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How Hiring Affects IT Performance

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How Hiring Affects IT Performance:

Wharton Undergraduate Research Scholars Program

Robert Dolan

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Introduction

Since the arrival of modern machine technology, the manufacture of motor vehicle parts and accessories[1] has shifted rapidly toward a commodity gig. The industry is notorious for its large, powerful customers, as price pressures continue to push margins downward over time. As expected in component manufacturing, the lack of branding leaves companies continuously vulnerable to new entrants, provided that they can reach minimum efficient scale. Production and distribution efficiency are the main source of competitive advantage in such an industry, and efforts to keep on pace with modern technological developments are imperative.

A few companies appear to be making the right decisions, with Johnson Controls, Gentex Corp, and Arvin Meritor posting recent annualized stock growth of 19%, 17.3%, and 16.7%, respectively. On the other hand, Federal-Mogul Corporation leads the negative growth camp at –37.4% annualized, followed by Goodyear Tire and Rubber at –28.3% and Bridgestone Corp at –23.5%. Federal-Mogul, a $10 billion corporation, officially filed for bankruptcy in October 2001.[2]

There could be many explanations for this asymmetry of success. In fact, Federal-Mogul attributed its cash flow woes to a financial restructuring and an overload of asbestos claims.[3] Interestingly, all three of the companies posting consistent growth have online job applications where potential recruits can apply directly through the corporate website,

[1] SIC code 3714
[2] http://www.infoplease.com/ipa/A0904494.html
[3] http://bankrupt.com/TCREUR_Public/011004.mbx

while most of the struggling counterparts lack an e-recruiting site. Could this fact be an indicator of the mindset of these companies regarding both IT spending and hiring practices?

By now, most people are familiar with the preliminary benefits that computers and the Internet have provided companies. For example, modern technology allows for significant improvement of intra- and interoffice communication, customer database management, order processing, order tracking, and inventory management. The advents of the Internet and online payment have revolutionized commerce, and computer software has spawned buzzwords like CRM, JIT, and one-to-one marketing. All in all, computers provide the tools to achieve better efficiency and profitability than a company could achieve without them.

In a commodity manufacturing industry of a large magnitude, it is important to utilize any potential efficiency advantage, which should include a strong focus on implementing the most up-to-date computer systems and controls through IT spending. However, computers are a “general purpose technology” and do not provide any specific benefit without intelligent workers to operate them (Bresnahan and Trajtenberg, 1995). The successful IT entrepreneur Michael Dell states the problem well: "All companies do not get the same results from their investments in IT. The world is still very much in the early stages of people figuring out how to use IT.” (*Fortune*, April 2004)

This paper centers on the notion that employees who are more adept with computer technology can implement new hardware and software more quickly and utilize it more effectively. Therefore, a focus on hiring skilled employees, especially those with computer skills, should significantly increase the value a firm can realize through IT spending.

This study begins with a section describing recent academic research relevant to the topic at hand. The section is titled "Formulation of Research Area", and it will briefly discuss research involving the measurement of returns on IT spending as well as the variables that affect these returns on IT investment. The subsequent section, "Framing Research Problem," will pare down the issues of IT investment and returns to the main focus of this paper – how a firm's hiring practices affect its return on IT investment. This section will also discuss the approaches taken to analyze this issue. The "Research Findings" section describes the analytical results and logic, while the "Conclusion" discusses the implications of these findings as well as potential future research topics as a result of this study.

Formulation of Research Area

Productivity is an important measure of the performance of an economy, and it is also a key driver of the performance of a firm. The productivity of the US economy has increased rapidly in recent years and this increase is likely due in part to efficiencies gained through the use of computers and related information technologies (Brynjolfsson and Hitt, 2003).

Many firms invest in information technology in order to improve the productivity of inputs. In the short run, improvements in IT such as upgrading the computers or software in a firm increase output approximately by their cost. However, in the long run, productivity generally increases as well (Brynjolfsson and Hitt, 2002: *Computing*). In addition, productivity gains from computer use are fundamentally existent now and in the past due to rapid price declines of computer technology based on innovation (Berndt and Griliches, 1990; Gordon, 1999).

It is generally accepted that computers and information technology have a positive effect on firm performance; however, the degree of this impact is notoriously difficult to measure. Productivity measures of computers are especially difficult to observe for the following reasons:

1) Many benefits of computers are underestimated or ignored in measures of overall output (e.g. product variety, timeliness, qualitative product improvements) (Boskin, 1997, and Brynjolfsson and Hitt, 1996).

2) Computers are inherently a "general purpose technology", meaning that their benefit to economic performance comes indirectly through efficiency improvements in other aspects of a business (Bresnahan and Trajtenberg, 1995).

This second point is particularly salient because it implies that there exist other moderating factors that affect the magnitude of the effectiveness of IT implementation. In other words, the purchase of computers and related IT does not result in any benefit unless they are used effectively by the company's employees.

Although it is difficult to measure, research studies seem to agree that computers regularly contribute to economic growth. The estimated contribution to growth for computers in the 1990s is upwards of 1% per year (Jorgenson and Stiroh, 1999; Oliner and Sichel, 2000). The implications of these studies are significant, yet it is also important to note the timing of these two studies. Both studies used data prior to the "bursting" of the tech bubble in 2000, and their numbers may have been inflated relative to the actual long-term benefits of information technology in hindsight. However, it is difficult to make any arguments against the fact that computers contribute significantly to the productivity and performance of firms.

Despite this generally accepted contribution to performance by IT, there exists evidence in the financial markets and at the firm level suggesting that both intangible costs and benefits are likely related to the implementation of information technology (Brynjolfsson and Yang, 1997, and Brynjolfsson and Hitt, 2002: *Computing*).

In addition, even though there is often productivity gains from IT investment, the extent of these gains is difficult to predict solely based on cost. In other words, there exist other factors that affect the ability of a firm to implement IT advances and maximize the resulting gains. The organizational structure of a company strongly affects how much productivity gain it can achieve from IT investment. A set of seven organizational practices, dubbed the "Digital Organization," has been proposed to identify organization practices that drive a firm's ability to achieve value through IT spending:

1) A policy of open information access and communication,
2) Distributed decision rights and "empowerment" of line workers,
3) Strong performance-linked incentives,
4) Active investment in corporate culture,
5) Regular communication of strategic goals throughout the organization,
6) An emphasis on recruiting and hiring top employees, and
7) Heavy investment in training, including online training, once they are hired.

The direct causality of these seven factors is very difficult to prove outside of a controlled experiment, but firms that adopt these policies are generally significantly more productive than industry standards, especially when the firms also invest considerable amounts of capital in the Internet and related information technologies (Brynjolfsson and Hitt, 2002: *Digital*).

The efficiency improvements allowed by computers can vary dramatically by industry and firm. Because of the wide variety of potential benefits offered by such IT investments and the continual technological advancements, it is important for employees to fully understand this technology in order to realize its maximum value. Employees who are more adept with computer technology can implement new hardware and software more quickly and utilize it more effectively. Referring to the sixth factor from the "Digital Organization" model, "an emphasis on recruiting and hiring top employees" positively drives a firm's ability to achieve value through IT spending (Brynjolfsson and Hitt, 2002: *Digital*). This idea is significant, yet the qualitative nature of this metric grants it further exploration.

Framing Research Problem

This paper will discuss the specific hiring practices of industry firms and integrate data from various sources in order to explore which of these practices significantly affect a firm's ability to realize value through IT spending. This discussion is important because there exists a high amount of variation between firms in many aspects of hiring, suggesting that an optimal practice has not been discovered. Furthermore, if discoveries are made that allow for significant improvement, hiring practices are a factor that many firms could adapt accordingly.

The specific focus of this paper will be on firm requirements and recruiting procedures for non-management positions. Education level of employees, relative compensation, involvement of executives in recruiting, and specific methods of recruiting, are some of the variables being tested in conjunction with each firm's performance, measured as 5-year stock price growth, and their relative focus on IT spending, as measured by the percentage of employees with computers.

For this study, the analysis has been narrowed to a single industry. Focusing on a single industry will help to reduce the confounding issues that may arise across industries, and it will also increase the validity and consistency of any secondary data collected. Ideally, the results of the study will be relevant across industries and the conclusions will involve general hiring practices that are beneficial to companies outside the set of companies analyzed in the study.

The motor vehicle parts manufacturing industry was chosen because of its specific characteristics. A moderate number of medium and large-sized competitors exist in this industry, whose firms produce mainly commodity machine parts. This commodity-manufacturing situation suggests that manual and information efficiency improvements are a significant source of growth for these companies, and these types of improvements are often a result of the value added by information technology. In addition, there exists a high variation in the performance of these companies in recent years, allowing for analyses on the causes of the performance disparities. Most importantly, the hiring practices vary greatly within this industry. Does commodity manufacturing imply that its non-managerial jobs are also commodities? Is it important to hire top employees in this type of industry?

Primary Research

Professor Lorin Hitt and his colleagues have collected a set of data from 253 large US-based firms relating to IT and organizational practices. This data has been collected through extensive employee surveys and interviews. SIC codes for these companies were obtained through public filings and Hoover's Online International Company Directory.

I conducted primary data collection by checking corporate websites of the industry sample companies for online employment applications. For the purposes of this research, companies who simply post a recruiting email address on their website were not considered to actively recruit online. The websites must include specific job openings

and allow users to apply directly through the website for the company to be considered having active "online recruiting."

Secondary Research

Historical price information on the stocks of companies in this study has been collected from finance.yahoo.com. Stock prices were taken from December 1998 and December 2003, and the compounded annualized return was calculated based on this 5-year spread.[4] Assuming a perfectly efficient market with perfect information, adjusted stock price growth is the best indicator of a company's performance. In an exceptionally commoditized industry, such as the automobile parts manufacturing, this performance growth is in turn a good indicator of efficiency gains, particularly those that are a result of technological innovation from IT spending. (See Conclusion: *Limitations* for caveats to assumptions.)

A Fortune poll[5] of 592 companies rating their peers on 8 criteria: technological innovation, employee talent, use of corporate assets, social responsibility, quality of management, financial soundness, long-term investment, and quality of products/services. The first two criteria, innovation and employee talent, are related to this study and the data has been extracted from the set to analyze the significance of these two key variables and their interaction. A correlation is assumed between employee

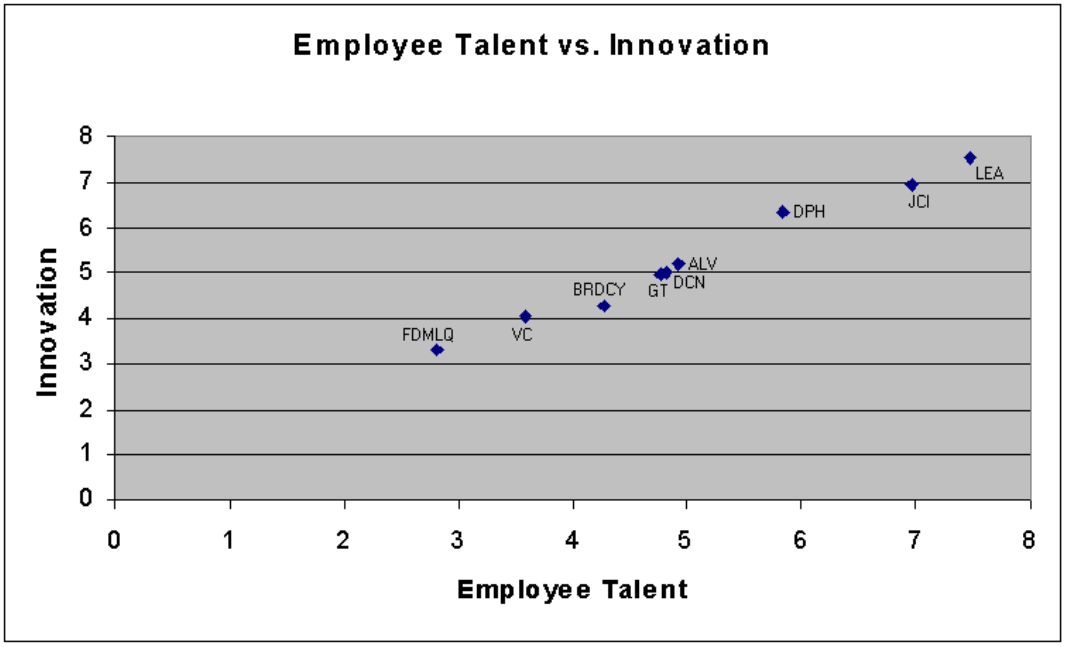
[4] Stock prices were adjusted for dividends and splits.
[5] http://www.fortune.com/fortune/mostadmired/subs/2004/industrysnapshot/0,19409,118,00.html (must have a subscription to view)

talent and a focus on hiring the best employees, as well as between technological innovation and information technology spending.

Difficulty Isolating the Issue

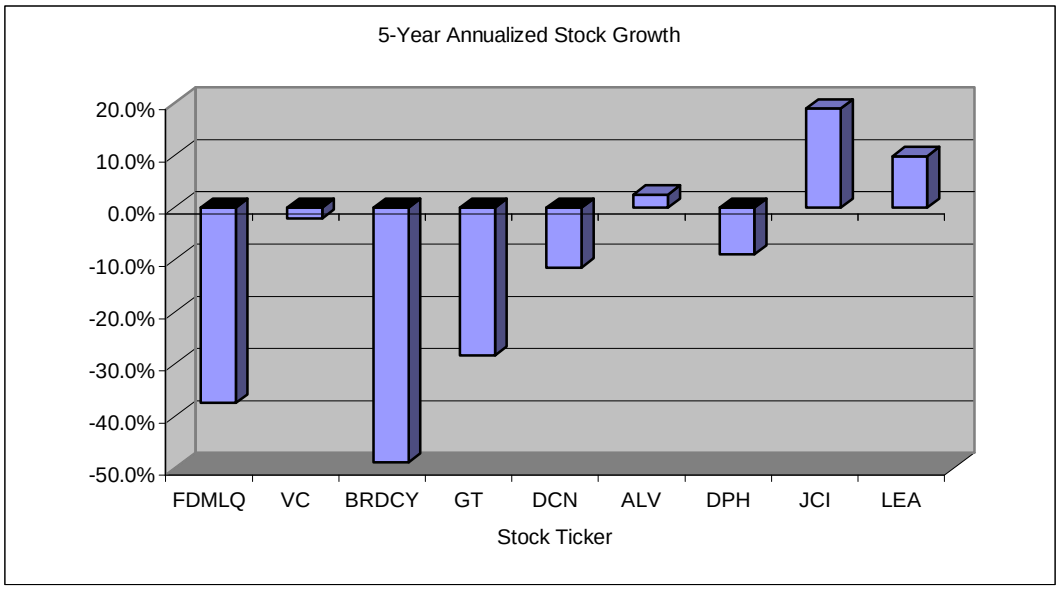
A simple analysis of the Fortune poll illustrates some of the difficulties associated with isolating the issue of firm hiring practices. See Exhibits 1 and 2 below. Note that firms with higher innovation and employee talent ratings, such as JCI and LEA, are more likely to have positive performance than firms lower on both scales, such as FDMLQ. However, there exists an almost a direct correlation between innovation and employee talent (r • .99). This correlation makes it difficult to determine whether innovation or employee talent would alone produce the same positive results that they do in combination. In addition, these two variables are both qualitative and difficult to quantify objectively. Firms with better performance are likely perceived as better on the majority of the criteria in Fortune's poll. Therefore, it is difficult to determine whether the performance is a result of these qualitative ratings, or the qualitative rankings are a result of the firm's performance.

Exhibit 1: Industry Perceptual Map



Source: Fortune Online, April 2004

Exhibit 2: Performance of Industry Firms



Source: Fortune Online, April 2004

The data from the HR survey by Hitt and his colleagues is more valid for this study than the Fortune data for a number of reasons. First, all of the Hitt's data was collected from company employees who experience the actual practices of the company, instead of from peers who can only observe the company from the outside. These employees are also probably less biased by their firm's performance in answering the survey questions (although they may wish to portray their own company in the best light). Also, Hitt's surveys asked many more specific questions about the firms' non-managerial hiring practices, which drastically increase the value of the data for this research study.

The major drawback of this survey data was that the sample did not include enough companies from the motor vehicle parts manufacturing industry. The SIC codes of respondent companies were matched to the data and those with code 371 were isolated. After the conglomerates and airline manufacturers were removed from the sample, only five companies remained.

Therefore, seven companies with SIC code 3714 were later added to the original sample from the survey data in order to get a better overall sample of the motor vehicle parts manufacturing industry. Delphi Corporation and Visteon Corporation, although significant industry competitors, are both recent spin-offs from divisions of larger corporations (General Motors and Ford Motor, respectively). Thus, they are likely idiosyncratic from the sample for reasons outside the scope of this study, and were not included in the sample under "Research Findings".

Analyses and Research Findings

First, analyses were performed on the smaller sample with the most complete set of associated data. This included the five companies from the original HR survey by Hitt with SIC codes 371: Federal-Mogul Corp. (FDMLQ), Gentex Corp. (GNTX), Oshkosh Truck Corp. (OSK), Rexhall Industries, Inc. (REXL), and Carlisle Companies, Inc. (CSL). The results can be interpreted independently or in comparison with the aggregate data analysis.

Correlations Within the Data

Variable 1: Percentage of employees who use general-purpose computers (a good measure of relative IT spending):

- With "hiring focus on educational background":
    - Industry: $r = .19$ ($p = .347$; not significant)
    - Aggregate: $r = .30$ ($p < .0001$)

Variable 2: Percentage of employees who use computerized process controls or machinery:

- With "hiring focus on educational background":
    - Industry: $r = .70$ ($p = .059$)
    - Aggregate: $r = .087$ ($p = .187$; not significant)

Comparing these correlations, it appears that the motor vehicle parts manufacturing industry is not necessarily focused on hiring educated workers if the company has a high percentage of general computing. On the other hand, they do focus on hiring educated workers when they have a high percentage of workers using computerized process controls or machinery. (Both of these correlations contrast those of the aggregate data set.) This characteristic could be unique to manufacturing focused companies, where intelligent workers are particularly essential in operating and monitoring the computerized manufacturing processes.

Incorporating Performance Measure

The variable "executives devote a significant part of their time to recruiting" is highly correlated with firm performance: r = .91 (p = .008). These results are surprisingly significant given the small sample size. This variable has been referenced in past research as an indicator of a firm's focus on hiring top employees (Brynjolfsson and Hitt, 2002: *Digital*). A similar interpretation of this current finding is that companies in this industry whose executives devote a significant amount of time to recruiting will have better employee screening as well as more ability to attract top employees. According to this result, this hiring practice is significantly associated with performance in this industry, independent of IT spending factors.

No other single recruiting practice in the survey is significantly correlated alone with performance in this industry.

This finding is not surprising since there exist many factors outside of hiring that affect a firm's ability to perform. An all-inclusive profit-determining model is very difficult to ascertain, and it has been similarly difficult to discover a hiring factor that stands alone significantly as a performance indicator. (Note that hiring focuses on "analytical skills" and "computer skills" have p-values of .085 and .088, respectively, and may be deemed important factors upon further testing).

Variable 3: Annualized 5-Year Stock Performance:

- With hiring focus on "educational background": r = .30 (p = .264; not significant)
- With hiring focus on "analytical skills": r = .63 (p = .085; not significant)
- With hiring focus on "interpersonal skills": r = .17 (p = .362; not significant)
- With hiring focus on "computer skills": r = .62 (p = .088; not significant)
- With hiring focus on "fit with the organizational culture": r = -.44 (p = .176; not significant)

Having a high percentage of workers using computers or computerized process controls and machinery does not necessarily translate into profitability.

The correlation between performance and percentage of employees who use general-purpose computers is r = .49 (p = .147; not significant). Although this correlation is somewhat high, it is not significant given the very small sample size of five (i.e. the p-value of .147 denotes about a 14.7% percent chance that this correlation is due solely to chance). An even more striking finding for this industry is the low correlation between performance and the percentage of employees who use computerized process controls or

machinery: r = -.01 (p = .495; not significant). These findings are consistent with the underlying model used in this paper and that computers do not independently contribute to performance.

Incorporating "Online Recruiting Indicator"

I propose that this variable can serve as an indicator of both the IT investing and the hiring practices of a firm, in an industry where not all firms yet recruit online:

1. Companies that recruit online are more focused on keeping their IT up-to-date.
2. Companies that recruit online will on average have more technologically skilled employees (or at least more employees with a minimum technological skill proficiency).

It is important to note that this assumption differs from the focus of most research on online recruiting. Past studies have shown that there exist efficiency gains from recruiting online. For example, recruiting online saves time and cost over recruiting in person, and it allows for the avoidance of task duplication of many HR functions (Groe, Pyle, and Jamrog, 1996). Although such efficiency benefits to recruiting online may exist, the focus of this paper related to online recruiting is solely as an indicator of a firm's hiring practices and relative position on information technology.

First, including only the five original companies, GNTX and OSK have active online recruiting, while FDMLQ, REXL, and CSL do not. The correlation between performance and online recruiting (a binary variable) is very high at r = .787 (p = .033).

The five-year annualized stock returns for these two companies that recruit online are 17.3% (GNTX) and 38.8% (OSK). The same annualized stock returns for the other three companies range from –37.4% to 5.7%. This stark contrast grants a further look at this "online recruiting" variable.

Seven more companies were incorporated into the industry sample, ArvinMeritor, Inc. (ARM), Johnson Controls, Inc. (JCI), Bridgestone Corp. (BRDCY), The Goodyear Tire & Rubber Co. (GT), Dana Corp. (DCN), Autoliv, Inc. (ALV), and Lear Corp. (LEA). The results of the analysis were similar. Although the correlation between online recruiting and performance is much lower ($r = .516$), it is still significant with the larger sample size of 12 ($p = .043$). Strictly from the data, a conclusion is reached that online recruiting in this industry is related to performance. Although there exist efficiency gains from recruiting online, I believe there is a deeper underlying explanation for this strong association between online recruiting and performance.

Conclusion

This research study was designed to analyze a highly qualitative issue in a robust manner using statistical metrics. The findings are important, yet there are limitations to the conclusions as well as the requirement of future research to reinforce the findings and explore adjacent research territory.

Conclusions and Implications

In the motor vehicle parts manufacturing industry:

- Executive involvement in recruiting is important for a firm to achieve success. Nobody wants to think that they are being hired into a commodity job as a commodity employee. In order to attract talented individuals to the manufacturing industry away from industries with higher profiles, executives must become involved.
- Having pervasive IT in this industry does not necessarily imply success. This supports the argument that IT must be associated with certain organizational practices, such as hiring skilled employees, in order to realize the value of IT spending.
- I propose that online recruiting is a significant indicator in this industry of both a firm's focus on keeping their IT up-to-date as well as a company's focus hiring technologically skilled employees (i.e. a company that hires online will *on average* have more employees with a minimum technological skill proficiency

than a company that does not hire online). If my proposition about the online recruiting indicator is correct, then a focus on up-to-date IT integration and hiring employees with a minimum technological skill proficiency are a complementary combination for achieving performance in this industry. Companies in this industry who currently recruit on their corporate website are significantly more successful than companies who do not. This supports the main argument of this paper that a focus on hiring skilled employees will increase the value a company realizes from its investments in technology. Past research has demonstrated the existence of efficiency benefits of online recruiting, but that is outside the focus of this study (Groe, Pyle, and Jamrog, 1996). However, in addition to serving as an indicator, online recruiting is definitely an effective initial screening of potential new employees to ensure that they are computer literate enough to accomplish meaningful tasks with information technology.

The nature of this industry and its idiosyncrasies make it difficult to generalize these conclusions. However, there do exist industries with similar characteristics to the motor vehicle parts manufacturing industry. Industries associated with commodity manufacturing or materials processes are likely to exhibit similar dependencies on efficiency of production and information flow, thus benefiting markedly from efficient IT implementation. Examples of such industries include some primary metal industries (SIC 33), fabricated metal products (SIC 34), and miscellaneous manufacturing (SIC 39).

In most other industries, it is more difficult to measure the benefits of IT because there exist moderating factors that make it more complicated to measure the effects of IT implementation. For example, a moderating factor in most industries is the existence of the branding of goods and services, where advertising and consumer perceptions also drive a firm's ability to perform.

In addition, the online recruiting indicator is not a distinguishing factor in these types of industries because the majority of companies already recruit on their corporate websites. One explanation for this is that companies in commercialized industries often have a more developed front on the Internet for commercial purposes and brand building. In some industries, creating a technologically progressive image is arguably as important actually remaining up-to-date on IT. Therefore, in industries where online recruiting is already ubiquitous, different measurement criteria for my hypothesis must be discovered.

Despite the complications of variation across industries, I believe that the underlying conclusions on the issue can be generalized. In every industry, it is important to hire skilled employees in order to realize the true potential value of IT spending. Information technology is a powerful tool in any business, but that is exactly what it is: a tool. This tool must be put in the right hands, because it is very often expensive and does not contribute toward performance while sitting in the shed.

Limitations

The most daunting limitation to any study of this sort is that fact that causality is near impossible to prove outside of a controlled experiment. Since the existence of a correlation between two variables does not necessarily imply causation, one must be careful in drawing conclusions from these statistics.

In addition, it is difficult to isolate the impact of certain variables within a multitude of inputs. How much of the performance of these firms is actually due to improvements from IT spending and the hiring of skilled people to use the IT? This is a very difficult question to answer, and it is important to understand that the results of this study are limited greatly by this fact. The specific industry was chosen to help limit the moderating factors and to isolate the variables in question, yet the numbers were analyzed with a specific concept in mind and based on the given assumptions -- another observer may reach different conclusions from the same statistics. For these reasons, it is important that future research be devoted to studying this topic to provide evidence for or against these conclusions, so that we can all get a better understanding of the issue at hand.

Looking Forward

There are many future questions raised by this study, but most importantly, further investigation is necessary on the impact of online recruiting. First, in order to confirm the conclusions I have reached, I must test the logic behind my proposition about online

recruiting – in an industry where not all firms recruit online, is online recruiting a sufficient indicator of a firm's stance on IT and hiring?

In addition, it was convenient that not all companies in the motor vehicle parts manufacturing industry had recruiting websites at the time of this study, so this binomial metric alone provided some useful insight. However, in the not so distant future, the majority of companies in all industries will likely do some or all of their recruiting online. More detailed research needs to determine the optimal use of online hiring for attracting top employees (i.e. application process, types of positions, screening criteria), as well as the caveats presented by avoiding more traditional recruiting methods. Specifically, quantitative research on how recruiting websites are used by firms will be more important as online recruiting steps toward ubiquity in the future. Also, there exist a multitude of online placement services and job recruiting websites (e.g. hotjobs.yahoo.com and www.monster.com). Study into impact of these general online recruiting websites and their effectiveness in recruiting productive employees will also be important in the future.

All in all, although there are some important findings in this study, it only scratches the surface of the issue of how hiring practices affect a firm's ability to realize value of IT spending.

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