0.53 and 0.42, indicating that the model captures a significant portion of variance in the company non-financial performance. Judging by the α values in Figure 4 and Figure 5, the hypothesized associations relating to ten of the eleven links among innovation strategy measures are significant.

Figure 4 shows the results of full structural analysis for upstream SBUs. Leadership orientation (X1) is significantly associated with supply-chain process innovation (X2), product innovation (X3), external sources (X4), internal sources (X5), investment level (X6), and company non-financial performance (productivity) (X7). Moreover, investment level (X6) is associated with supply-chain process innovation (X2), product innovation (X3), and external sources (X4). Further, investment level (X6) is associated with the company non-financial performance (productivity) (X7). However, the internal sources (X5) are not significantly associated with investment. The result is not expected but the fact is that an upstream SBU typically relies on gaining the benefits from innovation of external sources. It will acquire innovations through business partnership forms (such as Joint Operation Body for Enhanced Oil Recovery or JOB-EOR, Joint Operation Body for Production Sharing Contract or JOB-PSC); licensing agreements (Technical Assistance Contract or TAC, Consortium Cooperation System); or acquisition with other firms (Joint Operating Contract or JOC) in order to improve their economic value-added (EVA) (Embassy of the U.S.A. 2004).

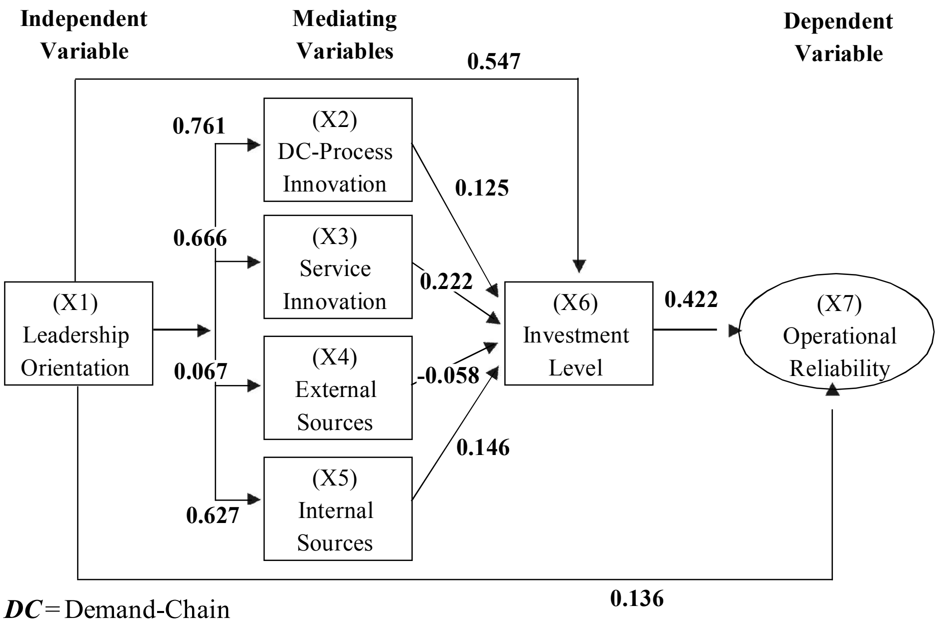
Figure 5 shows the results of full structural analysis for downstream SBUs. Leadership orientation (X1 or LO) is significantly associated with demand-chain process innovation (X2), service innovation (X3), external sources (X4), Internal sources (X5), investment level (X6), and company non-financial performance (operational reliability) (X7). Moreover, investment level (X6) is associated with demand-chain process innovation

Figure 4. **Results of Full Path Analysis Model Showing the Association Between Innovation Strategy and Company Non-Financial Performance (Productivity) for Upstream SBUs With Significant Standardized Path Coefficients ($p < 0.001$; $R^2 = 0.53$)**



SC = Supply-Chain

Figure 5. **Results of Full Path Analysis Model Showing the Association Between Innovation Strategy and Company Non-Financial Performance (Operational Reliability) for Downstream SBUs With Significant Standardized Path Coefficients ($p < 0.001$; $R^2 = 0.42$)**



DC = Demand-Chain

(X2), service innovation (X3), and internal sources (X5). Further, investment level (X6) is associated with the company non-financial performance (operational reliability) (X7). However, the external sources (X4) are not significantly associated with investment (X6). The result is not expected but the fact shows that the downstream SBUs of oil and gas companies relatively emphasize internal innovation orientations. With internal sources of innovation, a downstream SBU relies on its own in-house R&D efforts to generate demand-chain process innovation and service innovation. In addition, the downstream SBUs have made extensive use of internal innovation sources in their attempts to control the distribution of oil-based fuel and transmission of natural gas for domestic and international markets in order to increase their market-value-added (MVA) effectively (Directorate General of Oil and Gas 2004).

Structural Equation Modeling

The subsequent analysis for testing overall research models and developed hypotheses utilizes structural equation modeling (SEM) by operating AMOS 5.0 program. The objective of the test is to assess the goodness-of-fit between the model and the sample data (Byrne 2001). Table 5 and Table 6 show the complete model fits of the research constructs which indicate that the overall parameter of final model are good fit between the hypothesized model and the observed data (Hair et al. 2006). The examinations to find these goodness-of-fit statistics of the final model with respect to the acceptable parameter level have encouraged the author to seek some modifications of the hypothesized models in the efforts to attain adequate fit to the data.

The fully revised (final) structural model for upstream SBUs (after eliminating the path from Internal In-

Table 5. **SEM (Final) Results for Upstream SBUs**

Structural Relations	Standardized Regression Weights (y)	CR	*error* (ε)	Residual (ξ)
SCPI <——— LO	0.925	39.161	εLO = 0.067	
PI <——— LO	0.636	28.038	εSCPI = 0.074	ξSCPI = 0.262
ES <——— LO	0.678	24.109	εPI = 0.084	ξPI = 0.267
IS <——— LO	0.689	24.312	εES = 0.070	ξES = 0.247
INV <——— LO	0.543	12.480	εIS = 0.050	ξIS = 0.192
PROD <——— LO	0.171	3.754	εINV = 0.055	ξINV = 0.265
INV <——— SCPI	0.123	3.381	εPROD= 0.043	ξPROD = 0.365
INV <——— PI	0.122	3.331		
INV <——— ES	0.158	3.650		
INV <——— IS (Deleted)	**-0.046**	**-0.914**		
PROD <——— INV	0.536	12.460		

Goodness of Fit Measures

Chi-Square Statistic (X^2)	10.029
Degree of Freedom (df)	5
Normed Chi-Square (X^2/df)	2.006
GFI	0.998
AGFI	0.988
CFI	0.999
RMR	0.002
RMSEA	0.027
P	0.074
ECVI	0.042

novation Source (IS) to Investment (INV)) is presented in Table 5. Critical ratio (CR) values larger than 1.96 prove the path coefficient to be statistically significant at level $p < 0.05$. The overall model fit indices (the goodness-of-fit-index or GFI= 0.998; the goodness-of-fit-index adjusted for degrees of freedom or AGFI=0.988; the comparative fit index or CFI=0.999; the root mean square residual or RMR= 0.002; the root mean square error of approximation or RMSEA= 0.027; p-value= 0.074, and X^2/df= 2.006) are above the cutoffs for good fit. Therefore, the sequential model indicates a good predictor of the sample.

Table **6. SEM (Final) Results for Downstream SBUs**

Structural Relations	**Standardized Regression Weights (y)**	**CR**	***error* (ε)**	**Residual (ξ)**
DCPI <——— LO	0.761	25.007	εLO = 0.044	
SI <——— LO	0.666	28.038	εDCPI = 0.023	ξDCPI = 0.450
ES <——— LO	0.067	1.026	εSI = 0.028	ξSI = 0.481
IS <——— LO	0.627	26.546	εES = 0.031	ξES = 0.490
INV <——— LO	0.547	26.140	εIS = 0.029	ξIS = 0.397
OR <——— LO	0.136	2.726	εINV = 0.036	ξINV = 0.549
INV <——— DCPI	0.125	2.613	εOR = 0.022	ξOR = 0.382
INV <——— SI	0.222	5.326		
INV <——— ES (Deleted)	**-0.058**	**-0.944**		
INV <——— IS	0.146	2.846		
OR <——— INV	0.422	24.140		

Goodness of Fit Measures

Chi-Square Statistic (X^2)	15.712
Degree of Freedom (df)	7
Normed Chi-Square (X^2/df)	2.245
GFI	0.990
AGFI	0.977
CFI	0.988
RMR	0.007
RMSEA	0.031
P	0.048
ECVI	0.053

Table 6 shows the final structural model for downstream SBUs. After eliminating the path from ES (External Innovation Sources) to INV (Investment), the goodness-of-fit measures are iteratively used to determine whether the structural model fits the data well. Results obtained from the structural equation modeling analysis suggest that the sequential model exhibits a quite satisfactory overall fit: the values of goodness of fit index (GFI) and the adjusted goodness of fit index (AGFI). Comparative fit index (CFI) is exceeding recommended level 0.9 or close to 1. The root mean square residual or RMR; the root mean square error of approximation or RMSEA; p-value, and X^2/df are also exceeding recommended level (acceptable parameter levels are $1< X^2/df< 5$; RMSEA< 0.05; RMR close to 0; and p-value < 0.05). Because the goodness-of-fit statistics resulting from this analysis is a well-fitting model, this model is accepted.

In summary, 10 out of 11 paths specified in the hypothesized models (Figure 2 and Figure 3) are found to be positive and statistically significant with small errors (ε) of seven constructs (close to zero) and small residuals (ξ) of mediating and dependent variables (<2.58). These SEM results also provide important insights into the consistent and smallest ECVI values (Expected Cross-Validation Index) —0.042 and 0.053. According to Byrne (2001), the structural model having the smallest ECVI values exhibits the greatest potential for replication.

Hierarchical Multiple Regression Analysis

In this hierarchical multiple regression analysis, independent and mediating variables are entered separately, and are used to test whether the dependent variable (company non-financial performance—productivity or operational reliability) is predictable from the combined independent variable (leadership orientation) and mediators (process, product, external source, internal source of innovation, and investment). To demonstrate mediation, the analysis requires three regressions to be estimated. *First*, the dependent variable of company non-financial performance (i.e. productivity or operational reliability) must be predictable from the independent variable (leadership orientation). *Second*, the dependent variable (i.e., productivity or operational reliability) must be predictable from the mediators (process, product, external source, internal source of innovation, and investment). *Third*, the dependent variable (productivity or operational reliability) must be predictable from the combined independent variable (leadership orientation) and mediators (process, product, external source, internal source of innovation, and investment). If mediation occurs, the mediators will be significant in the third equation. Table 7 and Table 8 provide the complete results of the hierarchical multiple regressions predicting the link between innovation strategy and company non-financial performance for upstream and downstream SBUs.

Table 7 indicates that *the first step* explains 20.8 percent of the variance in company non-financial performance (Productivity), $F(2, 1330) = 348.550$, $p = 0.000$, Durbin Watson =1.649. As expected, a majority of the variance explained in company non-financial performance (Productivity) could be attributed to leadership orientation. Results from *the second step* of these regressions indicate that entering the mediators increases the amount of variance explained in company non-financial performance by approximately 33 percent, $F(3, 1329) = 945.826$, $p = 0.000$, Durbin Watson=1.726. Mediators positively predict the company non-financial performance (Productivity). The combined variables (independent variable —leadership orientation and mediating variables— process, product, external source, internal source of innovation, and investment) entered in *the third step* increase the amount of variance explained for company non-financial performance (pro-

Table 7. **Summary of Hierarchical Multiple Regression Analyses for Upstream SBUs**

R	R Square	Adjusted R Square	Std. Error of The Estimate	R Square	F-Change	Df1	Df2	Sig. F-Change	Durbin-Watson
Step 1									
0.465[a]	0.208	0.207	0.491250	0.208	348.550	2	1330	0.000	1.649
Step 2									
0.733[b]	0.537	0.536	0.375625	0.329	945.826	3	1329	0.000	1.726
Step 3									
0.736[c]	0.542	0.540	0.374225	0.005	3.491	8	1325	0.008	1.839

a. Predictors: (Constant), Leadership Orientation (LO)
b. Predictors: (Constant), Supply-Chain Process Innovation (SCPI), Product Innovation (PI), External Source of Innovation (ES), Internal Source of Innovation (IS), Investment (INV)
c. Predictors: (Constant), Leadership Orientation (LO), Supply-Chain Process Innovation (SCPI), Product Innovation (PI), External Source of Innovation (ES), Internal Source of Innovation (IS), Investment (INV)
d. Dependent Variable: Company Non-Financial Performance—Productivity (PROD)

ductivity) by 0.5 percent, *F* (8, 1325) = 261.252, p= 0.000, Durbin Watson= 1.839. Thus, the mediation does occur. The mediators are significant in the third equation. Therefore, the researcher finds that leadership orientation affects productivity through supply-chain process innovation, product innovation, external innovation sources, internal innovation sources, and investment. Six innovation strategy dimensions individually account for a significant portion of the variance in company non-financial performance (productivity) in the upstream SBUs.

Table 8 reveals that *the first step* explains 13.6 percent of the variance in company non-financial performance (operational reliability), *F* (1, 1332)= 290.449, P= 0.000, Durbin Watson= 1.591. It means that 13.6 percent of the variance explained in company non-financial performance (operational reliability) could be attributed to leadership orientation (dependent variable). Results from *the second step* of these regressions indicate that entering demand-chain process innovation, service innovation, external innovation sources, internal innovation sources,

Table 8. **Summary of Hierarchical Multiple Regression Analyses for Downstream SBUs**

R	R Square	Adjusted R Square	Std. Error of The Estimate	R Square	F-Change	Df1	Df2	Sig. F-Change	Durbin-Watson
Step 1									
0.368[1]	0.136	0.135	0.53538	0.136	290.449	1	1332	0.000	1.591
Step 2									
0.444[2]	0.197	0.195	0.51650	0.062	35.425	4	1329	0.000	1.616
Step 3									
0.448[3]	0.201	0.198	0.51549	0.004	8.259	8	1325	0.004	1.675

1. Predictors: (Constant), Leadership Orientation (LO)
2. Predictors: (Constant), Demand-Chain Process Innovation (DCPI), Service Innovation (SI), External Source of Innovation (ES), Internal Source of Innovation (IS), Investment (INV)
3. Predictors: (Constant), Leadership Orientation (LO), Demand-Chain Process Innovation (DCPI), Service Innovation (SI), External Source of Innovation (ES), Internal Source of Innovation (IS), Investment (INV)
4. Dependent Variable: Company Non-Financial Performance—Operational Reliability (OR)

and investment (mediating variables) increases the amount of variance explained in operational reliability by approximately (R- Square Change) 6.2 percent, $F(4, 1329) = 35.425$, $p = 0.000$, Durbin Watson=1.616. Mediators positively predict operational reliability. The combined variables (leadership orientation –an independent variable; demand-chain process innovation, service innovation, external innovation sources, internal innovation sources, and investment– mediating variables) entered in *the third step* increase the amount of variance explained for operational reliability (by R-Square Change= 0.4 percent, $F(8, 1325)= 3.491$, $p= 0.004$, Durbin Watson= 1.675. Thus, the mediation occurs. The mediators are significant in the third equation. Therefore, the researcher finds that leadership orientation affects operational reliability through demand-chain process innovation, service innovation, external innovation sources, internal innovation sources, and investment (mediators). Six innovation strategy dimensions individually account for a significant portion of the variance in company non-financial performance (operational reliability) in the downstream SBUs.

Decomposition of Path Variance

The author examines the results of the structural analysis further to determine the direct and indirect effect of innovation strategy dimensions on company non-financial performance (Alwin and Hauser 1975). A direct effect exists when a dimension of innovation strategy (i.e., leadership orientation) influences company non-financial performance (i.e., productivity or operational reliability) without the mediation of a third dimension. Figure 4 and Figure 5 show the coefficients representing the direct paths in the sequential models. However, to fully capture the effect of the six dimensions of innovation strategy on the company non-financial performance (i.e., productivity or operational reliability), one must also consider their indirect effects. Indirect coefficients show the impact of leadership orientation on company non-financial performance (productivity or operational reliability) through its influence on a third dimension (e.g., process innovation). Table 9 and Table 10 report the results for the direct and indirect paths.

The results of Table 9 suggest a direct path between leadership orientation (LO) and productivity (PROD), both because the path estimate is significant and because adding the path improves the model fit (total effect= 0.605). With a significant direct effect, the IS-PROD relationship (Internal Innovation Sources➔Productivity) becomes insignificant; internal sources of innovation (IS) do not mediate the relationship between LO and PROD as originally hypothesized. Because the total indirect effects between LO➔ SCPI➔ INV➔ PROD; LO➔PI➔INV➔PROD; and LO➔ ES➔INV➔ PROD are greater than 0.08; these indirect relationships would be interpreted (Hair et al. 2006). The original model hypothesizes that any effect of LO and PROD would be partially mediated by SCPI, PI, ES through the sequence of relationships linking LO with PROD for upstream SBUs.

The decomposition of variance shown in Table 10 suggests a direct path from leadership orientation (LO) to operational reliability (OR). The ES-OR relationship is insignificant; ES (external innovation source) is not a mediator between IS and PROD. Because adding indirect effects (DCPI, SI, IS, and INV) to the direct effect improves the model fit (total effect = 0.492), these indirect effects are partial mediators between LO and OR for downstream SBUs.

Therefore, the types of relationship are direct and indirect. In retrospection, the direct relationship between leadership orientation (LO) and productivity (PROD) or operational reliability (OR) makes sense because it adds to improving their productivity or operational reliability performance if they implement their innovation strategies effectively (Porter 1985). The original model hypothesizes that any effect of LO and PROD would be partially mediated by SCPI, PI, ES (for upstream SBUs), and by DCPI, SI, IS (for downstream SBUs) through the sequence of relationships linking LO with PROD or linking LO and OR.

Table 9. **Decomposition of Variance for Upstream SBUs**

Structural Path Estimates (Direct or Indirect Path)	Standardized Direct Effects	Standardized Indirect Effecs	Standardized Total Effects
LO➔PROD	0.171	-	-
LO➔INV➔PROD: 0.543 x 0.536	-	0.291	-
LO➔SCPI➔INV➔PROD: 0925 x 0.123 x 0.536	-	0.061	-
LO➔PI➔INV➔PROD: 0.636 x 0.122 x 0.536	-	0.042	-
LO➔ES➔INV➔PROD: 0.678 x 0.158 x 0.536	-	0.057	-
LO➔IS➔INV➔PROD: 0.689 x -0.046 x 0.536	-	-0.017	-
Total Effect of LO on PROD is	**0.171**	**0.434**	**0.605**

Note: LO=Leadership Orientation; SCPI=Supply-Chain Process Innovation; PI=Product Innovation; ES=External; Innovation Sources; IS=Internal Innovation Sources; INV=Investment; PROD=Productivity

Table 9. **Decomposition of Variance for Downstream SBUs**

Structural Path Estimates (Direct or Indirect Path)	**Standardized Direct Effects**	**Standardized Indirect Effecs**	**Standardized Total Effects**
LO➔OR	0.136	-	-
LO➔INV➔PROD: 0.547 x 0.422	-	0.231	-
LO➔DCPI➔INV➔OR: 0.761 x 0.125 x 0.422	-	0.040	-
LO➔SI➔INV➔OR: 0.666 x 0.222 x 0.422	-	0.062	-
LO➔ES➔INV➔OR: 0.667 x -0.058 x 0.422	-	-0.016	-
LO➔IS➔INV➔OR: 0.627 x 0.146 x 0.422	-	0.039	-
Total Effect of LO on OR is	**0.136**	**0.356**	**0.492**

Note: LO=Leadership Orientation; DCPI=Demand-Chain Process Innovation; SI=Service Innovation; ES=External Innovation Sources; IS= Internal Innovation Sources; INV= Investment; OR= Operational Reliability

Discussion and Implications

The researcher conducts structural equation modeling (SEM) and hierarchical multiple regression analysis as statistical tools to assess the goodness-of-fit between the research models and the sample data; and to test whether innovation strategy mediates the impact of leadership orientation on company non-financial performance. A hierarchical multiple regression analysis and SEM, partially and in an integrated manner, provide a means for the dynamic complexity of organizations. Both methods are making an explicit relationship between leadership orientation and company non-financial performance, and assessing the positive impacts of process innovation, product/service innovation, external innovation sources, internal innovation sources, and investment (partially mediators) on improving company non-financial performance (i.e., productivity or operational reliability), thereby enhancing understanding and ultimately contributing to the improvement of company financial performance—sales, net profit margin, return on assets (Santos et al. 2002). This hierarchical multiple regression analysis is generally lacking in the literatures. Most past studies have focused primarily on the association between a specific dimension of innovation strategy and company performance using multiple regression (Zahra and Das 1993).

SEM reveals that the sequential models have met goodness-of-fit criteria, thus the interpretation of the sequential models fits with the data. The results of the path analysis model and SEM: (1) support the importance of innovation strategy as a determinant of company non-financial performance —productivity (for upstream SBUs) or operational reliability (for downstream SBUs), (2) suggest that the sequential model is appropriate for examining the relationships among six dimensions of innovation strategy and company non-financial performance that oil and gas managers in upstream and downstream sectors can use to establish an effective innovation strategy. The sequential models also provide additional insights into the indirect contribution of the individual dimension of innovation strategy (as a partial mediator) to company non-financial performance— productivity or operational reliability.

Limitations and Future Research

The findings should be considered in light of the study's limitations. *First,* the current cross-sectional data do not permit the testing of causal relationships. This is a limitation because, for example, particular levels of company non-financial performance may encourage (or discourage) companies from pursuing particular innovation strategies as much as particular innovation strategies promote company performance. *Second*, other variables may moderate the effect of the four dimensions of innovation strategy on company performance. For example, the manufacturing experience of managers has been shown to influence the implementation of innovation activities (Ettlie 1990). A third limitation relates to the generalizability of the sample of single industry to the larger population of wide variety industries employing the link between innovation strategy and company non-financial performance.

This study develops a sequential model of innovation strategy —company non-financial performance links based upon a quantitative research approach. In terms of future research topics, several possible areas can be derived from this study.

One of the most promising research topics is to investigate the causal relations among the six innovation strategy dimensions. In order to conduct this type of study, researchers need to keep in mind three crucial elements. *First*, researchers should clearly define the number and characteristics of measurement instruments to predict dependent variable, independent variables, and mediating or moderating variables. *Second*, researchers must carefully design the research model to minimize reliability and validity problems. This type of research needs to be precise enough to demonstrate that a potential cause and effect could have co-varied. In addition, all six variables which are confounding variables must be ruled out.

Third, a cross-cultural comparative study can be suggested as another promising research topic based on the same measurement scales. Since the measurement scales for this study are largely focused on the managerial elements that relate to innovation strategy implementation and organizational improvement; the assessment and analysis of management activities in a different cultural setting may prove quite interesting. To accomplish this cross-cultural comparative study, researchers must carefully select the sample country so that innovation strategy is already in place there. At a minimum level, very similar principles of innovation strategy should be employed organization-wide. The promising benefit of this type of study is that researchers can identify how cultural differences affect the same innovation management philosophy.

Research Implications

The findings provide empirical evidence extending the previous model of Zahra and Das. These findings also provide a basis for useful recommendations for upstream and downstream SBU managers attempting to implement a sequential model of innovation strategy—company non-financial performance links. This study shows that upstream SBUs rely on external innovation sources. They will design innovation policies through business partnership development (such as Joint Operation Body for Enhanced Oil Recovery or JOB-EOR, Joint Operation Body for Production Sharing Contract or JOB-PSC); licensing agreements (Technical Assistance Contract or TAC, Consortium Cooperation System); or acquisition with other firms (Joint Operating Contract or JOC). In contrast, downstream SBUs emphasize on generating internal innovation sources to develop their own in-house R&D efforts. The downstream SBUs should make extensive policies of internal innovation sources in their attempts to control the distribution of oil-based fuel and transmission of natural gas for domestic and international markets effectively. Both policies would enhance understanding and ultimately contributing to the improvement of company financial performance —sales, net profit margin, return on assets.

The potential implications of the study also can be viewed from the integrated oil and gas chains. Internal development of organization (both upstream and downstream sectors) is deemed an important precursor to adapting to external environment (Ostroff 1992). In other words, the mechanism to adapt external environmental requires organizational members to realize the commitment of continuous process improvement and innovation beyond the job requirements as well as their formal job descriptions. A sequential model of innovation strategy —company non-financial performance links has to be determined to have beneficial organizational impacts in the long-term (to establish streamlined operations in order to reach long-term organizational effectiveness and efficiency) in the oil and gas industry. As Davila et al. (2006) states, "Organization with internal environments that foster a developed portfolio of continuous process improvement and innovations might be able to adapt to external environment changes more fluidly in order to sustain growth."

In conclusion, this study supports the importance of innovation strategy as a determinant of company non-financial performance. Its results show that decision makers of oil and gas companies in Indonesia can gain considerably from articulating and adopting a comprehensive (corporate) strategy for their innovation activities (upstream and downstream sectors). The gains that materialize from such a strategy can enhance a company's growth and value —economic value-added (EVA) and market value-added (MVA).

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APPENDIX

Innovation Strategy Dimensions for the Indonesia's Oil and Gas Industry (Upstream and Downstream Sectors)

The researcher collected data for innovation strategy in the Indonesia's oil and gas industry (upstream and downstream sectors) using multiple items which have adapted from Zahra and Das's study (1993). The items follow.

1. **Leadership Orientation**. Managers rated their company's leadership on innovation activities. The researcher asked them to circle the one number that best describe their company's situation over past 3 years (2002-2004), using the scale below.

1	2	3	4	5
Little Emphasis		Neutral		Major Emphasis

Your company's (Upstream or Downstream SBU)

a	Emphasis on being first to introduce new products or new oil and gas distribution stations to the market	1	2	3	4	5
b	Emphasis on being commercializing new oil and gas wells or technological models (or new retail sales)	1	2	3	4	5
c	Commitment to conducting cutting edge research and development (R&D) focusing on the interaction between quality and innovation	1	2	3	4	5
d	Reputation for being the industry's leader in pioneering oil and gas wells projects (productivity) or operational reliability	1	2	3	4	5
e	Ability to introduce new oil and gas wells projects or new retail services ahead of the competition	1	2	3	4	5
f	Emphasis on adapting a strategy of being the industry leader in offering new oil and gas wells projects (enhanced oil recovery or EOR technologies) or marketing networking	1	2	3	4	5

2. **Process Innovation**. Managers rate their companies' emphasis on the following items over the past 3 years (2002-2004). We asked them to circle the one number that best describe their companies' situation, using the scale below.

1	2	3	4	5
Little Emphasis		Neutral		Major Emphasis

Your company's (Upstream or Downstream SBU) emphasis on

a	Developing new production (exploitation, exploration, and refinery) methods and procedures or marketing distribution	1	2	3	4	5
b	Introducing more new methods of production (exploitation, exploration, and refinery) or marketing distribution than its major competitor	1	2	3	4	5
c	Introducing more new methods of production (exploitation, exploration, and refinery) of shipping and harbor than 3 years ago	1	2	3	4	5
d	Introducing more new methods of production (exploitation, exploration, and refinery) or promotional-mix than your industry average	1	2	3	4	5

3. **Product (Technology) Innovation**. Managers rated their companies' emphasis on and commitment to technology innovation activities over the past 3 years (2002-2004), using a five-point scale.

1	2	3	4	5
Very Low	Low	Average	High	Very High

Your company's (Upstream or Downstream SBU)

a	Level of technology innovation (water drive, solution test drive, and technology development) or R&D	1	2	3	4	5
b	Emphasis on modifying existing oil and gas well or field projects or marketing distribution system	1	2	3	4	5
c	Commitment to introducing more oil and gas well projects or new oil/gas distribution stations than its major competitors	1	2	3	4	5
d	Commitment to introducing more oil and gas well projects or new oil/gas distribution stations than your industry average	1	2	3	4	5
e	Commitment to introducing more oil and gas well projects or new oil/gas distribution stations than 3 years ago	1	2	3	4	5

4. **External Innovation Source (Position Innovation)**. Managers rate their companies' emphasis on the following items over the past 3 years (2002-2004). The researcher asked them to circle the one number that best described their companies' situation.

1	2	3	4	5
Minor Emphasis				Major Emphasis

Your company's emphasis (Upstream or Downstream SBU) on

a	Using new oil and gas well projects or new retail sales developed outside your company	1	2	3	4	5
b	Purchasing technologies (EOR) or R&D developed by other firms	1	2	3	4	5
c	Acquiring oil and gas wells/technologies or R&D through licensing agreements	1	2	3	4	5
d	Acquiring oil and gas wells/technologies through joint ventures (JOB) or R&D with other firms	1	2	3	4	5

5. **Internal Innovation Source (Paradigm Innovation)**. Managers rated their companies' emphasis on four items, covering the past 3-year period (2002-2004). The researcher asked them to circle the one number that best described their companies' situation.

1	2	3	4	5
Minor Emphasis				Major Emphasis

The extent of your company's (Upstream or Downstream SBU)

a	Reliance on internal R&D efforts in developing new oil and gas wells and technologies projects	1	2	3	4	5
b	Investment in developing new oil and gas wells and technologies projects or marketing intelligence internally	1	2	3	4	5
c	Reliance on proprietary technology and Distribution Information System	1	2	3	4	5
d	Maintaining a highly skilled R&D unit for oil and gas wells/technology development projects	1	2	3	4	5

6. **Investment**. Managers rated their companies' commitment to different aspects of innovation activities over the past 3 years (2002-2004) by circling the one number that described their opinions, following a five-point scale.

1	2	3	4	5
Very Low	Low	Average	High	Very High

Level of your company's spending (Upstream or Downstream SBU) on

a	R&D activities for potential oil and gas fields or corporate social responsibility	1	2	3	4	5
b	R&D activities compared with the industry's average	1	2	3	4	5
c	R&D activities compared with your major competitors	1	2	3	4	5
d	R&D staff (human capital) and equipment	1	2	3	4	5
e	Overall R&D compared with 3 years ago (2002-2004)	1	2	3	4	5

Company Non-Financial Performance. The study focused on oil and gas reserves and crude productivity measures (for upstream SBUs) and operational reliability measures (for downstream SBUs). The Level of Managers (Top, Middle, and Low) provided data on how well the upstream/downstream SBU emphasizes their companies' non-financial performance compared with their rivals and industry over the past 3-year period (2002-2004), as follows:

1. Your company's average crude, gas or geothermal reserves (defined as the level of productivity and cost efficiency) over the past 3 years (2002-2004) compared with its rivals and industry❻ **for Upstream SBUs**:

1a. Level of Productivity:

1	2	3	4	5
Very Low	Low	Average	High	Very High

1b. Cost Efficiency:

1	2	3	4	5
Very Low	Low	Average	High	Very High

2. Your company's operational reliability of distributing and to ensuring adequate oil and gas needed by the society over past 3 years (defined as operational reliability dimensions—on-time, on-specification, and on-budget (2002-2004) compared with its rivals and industry.
—>**for Downstream SBUs:**

2. a. On Time Performance:

1	2	3	4	5
Very Bad	Bad	OK	Good	Very Good

2. b On Specification Performance:

1	2	3	4	5
Very Bad	Bad	OK	Good	Very Good

2. c. On Budget Performance:

1	2	3	4	5
Very Bad	Bad	OK	Good	Very Good

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