SKILL GAPS, HUMAN CAPITAL FORMATION, AND STRATEGIC CHOICES: WHAT DO BUSINESSES DO WHEN FACING CRITICAL LABOR FORCE CHALLENGES?

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ABSTRACT

When employers face critical labor force challenges, what strategies do they pursue to remain competitive? Finding the right people for the job can be difficult, especially in fields with specialized knowledge and skills such as science, technology, engineering, and mathematics (STEM). To understand employers' strategic choices regarding workforce recruitment challenges, this study directed several questions to a panel of 200 managers from manufacturing and information technology sectors and 69 economic development professionals across Tennessee. Employers and economic development professionals were asked to rank eight current strategies they pursue when faced with critical workforce challenges, in order of importance. The same survey recipients were also asked to rank strategies they would prefer to use. This study aimed to investigate strategies organizations pursue in the search for talent to complete tasks, with a focus on STEM fields. This paper first reviews approaches and trends in literature with regard to human capital formation and recruitment strategies and then assesses the survey results within the context of strategic human resource management literature. Overall, research has found that managers use diverse methods to recruit and retain knowledge workers, and that there is a notable gap between managers' rankings of current actual and preferred strategic choices.

INTRODUCTION

Importance of Human Capital to Firms

Human capital has become an increasingly valuable asset to firms. Research has shown a significant contribution of strategic human resource management practices to the competitive advantage of firms (Arthur, 1994; Pfeffer, 1994; Becker and Huselid, 1998). Adequate human resource practices could influence organizationally relevant outcomes such as productivity and profitability (Delery and Doty, 1996). Empirical evidence, for example, suggests that a commitment to human capital could lower turnover rates twofold as compared with other methods and could lead to higher performance as found in a manufacturing setting (Arthur, 1994).

More important, an organization should adopt human resource practices that are contingent on firm strategy. In doing so, firms would reap higher profits, performing better on corporate financial performance measures such as return on assets and return on equity (Delery and Doty, 1996). Huselid (1995) and Youndt et al. (1996) studied the impact of universal and contingency

approaches on human capital enhancement to evaluate the effect of skilled and committed human capital on multiple dimensions of operational performance. The findings suggest a direct relationship between particular approaches to human resources and firm performance. Because a firm's human capital is crucial to its success, there is a need to integrate human resources into the formulation of a firm's strategy (Wright, McMahan, and McWilliams, 1994).

Moreover, employees with the required core competencies and capabilities help develop new products, provide world-class customer service, and implement organizational strategy (Becker et al., 1997). A high-performance work system (HPWS) could serve as an inimitable resource, supporting the effective implementation of corporate strategy and the attainment of operational goals (Becker and Huselid, 1998). This HPWS should include rigorous recruitment and selection procedures, performance-contingent incentive compensation systems, and management development and training activities linked to the needs of the business (Becker, Huselid, and Spratt, 997).

Human Capital and Economic Growth

A firm's corporate goals very much depend on the performance of its human capital. Based on the universalistic and contingency approaches of human resource management, adequate human capital management could lead to higher profits, lower turnover, and improvement in human capital skills (Huselid, 1995). Taken at an aggregate level, positive and potentially strong returns from companies will lead to robust growth in the economy. An adequate human resource strategy is not only beneficial for the firm but also an asset for the employees themselves. In this view, development of a firm's workforce and its systems for managing people is seen as an investment rather than a cost to be minimized (Becker and Huselid, 1998). This investment in human capital through a high-performance work system should provide a significant and increasingly important source of value creation for the company, the market, and the economy as a whole. Becker, Huselid, and Spratt (1997) found that a one-standard-deviation improvement in the quality of a firm's HPWS is associated with changes in market value of $15,000 to $60,000 per employee. For a firm with 10,000 employees, that number is equivalent to multiple millions of dollars in market-value increase. More to the point, a firm's human resources have an asset value that corresponds to the present value of future cash flows derived from the skills, motivation, and adaptability of the firm's workforce.

Addressing Human Capital Shortages and Research Questions

Because of its importance to business competitiveness and economic growth, selecting employees constitutes one of the biggest tasks an organization faces. The process of selecting employees can come with many challenges, such as organizational constraints, cost, time, and labor market demand. This process can be even more difficult when organizations are seeking employees with unique skills. Unique skills might include those required for jobs in the areas of science, technology, engineering, and mathematics (STEM). Even as the organization must find the right candidate, the candidate must also find the right organization. Finding the right fit has many benefits for the organization as well as the employee. The current paper aims to investigate

human resource management strategies through which organizations fulfill their need for employees with STEM skills. This paper particularly aims to answer the following four broad questions:

- What are the strategies organizations use to address critical skill shortages?
- Are there differences between revealed strategies and stated preferences on strategic choices to address the skill shortages?
- Does the industry in which a firm is located make a difference in a firm's strategic choices?
- How do a firm's attributes affect its strategic choices in addressing critical skill shortages or completing tasks in highly technical areas?

In the sections that follow, this paper first reviews the theoretical concepts regarding human capital formation. The second section introduces study challenges, hypotheses, and the construct used in this paper. The third section deals with study methodology. The fourth section presents the study's findings. The fifth section briefly discusses the implications and limitations of this study. The conclusion follows.

THEORETICAL BACKGROUND

Building Human Capital

Human capital investment has become a strategic decision for firms. By adopting a strategic human resource management (SHRM) framework, firms are building distinctive competencies, reorganizing competencies, and positioning business units more advantageously (Teece, 1984). By training employees to have skills with broader applicability, firms should be able to create a sustainable competitive advantage (Bhattacharya and Wright, 2005; Berk and Kaše, 2010). Depending on the needs of the firm or the need in the markets, the SHRM framework advises flexible types of human capital investment in line with corporate strategy. Common themes among adequate human capital development are selective staffing, comprehensive training, developmental appraisal, and externally equitable rewards (Snell and Dean, 1992; Flamholtz, 1971). Flamholtz (1971, 1972), focusing on internal extension or tightening of performance standards and budgets to improve employee productivity.

Improvements to human resource accounting are also imperative, in order to accurately measure the value of people as organizational resources (Flamholtz, 1972). Failure to measure and report the value of human resources to management can conceal suboptimal decision-making in organizations. Investment in human capital through training and development is critical if human capital is a key determinant of organizational success. Therefore, tools for monitoring and evaluating development programs in terms of their impact, result, and value is necessary (Flamholtz, Bullen, and Hua, 2003). Human resource accounting becomes a way of evaluating human resource decisions and issues and provides a set of measures for quantifying the effects of human resource management strategies on the cost and value of people as organizational resources.

Several combinations of permanent, temporary, flexible, and shared methods exist in the human capital building literature. Traditional approaches to internal human capital investment are

still used by many firms. However, the high cost of training employees without a guaranteed return is a risk most companies are less and less willing to take. To avoid these human capital investment costs, firms turn to cheaper alternatives such as temporary workers, contract workers, and outsourcing (Abraham and Taylor, 1996; Bettis, Bradley, and Hamel, 1992; Davis-Blake and Uzzi, 1993; Foote and Folta, 2002; Pfeffer and Baron, 1988). Contracting out business services is generally influenced by wage and benefit savings potential, volatility of output demand, and availability of specialized skills possessed by the outside contractors (Abraham and Taylor, 1996). In part, externalizing work is a tool to smooth out the workload of the regular workforce. There is an increase in contracting out during peak period tasks. Bettis, Bradley, and Hamel (1992) warn about the improper use of outsourcing in the continuing decline of many Western firms. Outsourcing should be part of a firm's strategy to aid in competitiveness instead of a defensive operational measure. There should be a clear understanding of the relationship between narrowly-based sourcing decisions and broad-based competitive decline, in both firms and entire industries, caused by outsourcing. An adequate outsourcing strategy would generally focus on areas far removed from core competencies. Also, measuring outsourcing needs in strategic and financial terms needs to be a normal strategy review process.

Domestic or international alliances and cooperation among firms are also methods commonly discussed in the literature (Kogut and Kulatilaka, 1994; Brush and Chaganti, 1996; Gardner, 2005). Such alliances are characterized by a high degree of cooperative strategies that are, however, not central to core operations (Brush and Cahganti, 1996). Cooperative activities, partnerships, and alliances are gaining popularity in new and small businesses. Resource pooling, as well as facility, equipment, and personnel sharing are common. Gardner (2005) stated the growth of alliances is due to the fact that job security and career ladders are being replaced with a doctrine of employability according to which promises to keep employees' skills current and to develop them for opportunities in other workplaces are valued commitments. In general, cooperative strategies among firms are novel in nature, as they are counterintuitive to the competitive nature of the firm itself. Brush and Chaganti (1996) find that cooperation among firms is due mostly to resource constraints and not to an inherent desire to transfer technology. Inherent cooperation is common, however, in the high-tech industry.

The final approach considered is resource based, whereby the link between a firm's resources and sustaining competitive advantage is examined (Barney, 1991; Flamholtz, Bullen, and Hua, 2003; Koch and McGrath, 1996; Matusik and Hill, 1998). A firm's resources, including its physical, human, and organizational capital, must all be used within a defined strategy that aims to improve the firm's competitive advantage. Such an advantage is sustained by implementing a strategy that exploits internal strengths through responses to environmental opportunities. A sustainable value-creating strategy is based on several indicators, including value, rareness, inimitability, and non-substitutability. Koch and McGrath (1996) developed a human resource sophistication index that ranks investments in human resource planning and hiring practices that are positively associated with labor productivity. Their findings show that firms that aggressively sought more employees, obtained more information about them, and screened out those with undesirable characteristics benefited from higher productivity. Matusik and Hill (1998) promoted a concept of contingent work whereby a firm's investment in human capital would lead to

knowledge accumulation, value creation, and, subsequently, the establishment of a competitive advantage.

Three Theories and Four Employment Modes

Lepak and Snell (1999) reviewed theoretical perspectives on human resource architecture and concluded that three major theoretical perspectives on human resources (resource-based view of the firm, human capital theory, and transaction cost economics) converge around four different employment modes:

(a) internal development—investing in employee skill sets to make or grow the firm's own human capital;
(b) acquisition—buying human capital from competitive markets, both domestic and international (overseas);
(c) contracting—using temporary staffing agencies or contract workers to get the job done;
(d) alliance—creating partnerships with other companies or entities to solve human resource challenges.

Depending on the type of tasks involved, firms may prefer one option to another. For example, if the tasks involve the firm's core competencies, the preference would be either to make their own human capital or buy (recruit) from the competitive market. For non-core tasks, the firms may use other, lower-cost available options. Using these four major frameworks, this paper developed eight different methods of human capital formation or completing critical tasks.

STUDY CONSTRUCTS AND HYPOTHESES

Recruiting STEM Employees

Human capital strategies for organizations are used to attract, engage, and retain employees as well as to increase performance (Graen & Grace, 2015). Recruiting employees can be completed both inside and outside the organization. While recruiting is important for the organization, it is also a costly process, estimated to require around $3,500 per new hire (Fleming & Jia, 2016). Due to the high cost, organizations are developing strategic methods of hiring employees with unique skill sets.

Recruiting for STEM areas. Developing and promoting STEM field knowledge has typically been introduced to students from kindergarten through 12th grade (McDonald, 2016; Hernandez et al., 2014). STEM education refers to studying or gaining professional practice in one of the STEM areas (Hernandez et al., 2014). In terms of STEM employment, computer occupations are the most common at 45 percent, followed by engineers at 19 percent (Fayer, Lacey, & Watson, 2017). STEM careers matter to organizations because the jobs are growing at a rapid pace. For example, STEM jobs increased by 10.5 percent from 2009 to 2015, while non-STEM jobs increased at 5.2 percent (Fayer, Lacey, & Watson, 2017). This creates a challenge for organizations in recruiting and selecting this unique, sought-after talent.

Study Construct: Revealed and Stated Preferences

This study is part of a broader project that aims to identify critical challenges and issues due to STEM-related skill shortages in Tennessee. In 2017, the broader STEM project survey results identified several key challenges companies are facing in the area of STEM workforce. Primarily, many survey respondents indicated it is challenging to find skilled STEM workers. Nearly four in five respondents indicated such skill shortages will negatively impact their companies' growth. The survey then asked how these companies are currently addressing the skill challenges by ranking their current practices and how they would have addressed the challenges if circumstances were different (actual/preferred strategies). They ranked the eight strategies given in Table 1.

Table 1

When facing skilled workforce challenges, please assess your company's strategy: (1= the lowest priority; 8= the highest priority)			
Revealed (Actual) Strategies in Order		Stated (Preferred) Strategies in Order	
Investing in Existing Employees		Investing in Existing Employees	
Investing in K-12 Education to Create Talent Pipeline		Investing in K-12 Education to Create Talent Pipeline	
Recruiting from the Competitive Market		Recruiting from the Competitive Market	
Using Temporary Staffing Agencies / Contract Work		Using Temporary Staffing Agencies / Contract Work	
Using Less Skilled Internal Employees for the Task		Using Less Skilled Internal Employees for the Task	
Recruiting from Overseas		Recruiting from Overseas	
Outsourcing the Task to Be Completed (US)		Outsourcing the Task to Be Completed (US)	
Outsourcing the Task to Be Completed (Overseas)		Outsourcing the Task to Be Completed (Overseas)	

Investing in Existing Employees for Skill Upgrade

Practitioners and researchers alike have provided reasons for investing in professional development. Little (2015) provides the following reasons for investing in professional development: 1) employees are happier if their employer expresses interest in their development; 2) organizations change, so keeping up with skills can be beneficial; and 3) when senior employees retire, the talent needs to be replaced and this process may be easier if other employees have been developed. In support of the stated reasons, the research also suggests that training and development opportunities can be factors in whether an applicant decides to accept or decline a job offer (Schmidt, 2007). Investing in employee talent through encouraging career adaptability can also increase both job satisfaction and retention (Coetzee & Stoltz, 2015). When looking specifically at employees in roles requiring constant contact with people, results have shown a high correlation between job training and overall job satisfaction (Schmidt, 2007). Research has shown that training helps employees, increasing their potential for career advancement and ultimate success (Coetzee & Stoltz, 2015). Some literature regards investing in employees' futures

as an important best practice for organizations (Biro, 2017). Developing a culture of continuous learning is a common method for retaining talent.

Fields focused on professional development. Among a sample of 284 engineers, research found a significant positive relationship between investment in training and development and organizational commitment (Coetzee, Mitonga-Monga, & Swart, 2014). Similarly, in a sample of information technology employees, results also showed that satisfaction with training and development practices and opportunities had a significant positive impact on retention (Renaud, Morin, Saulquin, & Abraham, 2015). Prior research has found that opportunity/lack of opportunity for training and development is significantly related to intent to leave among other IT professionals (Kim, 2012). Research conducted within samples of nurses also found a direct link between training and education offered and job satisfaction (Price & Reichert, 2017). As shown, investing in employees appears common across industries.

H1 *Large firms are more likely to invest in their own employees.*

H2 *Companies with research and development (R&D) expenditures are more likely to invest in their employees.*

H3 *Companies with technologically strong infrastructure are more likely to invest in their employees.*

Recruiting from Competitive Markets

In a recent survey administered by PricewaterhouseCoopers (2017), 53 percent of a total of 1,379 CEOs considered STEM skills very important. Furthermore, 12 percent stated it was difficult to recruit employees with STEM skills. Because of the distinctive requirements of the jobs, innovative recruiting techniques have been shown to be more beneficial than traditional methods (Rothwell, 2011; SHRM, 2016). Due to the complex nature of the work, organizations must attract technical talent by demonstrating intellectual challenges within the organization (Rothwell, 2011). Because STEM students have the training to understand multi-faceted issues and think logically through problems, organizations are challenged to demonstrate that their company can offer a more rewarding career than other companies (Kho, 2013). Recruitment techniques can be tailored to the anticipated market. For example, when technical employees are sought, recruitment methods that utilize technology may be more effective (APQC, 2012). Within a sample of 124 STEM students, prior research has shown that the offer of autonomy also plays a significant role in attracting STEM employees (Wei, 2016). Autonomy can refer to having control over work hours, work location (i.e., home or office), and decision-making authority (Wei, 2016).

"Knowledge workers" is the title that has been given to the group of individuals who have more specialized training with regard to acquiring specific knowledge (Rothwell, 2011). Students with a STEM education could be considered knowledge workers. Finding and hiring knowledge workers can be approached in a slightly different way from recruiting for traditional jobs. Organizations are often more strategic about attracting and retaining technical talent in a way that is linked to business needs and objectives (Rothwell, 2011). For example, one strategic model is to first identify short- and long-term business needs, then to identify the necessary talent necessary to fulfill the business needs, and finally to develop an action plan for attracting the talent (APQC,

2012). This process helps to ensure the strategy aligns with the objectives (Jansen & Ruse, 2008). To be strategic in recruitment of employees with technical skills, organizations need to be able to predict their future talent needs (Janesen & Ruse, 2008; SHRM, 2016). This is especially important when recruiting STEM employees, because the both the knowledge and skills required are highly developed (Jansen & Ruse, 2008).

To help select employees with the required STEM training, some organizations have switched to more innovative methods. Caterpillar, General Mills, and Lockheed Martin have all adopted an innovative method for talent acquisition (APQC, 2012). Through their process, employees in strictly technical roles are transitioned to take on more of a human resource role to contribute to the employee hiring process (APQC, 2012). For example, a mechanical engineer with 20 years of experience, who has demonstrated knowledge of the field and the skills required, may be included in the process of finding and selecting new talent in the field.

Recruiting from Overseas

In the past, recruiting from outside the United States was cost prohibitive. More recently, there has been a transition to recruiting from outside the United States because of the available talent world-wide (Manning, Massini, & Lewin, 2008). Attracting global talent can help with product development and innovation (Lewin, Massini, & Peeters, 2008).

Fields recruiting from overseas. Research suggests that looking globally for talent is becoming increasingly more common as fewer people in the United States are selecting careers in fields such as science and engineering (Lewin, Massini, & Peeters, 2008). Just as overseas talent is common in these two fields, it is also common in research and development (Manning, Massini, & Lewin, 2008). Furthermore, looking globally for talent is becoming common in technical areas which require specific knowledge and skills (Lewin, Massini, & Peeters, 2008). Trend analysis from 1990 to 2007 indicates that IT remains the field most heavily involved in overseas recruiting, followed by product development, administrative business processes, call centers, and procurement (Manning, Massini, & Lewin, 2008).

H4 *Large companies are more likely to recruit from the competitive market either domestically or internationally.*

H5 *Firms are more likely to recruit from the competitive market compared with other modes of recruitment.*

Using Temporary Staffing Agencies or Contract Work

Research suggests that according to executives, approximately 44 percent of the workforce in 2018 will consist of temporary positions or contractors (Shook & Knickrehm, 2017). Nearly 27 percent of the working-age population in the United States can be classified as independent workers (Manyika, Lund, Bughin, Robinson, Mischke, & Mahajan, 2016). Temporary or contract workers can benefit an organization through cost savings (Graff, 2012). As organizations make the transition to becoming leaner, more work can be completed with temporary workers.

Fields using temporary staff and contact workers. The trend of using temporary workers does not appear to be limited to a single field. Temporary workers are being used in areas such as IT, human resources, and finance (Sorensen, 2012). That being said, some industries have more pressure to engage in independent work (Manyika, Lund, Bughin, Robinson, Mischke, & Mahajan, 2016). For example, 38 percent of teachers are independent workers because of necessity.

H6 Manufacturing firms are more likely to use contract workers as opposed to the firms in professional and technical services, and education and healthcare.

Using less skilled internal employees to handle jobs

As we have mentioned, hiring the right employee presents challenges. A reported one in three employers have difficulty finding qualified candidates for job openings (HR Specialist, 2011). One area in which it has been found that the most qualified candidates are not hired is the business of childcare. In a recent study, researchers found that applicants to positions in this field who had more experience or more education were not significantly more likely to be selected (Boyd-Swan, & Herbst, 2017). In order to explain this finding, researchers postulated that hiring the most qualified candidate is the more expensive option in the already expensive field of childcare. Alternatively, researchers also suggest organizations may not believe that hiring the most qualified candidate adds substantial value (Boyd-Swan, & Herbst, 2017). While these findings are of interest, it is difficult to find empirical research regarding underqualified employees.

H7 Smaller firms are more likely to rely on less skilled internal employees to complete tasks because of the cost of recruiting.

Investing in K-12 education to create a talent pipeline

The U.S. Department of Labor has funded a large grant to help organizations manage the talent pipeline. One of the primary functions of the grant is to help organizations close the gap between academic courses and skills required on the job (Eramo, 2017). While this grant is not necessarily geared toward kindergarten through 12th grade, it signifies an interest in investing in a talent pipeline. Developing relationships with high school programs has been identified as one of the first steps in building a talent pipeline (Chesney, 2017). Wells Fargo and WellCare are two organizations that capture the value of investing in teenagers (Join Wells Fargo, 2013). A review of multiple sources regarding building a talent pipeline revealed that only rare articles recommend starting before the undergraduate level (Skrzypinksi, 2017; Waters, 2017). While the government has increased the funding for STEM fields to develop this talent, there is a lack of empirical evidence that organizations are doing the same.

H8 Firms in professional and technical services, education, and healthcare are more likely to promote investing in a talent pipeline.

Outsourcing tasks to companies/individuals in the U.S./overseas

This option is similar to contracting with staffing agencies. In this case, a task is outsourced to an independent contractor. Many manufacturing firms use this option strategically to improve their competitive position. However, when firms do use this option, they often outsource tasks that are not related to their core competencies (Bettis et al., 1992).

H9 Firms that are involved in exports may have a strong preference for recruiting or outsourcing tasks overseas.

Revealed versus stated strategic preferences

The present study intends to help understand the difficulties organizations may face in recruiting unique talents, such as those in STEM fields. The study analyzes managers' revealed (actual) preferences and stated (preferred) preferences for addressing critical skill gaps in STEM-related areas.

H10 Firms' revealed strategies are expected to differ significantly from their stated strategies.

METHOD OF ANALYSIS

Data

In 2017, the Business and Economic Research Center (BERC) initiated a STEM workforce skill assessment survey in Tennessee. BERC followed a two-step approach to collect the data from a long survey: (1) sending the survey to businesses and educational and professional development organizations in the state, and (2) using a carefully screened panel of 200 participants who are in charge of their companies' operations or human resource functions. The former approach yielded about 69 usable responses. The latter approach was initiated in cooperation with Qualtrics, producing 200 usable responses. The breakdown of responses by major sectors is presented in Table 2.

Table 2

Distribution of Survey Responses by Major Sectors	
Major Sectors	Percent of Total responses
Education and Healthcare	21.35%
Manufacturing	24.72%
Professional and Technical Services	36.70%
Other	17.23%
Total Responses	100.00%

In identifying business panels, BERC in cooperation with Qualtrics used the following screening questions:

- What is your current role in the company?
- How would you describe your industry?
- How many employees work for your company?
- Where is your company located?

Variables Used in This Study

The STEM survey included more than 50 multiple-choice and open-ended questions. Of these, this paper will use the following variables in assessing the strategies companies pursue regarding skill gaps in STEM-related fields:

- What is your industry classification?
- How many employees work for your company?
- Does your company export goods and services overseas?
- Does your company participate in innovative activities such as research and development or the commercialization of patents?
- Are enough high-quality/competitive individuals being produced for STEM occupations in Tennessee?
- Are high schools and colleges in Tennessee equipping students with the proper skills for STEM-related jobs?
- Is the workforce in Tennessee going to meet the demands of advanced technology?
- How is your company positioned to take advantage of technological changes?
- When facing skilled-workforce challenges, please assess your company's current strategy by ranking each of eight options (1 = the lowest priority; 8 = the highest priority).

- When facing skilled workforce challenges, please assess your company's preferred strategy by ranking each of eight options (1 = the lowest priority; 8 = the highest priority).

Estimation Method

Given the nature of the dataset (ordinal rank preferences and discrete variables), this study uses two nonparametric assessment tools to test the study hypotheses: the Friedman test and Spearman's Rho correlations.

Friedman Test

The Friedman test is a nonparametric test used to compare more than two dependent samples. It tests the following null hypothesis for *k*-related samples: *Ho: The distribution of k-related samples are the same.* For each variable, sum of the ranks for cases is calculated and then averaged using the following formula (SPSS, version 23):

$$\overline{R}_1 = \frac{C_1}{N} \quad (1)$$

Where $\bar{R}_1$= Mean rank
C_1= Sum of the rank of the cases
N = Number of cases

Using the Friedman test statistics, we then calculate χ^2 distribution.

$$Ftest = \left[\frac{12}{(N*k*(k+1)}\right] * \sum C^2 - [3 * N * (k+1)] \quad (2)$$

Where N = number of cases
K = number of variables / groups
C = sum of the rank of the cases

Degree of freedom (df) is *k-1.*

The Friedman test may tell us whether the ranking among groups is significant, but it does not provide pairwise comparison. To understand how each group's ranking differs from the other, we perform the Wilcoxon signed ranks test.

Spearman's Rho

Spearman's Rho is a nonparametric test used to measure the correlation between two variables. Spearman's rank-order correlation is the nonparametric version of the Pearson product-moment correlation. The formula for Spearman's rank-order correlation is given below.

$$Spearman's\ Rho\ (\rho\ or\ rs) = 1 - \frac{6\sum d_i^2}{n(n^2-1)} \quad (3)$$

Where d_i = difference in paired ranks
N = number of cases

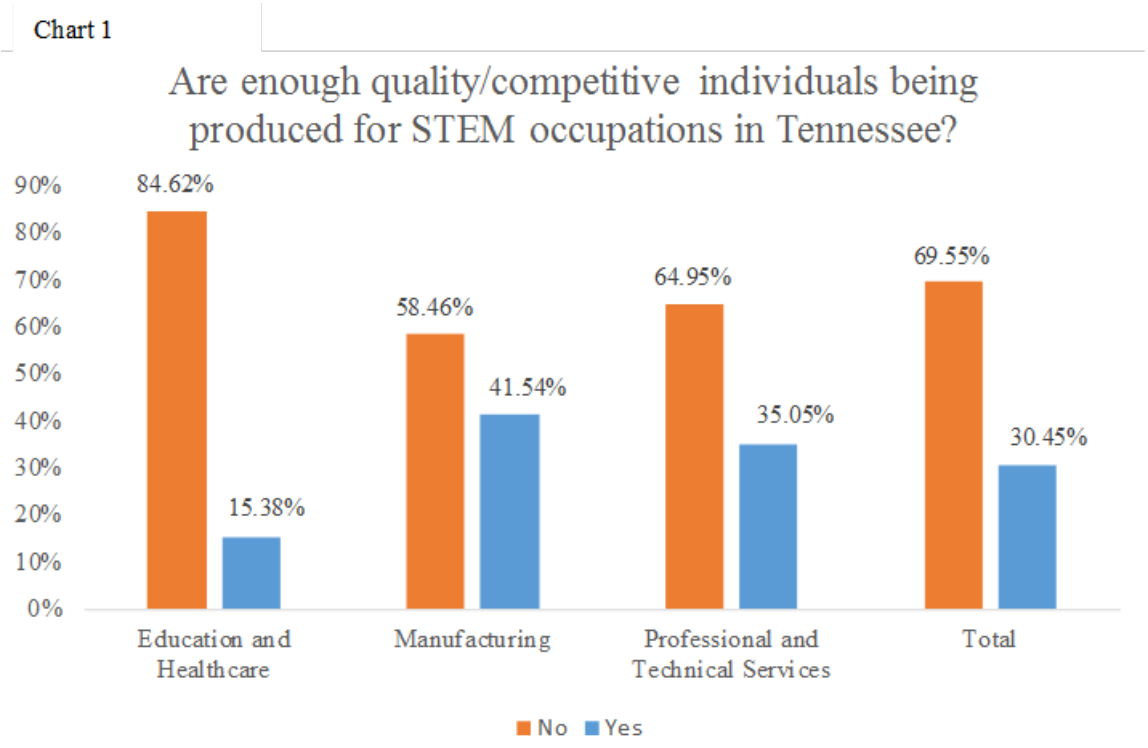
Spearman's rank-order correlation (ρ *or* rs) takes a value between +1 and -1; +1 indicating a perfect positive association; 0 indicating "no-association"; and -1 indicating a perfect negative association. We used SPSS to analyze the association between variables of interest.

RESULTS

State of the STEM Skill Pipeline in Tennessee

BERC's STEM survey asked businesses several questions regarding the state of STEM skills in Tennessee in 2017. The results do not show a promising outlook, as nearly 70 percent of businesses surveyed indicated there are not enough high-quality/competitive individuals being produced for STEM occupations in Tennessee (Chart 1).

Chart 1



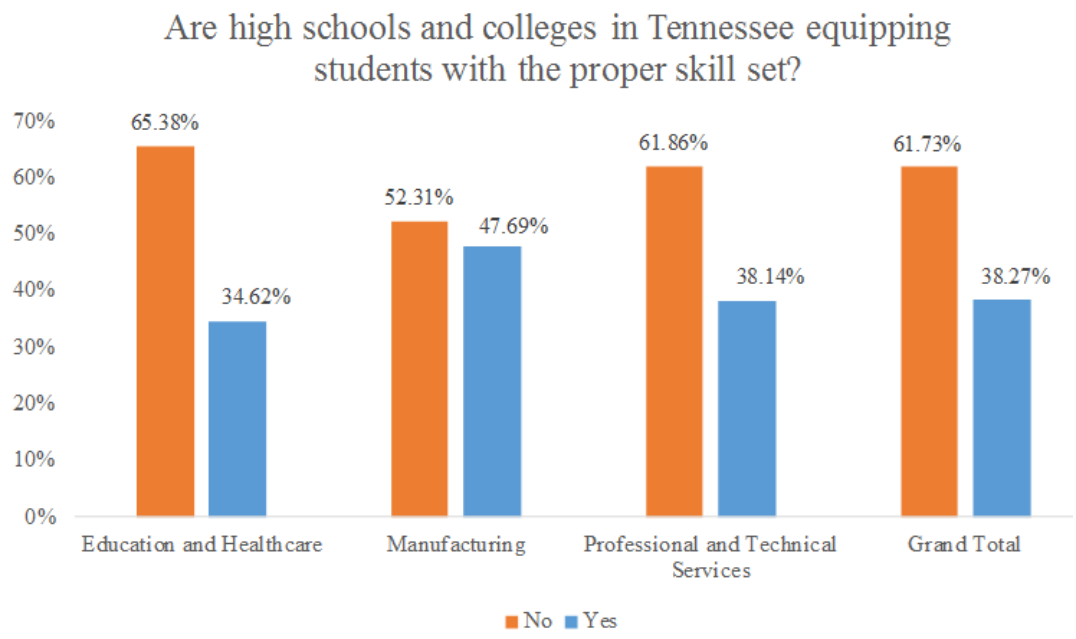
Source: The Authors' Survey of Industry Managers in Tennessee in 2017

When we look at the results by sectors, the largest gap seems to be in the education and healthcare sectors, where nearly 85 percent of managers suggested there are not enough

competitive individuals produced for education and healthcare occupations in Tennessee, followed by professional and technical services (65 percent) and manufacturing (58 percent).

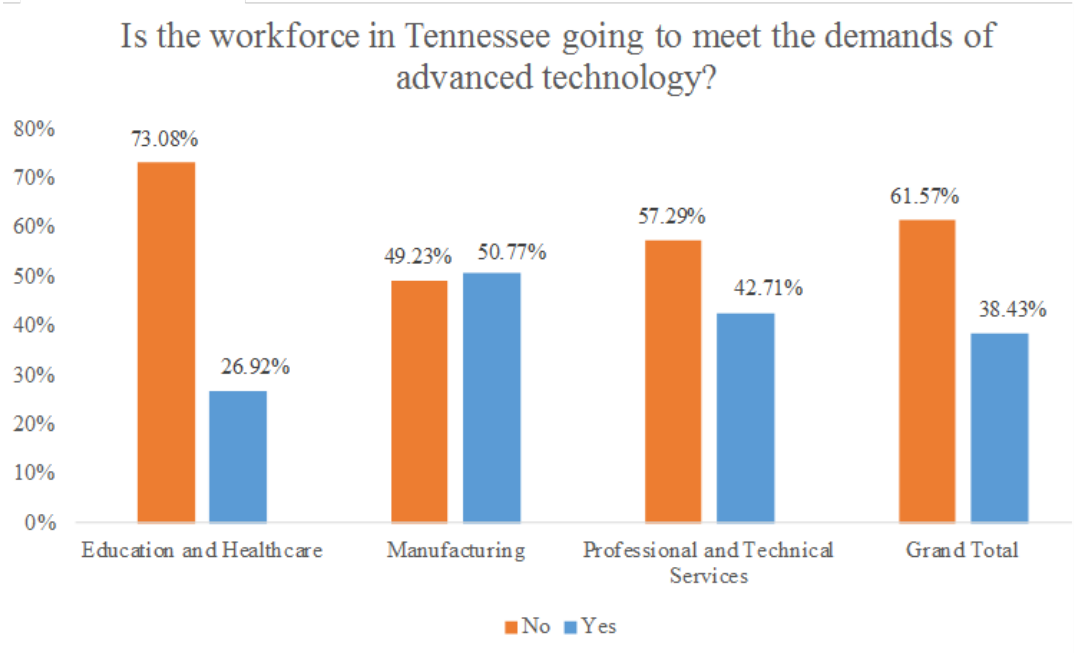
Are high schools and colleges in Tennessee equipping students with the proper skill set? Overall, 62 percent of managers indicated students are not acquiring the proper skill set. Similar to the responses to the previous question, more than 65 percent of managers in the education and healthcare sector suggested students are not equipped with the proper skill. Similarly, about 62 percent of managers in professional and technical services argued that both high schools and colleges are not properly training students. The manufacturing sector was almost evenly split on this question, with just over 52 percent of managers suggesting that skill set development is a problem (Chart 2).

Chart 2



Source: The Authors' Survey of Industry Managers in Tennessee in 2017

Chart 3



Source: The Authors' Survey of Industry Managers in Tennessee in 2017

Finally, we asked business managers whether the workforce in Tennessee is going to meet the demands of advanced technology. The results are very discouraging, as 62 percent of managers answered this question "No." Again, an overwhelming percentage of managers (73 percent) in the education and healthcare sectors argued the workforce in Tennessee is not going to meet the demands of advanced technology (Chart 3). The professional and technical services sector echoed this sentiment, albeit mildly. Managers in the manufacturing sector were split 50/50 on this issue.

Responses to these three questions by managers in Tennessee suggest that finding employees with the proper STEM skill set is a challenge for companies. When faced with this challenge, what human resource strategies do these managers use to make sure their business remain competitive in the market?

Firm Size, R&D Investment, and Technology Readiness

In this part of assessment, we tested three general hypotheses regarding the relationship between human resource strategies and firm attributes. Before analyzing the relationship, we conducted a nonparametric Friedman test. The Friedman test suggests the ranking across groups for both revealed and stated strategies is significant (Table 3).

Table 3

Friedman Test: Is Preference Ranking Significant?

Revealed Preferences: Descriptive Statistics

	N	Mean Rank	Std. Deviation	Minimum	Maximum
Investing in Employees	217	6.94	1.47995	1.00	8.00
Investing in Pipeline	217	5.40	1.98153	1.00	8.00
Competitive Market	217	6.22	1.58818	1.00	8.00
Contract Worker	217	4.45	1.56013	1.00	8.00
Less Skilled Worker	217	4.27	1.92990	1.00	8.00
Recruiting from Overseas	217	2.74	1.67778	1.00	8.00
Outsourcing Domestic	217	3.74	1.73412	1.00	8.00
Outsourcing Overseas	217	2.25	1.73013	1.00	8.00

Test Statistics[a]

N	217
Chi-Square	668.931
df	7
Asymp. Sig.	.000

a. Friedman Test

Stated Preferences: Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
Investing in Employees	216	7.0185	1.30816	2.00	8.00
Investing in Pipeline	216	5.5880	2.11564	1.00	8.00
Competitive Market	216	6.1204	1.47360	1.00	8.00
Contract Worker	216	4.6343	1.60827	1.00	8.00
Less Skilled Worker	216	4.2500	1.63465	1.00	8.00
Recruiting from Overseas	216	2.7269	1.49866	1.00	8.00
Outsourcing Domestic	216	3.5602	1.74572	1.00	8.00
Outsourcing Overseas	216	2.1019	1.78333	1.00	8.00

Test Statistics[a]

N	216
Chi-Square	720.401
df	7
Asymp. Sig.	.000

a. Friedman Test

We then tested the following three hypotheses to see how firm attributes affect human resource strategies:

H1 *Large firms are more likely to invest in their own employees.*

H2 *Companies with research and development (R&D) expenditures are more likely to invest in their employees.*

H3 *Companies with a technologically strong infrastructure are more likely to invest in their employees.*

For the first hypothesis (H1), measuring the correlations between company size and human resource strategies, Spearman's Rho bivariate correlations do not support our hypothesis: large company size does not necessarily lead to investing in employees for skill development as a preferred human resource strategy. Both revealed and stated strategy rankings are not significant with regard to the relationship between firm size and investing in employees for skill development (Table 4).

Table 4

Spearman's Rho Correlations: Revealed (Actual) Preferences

[1= the least preferred; 8= the most preferred]		Investing in Employees	Investing in Pipeline	Competitive Market	Contract Worker	Less Skilled Worker	Recruiting from Overseas	Outsourcing Domestic	Outsourcing Overseas
[H2]Does your company invest in R&D? (Yes, No) [1,0]	Correlation Coefficient	-.042	.036	.021	-.042	**-.302****	**.209****	-.012	**.136***
	Sig. (2-tailed)	.533	.595	.760	.538	.000	.002	.863	.042
	N	221	221	220	222	223	219	221	224
[H3] How is your company positioned technologically? (Weak, Average, Strong) [0,1,2]	Correlation Coefficient	.024	.132	-.022	-.005	**-.261****	.093	.065	-.010
	Sig. (2-tailed)	.719	.050	.747	.947	.000	.172	.334	.879
	N	221	221	220	222	223	219	221	224
[H1] What is the size of your company? (Small, Medium, Large) [0,1,2]	Correlation Coefficient	-.071	-.060	**.178****	.031	-.015	.001	-.048	.073
	Sig. (2-tailed)	.294	.375	.008	.649	.823	.993	.479	.277
	N	221	221	220	222	223	219	221	224

Spearman's Rho Correlations: Stated (Preferred) Preferences

[1= the least preferred; 8= the most preferred]		Investing in Employees	Investing in Pipeline	Competitive Market	Contract Worker	Less Skilled Worker	Recruiting from Overseas	Outsourcing Domestic	Outsourcing Overseas
[H2]Does your company invest in R&D? (Yes, No) [1,0]	Correlation Coefficient	**-.204****	-.039	-.041	-.093	-.119	**.268****	.118	.023
	Sig. (2-tailed)	.002	.566	.546	.171	.079	.000	.082	.733
	N	218	219	221	219	220	217	220	222
[H3] How is your company positioned technologically? (Weak, Average, Strong) [0,1,2]	Correlation Coefficient	-.070	.118	-.107	-.029	**-.243****	.104	.067	-.085
	Sig. (2-tailed)	.303	.081	.114	.672	.000	.126	.320	.204
	N	218	219	221	219	220	217	220	222
[H1] What is the size of your company? (Small, Medium, Large) [0,1,2]	Correlation Coefficient	-.109	-.049	.082	.111	.022	-.001	-.047	.036
	Sig. (2-tailed)	.109	.473	.225	.102	.747	.990	.490	.591
	N	218	219	221	219	220	217	220	222

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

What is the relationship between investing in R&D and investing in employees? Do the companies that invest heavily in research and development prefer creating their human capital through investing in their employees? Our findings do not confirm this hypothesis under the revealed strategy model. However, under the stated strategy model, the relationship is significant, in the opposite direction. At the same time, the relationship between R&D and recruiting from overseas is highly significant and positive. This suggests that companies with R&D expenditures prefer chasing the talent across the globe to investing in existing employees as a human resource strategy to fill shortages.

The third hypothesis (H3) involves the relationship between technology readiness and human resource strategies: companies with a technologically strong infrastructure are more likely to invest in their employees. This hypothesis was also not supported by the data. There is a strong negative relationship between technology readiness and using less-skilled workers to fill the skill gap in a company.

Company Size and Recruiting from Competitive Markets

Is there a relationship between company size and recruitment from competitive markets? To test this hypothesis (H4), we look at the Spearman's Rho correlations between company size and human resource strategy preference rankings under the revealed and stated preferences scenarios. The findings support the hypothesis. Indeed, there is a strong positive correlation between company size, measured as small, medium, or large, and recruiting from competitive markets under the revealed strategy scenario. However, data does not suggest either a positive or negative connection between firm size and recruiting from overseas (Table 5).

Table 5

Spearman's Rho Correlations: Revealed (Actual) Preferences

		Investing in Employees	Investing in Pipeline	Competitive Market	Contract Worker	Less Skilled Worker	Recruiting from Overseas	Outsourcing Domestic	Outsourcing Overseas
What is the size of your company? (Small, Medium, Large) [0,1,2]	Correlation Coefficient	-.071	-.060	**.178****	.031	-.015	.001	-.048	.073
	Sig. (2-tailed)	.294	.375	.008	.649	.823	.993	.479	.277
	N	221	221	220	222	223	219	221	224

Spearman's Rho Correlations: Stated (Preferred) Preferences

		Investing in Employees	Investing in Pipeline	Competitive Market	Contract Worker	Less Skilled Worker	Recruiting from Overseas	Outsourcing Domestic	Outsourcing Overseas
What is the size of your company? (Small, Medium, Large) [0,1,2]	Correlation Coefficient	-.109	-.049	.082	.111	.022	-.001	-.047	.036
	Sig. (2-tailed)	.109	.473	.225	.102	.747	.990	.490	.591
	N	218	219	221	219	220	217	220	222

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Competitive Market Recruitment versus Other Modes

Do firms prefer a competitive market recruitment strategy to other modes of recruitment? Based on the data, our hypothesis (H5) is partially supported. As highlighted in Table 3 above and Table 6 below, a competitive market strategy is the second-most preferred strategy among eight employment modes. This finding is consistent across the sectors this study covers. The mean rank value is second to investing in employees across major sectors.

Table 6

Friedman Test: Is Preference Ranking Significant?
Revealed Preferences: Industry Comparison

[1= the lowest; 8= the highest]	Manufacturing N	Manufacturing Mean Rank	Educational and Healthcare N	Educational and Healthcare Mean Rank	Professional and Technical Services N	Professional and Technical Services Mean Rank	Other Industries N	Other Industries Mean Rank
Investing in Employees	62	**6.60**	38	**6.68**	95	**7.14**	22	**7.45**
Investing in Pipeline	62	**5.42**	38	**5.47**	95	**5.46**	22	**4.95**
Competitive Market	62	**5.95**	38	**6.13**	95	**6.41**	22	**6.27**
Contract Worker	62	4.08	38	4.95	95	4.51	22	4.41
Less Skilled Worker	62	4.06	38	4.89	95	4.01	22	4.86
Recruiting from Overseas	62	3.44	38	2.58	95	2.47	22	2.18
Outsourcing Domestic	62	3.60	38	3.47	95	3.85	22	4.14
Outsourcing Overseas	62	2.85	38	1.82	95	2.15	22	1.73

Test Statistics[a]	
N	62
Chi-Square	127.823
df	7
Asymp. Sig.	.000

a. Friedman Test

Test Statistics[a]	
N	38
Chi-Square	131.009
df	7
Asymp. Sig.	.000

a. Friedman Test

Test Statistics[a]	
N	95
Chi-Square	345.646
df	7
Asymp. Sig.	.000

a. Friedman Test

Test Statistics[a]	
N	22
Chi-Square	93.182
df	7
Asymp. Sig.	.000

a. Friedman Test

A further analysis using Wilcoxon Signed Ranks Test suggests that compared with seven other employment modes, preference ranking for recruiting from competitive markets is significantly different from the other seven employment modes. Especially in the areas of recruiting from overseas and outsourcing tasks overseas, the difference is significant and effect size is very large ($r > 0.5$) (Table 7).

Table 7

Ranks and Wilcoxon Signed Ranks Test Statistics: Revealed Preferences

Pair of Rankings (1)	Directions of Relationship (2)	N (Number of Cases) (3)	Z-Score (4)	Asymp. Sig. (2-tailed) (5)	Effect Size (r) (6)
Competitive Market - Investing in Employees	Negative Ranks	151	-5.149	.000	0.25
	Positive Ranks	67			Significant
	Ties	0			but small
	Total	218			
Contract Worker - Competitive Market	Negative Ranks	182	-9.014	.000	0.43
	Positive Ranks	36			Significant
	Ties	0			but
	Total	218			medium
Competitive Market - Investing in Pipeline	Negative Ranks	85	-4.196	.000	0.20
	Positive Ranks	133			Significant
	Ties	0			but
	Total	218			small
Less Skilled Worker - Competitive Market	Negative Ranks	173	-8.649	.000	0.41
	Positive Ranks	47			Significant
	Ties	0			but
	Total	220			medium
Recruiting from Overseas - Competitive Market	**Negative Ranks**	**197**	**-11.522**	**.000**	**0.55**
	Positive Ranks	**22**			**Significant**
	Ties	**0**			**and**
	Total	**219**			**large**
Outsourcing Domestic - Competitive Market	Negative Ranks	182	-9.984	.000	0.48
	Positive Ranks	37			Significant
	Ties	0			but
	Total	219			medium
Outsourcing Overseas - Competitive Market	**Negative Ranks**	**200**	**-11.767**	**.000**	**0.56**
	Positive Ranks	**19**			**Significant**
	Ties	**0**			**and**
	Total	**219**			**large**

1. Difference in rankings
2. Cases ranked higher or lower for the reference group
3. Number of cases either higher or lower for the reference group
4. Wilcoxon test score (z- score)
5. Significance of ranking difference
6. Effect size of ranking difference (r= z-socre/square root of all cases (two groups))

Contract Work and Industry Relationships

As a human resource strategy, is contract work more associated with the manufacturing sector (H6)? Data indicates that as a human resource strategy, contract work in manufacturing is as common as in other sectors. The Friedman test shows a mean rank score of 4.08 for contract work, making it the fourth-preferred strategy in the manufacturing sector. In other sectors, we see a similar ranking for contract work as the fourth-preferred employment mode (Tables 3 and 6).

Company Size versus Less-Skilled Workers

We hypothesized that smaller firms are more likely to rely on less-skilled internal employees to complete tasks because of the cost of recruiting (H7). We expected to see a negative and significant relationship between the less-skilled worker mode of completing tasks and the company-size variable. Based on Table 5, the sign of the relationship is correct, but the relationship is not significant.

Investing in Talent Pipeline by Industry

Our eighth hypothesis (H8) is about the relationship between industry and investing in a talent pipeline. Our rationale behind this hypothesis that "the firms in professional and technical services, education, and healthcare are more likely to promote investing in a talent pipeline" was that many businesses in the professional services, educational, and healthcare sectors are driven by local needs and concerns and therefore more likely to invest in a talent pipeline. Findings (Table 6) suggest this is not the case. In the sectors we covered, the mean rank test shows investing in a talent pipeline is considered the third-preferred strategy across sectors.

Outsourcing and Exporting

We hypothesized that firms that are involved in exports may have a strong preference for recruiting or outsourcing tasks overseas (H9) or have a preference for overseas recruitment. We expect firms, through international involvement, to create alliances and a competitive space for their goods and services overseas. The findings in Table 8 suggest support for our hypothesis: a firm's export orientation is positively related to recruiting and outsourcing overseas under the revealed strategy scenario. Under the stated strategy ranking, export orientation is positively connected with recruiting overseas.

Table 8

Spearman's Rho Correlations: Revealed (Actual) Preferences

		Investing in Employees	Investing in Pipeline	Competitive Market	Contract Worker	Less Skilled Worker	Recruiting from Overseas	Outsourcing Domestic	Outsourcing Overseas
[H9] Does your company export? (Yes, No) [1,0]	Correlation Coefficient	.030	-.063	-.034	-.098	**-.212****	**.292****	.031	**.141***
	Sig. (2-tailed)	.653	.350	.621	.147	.001	.000	.648	.035
	N	220	220	219	221	222	218	220	223

Spearman's Rho Correlations: Stated (Preferred) Preferences

		Investing in Employees	Investing in Pipeline	Competitive Market	Contract Worker	Less Skilled Worker	Recruiting from Overseas	Outsourcing Domestic	Outsourcing Overseas
[H9] Does your company export? (Yes, No) [1,0]	Correlation Coefficient	-.072	-.017	-.023	-.077	-.111	**.169***	.084	.125
	Sig. (2-tailed)	.291	.798	.735	.255	.100	.013	.215	.063
	N	217	218	220	218	219	216	219	221

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Revealed versus Stated Strategy Ranking

Finally, we hypothesized that (H10) firms' revealed strategy rankings are expected to differ significantly from their stated strategy rankings. In many cases, the realities of the business environment may lead managers to accept and implement less than optimal human resource recruitment strategies. Therefore, revealed ordinal utility function may differ significantly from

the stated ordinal utility function. To test this hypothesis, we obtained the Spearman's Rho correlation matrix for the revealed and stated strategy rankings. According to Table 9, rankings under the two different scenarios are positively correlated. In several areas, as expected, we see significant changes in ranking; for example:

- investing in employees is negatively correlated with recruiting overseas;
- investing in a talent pipeline is negatively correlated with contract workers and outsourcing domestically, suggesting managers prefer investing in a talent pipeline to resorting to contract workers and domestic outsourcing;
- contract workers are positively correlated with less-skilled workers;
- less-skilled workers are negatively correlated with investing in a talent pipeline;
- recruiting overseas is negatively correlated with investing in employees and less-skilled workers;
- domestic outsourcing is negatively correlated with contract workers;
- outsourcing overseas is negatively correlated with investing in a talent pipeline.

Negative correlations suggest revealed strategy ranking moves in the opposite direction of stated strategy ranking.

Table 9

Spearman's Rho Correlations: Revealed versus Stated Preferences

			Stated Preferences							
			Investing in Employees	Investing in Pipeline	Competitive Market	Contract Worker	Less Skilled Worker	Recruting from Overseas	Outsourcing Domestic	Outsourcing Overseas
Revealed Preferences	Investing in Employees	Correlation Coefficient	**.525****	-.019	-.009	.065	.033	**-.140***	-.062	-.103
		Sig. (2-tailed)	.000	.785	.895	.340	.625	.040	.361	.128
		N	217	217	218	217	218	216	218	219
	Investing in Pipeline	Correlation Coefficient	-.076	**.502****	-.111	**-.137***	-.107	-.118	**-.142***	-.113
		Sig. (2-tailed)	.266	.000	.103	.043	.117	.084	.036	.098
		N	216	217	217	217	217	217	216	217
	Competitive Market	Correlation Coefficient	-.081	.057	**.318****	.082	-.094	.009	-.042	-.127
		Sig. (2-tailed)	.237	.404	.000	.229	.166	.899	.533	.061
		N	217	217	218	217	218	216	218	219
	Contract Worker	Correlation Coefficient	.042	-.065	-.051	**.229****	**.167***	-.043	-.084	-.090
		Sig. (2-tailed)	.535	.335	.453	.001	.013	.531	.218	.183
		N	218	219	219	217	219	217	218	219
	Less Skilled Worker	Correlation Coefficient	.014	**-.201****	.067	.108	**.376****	-.117	-.121	-.042
		Sig. (2-tailed)	.841	.003	.319	.110	.000	.084	.075	.531
		N	217	219	220	219	220	217	219	221
	Recruiting from Overseas	Correlation Coefficient	**-.147***	-.112	-.018	-.056	**-.157***	**.542****	-.130	.118
		Sig. (2-tailed)	.031	.099	.788	.410	.021	.000	.056	.082
		N	217	217	218	216	217	216	217	218
	Outsourcing Domestic	Correlation Coefficient	.075	-.090	-.070	**-.205****	-.062	-.116	**.461****	.030
		Sig. (2-tailed)	.268	.184	.299	.002	.366	.088	.000	.661
		N	218	217	219	218	218	216	220	220
	Outsourcing Overseas	Correlation Coefficient	**-.258****	-.133	-.122	-.039	-.091	.063	.121	**.433****
		Sig. (2-tailed)	.000	.050	.072	.567	.181	.353	.073	.000
		N	218	219	220	219	220	217	220	221

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

DISCUSSION AND LIMITATIONS

This paper is part of a broader project that assesses the state of the STEM workforce in Tennessee in 2017. This paper deals with the component of that project that addresses challenges associated with STEM skill shortages across industries. Overall, study findings indicate that those individuals with decision-making authority at their companies overwhelmingly argue that the STEM skill issue is a major problem across sectors in Tennessee. How do these managers address skill challenges? Informed by the literature, we constructed a survey to measure which human capital formation strategies these managers currently use and which measures they would prefer to use under ideal conditions.

Theoretically, the study findings confirm traditional approaches to human capital formation as the top two choices of managers across sectors: (1) creating human capital by investing in existing employees to improve their skill set in order to tackle STEM-related deficiencies, and (2) buying human capital by recruiting from the competitive marketplace. However, the third choice was investing in a talent pipeline, which does not easily fit into the "lease or ally" strategies of human capital formation. The approach of investing in a talent pipeline in a community is very much in line with the recent conceptual framework advanced by Porter and Kramer (2011), with their emphasis on creating shared values in a community to create a competitive advantage.

There have been a notable number of theoretical and empirical studies in the past two decades regarding several forms of outsourcing and international recruiting. Because of the prominence of this issue, we expected to see a relatively high level of preference for the strategy of outsourcing and overseas recruitment in addressing STEM-related skill challenges. However, the findings show that managers across industries ascribe the lowest preference to this strategy.

The last conceptual issue that requires attention is the inclusion of less-skilled internal employees among the human capital formation/task completion categories. It is interesting to note the mean rank for this category is higher than for others. The purpose of adding this category was to see whether managers prefer this suboptimal choice in handling STEM-related challenges. Indeed, findings show a relatively high preference for using existing, less-skilled employees to complete tasks that may be considered a firm's core competencies.

Methodologically, the survey questions captured some critical dimensions regarding the modes of employment or task completion. However, the survey and analysis components leave room for improvement. For example, forced ordinal ranking of employment modes may have biased the results. Alternatively, the survey could have asked managers to rank each category independently, from one to five or any other number. Furthermore, when answering questions regarding strategic human resource management approaches, managers may not have made a clear distinction between core versus non-core tasks when dealing with employment modes. Since we are discussing STEM-related issues, we made the assumption that the challenge was related to firms' core competencies.

Empirically, the study's findings suggest the skill challenge is prevalent across sectors in Tennessee. Managers can play an important role in creating a competitive business environment by making the right strategic choices regarding employment modes. In certain cases, there are

significant variations between managers' revealed and stated strategy rankings. Some actual strategies may result in extremely suboptimal results. For example, managers may be forced to use less-skilled existing employees to handle a task related to their firm's core competency instead of recruiting from the competitive market. In these areas, the findings provide an awareness of a menu of options managers can pursue to make a difference in their firms' sustainable competitive advantage.

Many of the survey challenges and methodological issues are also limitations of this study. In subsequent studies, there should be several improvements:

1- including additional questions to separate core from non-core competencies;
2- modifying the ranking of employment modes to reduce bias associated with forced ranking of one to eight;
3- increasing sample size and variation in rankings so that a factorial model can be constructed to identify unobserved latent indicators;
4- extending the geographical coverage of the survey across several states.

CONCLUSION

This study analyzes strategic challenges associated with STEM-related skill shortages. The study findings suggest that to address critical skill shortages, managers prefer two of the traditional approaches to human capital formation: creating their own human capital through investing in their employees and buying (or recruiting) highly competent individuals from the competitive marketplace. As a third preference, many managers chose investment in a talent pipeline as a strategic option. Although investing in a talent pipeline may be risky for companies in the short run, it may create a good return on investment in the long run. Choosing this option before contract work (leasing) and outsourcing (allying) suggests that managers look at the issue from the stakeholders' perspective rather than the firm's narrow, short-term shareholder profit perspective. On the other hand, the study also suggests that a substantial number of managers are willing to handle tasks related to their firms' core competencies with less-skilled internal employees. This suboptimal approach to addressing critical skill shortages may dramatically affect the firms' competitive advantage in the market. Finally, many firm attributes, such as technology readiness, size, R&D spending, and exporting, are not strongly associated with the managers' preferences for employment modes. This may be partially related to sample size and the geographical scope of the study. Further inquiry into these areas may provide additional insights regarding these shortcomings of this study.

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