AN EMPIRICAL EXAMINATION OF ENTREPRENEURIAL AUTONOMY AND FIRM PERFORMANCE IN TECHNOLOGY SERVICES ORGANIZATIONS

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ACADEMIC ABSTRACT

A contingency based model shows that firm performance for technology services organizations (TSOs) is positively related with entrepreneurial autonomy and technology intensity; and negatively related with environmental hostility. Further, firm size is found to have a moderating effect on the relationship of TSO performance with entrepreneurial autonomy, technology intensity and environmental hostility. Post-hoc analysis reveals that entrepreneurial autonomy, technology intensity and environmental hostility have significant relationships with performance in large TSOs; but in small TSOs, only technology intensity is significantly related to performance. Interestingly, technology intensity is a mediator in the relationship between entrepreneurial autonomy and performance in small TSOs.

INTRODUCTION

A recent quote from the Wall Street Journal provides the business context for this study:

“Allen Oliff and his team of scientists realized a promising breast-cancer compound called Tykerb had been languishing in the company's labs for years. The scientists decided it merited further study and scrapped several other projects to devote half their financial resources to Tykerb...... But Tykerb might never have been developed if not for a radical change five years ago in how the London-based pharmaceutical giant approaches research and development. Before the restructuring, a committee of research and development chiefs far from the company's labs decided which drugs to fund. Now, frontline scientists like the 56-year-old Dr. Oliff set priorities and allocate resources. The shift, Glaxo executives say, has helped produce an entrepreneurial environment akin to a smaller, biotechnology outfit. Glaxo's experience could help answer a pressing issue confronting many pharmaceutical companies: how to prevent research from being stifled by the bureaucracy that's inevitable in an industry where consolidation has created a handful of global giants.” (Jeanne Whalen, Wall Street Journal, Eastern USA Edition, March 27, 2006; Page B1, italics added).

In an uncanny connection between theory and practice, Glaxo’s restructuring process mirrors the quote below (Lumpkin & Dess, 1996:141-142, italics added):

“(M)any large firms have engaged in changes in organizational structure such as flattening hierarchies and delegating authority to operating units. These moves are intended to foster autonomy, but the process of organizational autonomy requires more than a design change. Firms must actually grant autonomy and encourage organizational players to exercise it … the process involves champions who promote entrepreneurial activity by shielding the new venture innovators from organizational norms or resource constraints that might cause the new enterprise to be rejected. Thus, the exercise of organizational autonomy is often characterized by a two-stage process involving a project definition that is carried out by autonomous organizational members and a project impetus that is carried out by champions who sustain the autonomous efforts.”
The first quote from the *Wall Street Journal* shows an example of how providing autonomy in organizations can facilitate firm success in the long run. In conjunction with the second quote, it provides answers to two important questions; does providing the individual manager with autonomy have a parallel in providing autonomy to managers across the organization; and if so, in what organizational context? The Glaxo scenario presented above suggests that the answer to the first is “Yes,” and based on the arguments provided by Lumpkin and Dess (1996), we can focus on the context as being “corporate entrepreneurship” across the organization. The above perspectives based on both theory and practice, provide a starting point for our study.

The role of autonomy in spurring innovative thinking as well as entrepreneurial behavior has received interest from many fields in the social sciences. However, unlike the above quotes, the literature has mainly focused on examining autonomy from an individual perspective. The links between an individual manager’s need for autonomy, autonomy at the organizational level, and corporate entrepreneurship, have been addressed in a theoretical framework developed by Harrell and Alpert (1979). They have proposed that an individual’s need for autonomy can be successfully harvested in established organizations by offering autonomy at the organizational level, in order to facilitate corporate entrepreneurship. Our study therefore focuses on the phenomenon of autonomy in the context of “corporate entrepreneurship.” We therefore use the term “entrepreneurial autonomy” in order to differentiate it from “individual autonomy.”

**Technology and Technology Services Organizations (TSOs)**

Technology, the sum of a firm’s knowledge and skills, may be defined as a collection of basic and applied knowledge (including skills and artifacts) that can be used to conceptualize, develop, create and deliver new products and/or services (Zahra & Bogner, 2000; Song & Montoya-Weiss, 2001). Technology intensity is therefore defined as the level of technology – i.e. basic and applied knowledge available to and used by a firm. From a resource based perspective, technology is a knowledge based resource. It is important for a firm to focus on knowledge based resources for their potential to provide a sustainable competitive advantage since they are inherently difficult to imitate (McEvily & Chakravarthy, 2002).

Based on the above conceptualizations and because of our interest in service firms, we define technology services organizations (TSOs) as organizations that sell technology as a knowledge based service in the forms of studies, designs, plans, management consultations, evaluations, tests, analyses, maintenance, and purchasing advice. A TSO will therefore have basic and applied knowledge (including skills and artifacts) available as inputs (e.g., via its vendors and suppliers), and use it in its processes (e.g., in the form of training and technological skills of its employees). It is important to understand that though often a TSO’s output may seem “low-tech,” e.g., a design or consulting report - the inputs, processes, and personnel used in providing that output may use high levels of technology. As around the world, there are an increasing number of service firms identifying themselves as providers of technology services it leads us to focus on technology services organizations or TSOs.
LITERATURE REVIEW & HYPOTHESES DEVELOPMENT

Entrepreneurial Autonomy and Corporate Entrepreneurship

As early as the 1940s, Schumpeter (1942) predicted a shift from the individual entrepreneur to entrepreneurship that would be dominated by firms – i.e., corporate entrepreneurship. Autonomy has been emphasized in a corporate entrepreneurship context by Burgelman (1983), and has been defined as the freedom granted by firms to individuals or teams to engage in and support new ideas, experimentation, and creativity, and take action free of stifling organizational constraints (Lumpkin & Dess, 1996; 2001). A recent review of this emerging sub-field of corporate entrepreneurship has called for an extended examination of all the factors connected with corporate entrepreneurship (Dess et al., 2003).

Though autonomy as a dimension of corporate entrepreneurship has been theorized in the literature, our literature review on this topic provided only a few instances of empirical research on this dimension (e.g., Antoncic & Hisrich, 2001; Thornhill & Amit, 2001; Zajac, Golden & Shortell, 1991). The dearth of empirical studies focusing on autonomy at the organizational level resonates with Vecchio’s (2003) comments when he aptly points out that arguments for organizational level autonomy “… are based on the premise that larger firms suppress personal freedom and the potential for entrepreneurial initiatives. Empirical evidence in support of these contentions, however, is lacking. … In short, rhetoric surrounding the drive for independence as a core element of entrepreneurial interest, despite its self-evident character, needs to be empirically demonstrated” (Vecchio, 2003:308). This motivates us to empirically examine the dimension of autonomy from a corporate entrepreneurship perspective in our research.

Environmental Hostility, Technology Intensity, and Firm Size

Research has suggested that a firm’s performance is also associated with environmental factors (Guth & Ginsberg, 1990; Zahra, 1991; Dess, Lumpkin & McKee, 1999; Naman & Slevin, 1993). Further, the use of entrepreneurial behavior by firms to manage their competitive landscape in a hostile environment is a recurrent theme in the strategic management literature. Specifically, corporate entrepreneurship has been found to play a significant role for firms in a competitive environment (Barringer & Bluedorn, 1999). Therefore, since a firm’s performance is influenced by environmental variables such as dynamism, hostility, and heterogeneity (Boyd, Dess & Rasheed, 1993; Zahra, 1996); there is a need for the simultaneous examination of entrepreneurial autonomy and environmental hostility when investigating firm performance.

Additionally, since challenging environmental conditions are often found in high technology industries (Khandwalla, 1987), these industries seem to have a disproportionate number of entrepreneurial firms (Maidique & Hayes, 1984). Management researchers have been interested in the performance of technology intensive firms in an entrepreneurial context. For instance, Belderbos and Sleuwaegen (2005) identify firms that produce electronics products as technology intensive, and subsequently differentiate them based on the patents created by these firms; while Deeds (2001), studies “high technology” firms (in this case biotechnology firms) and their performance in terms of entrepreneurial wealth creation. Since CE allows firms to acquire knowledge, learn about emerging technologies, new processes, or knowledge of markets (Ahuja
& Lampert, 2001), it is critical for performance in technologically intensive firms such as the TSOs in our study. Further, it has also been argued that autonomy in successful high technology companies is manifested when key decisions are made immediately by people dealing with problems, rather than being made later by top management (Bahrami & Evans, 1987). This leads us to examine technology intensity along with entrepreneurial autonomy when investigating firm performance.

Finally, an organization’s entrepreneurial behavior has been linked to the size of the organization (Covin & Slevin, 1989; Wiklund & Shepherd, 2003). Our research focuses on firm size since researchers have implied that large corporations stifle individual independence (i.e., autonomy), which in turn may lead to stifling entrepreneurial behavior among their managers (Vecchio, 2003; Harrell & Alpert, 1979). Further, studies have shown that small and large firms differ significantly in their responses to hostility in the industry environment (Roman, 1991; Dean, Brown & Bamford, 1998). In addition, there are differences in the degree of technological knowledge possessed by small and large firms (Das, Sen, & Sengupta, 1998). These divergences can result in differences in their behaviors; e.g., Chen & Hambrick (1995) found that smaller firms exhibit different competitive behaviors compared to large firms, and suggested that other researchers need to examine the firm size variable more extensively.

**Entrepreneurial Autonomy and Firm Performance**

Nadler and Gerstein (1992) suggest that autonomous action in the organization is facilitated by giving employees a clear vision, knowledge of strategy, and clarity of goals, skills to upgrade their expertise; and allowing free flow of information throughout the organization to facilitate autonomous decision-making in order to achieve the desired goals. Decision-makers will need to be provided skills, resources, and support, as well as access to organizational information to make appropriate decisions (Bowen, Chase, & Cummings, 1990; Spreitzer, 1996); especially since information sharing increases their expertise and overall knowledge of the company’s processes, making them capable of making critical decisions (Bowen, et. al. 1990). Hence entrepreneurial autonomy will require both allowing individuals who are experts to have a greater say in decision-making, and providing them with the information to make better decisions. Therefore, to improve performance in service firms, it becomes important to promote autonomy in their organizations. While no specific studies focusing on corporate entrepreneurship (CE) have linked entrepreneurial autonomy and performance, related studies have shown that other dimensions of corporate entrepreneurship can improve a company’s long-term financial performance (Wiklund & Shepherd, 2003; Zahra & Covin, 1995). Entrepreneurial autonomy being a key CE dimension, we assert that a TSO that offers a greater level of entrepreneurial autonomy will have better performance. Thus:

**H1:** *Entrepreneurial autonomy and firm performance* in technology services organizations are positively related.

**Technology Intensity and Firm Performance**

Firms may be categorized based on varying levels of technology intensity. For example, high technology firms have been defined as those having a higher ratio of R&D to sales (Dhanani,
O’Shaughnessy & Louw, 1997; Zahra & Bogner, 2000); firms that rely on technology to attain a competitive advantage (Bruton & Wan, 1994); and as firms whose outputs and/or processes are technology intensive (Mohrman & Von Glinow, 1990; Zahra, 1996). Higher levels of technological intensity in a firm suggest that it has personnel with high levels of scientific and technical knowledge (Bahrami & Evans, 1987). For the purpose of this paper, a TSO with a high level of technology intensity would require from its vendors, use in its processes, and have personnel with high levels of knowledge, skills and artifacts to conceptualize, develop, create and deliver its services. A firm’s technological knowledge allows it to exploit new opportunities (Cohen & Levinthal, 1990), and provides the firm with an ability to obtain a sustainable competitive advantage which in turn may lead to higher performance (McEvily & Chakravarthy, 2002). It has been argued that a high level of technology intensity allows firms to deliver services with greater efficiency and greater customization (Bitner, Ostrom & Meuter, 2002). Further an empirical study of firms has shown that the use of newly emerging technologies has a positive influence on firm performance (Lee & Grewal, 2004). Similarly, Wiklund and Shepherd (2003) have shown that knowledge based resources are positively related to firm performance. Hence, we would expect that higher levels of technology intensity should lead to higher performance in TSOs. Thus:

**H2:** Technology intensity and firm performance in technology services organizations are positively related.

Environmental Hostility and Firm Performance

A major stream of research in the strategy area has focused on examining a firm’s actions in light of the environment it faces (Lawrence & Lorsch, 1967; Covin & Slevin, 1989). Environmental hostility can be interpreted as unfavorable external conditions for a firm (Zahra & Garvis, 2000), and might be due to intense competition, industry structure, governmental regulations, or a relative lack of exploitable opportunities (Covin & Slevin, 1989; Kashlak & Joshi, 1994; Porter, 1980). In contrast benign environments have high levels of munificence, low risk, and are rich in investment and marketing opportunities (Covin & Slevin, 1989). Hostile environments cause companies to engage in pioneering activities, to target emerging segments and preempt rival entry, which may have an effect on firm performance (Utterback, 1994). This in turn may require greater levels of resources and therefore a higher potential for reduced profitability. Changes in technological knowledge can create a stochastic environment (Weick, 2001); which in turn, can enhance or reduce existing demand in the marketplace (Scherer & Ross, 1990). This is particularly true for high technology firms as they also face additional uncertainties due to reduced product life cycles or higher demand for resources for R&D activities (Qian & Li, 2003). Therefore hostile environments can threaten a firm’s profitability (Lyonski, Levas & Lavenka, 1995). Thus:

**H3:** Environmental hostility and firm performance in technology services organizations are negatively related.
**Autonomy, Firm Size, and Firm Performance**

We propose that in addition to the well documented direct relationship between firm size and autonomy, firm size also moderates the relationship between entrepreneurial autonomy and firm performance. Harrell and Alpert (1979) have noted that as the level of autonomy varies among firms of different sizes, the effect of this variation is reflected in firm performance. It has been argued that performance of large firms may be improved if they create organizational climates that resemble those of small firms (Chandler, 1990). Thus researchers have suggested that larger firms provide such a climate to be more effective (and thereby improve their performance), by creating autonomous business units with significant authority over their lines of business and separate profit and loss responsibilities (Chandler, 1956; Williamson, 1975; Weick, 1983). From a corporate entrepreneurship perspective, the need for autonomy to improve firm performance in large organizations is so great that many firms create such alternative mechanisms to provide autonomy to managers in order to achieve desired corporate goals. For example, some large companies establish separate entrepreneurial units (Lockheed’s “skunk works,” IBM’s PC division, AT&T’s Bell Labs), to create new products and improve firm performance. Thus, as suggested by Harrell and Alpert (1979), it is critical for larger firms to offer more entrepreneurial autonomy to managers to allow them to improve performance by capitalizing on entrepreneurship initiatives.

**H4a:** The positive relationship between entrepreneurial autonomy and firm performance in TSOs is strengthened as firm size increases (ceteris paribus).

Similarly,

**H4b:** The positive relationship between technology intensity and firm performance in TSOs is weakened as firm size increases (ceteris paribus).

**H4c:** The negative relationship between environmental hostility and firm performance in TSOs is strengthened as firm size increases (ceteris paribus).
METHODS

Sample

Our sample was obtained from TSOs in the Mid-Atlantic region. In an ideal situation, a wider geographic region should have been used to obtain the sample, but it was not feasible to reach such a population for our study. So at the risk of sacrificing some degree of external validity we focused on a sample from Mid-Atlantic region. A similar approach has been used in other studies (e.g., Parkhe, 1993), when access to the total population is not feasible. It must also be pointed out that due to their business with the federal government, many TSOs around the US have offices in the Mid-Atlantic region and are members of the Northern Virginia Technology Council (NVTC), the source of our sample. This mitigates the above mentioned limitation concerning the generalizability of our study. For data collection we contacted member organizations of the Northern Virginia Technology Council (NVTC), and managers of these organizations were requested to participate in the survey. There are nine hundred member firms in NVTC. Our initial request for participation generated 79 responses. Three months later, a follow-up request generated 22 additional responses. Thus, a total of 101 responses were received, with a response rate close to 12%, which is in the expected range of questionnaire based research. A total of 86 usable responses were utilized for subsequent analysis. The main reason to drop firms from the sample was that they did not qualify as TSOs.

To examine for non-response bias, the responses of early and late sets of respondents were compared. This comparison was conducted with the underlying assumption that the opinions of late respondents are representative of the opinions of non-respondents (Armstrong & Overton, 1977; Narasimhan & Das, 2004). Student t-tests between demographic variables, and more importantly, the four variables of interest in our research indicated no significant differences between the first and second sets of respondents. We used both procedural and statistical steps suggested by Podsakoff et al., (2003), to remedy the limitation concerning mono method bias and mono response bias. In their review of common method biases in behavioral research, they suggested that procedurally, researchers need to create temporal, proximal, psychological or methodological separation of measurement of criterion and predictor variables.
RESULTS

Main effects and moderated effects

Our primary interest was to investigate the direct effects of entrepreneurial autonomy, technology intensity, and environmental hostility on a technology service organization’s performance. This was tested through hypotheses H1-H3. In addition we were interested to investigate the role of firm size as a moderator in the above relationships through hypotheses H4a-H4c. Table 1 provides the results of both direct and moderation effects.

Insert Table 1 about Here

Hypothesis 1 proposed that a high level of entrepreneurial autonomy in TSOs leads to high levels of performance. Our regression results supported this hypothesis. In Step 2 of Table 1, the direct impact of entrepreneurial autonomy was significant (p < 0.1), with a standardized beta coefficient of 0.145; lending support to Hypothesis 1. H2 focused on the level of technology intensity and its direct effect on firm performance. From Table 1, Step 2, we see that technology intensity has a significant (p <0.005) and positive relationship with firm performance, with the standardized beta coefficient for technology intensity being 0.279. Thus, we found support for Hypothesis 2. Finally, we found a strong main effect relationship between environmental hostility and firm performance for TSOs. This main effect was negative with standardized beta coefficient being -0.324, and significant (p < 0.005). This provides support for Hypothesis 3. Therefore all three hypotheses dealing with main effects of independent variables were supported, with the overall model being significant at F value = 6.392, (p < 0.000). The Adjusted R2 is 24.1%.

The next set of hypotheses (4a, 4b, and 4c) focused on the moderating effect of firm size. The interaction model (Step 3, Table 2) indicates that the interaction term of entrepreneurial autonomy and firm size was significantly and positively related with performance (p < 0.05; standardized beta coefficient = 0.464). This shows that as firm size increases, the positive relationship between entrepreneurial autonomy and firm performance is strengthened, thereby supporting Hypothesis 4a. The interaction term of technology intensity and firm size was significantly but negatively related with performance (p < 0.05, standardized beta coefficient = negative 0.408). This shows that as firm size increases, the positive relationship between technology intensity and firm performance is weakened, thereby supporting Hypothesis 4b. Finally, the interaction term of environmental hostility and firm size is significantly but negatively related with performance (p < 0.05; standardized beta coefficient = negative 0.380), This shows that as firm size increases, the negative relationship between environmental hostility and firm performance is strengthened, thereby supporting Hypothesis 4c.

Therefore firm size does moderate the relationships between firm performance and entrepreneurial autonomy, technology intensity, and environmental hostility, and in the expected direction. The overall model was significant at p < 0.000, and the adjusted R2 was 28.9 %. ΔR2 was 0.070, indicating a 7% increment over main effects.
**Exploratory data analysis**

Our total sample of 86 was divided into two parts by using the median split. 45 TSOs were classified as large (number of employees ≥ 50), and 41 TSOs were classified as small (number of employees < 50). We conducted a Chow Test to examine if significant differences exist among the two subgroups of firms. Based on our Chow test’s results (F = 6.03, p < 0.000), we found that firm size as a contingent variable had significantly different subgroups – large and small. Next we conducted a regression analysis separately for each subgroup, with entrepreneurial autonomy, technology intensity, and environmental hostility as predictors and firm performance as the criterion variable. The regression results for these sub-groups show that for large size TSOs, firm performance had a significant relationship with entrepreneurial autonomy (p < 0.015; standardized beta coefficient = 0.290); technology intensity (p < 0.05; standardized beta coefficient = 0.232); and environmental hostility (p < 0.000; standardized beta coefficient = -0.539); similar to the results obtained for the full sample. Moreover, the variable entrepreneurial autonomy has a much stronger relationship with performance in the large sized TSOs subgroup as compared to the complete sample.

Interestingly, for small sized TSOs, only the relationship between technology intensity and firm performance was significant (p < 0.015; standardized beta coefficient = 0.423). This indicated that the constructs “entrepreneurial autonomy” and “environmental hostility” do not have the same relationships with performance in smaller technology service organizations as they do in larger TSOs. Also, as expected, the results support our moderation hypotheses 4a, 4b, and 4c; with the regression coefficients for autonomy and environmental hostility being highly significant in large organizations but not significant in smaller ones, and the regression coefficient for technology intensity being twice as strong for smaller organizations than larger ones. Researchers have suggested alternative approaches for investigating the effect of key variables as a means of exploring contingency relationships among them (Venkatraman, 1989; Boal and Bryson, 1987). These include approaches that incorporate moderating and mediating effects. Since entrepreneurial autonomy and environmental hostility were not related to performance in small TSOs, therefore, to obtain additional insight into the model, we further investigated if they each solely had a relationship with firm performance that was mediated by technology intensity. Our analysis indicated that the level of technology intensity did mediate the relationship between entrepreneurial autonomy and firm performance in small TSOs; whereas for environmental hostility, it did not have such a mediating role. The results are provided in Table 2.

**Insert Table 2 about here**

Therefore, the positive relationship between entrepreneurial autonomy and firm performance was mediated via the level of technology intensity in small size TSOs. In other words, if entrepreneurial autonomy affected technology intensity and technology intensity affected firm performance, then entrepreneurial autonomy had an indirect effect on firm performance that was carried via technology intensity.
DISCUSSION AND CONCLUSION

Our objective for this research was to examine the direct relationship between entrepreneurial autonomy, level of technology intensity, and environmental hostility, with performance in technology services organizations. Further, we wanted to investigate if the size of the firm acted as a moderator in these relationships. All three of our main effect hypotheses were supported. The moderating role of firm size was also found to be significant in the relationships between the three constructs and firm performance. As an extension of this finding, we explored the data further and found that among larger firms the same relationships hold true for entrepreneurial autonomy, technology intensity, and environmental hostility. For smaller firms, only technology intensity was related to firm performance. Additional exploratory analysis allowed us to observe that among smaller firms the level of technology intensity mediates the relationship between entrepreneurial autonomy and performance. These results are further discussed below.

There are several contributions of this study to the entrepreneurship area. First, our study contributes towards understanding autonomy in an organizational level, and entrepreneurship context (Harrell & Alpert, 1979), by defining and measuring autonomy across the organization as “entrepreneurial autonomy.” Researchers have suggested that from a firm’s entrepreneurial orientation perspective, autonomy is both allowing managers the freedom to act independently, combined with allowing free flow of information in the organization so that they can effectively make critical decisions (Lumpkin & Dess, 1996; Nadler & Gerstein, 1992). We have managed to measure such a construct and labeled it as “entrepreneurial autonomy.”

Secondly, within the CE literature, we have shown that entrepreneurial autonomy is indeed a critical factor in TSOs to achieve higher performance. In so doing, we have responded to the need for empirical studies about the role of autonomy in an entrepreneurship context (Vecchio, 2003), and link it to firm performance in conjunction with firm size. Our finding is also consistent with Lumpkin and Dess (1996) who have identified autonomy as one of the dimensions of a firm’s entrepreneurial orientation.

The third contribution of the present paper is its focus on TSOs. As the industrialized world (and developing countries) moves towards becoming service economies, it is critical that academic research also focuses on these service firms. As service firms in different industries may behave differently, there is a need to study them separately, as outlined by researchers in various fields (Rust 2004; Bowen & Hallowell, 2002). Our study responds to this need with its focus on TSOs and finds that for these service firms, the level of technology intensity has a direct relationship with firm performance. Again, previous researchers have focused on constructs such as R&D intensity of a firm as representative of the technology intensity of that firm (e.g., see Qian & Li, 2003). These operationalizations seem to work well for manufacturing firms, but do not fully capture a firm’s technological knowledge base when the firm is a technology service organization. Our study has therefore used a perception based operationalization of technological intensity for a service firm, providing an alternative for capturing a firm’s technology intensity.

Additionally, our study not only examines the relationships among constructs from the perspective of TSOs but also from the perspective of firm size. It is consistent with the arguments put forth several decades ago by Penrose (1959:19) who suggested that “… The differences in the
administrative structure of the very small and the very large firms are so great that in many ways it is hard to see that the two species are of the same genus.” Our results further develop the notion that small firms are not reduced versions of large firms (Dean et al., 1998; Shuman & Seeger, 1986). In the present paper, we found that differences in a firm’s internal characteristics such as entrepreneurial autonomy do play a different role based on the size of the firm in explicating the firm performance. Particularly, our exploratory analysis suggests that though among larger firms, in the presence of technology intensity and environmental hostility, the level of entrepreneurial autonomy has a positive relationship with firm performance; there was no such relationship in smaller firms. We could interpret this result in light of the arguments put forth by researchers (Tushman & Romanelli, 1985; Lawrence & Lorsch, 1967; Beaver, 2003), that problems of coordination and integration in large firms normally tend to restrict autonomy among many managers; however our results indicate that in an entrepreneurial context a firm can improve performance by promoting entrepreneurial autonomy.

Finally, from a theory development perspective, Chen and Hambrick (1995) had examined the external aspect of firm behavior and showed that smaller firms respond to their competitors differently than larger firms. Similarly, focusing on internal aspects, our study contributes to incremental theory building by empirically showing that in larger TSOs, presence of entrepreneurial autonomy is positively related with firm performance; whereas, the same relationship does not hold true for smaller TSOs. Instead, in smaller TSOs, an internal factor such as technology intensity mediates the relationship between another internal variable, namely entrepreneurial autonomy, with firm performance. Therefore, based on our exploratory analysis, we have established that for TSOs, additional examination is needed concerning entrepreneurial autonomy from the corporate entrepreneurship perspective.
Technology Intensity as a Mediator

In applying contingency frameworks, it has been suggested that the introduction of additional variables into the analysis of a two-variable relationship can help reduce the potential for misleading inferences and foster a better understanding of the relationship (Lumpkin & Dess, 1996). For example, researchers have suggested the investigation of mediating effects in further clarifying the relationship between variables in a contingency framework (Venkatraman, 1989). Therefore our final contribution is towards an incremental theory development by the examination of the mediating effect of technology intensity on the relationship between entrepreneurial autonomy and performance among smaller firms.

Our results show that higher level of entrepreneurial autonomy among smaller firms did not directly affect firm performance. Our exploratory analysis concerning the mediation effect of technology intensity on the relationship between entrepreneurial autonomy and firm performance allows us to interpret that a greater level of entrepreneurial autonomy among smaller TSOs creates a context for accumulation and building of knowledge based resources at a greater level - i.e., technological resources. The significant mediation relationship allows us to argue that in accordance with the arguments provided by Cohen and Levinthal (1990), the presence of autonomy enables the firm to build absorptive capacity, and therefore allows employees to seek new knowledge. This absorptive capacity in turn may lead to higher technological intensity among smaller firms. Our argument is supported by the observation made by Das et al. (1998) that small firms may develop and possess a relatively greater degree of technological knowledge. This in turn leads to better firm performance. These findings suggest that in small firms, the relationship of entrepreneurial autonomy and firm performance is linked by technology intensity. Thus our results extend some of the conclusions of the knowledge based resources research stream as suggested by Cohen and Levinthal (1990), and empirically supported by Wiklund and Shepherd (2003). To us, this is a significant new development, particularly in the context of TSOs, in understanding the use of the knowledge based resources in the development of competitive advantage and firm performance; an area studied by both strategy and entrepreneurship researchers.

While we identify above mentioned significant contributions to the research through the present study, we must acknowledge some limitations of the research. First, the sample draws from mid-Atlantic region of the USA and it needs to be seen if the results can be validated either across the USA or even in a worldwide sample. Due to the limited data availability we concede that a larger sample with larger geographical area must be covered in the future research. Secondly, our research may suffer from mono-response problems, though care was taken to reduce this bias. As such we have tried to alleviate this problem by having multiple item constructs, and therefore to a large extent we have confidence that our study does not face severe problems due to this limitation. Notwithstanding the limitations stated above, we feel that the contributions of our research are significant for TSOs, which need to be studied extensively as world economies become increasingly service oriented due to the rapid growth in computer and telecommunication technologies. Thus, future researchers may want to examine larger sample data with three levels of separation by size (large, medium and small), so as to study the impact of autonomy and other related constructs from the CE literature on service firms and particularly technology oriented service firms.
Hence our examination of the relationship between autonomy and firm performance in the context of firm size would add to the growing literature of corporate entrepreneurship, and such efforts would reduce the concerns raised by Miles and Covin (2002:22) who suggested that “Solid theoretical frameworks and empirically grounded and managerially useful prescriptions involving corporate entrepreneurship have not progressed as quickly as enthusiasm for the practice.”

REFERENCES AVAILABLE UPON REQUEST
**TABLE 1**

Hierarchical Regression Results for all Technology Services Organizations (n = 86): Using Mean Performance as Outcome Variable

<table>
<thead>
<tr>
<th>Variable</th>
<th>Step 1</th>
<th>Step 2</th>
<th>Step 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firm Age (in months)</td>
<td>0.014 (Not Sig)</td>
<td>0.041 (Not Sig)</td>
<td>0.088 (Not Sig)</td>
</tr>
<tr>
<td>Firm size (Log # of Employees)</td>
<td>0.130*</td>
<td>.121 (Not Sig)</td>
<td></td>
</tr>
<tr>
<td>Entrepreneurial Autonomy</td>
<td>0.145*</td>
<td>-.300*</td>
<td></td>
</tr>
<tr>
<td>Technology Intensity</td>
<td>0.279***</td>
<td>.718***</td>
<td></td>
</tr>
<tr>
<td>Environmental Hostility</td>
<td>-0.324***</td>
<td>.063 (Not Sig)</td>
<td></td>
</tr>
<tr>
<td>Firm size * Entrepreneurial Autonomy</td>
<td></td>
<td></td>
<td>.464**</td>
</tr>
<tr>
<td>Firm size * Technology Intensity</td>
<td></td>
<td></td>
<td>-.408**</td>
</tr>
<tr>
<td>Firm size * Environmental Hostility</td>
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<td></td>
<td>-.380**</td>
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<tr>
<td>$R^2$</td>
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<td>0.285</td>
<td>0.355</td>
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<td>$\Delta R^2$</td>
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<td>0.070</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
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<td>0.289</td>
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<tr>
<td>$F$-statistic</td>
<td></td>
<td>6.392****</td>
<td>5.308****</td>
</tr>
</tbody>
</table>

*a Standardized regression Coefficients are shown. The numbers in parentheses are p-values.

*p <0.1

**p <0.01

***p <0.005

****p <0.000
**TABLE 2**

Small Size Technology Services Organizations: Regression Results showing Technology Intensity Mediates between Entrepreneurial Autonomy and Performance

<table>
<thead>
<tr>
<th>Variable</th>
<th>St’d Beta</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mediation Step 1a: Dependent variable is Performance</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entrepreneurial Autonomy</td>
<td>0.208</td>
<td>p &lt; 0.1</td>
</tr>
<tr>
<td><strong>Mediation Step 1b: Dependent variable is Performance</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technology Intensity</td>
<td>0.474</td>
<td>p &lt; 0.005</td>
</tr>
<tr>
<td><strong>Mediation Step 2: Dependent variable is Technology Intensity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entrepreneurial Autonomy</td>
<td>0.461</td>
<td>p &lt; 0.001</td>
</tr>
<tr>
<td><strong>Mediation Step 3: Dependent variable is Performance</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entrepreneurial Autonomy</td>
<td>0.013</td>
<td>(Not Sig)</td>
</tr>
<tr>
<td>Technology Intensity</td>
<td>0.480</td>
<td>p &lt; 0.005</td>
</tr>
</tbody>
</table>