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COMPETENCIES OF CEOs IN TECHNOLOGY-ORIENTED SMEs: AN EXPLORATORY STUDY OF SKILLS FOR SURVIVAL & INITIAL GROWTH

A competency framework for CEOs of small and medium-size technology-oriented firms is proposed with five skill groupings: leadership, entrepreneurship, managerial roles, functional skills, and other competencies. Based on a survey (N=48) in the Ottawa-Carleton region, most competencies were considered important at both the survival and initial growth stages. In addition, four competencies were retained in a discriminant function: innovating in products/services, developing subordinates, delegating effectively, and planning and monitoring cashflows. The competency framework shows some promise as a roadmap for CEO skills development.

Introduction

Approximately 4% of new ventures, known as "gazelles", experience fast growth in sales and employment numbers (Birch, et al., 1999). They have at least a 20% sales growth per year over several years, and tend to expand when more established firms may be downsizing. Many gazelles are found among knowledge-based and technology-oriented small and medium-size enterprises (SMEs) that are benefiting from the expanding knowledge-based economy.

Based on the stages of organizational development model for technology-oriented new ventures (Kazanjian and Drazin, 1990; Hansen and Bird, 1997), the initial survival stage involves approximately the first five years of operation. This stage may include product/service conception and development, product/service introduction, and first commercial sales. In the following five years of operation, the firm may experience rapid growth, in both sales and number of employees, because of its unique product/service and market acceptance. In each stage, the CEO faces a distinct set of challenges due to internal and external organizational factors. To meet these challenges, the CEO has to exercise a set of skills specific to these organizational factors. Yet, technology-oriented entrepreneurs tend to be more reactive than proactive in identifying their own learning needs (Sexton et al., 1997).

The purpose of the current study is to explore the collective knowledge of CEOs on the competencies they require to lead and manage a technology-oriented enterprise through the survival and fast growth stages. This competency framework could help to orient advisors and trainers that support the CEOs of these promising business ventures. The findings of an initial survey in the Ottawa-Carleton region are reported and discussed. For this exploratory study, a descriptive list of competencies is used.

A Competency Framework

Sexton et al. (1997) have done some initial work on identifying the learning needs of entrepreneurs in growth-oriented firms (minimum of 10% annual growth rate in sales). They identified ten priority topics related to the functional activities of the firm, such as financing and human resources. They found that the CEOs of technology-oriented firms put less emphasis on "compensation for self and associates" and "management succession" than CEOs of other types of firms (family business, music business). While interesting, this study lacked a conceptual framework on the nature, development and practice of the desired competencies. In order to lay a solid foundation for understanding the learning needs of CEOs in these technology-oriented firms, initial reflection on the nature of competencies is appropriate.

A competency is effective performance of a task or activity in a job setting, due to the underlying characteristics of the individual: motives, traits, skills, self-image, social role, or knowledge and experience (Boyatzis, 1982). The emphasis is on behaviour and performance, and as such is a dynamic concept. Following in the footsteps of Boyatzis (1982), other researchers have developed and validated variations of a managerial competency framework. The fascinating framework proposed by Schoenfeldt and Stenger (1990) is composed of four dimensions (functions, roles, targets, and management/leadership style). Though the sophistication and comprehensiveness of the model has much to recommend it, its complexity creates measurement difficulties. In contrast, the work of Quinn et al. (1996) on the master manager is based on only two organizational dimensions (flexibility vs. control, and external vs. internal), and is summarized by eight managerial roles. Of the two competency frameworks, the latter has a larger following of researchers.

The current study aims to create a competency framework appropriate for technology-oriented SMEs. The goal is to develop an initial framework of competencies that would be useful tool for the investigation of CEO skills development, and a guide for advisers and trainers that support these CEOs as they grow their organizations. The researchers chose to retain the breadth of competencies outlined by Schoenfeldt and Stenger (1990), but not keep the detailed mechanisms they developed. This approach permitted the possibility of incorporating the managerial roles identified by Quinn et al. (1996), along with other promising CEO competencies identified in the literature, in order to create an initial framework competencies.

Based on a review of the literature, we propose the following framework of CEO competencies:

- leadership competencies (Bass and Avolio 1993)
- entrepreneurial competencies (Miller and Friesen, 1982)
- managerial roles (Quinn et al., 1996), and
- functional competencies (Zinger et al., 2001)
- other competencies.

Leadership Competencies

In order to lead radical change, such as rapid growth, the CEO exhibits transformational leadership (Bass and Avolio, 1993). The CEO communicates and persuades other organizational members that he/she has an exciting vision of the organization, builds their confidence, and leads them into committing extra effort to help realize the vision. The employees become aligned with the CEO's vision and long-term goals. In periods of stability, the CEO demonstrates transactional leadership: linking job performance to valued rewards, and ensuring that employees have the resources needed to get the job done. In this case, the employees are aligned with the short-term organizational goals. When the firm is adding large numbers of employees, their effectiveness depends to some degree on the availability of rewards (both tangible and intangible), and job-related resources. To measure leadership competencies, Bass and Avolio (1989) developed and tested a multi-item questionnaire, and Hartog et al. (1997) used a revised shorter version.

Entrepreneurial Competencies

Building on the work of Miller and Friesen (1982), Miller (1983) measured three entrepreneurial orientations: product-market innovation, high risk-taking for large benefits, and proactivity in the market. Additional scale development was undertaken by Covin and Slevin (1986, 1989). See Wilkund (1998, 1999) for a review of the literature on entrepreneurial orientation. Though entrepreneurial orientation is often viewed as a firm-level concept, it can easily be translated to the individual level of behaviour where the CEO contributes directly to the firm's development.

Managerial Roles

Quinn et al. (1996) proposed eight managerial roles: mentor, facilitator, monitor, coordinator, director, producer, broker, and innovator. Each role is composed of specific competencies; for example, the role of mentor involves communicating effectively, and developing subordinates. These eight roles reflect two organizational dimensions: flexibility vs. control, and internal vs. external. Depending upon the organizational goals, the CEO places greater emphasis on certain managerial roles. Rojas (2000) provides a review of the strong reliability and validity of Quinn's framework.

Functional Competencies

In their review of the literature on small businesses, Zinger et al. (2001) identified (and later tested) ten managerial capabilities: customer service, business image, pricing, operations management (purchasing, inventory control), ability to develop new products and services, financial management (monitoring receivables, developing financial projections), general management (monitoring business trends, delegating), using computer technology, advertising and promotion, and financial control (using budgets for setting targets and evaluating results). It is assumed that each of these functional capabilities is composed of specific competencies. Note that these capabilities parallel the traditional functional areas.

Other Competencies

The practitioner literature puts great emphasis on a variety of competencies, some of which appear to be trait-based. Though not exhaustive, the following competencies were included to round out the framework: networking, perseverance, conceptual skills, technical competence, judgement, and intuition (Bennis, 1999; Collins, 2001; Drucker, 1998; Moss Kanter, 1999).

Method

The above framework of competencies guided the construction of a survey questionnaire. Initially, a small pilot project was executed: ten questionnaires were faxed to the CEOs of local technology-oriented SMEs. Two completed questionnaires were returned. The findings indicated that our procedure was satisfactory, but that our seven-point scale needed adjustment.

The revised questionnaire was distributed by fax to the CEOs who were listed in the Ottawa High Technology Directory. The entire listing was used, but firms with 500 employees or more were omitted. The population was composed of 431 individuals. A letter of support from OCRI (Ottawa Centre for Research & Innovation) introduced the survey. A second and third wave of questionnaires was sent to increase the response rate.

Questionnaire

The questionnaire was divided into sections grouping similar questions: description of the respondent, description of the firm, and finally the required competencies of the CEO/President. The expression "skills" was used instead of "competencies" because the former is colloquial. The competencies section included 39 descriptive items (see Table 1 for details):

- Five items on leadership: transformational (3 items) vs transactional (2)
- Three items on entrepreneurial competencies: innovation (1 item), proactive (1), and risk-taking (1)
- Sixteen items, that is two for each managerial role: mentor, facilitator, monitor, coordinator, director, producer, broker, and innovator
- Ten items on functional areas
- Five items on other competencies.

Because of the brevity of the questionnaire and the need to impose a standard format, these items were inspired, but not taken directly, from previously validated scales.

The competency items were listed in a random fashion. Respondents were asked to indicate the level of importance of each skill for two periods of time: Years 1 to 5 (survival), and Years 6 to 10 (rapid growth). Level of importance was indicated on a seven-point scale, ranging from somewhat important (1), very important (4), to extremely important (7)[a].

Results

Of the 431 individuals targeted, 69 were not reachable (disconnected, fax not functioning). Of the 362 individuals contacted, 24 were excluded (area office closed, sold/merged, not a technology-oriented firm). The effective population became 338 CEOs/ Presidents. Forty-eight completed questionnaires were received, giving a response rate of 14.2% (48/338).

Description of the Respondents

Seventy-seven percent of the respondents were the CEO/President of the firm, and 67% were the founder. Over 80% of respondents stated that they had experience with a fast-growth firm, most of whom had an executive position. On average, respondents had 13 years (S.D. = 7.2) of senior management experience.

Description of the Firms

The respondents came from the following types of firms:

- 19% Life Sciences (pharmaceuticals, biotechnology, medical devices, environmental sciences)
- 25% Networks & Communications (computer networking, communications equipment and services, wireless communications, internet connection service providers)
- 31% Software (development of custom and/or packages software products and services)
- 4% Semiconductors, Systems & Peripherals (design, manufacture, and/or integrate electronic products and systems)
- 19% Diversified Technologies (design, develop, manufacture, and/or integrate systems for specific uses such as marine, mining, petroleum, GIS or forest applications)
- 2% Other.

Sixty-five percent of the firms began operating in 1990 or later. The median number of full-time employees was 24.5, with a range of 2 to 210 employees. Only 48% of the sample had an average annual growth in sales over the five- year period (1994 to 1998) of 21% or greater and could be classified as high growth firms. The percentage climbs to 67% for growth in sales of 11% or greater. In 2001, the median growth rate in sales was reported at 19.5%. As previously mentioned, over 80% of respondents stated that they had experience with a fast-growth firm.

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[a] Originally, the seven-point scale was labeled as follows: not important (1), somewhat important (4), and critically important (7). The two respondents in the pilot study marked mostly the numbers 6 and 7, making no use of the lower end of the scale. Therefore, the scale was modified to somewhat important (1), very important (4), and extremely important (7).

Competencies of CEOs/Presidents

Table 1 summarizes the results of the competencies section of the instrument. For both periods of time (initial survival, and fast growth), all of the competencies were considered at least very important (mean of 4 or higher). The only exception was Advertising (3.54, 3.65). In order of importance, the top five competencies required during the survival stage were perseverance, communicating effectively, judgement, personally working productively, and thinking creatively. For the subsequent fast growth stage, the top five competencies were a little different: communicating effectively, judgement, delegating effectively, perseverance, and thinking creatively. The human resource competencies appear to take on more importance in the growth period.

A series of paired sample t-tests was executed (Table 1), and 14 significant findings were found. When comparing the fast growth to the survival stage, there was a significant increase in the importance of the following competencies: communicating effectively, developing subordinates, managing organizational performance, planning and goal setting, delegating effectively, fostering a productive work environment, building/maintaining a power base, and creating change. In contrast, there was a significant decrease in the importance of the following competencies: innovating in products/services, managing projects, selling and promotion, planning and monitoring cashflows, perseverance, technical competence, and intuition.

TABLE 1. Paired Samples T-Test of CEO Competencies (n = 48)

	Mean - Initial Survival	**Mean - Fast Growth**	**T**	**Sig. (2-tailed)[b]**
Leadership Competencies				
Transformational Leadership				
Creating a strategic vision	5.98	5.96	0.11	n.s.
Building employee commitment	5.65	5.69	-0.17	n.s.
Aligning employee and corporate goals	5.28	5.70	-1.93	.06
Transactional Leadership				
Linking employee job performance to valued rewards	5.02	5.21	-0.95	n.s.
Obtaining resources for employees	4.96	4.81	0.78	n.s.
Entrepreneurship Competencies				
Innovating in product / services	5.79	4.96	4.80	.000
Acting proactively in the market	5.65	5.74	-0.45	n.s.
Taking high risk-taking for large benefits	4.49	4.32	0.75	n.s.
Managerial Competencies				
Mentor Role				
Communicating effectively	6.22	6.39	-2.07	.04
Developing Subordinates	4.51	5.79	-5.43	.000

[b] Degrees of freedom varied from 44 to 47. For designing work, df=39.

Facilitator Role				
Building Teams	5.43	5.66	-1.23	n.s.
Managing Conflict	4.70	5.19	-1.81	.08
Monitor Role				
Monitoring individual performance	4.53	4.34	0.84	n.s.
Managing organizational performance	4.65	5.59	-3.94	.000
Coordinator Role				
Managing projects	5.04	4.30	2.92	.005
Designing work	4.55	4.20	1.90	.07
Director Role				
Planning and goal setting	5.40	5.77	-2.46	.02
Delegating effectively	4.74	6.17	-7.53	.000
Producer Role				
Personally working productively	6.02	5.84	1.31	n.s.
Fostering productive work environment	5.20	5.57	-2.12	.04
Broker Role				
Building / maintaining a power base	4.20	4.73	-3.12	.003
Presenting ideas	5.70	5.80	-1.09	n.s.
Innovator Role				
Thinking creatively	6.02	6.04	-0.16	n.s.
Creating change	4.77	5.44	-2.84	.007
Functional Competencies				
Pricing	4.79	4.64	0.71	n.s.
Advertising	3.54	3.65	-0.57	n.s.
Selling and promotion	5.52	5.09	2.07	.04
Improving business image	5.25	5.65	-1.89	.07
Customer service	5.94	5.74	1.10	n.s.
Operations (inventory control, purchasing, delivery)	4.19	4.40	-0.81	n.s.
Planning and monitoring cashflows in accounts receivable and payable	5.92	5.04	3.57	.001
Using computer technology	5.38	5.04	1.83	.07
Creating / revising business plan	5.40	5.23	0.87	n.s.
Other Competencies				
Networking	5.54	5.83	-1.39	n.s.
Perseverance	6.54	6.15	2.73	.009
Conceptual skills	5.71	5.80	-0.78	n.s.
Technical competence	5.29	4.54	3.86	.000
Judgement	6.15	6.23	-1.00	n.s.
Intuition	5.96	5.47	3.05	.004

In order to assess the relative contribution of each of these findings to distinguishing the two stages of firm development, a stepwise discriminant analysis was performed comparing the importance attributed to each of the 39 competencies at the two stages. A dummy variable was created, Stage of the Firm, with 1=initial survival and 2=rapid growth. The sample of 48 respondents was treated as if there were 96 respondents, with half indicating the importance of the competency for initial survival, and the other half doing the same for rapid growth. The F-value for inclusion of a variable in the discriminant function was set at the default value of SPSS. This partial F is a test of the significance of the amount of group separation added by a given variable above and beyond the separation produced by previously entered variables. When missing data occurred, the mean of that variable was substituted and classification of the subject was made on that basis. The results of the analysis are presented in Table 2. The canonical correlation (between the discriminant function and the dichotomous dependent variable) was .68.

Table 2. Discriminant Function for Initial Survival/Rapid Growth Stages of the Firm

Canonical r	Wilk's Lambda	Chi-square	Df	Signif.
.684	.532	58.06	4	p < .001

Classification Results

Actual Group	Cases	Predicted Survival	Predicted Growth
Survival	48	36 (75.0%)	12 (25.0%)
Growth	48	8 (16.7%)	40 (83.3%)

Average percent correctly classified: 79.2%

Discriminant Function

Variable	Standardized Coefficient
Innovating in products/services	-.488
Developing subordinates	.584
Delegating effectively	.592
Planning and monitoring cashflows.	-.312

The discriminant function significantly (p<.001) separated the two stages, and the classification function produced a 79.2% correct classification of "subjects". A total of four variables met the entry level criterion:

- Innovating in products/services
- Developing subordinates
- Delegating effectively
- Planning and monitoring cashflows.

The results indicate that, compared to the initial survival stage, the fast growth stage was characterized by less importance attributed to the competency "innovating in products/services"(Means, 4.96 vs. 5.79). A similar reduction in importance was noted for "planning and monitoring cashflows" (5.04 vs. 5.92). On the other hand, more importance was attributed to "developing subordinates" (5.79 vs. 4.51) and "delegating effectively" (6.17 vs. 4.74).

The growth stage appears to witness a shift away from the CEO doing key activities by oneself, to developing employees and colleagues to assume these responsibilities and then giving them the authority that comes with these responsibilities.

Discussion

Our framework and list of CEO competencies help to identify the key competencies that may need development and support at the two stages of the technology-oriented firm, namely, initial survival and fast growth. The findings emphasize that CEOs are of the opinion that they require numerous competencies to achieve success at each stage. These competencies span the entire spectrum of competencies: leadership, entrepreneurship, managerial roles, functional competencies, and other competencies such as perseverance, judgement, and thinking creatively. At the same time, CEOs point out a shift in the importance of certain competencies from the survival stage to fast growth, away from a hands-on approach and towards developing and managing the firm's human resources.

The framework shows promise as "a roadmap for the selection and development of management talent. Once the roadmap has been developed, it is necessary to either find or construct the appropriate devices for collecting information about individuals" (Schoenfeldt and Stenger, 1990). Our instrument only used a few items to measure each skill area. In a follow-up study, the full scale of specific competencies developed by other researchers could be applied.

There is a need to study the specific industries included in "technology-oriented" firms. Schwartz et al. (1997) demonstrated that different industries (semiconductors vs. medical equipment vs. software) differed in their strategic practices. Their findings suggest that the CEO competencies underpinning these strategies would likely differ as well. Our sample was too small to attempt to compare industries such as bio-technology and multi-media.

Sexton et al. (1997) reported that CEOs prefer learning experiences that address a current problem and that involve experienced executives and managers who share their experience. Preferred sources of information include the business roundtable, and the half-day seminar. Clearly, CEOs view their time as a precious resource. Though these types of development events are preferred by CEOs, they may not be the best way to train and develop certain competencies such as interpersonal communications and delegation. Perhaps on-the-job coaching, or some variation that does not embarrass the CEO, would be appropriate. For example, the Queen's Centre for Enterprise Development offers a mentorship service specifically tailored to the CEOs of technology-oriented firms with high growth prospects. Developing and delivering CEO training and development activities that are viewed as relevant remain a challenge for professional trainers and advisors.

Conclusion

Our study has presented a framework of CEO competencies for technology-oriented SMEs, and has demonstrated the distinct profile of competency requirements in the two stages of firm development, namely the survival and fast growth stages. However, as an exploratory study, it has a number of limitations. First, the sample size of CEOs was small, and not all participants had experience with a fast growth firm. The response rate was also low, leaving the concern of non-respondent bias unaddressed. Second, only the point of view of the CEOs was covered; no confirmation was obtained from an independent source of information. Third, the framework of competencies covers many complex competencies in a summary manner and lacks the robustness of more focused instruments. On the other hand, the breadth and brevity of our list of competencies recommend it as an orientation tool

The survey findings are sufficiently interesting to encourage the researchers to continue to study CEO competencies in technology-oriented SMEs. A larger sample is currently being sought in the high technology communities of Kitchener-Waterloo, Toronto, and Boston. If the larger data set confirms our original findings, we could pursue two lines of enquiry. First, how can the CEO competencies framework orient advisors and trainers that support these CEOs? Can the list of

competencies be used as an interview or discussion tool? Can it help to identify competencies on which the CEO would like to work? Second, how can the CEO competencies framework be developed further for more in-depth assessment of the CEO's skills? A number of validated instruments are available for some of the competencies, while others may need to be developed. How could in-depth assessment be of value to the CEOs for whom time is precious? The researchers will attempt to answer these questions, in collaboration with practitioners, as part of a long-term research agenda.

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