

行政院國家科學委員會補助專題研究計畫成果報告

研究發展策略、績效衡量、獎酬制度與研發效能之關係： 平衡計分卡之實證研究

計畫類別：☒ 個別型計畫 ☐ 整合型計畫

計畫編號：NSC89-2416-H-002-006

執行期間：88 年 8 月 1 日至 89 年 7 月 31 日

計畫主持人：杜榮瑞教授

共同主持人：

本成果報告包括以下應繳交之附件：

- ☐ 赴國外出差或研習心得報告一份
- ☐ 赴大陸地區出差或研習心得報告一份
- ☐ 出席國際學術會議心得報告及發表之論文各一份
- ☐ 國際合作研究計畫國外研究報告書一份

執行單位：台灣大學會計學系

中 華 民 國 八 十 九 年 十 月 三 十 一 日

國科會專題計劃成果報告

計劃名稱：研究發展策略 績效衡量 獎酬制度與研發效能之關係：
平衡計分卡之實證研究

計劃編號：NSC89-2416-H-002-006

執行期限：88 年 8 月 1 日至 89 年 7 月 31 日

主持人：杜榮瑞教授

執行機構及單位：台灣大學管理學院會計學系

中文摘要

本研究從平衡計分卡的觀點探討研究發展策略與績效衡量的關係，並探討績效衡量在研究發展策略與研發效能關係間的調節角色。本研究發現：研究發展策略(積極型或防禦型)與績效衡量(財務、顧客、內部過程，及學習與成長)間有顯著關係，但績效衡量之調節角色則不顯著。

關鍵詞：平衡計分卡、研究發展策略、積極型、防禦型、績效、績效衡量。

Abstract

This study tests the hypotheses derived from the balanced scorecard that firms adopting different R&D strategies are expected to place differential emphasis on various performance measures. This study also explores the moderating role of performance measurement on the association between R&D strategy and performance. The results suggest that firms adopting prospector strategy tend to place different degree of importance on various performance measures from firms adopting defender strategy. Further, this study finds that prospectors differ significantly from defenders in their emphasis on financial, innovation, cost efficiency, and learning and growth measures. However, the moderating role of performance measurement is not significant.

Key words: the balanced scorecard, research and development strategy, prospector, defender, performance, performance measures.

Motivation and Purposes

Innovation through research and development (R&D) activities is a major source of competitive advantage in today's rapidly changing environments (Hayes, Wheelwright and Clark 1988; Porter 1985). The importance of R&D has made many firms devote to R&D activities, and also inspired studies concerning R&D strategy and its performance.

This study attempts to examine the linkage between R&D strategy and performance measures from the balanced scorecard (BSC) perspective, and the moderating role of performance measurement on the association between R&D strategy and its performance. This inquiry is very important for the following reasons. First, no extant research has examined both linkages. Second, it provides another approach to test the BSC propositions. The BSC propositions have been experimented and tested at the level of case studies, yet no notable study examines the BSC notion at the large sample level. Third, it adds evidence to the contingency theory concerning the fit between strategy and management accounting systems, and its effect on performance. Finally, but not

the least, the present study contributes to the line of research suggested by Ittner and Larcker (1998).

Results and Discussion

Before testing whether the BSC concept is implemented by firms adopting different R&D strategies, factor analysis was conducted. Principal components analysis was applied to reduce the 32 performance measures into eight factors with eigenvalues greater than unity. The eight factors account for 70% of total variance in the data. After oblique rotation of the factor solution, the resulting factors are identified as: costs and financial benefits, control of schedule and quality, innovation achievement, knowledge and work attitude, customers' satisfaction, control of design and expenditure, training and staff competence, and cross-functional integration.

Test of H1 Having identified the eight performance measure factors multivariate analysis of variance (MANOVA) was conducted to test the association between R&D strategy and performance measures. Using R&D strategy (prospectors vs. defenders) as the independent variable and the degree of importance placed on each of the eight performance measure factors (measured by factor score) as the dependent variables to conduct MANOVA test yields a significant association between them (Wilks' Lambda = 0.572; $p = 0.001$). Thus, H1 is supported. To further identify the performance measure factors on which these two strategy groups place importance differently, H2 ~ H5 are tested.

Test of H2 H2 concerns the differential emphasis made by the two groups on financial measures. Table 5 shows that these two groups do differ significantly in their emphasis on financial measures ($p = 0.0004$ two-tailed).

However, the difference is not in the expected direction. The factor scores for prospectors and defenders are 0.426 and -0.413, respectively. This result is also inconsistent with Ittner, Larcker and Rajan (1997) who find that defenders place more importance on financial measures than prospectors.

Test of H3 H3 predicts the equal importance of core customer measures placed by prospectors and defenders. Among the eight factors, factor 5 (customer satisfaction) represents the core customer measure. ANOVA result indicates that prospectors and defenders do not differ significantly in the importance placed on this measure ($F=0.11$, $P=0.7360$). Thus, H3 is supported.

Test of H4a H4a predicts that prospectors place more emphasis on innovation-related process measures than defenders. Among the eight factors, factor 3 (innovation achievement) belongs to this group of measures. Results of ANOVA show that prospectors and defenders do differ significantly in their emphasis on innovation achievement ($F = 12.44$, $p = 0.0008$, two-tailed). This difference is also in the expected direction. The factor scores of these two groups are 0.404 and -0.392, respectively.

In addition to factor 3, factor 8 (cross-functional integration) may also be relevant to innovation process. Factor 8 concerns the integration of technology, manufacturing and market and therefore may be more important for prospectors than for defenders. ANOVA test shows that prospectors differ from defenders in their emphasis on this factor ($F = 8.58$; $p = 0.005$, two-tailed). The difference is also in the expected direction with the factor scores for these two strategy groups of 0.3440 and -0.3339, respectively. Thus, H4a is supported.

Test of H4b H4b predicts that defenders place more importance on cost efficiency measures than prospectors. Factor 6 (control of design and expenditure) may, in a broad sense, belong to this kind of measures. Results of ANOVA indicate that these two groups differ significantly in the importance of the “control of design and expenditure” measure ($p = 0.009$, two-tailed). Yet, the difference is not in the expected direction. The factor scores are 0.400 and -0.388 , respectively. Cultural and institutional factors can be employed to account for the inconsistency.

Test of H4c H4c predicts that prospectors and defenders place equal importance on quality and time process measures. Factor 2 (control of schedule and quality) may fall into this category of measures. Results of ANOVA show that prospectors do not differ significantly from defenders in their emphasis on the “control of schedule and quality” measure ($F = 1.05$, $p = 0.3092$). Thus, H4c is supported.

Test of H5 H5 hypothesizes that prospectors place more emphasis on the learning and growth measures than defenders. Factors 4 (knowledge and work attitude) and 7 (training and staff competence) are measures of this perspective. Results of ANOVA using factor 4 as the dependant variable show that prospectors and defenders do not differ significantly in this respect ($F = 2.77$, $p = 0.1007$). Using factor 7 as the dependent variable, ANOVA results indicate that prospectors differ significantly from defenders in the importance placed on the “training and staff competence” measure ($F = 8.63$, $p = 0.0046$) and that the difference is in the expected direction (factor scores are 0.345 and -0.335 , respectively). Thus, H5 is partially supported.

Test of H6 H6 hypothesizes that the fit between R&D strategy and performance measurement will lead to

higher performance. The result of statistical tests suggests no significant role of performance measurement on the linkage between R&D strategy and performance.

Contributions

Prior research examines either R&D performance measures alone or associations between R&D strategy and performance. This study extends and integrates prior research by investigating the linkage between R&D strategy and performance measures, and the moderating role of performance measurement on the association between R&D strategy and performance. Moreover, this study is the first to test the BSC notion at a large sample level. Finally, this study contributes not only to the research line suggested by Ittner and Larcker (1998), but also to the contingency study.

References

- Bergen, S.A. and C.P. McLaughlin. 1988. The R&D/production interface: A four-country comparison. *International Journal of Operations & Production Management* (July):5-13.
- Brockhoff, K., and A.K. Chakrabarti. 1988. R&D/marketing linkage and innovation strategy: some West German experience. *IEEE Transactions on Engineering Management*, 35: 107-174.
- _____, and A. Pearson. 1992. Technical and marketing aggressiveness and the effectiveness of R&D. *IEEE Transactions on Engineering Management*, 39: 318-324.
- Francis, P.H. 1992. Putting quantity into the R&D process. *Research. Technology Management*, 35: 16-

- 23.
- Govindarajan, V., and J. Fisher. 1990. Strategy, control systems, and resource sharing: impact on performance. *Academy of Management Journal*, 33 (June): 259-285.
- Giffin, A., and A.L. Page. 1993. An interim report on measuring product development success and failure. *Journal of Product Innovation Management*, 10: 291-308.
- Hayes, R.H., S.C. Wheelwright, and K.B. Clark. 1988. *Dynamic Manufacturing*. New York: The Free Press.
- Ittner, C.D., and D.F. Larcker. 1997. Quality strategy, strategic control systems, and organizational performance. *Accounting, Organizations and Society*, 22: 293-314.
- _____. 1998. Innovations in performance measurement: Trends and research implications. *Journal of Management Accounting Research*, 10: 205-238.
- _____, and M.W. Meyer. 1997. Performance, compensation, and the balanced scorecard. Working paper, The Wharton School, The University of Pennsylvania.
- _____, and M.V. Rajan. 1997. The choice of performance measures in annual bonus contracts. *The Accounting Review*, 72 (April): 231-255.
- Kaplan, R.S., and D. Norton. 1992. The balanced scorecard measures that drive performance. *Harvard Business Review*, January-February, 71-79.
- _____. 1993. Putting the balanced score to work. *Harvard Business Review*, September-October, 134-147.
- _____. 1996a. Using the balanced scorecard as a strategic management system. *Harvard Business Review*, January-February, 75-85.
- _____. 1996b. *The Balanced Scorecard: Translating Strategy into Actions*, Cambridge, MA: Harvard Business School Press.
- McGrath, M.E., and M.N. Romer. 1994. The R&D effectiveness index: a metric for product development performance. *Journal of Product Innovation Management*, 11: 213-220.
- Miles, R.E., and C.C. Snow. 1978. *Organizational Strategy, Structure, and Process* New York: McGraw-Hill.
- Miller, D., and P.H. Friesen. 1982. Innovation in conservative and entrepreneurial firms: two models of strategic momentum. *Strategic Management Journal*, 3: 1-25.
- Moser, M.R. 1985. Measuring performance in R&D settings. *Research Management*, 28: 31-33.
- Nayak, P.R. 1992. Measuring product creation effectiveness. *Journal of Business Strategy*, 13: 48-52.
- Simons, R. 1987. The relationship between business strategy and

accounting control systems: an empirical analysis. *Accounting, Organizations and Society*, 12 (July): 357-374.

Spital F.C., and D.J. Bickford. 1988.
An empirical study of the relationships between technology strategy and competitive strategy. *Academy of Management Proceedings*, 340-344.

Werner, B.M., and M.F. Souder. 1997b. Measuring R&D performance — state of the art. *Research. Technology Management*, 40: 34-42.

Zahra, S.A., and J.G. Covin. 1993. Business strategy, technology policy and firm performance. *Strategic Management Journal*, 14: 451-478.