University of Alberta

Is the productivity of firm resources moderated by task interdependence? A study of winning and losing teams in Major League Baseball and the National Hockey League.

by

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Abstract

Resource-based logic suggests that some firms out-perform others because the firm owns and uses firm-specific, productive assets. What makes a firm's assets productive? I argue that organizational task interdependence (the way that work flows between work units) moderates the relationship between a firm's resources and firm performance to make the firm's assets more or less productive. I propose and test 5 hypotheses. Hypothesis 1 tests whether discrete resources, assets that produce a competitive advantage independently from other assets, are more productive in simple or complex organizations. Hypothesis 2 tests whether systemic resources, assets that combine to produce a competitive advantage, are more productive in simple or complex organizations. Hypotheses 3 and 4 examine whether a particular human resource (HR) strategy is more productive in simple or complex organizations. Hypothesis 5 tests if an interaction between discrete and systemic resources is productive in simple and/or complex organizations. I test my hypotheses in the natural laboratory of professional sport. I use Major League Baseball (MLB) as a representative example of simple organizations and the National Hockey League (NHL) as a representative example of complex organizations. I determine that discrete resources are productive in both simple and complex organizations while systemic resources are more productive in complex organizations. A Human Capital (HC) HR strategy is more productive in simple organizations while a Human Process (HP) HR strategy is more productive in complex organizations. Finally, the interaction between discrete and systemic resources is productive in simple but not in complex organizations. The productivity of the interactions, however, does not differ significantly between simple and complex organizations.

Dedication

For Anne and Elizabeth.

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CHAPTER I

Introduction

> We are looking forward to building the type of team the Rangers are able to buy.
>
> Bobby Smith, General Manager Phoenix Coyotes

> Only in baseball can a team player be a pure individualist first and a team player second, within the rules and spirit of the game.
>
> Branch Rickey, General Manager Brooklyn Dodgers

> Don't think, it can only hurt the ball club.
>
> Crash Davis, Catcher Durham Bulls

A main question of strategic management is: why do some firms out-perform others (Barney & Hesterly, 1996)? Resource-based logic suggests that some firms out-perform others because the firm owns and uses firm-specific, productive assets (e.g., Barney, 1991). Resources can be broadly categorized on the basis of their productivity. Discrete resources are assets that produce a competitive advantage without the aid of other firm assets (Miller & Shamsie, 1996). A competitive advantage develops when a firm has the exclusive right to use these assets. Systemic resources are assets that produce a competitive advantage in conjunction with other firm assets (Miller & Shamsie, 1996). A competitive advantage develops when a firm builds systems that other firms cannot duplicate. A firm with more productive resources, whether they are discrete or systemic, is in a better strategic position than its competitors.

The strategic human resource management (SHRM) literature also recognizes the importance of discrete and systemic human resources. The individuals within a firm comprise the human capital pool (HCP) of the organization. The members of the organization's HCP are endowed with specific strengths, weaknesses, talents, and skills. Some organizations have more skilled workers than others. The organizations with more stocks of high quality human assets have a human capital advantage (Boxall, 1996). Similarly, Boxall (1996) notes that some firms have a human process advantage. This advantage develops through the causally ambiguous, socially complex, historical structures that develop within an organization. As the members of the HCP work together, they create informal systems that, as a whole, are more productive than each individual on their own.

What makes a firm's assets productive? It is difficult to answer this question. Some research suggests that productive assets are those to which a firm has privileged access (Miller & Shamsie, 1996). Others argue that assets are productive if they are used in conjunction with firm-specific practices (e.g., Grant, 1991). Regardless, there is disagreement as to the causes of differential asset productivity.

A variable that has not been included in the discussion of asset productivity is task interdependence. The early organizational literature identified different ways that work flows between work units in simple and complex organizations (Thompson, 1967). Research determined that task interdependence has a significant effect on the way that work units coordinate and communicate (Van de Ven, Delbecq, & Koenig Jr., 1976). Research has not yet determined if a firm's task interdependence has a moderating effect on the productivity of a firm's resources.

Professional baseball and hockey are natural laboratories to test whether task interdependence affects resource productivity. First, both hockey and baseball are excellent examples of the different types of task interdependence present in simple and complex organizations. Baseball is an excellent example of a simple organization because work flows between work units using pooled or sequential interdependence. Batting in baseball has been previously cited as an example of pooled interdependence (Keidel, 1984). As well, fielding in baseball is analogous to sequential interdependence. Hockey is an excellent example of a complex organization because work flows between work units using team and reciprocal interdependence. Although hockey has not been used previously as an example of team and reciprocal interdependence, basketball has been cited as an example of team and reciprocal interdependence (Keidel, 1987; Van de Ven et al., 1976). There are enough similarities between hockey and basketball to argue that hockey is also a good example of both team and reciprocal interdependence.

Professional sport is an excellent research site because there is a large amount of available, public data. Major League Baseball (MLB) and the National Hockey League (NHL) have extensive statistics that relate to player and team performance. As well, team payroll figures are readily available and some empirical evidence suggests that performance can be predicted by the size of a team's payroll (Gerrard, 2005; Quirk & Fort, 1997; Scully, 1974). This offers a convenient starting point from which to test the productivity of a team's resources. The following are anecdotal examples that indicate why professional sport is a good site to test if task interdependence moderates resource productivity.

In 2004, the small market Calgary Flames advanced to the seventh and final game of the NHL Stanley Cup finals. The low payroll, small market Flames were not expected to advance past the first round of the playoffs. In fact, two of the teams the Flames defeated during the playoffs employed more expensive and, arguably, more talented players. Yet, the Flames came within one game of winning the league championship.

The Oakland Athletics have surprised many experts with their consistent above-average team performance. Over the last five years the Athletics have finished as one of the top ten teams in MLB despite having one of the league's lowest payrolls. This feat has not gone unnoticed (e.g., Lewis, 2003). Few teams, however, have been able to duplicate the Athletics' success.

The New York Rangers are a salient example of a high payroll team significantly under-performing. During a nine-year period, the Rangers had the league's highest payroll five times. The other four years the Rangers' payroll was second, third and fourth highest in the league. Throughout this period, however, the team did not perform like a top payroll team, missing the playoffs for seven consecutive seasons.

The New York Yankees and the Boston Red Sox are two examples of teams that have met the performance expectations of a large payroll. In 2004, the Boston Red Sox won the World Series for the first time in 86 years. The Red Sox had the second highest payroll for that year at $127 million. Similarly, from 1996 to 2005 the New York Yankees had the league's highest payroll every year except one. During this time the Yankees went to the World Series 6 times, winning 4.

The preceding anecdotal evidence indicates that team performance in professional sport is not easily explained. What, then, affects team performance? My primary research question addresses this. I investigate whether an organization's task interdependence moderates the productivity of a firm's resources and, thus, a firm's performance. This research addresses this question by exploring differences in team performance in professional hockey and baseball. To answer this question I take the following steps.

In Chapter Two I review the differences between discrete and systemic resources. This is followed by a discussion of task interdependence. On the basis of the two literatures, 5 hypotheses are proposed. In Chapter Three I discuss the research sites, the different variables and the statistical models that I use to test my hypotheses. In Chapter Four I discuss the results of the different models. I determine that discrete resources are productive in both simple and complex organizations while systemic resources are more productive in complex organizations. I also find that a human capital (HC) HR strategy is more productive in simple organizations while a human process (HP) HR strategy is more productive in complex organizations. Finally, I determine that the interaction between discrete and systemic resources is productive in simple and not complex organizations.

In Chapter Five I discuss the implications, strengths, limitations and future directions of this investigation. One managerial implication is that task interdependence has a significant effect on the productivity of a firm's resources and, therefore, the ability of a firm to outperform its rivals. Another implication for managers is that, depending on the firm's task interdependence, certain resources are more productive and better suited to produce a competitive advantage than others. The main strategic implication for managers of professional baseball teams is that a team with the best players will win the majority of its games. For managers of professional hockey teams the main implication is that teams with superior organizational systems will win the majority of their games.

CHAPTER II

Literature Review

Resource-based logic suggests that firms possess resources (Barney & Hesterly, 1996; Hoopes, Madsen, & Walker, 2003) but not all resources are equally dispersed across all firms (Peteraf, 1993). Only specific assets produce a competitive advantage for an organization (Barney, 1991). Non-imitable (Dierickx & Cool, 1989) and non-substitutable (Barney, 1991) resources are most productive and have the potential to position a firm advantageously. An organization that owns productive assets that others do not has the potential to produce a competitive advantage. A manager's role is to evaluate and determine which resources are most productive. These resources will provide the firm with the most substantial return.

Miller and Shamsie (1996) categorize resources on the basis of assets productivity. Discrete resources produce superior firm performances without any input from other assets. Systemic resources produce superior firm performances when they combine with other assets to create a complementary system. Although there are other ways to categorize firm resources[1], the Miller and Shamsie typology is an excellent way to classify and identify the types of resources firms have at their disposal.

Discrete Resources

Discrete resources are assets that produce rents independently from other resources (Miller & Shamsie, 1996). These resources are long-term fixed and current

[1] A more extensive review of resource types is found in Appendix A.

organizational assets. A competitive advantage usually accrues to a firm that has larger stocks of these resources. Discrete resources are highly fungible and easily identifiable. To be classified as a discrete resource, however, the asset has to be a source of a firm's competitive advantage.

Amit and Schoemaker (1993) and Miller and Shamsie (1996) argue that inimitability is the main factor in determining if a resource can create a competitive advantage for a firm. One way a discrete resource is made inimitable is when a firm exercises its ownership rights to the resource. If a firm has the legally protected right to a particular resource, then the discrete resource is inimitable because only one organization has the legal right to use the asset. It is the protected right to own and the protected right to exclusively use a discrete resource that makes these resources immobile. This immobility makes discrete resources a source of a competitive advantage (Foss & Knudsen, 2003).

Another way that discrete resources are made inimitable is when there is opacity about how a manager values the firm's resources. A manager's skill at identifying and acting upon imperfections in strategic factor markets is a source of competitive advantage. When managers process information in ways that differ from their competitors, it allows organizations to enact strategies that others cannot. This uncertainty about managerial decision-making processes makes discrete resources a source of a competitive advantage.

An example of a discrete resource is a firm's human capital pool (HCP). The HCP consists of the employees of a firm and the various skills that these individuals possess (Wright, Dunford, & Snell, 2001). Boxall (1996) argues that firms develop a human capital advantage by acquiring and employing individuals with exceptional skills and attributes. The skills of the individuals are unique to the firm because they are non-imitable due to ownership rights. Acquiring assets to improve the composition of the HCP of a firm is an example of a HR strategy that can be the source of a competitive advantage.

Systemic Resources

Systemic resources (Miller & Shamsie, 1996) are assets that produce rents in collaboration with other resources. Systemic resources reside in the intricate connections that assets and individuals have with each other (Black & Boal, 1994). These resources are hard to define, quantify, and imitate.

Systemic resources produce a competitive advantage when they are inimitable. One condition that makes these resources inimitable is when the ownership rights possessed by the firm protect a group of resources that allows for their strategic use as a whole. When these different resources are used as a system, they produce a synergy that allows complex organizations to enact strategies that other firms cannot.

Systemic resources are also a source of competitive advantage when there is uncertainty as to how the assets work together. Two causes of this are causal ambiguity (Reed & DeFillippi, 1990) and time compression diseconomies (Dierickx & Cool, 1989). When there is uncertainty about how the productive processes of an organization work these processes are difficult to imitate. Nevertheless, the inimitability of systemic resources occurs only to the extent that they are unobservable. Opacity reinforces the causal ambiguity of a firm's productive processes. Causal ambiguity makes systemic resources inimitable because the productive processes are embedded in the organization's opaque activities (Makadok, 2001). Time compression diseconomies also prevent imitation by creating uncertainty. Time compression diseconomies occur because it takes a substantial time investment to build productive systems. As a firm accumulates assets, employees and managers learn how to best use these assets. The accumulated knowledge about these assets and how they can be used is a systemic resource that is non-imitable.

An example of a systemic resource is a firm's specific HR systems (Lado & Wilson, 1994). Boxall argues that a human process advantage is created when firms develop "casually ambiguous, socially complex, historically evolved processes such as learning, cooperation and innovation" (1996, p. 67). A human process HR strategy that makes the most effective use of a talented work force can create a competitive advantage.

Resources and strategy in a sport context

There is evidence that discrete resources affect the performance of a sport team. A number of studies investigate the effects of coaching, a discrete resource, on team performance. Jacobs and Singell (1993) found that superior managers won more games than those of lesser quality. As well, managers of superior quality have an effect on player performance. Jacobs and Singell conclude that coaching ability is a significant predictor of player and team performance in professional sport. Pfeffer and Davis-Blake (1986) also argue that coaching in the National Basketball Association (NBA) affects team performance. Their findings indicate that coaches with better career records, with previous experience, and with a record of improving the performance of other teams are associated with improved team performance.

Player quality is another discrete resource that affects team performance. Gerrard (2005) demonstrates that better players have a significant effect on a team's seasonal performance in the FA Premier League[2]. Salary, international games played and a measure of team athletic resources are significantly related to better sporting performance. Smart and Wolfe (2003) also show that MLB teams with better players are more likely to have better winning percentages than their opponents. They argue that superior player resources explain 68 % of the variance of MLB team performance.

Sport research also demonstrates that systemic resources can have a significant effect on team performance. Berman, Down and Hill (2002) show that tacit knowledge affects NBA team performance. They demonstrate that tacit knowledge, in the form of shared player experience, increases team performance. They also demonstrate that systemic resources are subject to decay over time. Berman et al. also demonstrate that there is a significant interaction between coaching and shared knowledge. Their results show that coaches have the greatest impact on teams that are low in shared experience. The results provide evidence that coaching helps teams build their systemic resources.

Smart and Wolfe (2000) also demonstrate that the interaction of discrete and systemic resources can affect team performance. They determine that specific systemic resources (e.g., history, culture, relationships, and trust) are important for the effective use and development of discrete resources (e.g., physical and human assets). Their study shows that the Pennsylvania State University (PSU) football team has a competitive advantage when compared to the University of Minnesota and the University of Illinois. The coaching staff of PSU is competent at using its physical and human resources

[2] The FA Premier League is the top professional soccer league in England.

because their relationships with the players are predicated on the coaching staff's unique history and culture. The coaching staff interacts with the team's discrete resources. This interaction builds more productive resources that lead to a competitive advantage.

The strategy a team takes to acquire and develop players also affects team performance. A team that attempts to identify and acquire the best players available is implementing a strategy designed to improve the quality of the team's HCP. A team that attempts to build the complementarities between the players on the team is implementing a strategy designed to improve the team's human processes. Wright, Smart and McMahn (1995) demonstrate that the performance of NCAA basketball teams is affected by the team's strategy, the team's human resource practices and the fit of these two factors. They demonstrate that team strategy has an effect on the players a team recruits. Moreover, they demonstrate that team performance is maximized when there is a fit between team strategy and the types of players on the team. The decision to formulate and implement one particular strategy over another significantly affects team performance.

Task interdependence

Interdependence is a topic that has received a considerable amount of attention in the field of organization studies. Some researchers have argued that interdependence is one of the defining features of an organization (Hickson, Hinings, Lee, Schneck, & Pennings, 1971; Lawrence & Lorsch, 1969). The broad approach taken by researchers toward interdependence belies one of the problems that plagues research in this area: a coherent definition of what is meant by interdependence does not exist (McCann & Galbraith, 1981; Pennings, 1975; Wageman, 2001). Despite the variation in approaches to interdependence, Wageman (2001) has developed a typology of interdependence types that succinctly categorizes the various types of interdependence. According to Wageman, interdependence can be divided into two broad categories, behavioural and structural.

Behavioural interdependence refers to "the actual amount of task related interaction actually engaged in by group members in completing their tasks" (Wageman, 2001, p. 207). Research in this area of interdependence focuses on the interactions that occur between individuals within an organization and how these interactions impact organizational actions. Structural interdependence, in contrast, refers to the "elements outside the individual and his or her behaviour...that define a relationship between entities such that one affects (and is affected by) the other" (Wageman, 2001, p. 198). Research in this area is directed toward understanding how the structural features of interdependence impact an organization's actions.

There are two areas of structural interdependence that have received a significant amount of attention: outcome and task interdependence. Outcome interdependence refers to the effect that shared outcomes among group members have on those outcomes. This area of research is concerned with how goals and rewards can impact the performance of tasks. Reward structure congruence has been investigated to determine how the structure of goals and rewards can impact an organization.

Research in the area of task interdependence is concerned with how the structure of an organization's workflow impacts an organization's actions. As organizations become increasingly complex, they are commonly divided into smaller parts. This division of labour increases the number of sub-units within an organization. To meet the needs of the organization, work needs to move between the different units of the organization. When the amount of work that flows between units increases, so to does the degree of task interdependence that is present in an organization (Van de Ven & Ferry, 1980). As the number of organizational sub-units increases, it is more difficult to coordinate the activities of these units. The result is that complex organizations need different mechanisms to control and coordinate the actions of their sub-units.

The definition of task interdependence to be used throughout is as follows: task interdependence refers to the manner that work flows between an organization's work units (Van de Ven & Ferry, 1980, p. 166). Work flow between work units is conceptualized as the transfer of work activities (organizational inputs and outputs) between individuals, groups, teams, and/or organizations in order to achieve a common organizational goal. This definition best reflects how the structure of an organization impacts an organization's actions.

The four most common types of task interdependence are pooled, sequential, reciprocal,(Thompson, 1967) and team (Van de Ven et al., 1976)[3]. As organizations become more complex so does the task interdependence of the organization. The types differ in the manner that work flows to different work units in the organization. As an organization's workflow becomes more complex, the coordination of organizational work units becomes more difficult (Wageman, 2001). A comparison of the different types of task interdependence can be found in Table 1. A visual representation of the 4 types of interdependence can be found in Figures 1 through 4.

There is an additive characteristic to the types of task interdependence. In the simplest organizations, workflow is pooled. In the most complex organization, workflow

[3] A more detailed explanation of task interdependence is found in Appendix B.

is team interdependent. Complex organizations, however, also contain elements of pooled, sequential, and reciprocal types of interdependence. As organizations and their workflow become more complex, so does their organizational task interdependence. Nevertheless, even the most complex organization will retain some of vestiges of past types of task interdependence.

Summary

Evidence indicates that the way that work flows between different organizational work units affects a firm's actions and behaviours (Thompson, 1967). As an organization's workflow becomes increasingly interconnected, the mechanisms needed for coordination and control also increase in complexity (Thompson, 1967; Van de Ven et al., 1976). The result is that task interdependence affects an organization's business processes.

The effectiveness of an organization's business processes depends on the resources it owns and uses. Because task interdependence affects a firm's business processes it will also affect the productivity of a firm's resources. A manager who recognizes that interdependence affects the productivity of an organization's resources is in a superior position relative to his or her competitors. Despite indications that task interdependence is an important variable to consider, strategic management has yet to consider the effect that a firm's task interdependence has on the productivity of a firm's resources.

I predict that discrete resources are more productive in simple organizations because the firm's workflow is predetermined and unidirectional. Because the work units operate independently this limits the interaction and communication required by the work units to create their outputs. The non-contingent or partially contingent nature of the workflow between the work units creates a situation where discrete resources are the most productive type of resource a simple organization can possess.

Discrete resources are most productive in simple organizations because they are inimitable and non-substitutable. These resources are inimitable and non-substitutable when the ownership rights possessed by a firm protect their strategic use and when there is uncertainty about how these assets are valued. When these resources are acquired and used, firms enact strategies that other firms cannot. This leads to the first hypothesis:

> **H1: Discrete resources are more productive in simple organizations rather than in complex organizations.**

I predict that systemic resources are more productive in complex organizations because the flow of the work between the units is flexible and multidirectional. Each work unit is fully contingent on other work units to produce outputs for the firm. This maximizes the amount of interaction and communication required of the units to produce outputs. The fully contingent nature of the workflow in complex organizations creates a situation where systemic resources are the most productive type of resource a complex organization can possess. This leads to the second hypothesis:

> **H2: Systemic resources are more productive in complex organizations rather than in simple organizations.**

I also predict that the fit between an organization's HR strategy and its task interdependence will affect an organization's performance. If an organization implements a human capital (HC) HR strategy to acquire assets to improve the quality of the human capital pool then, arguably, the strategy will be more effective if the task interdependence of the firm is better suited to use the resources that the firm acquires. In an organization that implements a human process (HP) HR strategy to build and improve its human capital systems the way that work flows should be conducive to team work and the development of systemic resources. This leads to the next two hypotheses.

H3: The implementation of a Human Capital (HC) HR strategy produces better firm performance in simple organizations rather than in complex organizations.

H4: The implementation of a Human Process (HP) HR strategy produces better firm performance in complex organizations rather than in simple organizations.

Research also shows that there are instances when resources do not work in isolation (Berman et al., 2002; Smart et al., 2000). A firm that is able to use their discrete resources to leverage their systemic resources, and/or vice versa, could have a competitive advantage over their rivals. As well, a firm's task interdependence could affect the productivity of these interaction resources. This leads to the final hypothesis.

H5: The interaction of discrete and systemic resources produces superior firm performances in both simple and complex organizations.

In the following section I discuss the methodology and the models I employ to test these five hypotheses.

CHAPTER III

Research design

A cross-sectional research design (De Vaus, 2001) is employed to examine empirically the moderating effects of task interdependence on discrete and systemic resource productivity. There are a number of reasons why this approach is most appropriate for this investigation. First, cross-sectional designs are particularly appropriate for measuring differences between groups. The research question that is asked concerns the differences between simple and complex organizations. Second, cross-sectional designs are used to examine existing differences that exist in the sample. Third, time is not an issue in cross-sectional designs. All the data in this type of research design is collected at a similar point so that the data can be compared.

A weakness of a cross-sectional research design is that it is difficult to determine if there is a causal link between different variables. The goal in a cross-sectional design is to explain the relations between the dependent variable and one or more independent variables. This is often difficult to do because of the nature of the research design.

I employ multivariate probit[4] regression models to test the association between the variables in the models. The use of multivariate statistical models, with statistical control variables, helps "remove the confounding effects of a set of variables at once and focus on the 'pure' effects of an independent variable" (De Vaus, 2001, p. 211)

Sampling

The most appropriate research sites for this investigation have a number of similar

[4] Although probit models were used in the investigation, logit models were also tested. It was found that the differences in the results were negligible.

characteristics. First, the various types of organizational task interdependence are easily observable and measurable in each research site. There is little difficulty in identifying which type of interdependence is most prevalent within a particular research site.

A second consideration is whether or not the firm's resources are easily accessible. A common critique of empirical, resource-based research is that some resources are difficult to identify and measure (Priem & Butler, 2001). To minimize this difficulty, both research sites have identifiable resources and a large quantity of data.

Finally, there are significant differences between the types of interdependence being examined. The different research sites are substantially different from one another. Each research site is different enough so that questions do not arise about which type of interdependence is most prevalent.

Research sites

I use two professional sport leagues as my research sites. I use Major League Baseball (MLB) as an example of baseball in this study. Baseball teams are excellent examples of simple organizations. The National Hockey League (NHL) is an example of hockey in this study. Hockey teams are excellent examples of complex organizations. In the following paragraphs I describe the logic behind the choice of each site.

Major League Baseball as an example of a simple organization

I use MLB as a site of this investigation for a number of reasons. The first reason is that batting in MLB is an excellent example of pooled task interdependence[5]. When a baseball team is on offence the team's structure is akin to a simple organization that is

[5] A brief explanation of the rules of baseball is provided in Appendix C.

organized using pooled interdependence (e.g., Keidel, 1984, 1987). When a player comes to bat he[6] is independent of his teammates. He alone faces the pitcher. At bat the player is a work unit. The batter, as an organizational work unit, acts independently to produce a common output, runs scored. The batter's output is not contingent on the other players on the team for any component of the work. Communication and coordination between teammates is unnecessary because each batter is independent.

It might be suggested that batters are also sequentially interdependent. The direction of the workflow cannot be altered because a baseball manager is unable to change the batting order once it has been completed. The actions of one batter can affect the actions of the batter that comes after him in the batting order. It should be noted, however, that each batter remains an independent work unit. There is always the possibility that the previous batter's actions will not be recognized or taken into consideration. Consequently, because the previous batter's actions do not necessarily affect the current batter's actions it is difficult to argue that batting in baseball is sequentially interdependent.

On the defensive side of the ball, the players of a baseball team are sequentially interdependent. Every play begins with the pitcher throwing the ball toward home plate. The players in the field then produce the team's outs. There is a specific, predetermined direction of the work. The work must move from one player to another to make an out. Although each player is an independent work unit in the field, an out cannot be made unless the players on the field sequentially interact with each other.

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[6] Gender specific pronouns will be used when discussing MLB and the NHL because only men participate in these leagues.

The National Hockey League as an example of a complex organization

I use the National Hockey League (NHL) as another site for this investigation. NHL hockey teams are excellent examples of complex organizations that are team and reciprocally interdependent[7]. The sport of hockey is not commonly referred to as an example of reciprocal or team interdependence. This does not mean that it is not a good example of these types of task interdependence. Hockey and basketball are similar in the way the work flows between work units. The players on each team are work units. In both sports the players are dependent on their teammates' actions for their inputs so they can produce outputs. The flow of the work between the players on the ice and on the court is such that the outputs of one player become the inputs of another. This occurs either immediately, with team interdependence, or after a period of time, with reciprocal interdependence. Keidel (1984; 1987) argues that basketball is an example of reciprocal interdependence and Van de Ven et al. (1976) argue that basketball is an example of team interdependence. Because of the similarities between baseball and hockey a parallel between the sports can be drawn[8].

There are a number of characteristics, beyond the parallel between hockey and basketball, which indicate that hockey is a good example of team and reciprocal interdependence. For example, if one player passes the puck to another player, the output of one player has immediately become input of another and vice versa. Moreover, players are not limited to whom they can pass the puck. As long as a player is on the ice, he can receive inputs and create outputs. The flow of the work is multi-directional and the

[7] A brief explanation of the rules of hockey is provided in Appendix D.

direction the workflow travels develops spontaneously. The multi-directional, spontaneous flow of work necessitates greater coordination of work unit operations. The players are given broad offensive and defensive responsibilities that they use to guide their actions. With these responsibilities and rules in mind, players are given the leeway to adjust their behaviour depending on the circumstances they face.

Sample

Major League Baseball

Major League Baseball has a large amount of statistical information about the league, its teams, and its players. The baseball data for this investigation is collected from "Baseball Oracle 2005" an on-line baseball database. The database is comprised of statistics for all players and teams starting in 1871 and ending in 2004. The reliability and accuracy of the data are confirmed with other data sources, specifically the Baseball Almanac (Schlossberg, 2002). Other data includes player salaries. The data for player salaries is also from the "Baseball Oracle 2005" database. This information is verified using Rodney Fort's on-line Sports Economics Data and Bibliography. The MLB study period begins with the individual game-by-game results and payroll information from the 1996 season. The study period ends with the individual game-by-game results and payroll information from the 2004 season.

The National Hockey League

The NHL has large quantity of statistical information that provides insight into the

[8] Although Keidel argue that basketball is an example of reciprocal and Van de Ven et al. argue that basketball is an example of team interdependence, neither has used basketball as an empirical site of

operation and performance of the league, its teams, and its players. Most of the hockey data is collected from the Hockey Research Association. This organization operates a website (www.hockeyresearch.com/stats/index.phtml) that has a comprehensive archive of eleven years of team and player data starting with the 1988-89 season and ending with the 1998-99 season. Data is also collected from The Hockey Summary Project (http://www.shrpsports.com/hsp/), the NHL's website (www.nhl.com), and Hockeydb.com (www.hockeydb.com). The accuracy of the data is verified by consulting Total NHL (Diamond, 2003). The necessary team payroll information is from *The Hockey News*. *The Hockey News* publishes an annual list of team payrolls and player salaries. The NHL study period begins with the individual game-by-game results and team payroll information from the 1996/97 season. The study period ends with the individual game-by-game results and team payroll information from the 2003/04 season.

Variables[9]

Dependent Variable

Game-by-game wins or losses is the dependent variable of this study. This measure is an unambiguous way of determining if one team has an advantage over the other. Game-by-game wins and losses has not been used in previous studies of sport management. Seasonal measures of performance such as total seasonal wins or team winning percentage have been traditionally used as the independent variable in sport and management studies (e.g., Smart & Wolfe, 2003). Game-by-game wins or losses is used

investigation.

[9] A comprehensive description of the different variables is found in Table 2.

as the dependent variable of this study because it is, arguably, the best way to measure the effects of task interdependence on resource productivity. Each player works intra-game to produce either wins or losses. Because of this, aggregate measures of team performance such as win percentage or total wins do not capture the intra-game effect that task interdependence has on the productivity of a team's resources.

If task interdependence moderates the ability of a team's bundle of resources to produce a competitive advantage then teams with a specific resource composition will be more successful than their opponents when they compete against each other on a game-by-game basis. A home team is assigned a 1 for a win and a 0 for a loss. In hockey, ties games are removed from the sample to eliminate possible confusion as to the outcome of each game. To operationalize the dependent variable I use home team wins and losses.

Independent Variables

The independent variables of the study represent the stock of resources that each team owns at the start of each season.

Discrete Resources

Players

Professional athletes, especially highly skilled ones, have the ability to produce team wins without the help of other players. There are instances where one player has had a significant effect on the outcome of a game. When these athletes are under contract to a team, they cannot work for another team. This makes a player under contract a discrete resource.

Each MLB and NHL team has a measure of the amount of money spent on player contracts. The amount of a player's salary is an indication of his past and future productivity. Players who are, or have been, more productive are paid higher salaries than players who are, or have been, less productive. The team that signs more high quality players will have a higher team payroll than a team with fewer high caliber players. The size of a team's payroll is indicative of a team's stock of discrete resources.

There are some limitations to this measure. The first is that intra-season roster changes make it difficult to accurately aggregate team payroll on a game-by-game basis. If a player is added to a team's roster through a trade or free agency, it is difficult to know how the new player's contract should be tabulated in the team's payroll. It is for this reason that payroll is measured at the start of each season.

Another limitation of this measure is in the data. The payroll data for both the NHL and MLB does not include player bonuses. Some players do not have bonuses in their contracts. Others do not reach bonus targets. Nevertheless, there are times when a player's base salary is underrepresented. Despite this limitation, salary is still a good proxy for the productivity of a team's discrete resources.

A strength of the player salary measure is that it places a value on player abilities that are not easily quantifiable. For example, player productivity is usually measured by their offensive or defensive contributions (Smart & Wolfe, 2003). Yet the productivity of a player is not always reflected by his statistical contributions. Often players are paid for the "intangible" qualities that they bring to the team. These intangible qualities are best measured in the way a team values the productivity of its players. The size of a team's payroll at the start of the season is a good approximation of the value of the stock of discrete resources that a team owns and can use during the season to produce team wins. To operationalize this discrete resource measure I use a team's payroll in USD's at the start of the season.

All-stars

A variable common to both sports is the number of all-star players on the team's roster at the start of the current season. All-stars are the players who performed at the highest level during the first half of the season. The fans of the NHL and MLB vote for the starting line-ups of the all-star games. This leads to some bias as to which players are selected to the team because of ballot box stuffing. The league then selects the remainder of the team on the basis of player performance. Regardless of fan practices, all-star players are, for the most part, those individuals whose play has been better than their peers for the first half of the season. The number of all-stars a team employs can affect a team's performance. First, all-stars are players who have performed at a high level the previous season. There is the expectation that past performance will be duplicated in future seasons. As well, the influence of all-stars on other players cannot be underestimated. All-star players can provide their teammates with invaluable experience and knowledge. To operationalize this discrete resource measure I calculated the percentage of a team's players who, at the start of the season, had played in the previous year's all-star game.

General Managers and Coaches

There are other individuals who possess skills that can create a competitive advantage for a professional sport team. A team will have a competitive advantage when it employs individuals who have more skills than their opponents. These individuals possess skills that allow them to evaluate and use players in ways that other organizations cannot. These individual's skills allow teams to make strategic decisions that other teams cannot. A team has a competitive advantage if it employs individuals who have greater stocks of individual skills.

Outside of the players on the field or the ice, there are two identifiable individuals in professional baseball and professional hockey whose skills and abilities lead to a competitive advantage. The first is the team's General Manager (GM). The second is the coach in hockey and the manager in baseball. A separate discussion of each is outlined in the following paragraphs

General Managers and team HR strategy

The GM of a professional sport franchise is responsible for effectively using the team's resources to acquire players to build a winning team. Although the GM has other duties (e.g. marketing, finance, etc.) there is a trend in professional sport is for teams to separate the business duties and sport duties of the GM into two separate jobs (e.g. the Edmonton Oilers). The individual skill measured in the study is the GM's ability to implement a specific HR strategy to build a winning team.

In this study I categorize the two HR strategies as discrete resources. Although an argument could be made that team strategies are systemic resources, there is both empirical and anecdotal evidence that indicates that an individual's influence on an organization has an effect on the strategic direction of an organization. For example, Wright et al. (1995) demonstrate that coaches in NCAA Division I basketball have a distinct impact on the strategy of their team. Each coach has a preferred strategy and makes player personnel decisions on that basis. Although Wright et al. (1995) only discuss the impact of coaches in NCAA Division I basketball, the coach of these teams also plays the role of the GM. He recruits and selects the players that he believes best fit the team's system. This evidence offers support for the assertion that the strategic acquisition and development of organizational resources is impacted by a GM's strategic outlook.

Similarly, Kraatz and Moore (2002) demonstrate that top executives and the migration of these top executives from one organization to another affects an organization's strategy. They found that liberal arts colleges tend to adopt professional programs after they hired presidents away from schools that offered similar programs. They argue that it was the arrival of a new president that created a significant shift in the organization's strategy. This is further evidence that individuals in positions of organizational power have a substantial influence over the strategic direction of an organization.

In sport, Douglas Hunter (1999) writes about the strategy Glen Sather implemented when he was building the Edmonton Oilers after they joined the NHL in 1979. Hunter states that "...in Glen Sather, Gretzky found a coach and manager who was not only smart enough to let him play the way he knew best, but was willing to shape an entire team lineup around the kind of game Gretzky made possible" (Hunter, 1999, p. 103). Similarly, two individuals have shaped the strategy of the Oakland Athletics: Sandy Alderson and Billy Beane. Both men have used their organizational power to implement a strategy that has shaped how the team values and acquires players (Lewis, 2003). In fact, Alderson took the approach that the GM implemented a team's strategy by stating "Art Howe (Oakland's manager) was hired to implement the ideas of the from office, not his own"(Lewis, 2003, p. 61)

The aforementioned research and anecdotal stories demonstrate that strategy can be housed in a particular individual. These individuals, when under contract to a particular team, are inimitable and non-substitutable. The GM of a sport team is a unique asset that can, alone, help a team build and sustain a competitive advantage. Thus, the skills of the GM, a discrete resource, are reflected in the human resource strategy that the team implements to acquire players.

Two variables are used to measure the different HR strategies GMs use to build winning teams. The first is a human capital (HC) HR strategy. This proxy measures the number of top paid, marquee players each team employs at the start of the season. For this study, a marquee player is any player whose salary is in the top twenty percent of the league's salary ranks. A team with a higher percentage of marquee players on their roster at the start of each season is considered to have implemented a HC HR strategy. A team with lower percentage of marquee players on their roster at the start of the season is considered to have not implemented a HC HR strategy. To operationalize whether a GM implements a HC HR strategy I calculated the percentage of marquee players on a team's roster at the start of the season.

The second is a human process (HP) HR strategy. This is measured using the Herfindahl Index. The Herfindahl Index is used in the Industrial Organization literature as an economic measure of industry concentration. An industry's Herfindahl score is calculated by summing the squares of each organization's market share in a particular industry. An industry with a high Herfindahl score is oligopolistic. An industry with a low Herfindahl score is more competitive because fewer firms have a concentrated amount of the market share. For this investigation the Herfindahl Index is a measure of the sum of squares of each player's salary percentage for each team in the NHL and MLB. A high payroll Herfindahl score indicates that a team has invested a large portion of the team's payroll resources into a small number of players and that there is a wide dispersion of salary amongst the players on the team. This indicates that more importance is placed on one or a few select players because there are fewer players on the team who have the skills to win a game on their own. A low payroll Herfindahl score indicates that the team has a more equitably distributed team payroll and that there is a narrow dispersion of salary amongst the players on the team. This indicates that more importance is placed on team processes because the team has a number of players on the team who have the skills to help the team win games. To operationalize whether or not a GM implemented HP HR strategy I calculated the Herfindahl Index for each team's payroll.

Coaches/Managers

Player Management Skills

The head coach of a NHL team and the manager of a MLB team possess skills that are inimitable. One skill a coach/manager should possess is the ability to evaluate and use the players he has on the team. The coach/ manager makes the final decision about who plays and who does not. He bases these decisions on his evaluation of the players and how he can use the players on the team to produce wins. The success or failure of the team rests with how well the coach/manager uses and evaluates the players he has been provided.

In hockey, a coach is responsible for matching his personnel against the opponent's personnel. "To get the right players on the ice" (Dryden, 1984, p.45) is the essence of the player management skill that a coach needs to produce wins. A coach has better player evaluation skills if he can identify and use his players to neutralize the opponent's strengths and exploit the opponent's weaknesses. The coach that is the most skilled in this area is the most productive discrete asset.

In baseball a manager also makes all personnel decisions. The batting line-up, the players' positioning and the choice of pitchers are among the responsibilities of the manager. The manager has to not only identify the strengths and weaknesses of his own team, but he also has to determine how he can best use his assets against the team's opponent. A manager might decide to have his best pitcher start a game on only three days rest[10] if this will help the team throughout the season. As well, in the American League, the designated hitter allows managers to rest position players without losing their offensive talents. If the manager is adept at identifying the particular strengths of the different players on the team then he can use them in situations where they will be most productive.

A manager with better player management skills is better able to recognize the strengths and weaknesses of his players. The coach/manager who is better at evaluating his players will be able to identify the situations where certain players are most likely to

[10] A starting pitcher in MLB usually waits 5 days between games to prevent injury to his pitching arm.

succeed. A coach with better player management skills will find ways of using his players in situations in which they are likely to succeed.

A coach/ manager that is better at deploying his players in situations where they will succeed will win more games with his team. He will also have a longer tenure with the team. A coach/manager that has more wins with a team and has a longer tenure with a team has demonstrated that he has better player management skills than his colleagues. This makes coaches/managers with better player management skills a more productive discrete resource than another coach/manager who has fewer wins with his team or few consecutive games coached/managed with the team. To operationalize this discrete resource coaching measure I use two proxies: consecutive games coached with a team and coach/manager wins with a team.

Sport Specific Skills

A coach/manager that has more sport specific skills is better able to understand the game and implement processes that improve the chances of the team to win the game. Leonard Koppett (2004), noted baseball writer, argues that the essential intra-game duty of a manager is to make decisions. Most of the time managers make "orthodox moves" because all managers know what these are and they have proven to be the most successful in the past. These orthodox moves come from a better understanding of the sport and the strategies needed to win games.

Coaches/managers that have coached more games are expected to have better sport specific skills than another coach/manager who has coached fewer games. A veteran coach/manager has more experience running a team during game situations. The experienced coach will know how to create a game plan to take advantage of the other team's weaknesses. Although a coach/manager with less experience can also be adept at creating a game plan and running a team, there is a steep learning curve that many coaches cannot overcome (Grusky, 1963). Furthermore, a coach/manager with more sport specific skills than his colleagues will have a winning record over his career. A coach/ manager who has more sport skill than his competitors will have demonstrated this by winning more games than other managers.

Sport specific skill is also measured by how well coaches/managers perform relative to their peers. One way to measure this relative performance is to determine if the coach/manager has won any coaching awards or league championships throughout his career. Both the NHL and MLB keep records of which managers and coaches have won managerial awards and team championships. A manager with more sport specific skill has won more championships than his peers. Similarly, a coach that has more sport specific skill has won more coaching awards than his peers. A coach/manager with more championships and coaching awards than his peers is a more productive discrete resource. To operationalize this discrete resource coaching measure I use five proxies: the coach/manager's career games coached, career victories, career winning percentage, career coaching/managing awards won and career league championships won.

Systemic Resources

The difference in the task interdependence of baseball and hockey dictates that there are some different measures for the effects of systemic resources on team performance. There are, however, some similar measures as well. The common measures between hockey and baseball are discussed first. This is followed by a discussion of the measures that are unique to each sport.

Common Measures

Turnover

A sport team with less year-to-year turnover has a greater stock of systemic resources than its competitors. A team with less player turnover has more systemic resources because complementarities are likely to have developed between the players. Over time, players identify the strengths and weaknesses of their teammates. As players work together they also recognize that each player has specific tendencies. When the players on the team identify these patterns and routines they can adjust their actions to complement their teammate's actions.

A team with more players who complement each other has a greater stock of systemic resources than its competitors. The longer players play together, the more likely it is that these patterns and routines will develop into a source of a competitive advantage. A team with less player turnover in its roster at the start of the season has a greater stock of systemic resources than a team that has more player turnover. To operationalize this systemic resource variable I measure the percentage of new players on a team's roster at the start of the season.

There are some limitations to the turnover measure. The first limitation is that there is an assumption that complementarities will develop because teams have little turnover. A measure of turnover does not take into consideration which players are leaving the team. A team with a large amount of turnover could merely be losing fringe players. The loss of these players is not likely to significantly affect team performance. On the other hand, a team that loses players that are at the core of the team that has been together for a substantial period of time could see a significant decline in team performance.

The synergy between players is a systemic resource that affects team performance. A team that has greater synergy amongst its core players will produce more wins. A team with less synergy amongst its core players will produce fewer wins. To operationalize this systemic resource variable I measure the percentage of players whose tenure with the team is three consecutive years or less at the start of the season.

A three-year cut off point is used to distinguish between a team's core players and the team's fringe contributors. A core contributor is a player who the coach and GM identify as a significant part of the team. A player who is not a core contributor to the team will have a shorter tenure than a player who is a substantial contributor to the team's performance. Teams that have more core players have greater stocks of systemic resources than their competitors.

A core contributor, for the purposes of this study, is a player who has spent more than three consecutive years with the same team. In the NHL, three years is used as the cut off point for a number of reasons. The first is that the length of a NHL rookie contract is three years. As of 1994, a player who enters the NHL signs a rookie contract. This contract covers the first three seasons of a player's career[11]. Although there are some exceptions to this rule (see footnote 11), the majority of players in the NHL signed a three-year rookie contract. A player who is not a core contributor to a NHL team is not resigned after his first three seasons with the team.

A second reason for the three-year cut off is that three years is the approximate average tenure of a NHL player. The average length of a player's career in the NHL ranges from 3 to 7 years. Any player who is on a team for more than three years is a significant team asset.

In MLB the three-year cut off is used because a player is eligible for arbitration rights after three seasons of service. Although a player does not have unrestricted free agent rights after this period of time, a team will walk away from any salary arbitration decision that is unreasonable compared to the player's performance. A player who is not with a team after three years is not an asset that the team highly values.

Another reason for the three year cut off is that the average career length in MLB is 5.6 years for batters and 4.8 years for pitchers (Schall & Smith, 2000). The mid-point of these career lengths is 2.6 and 2.4 years respectively. Because it is difficult to measure half seasons, the average of the two midpoints is rounded up to three years. This provides an indication that the average player will play close to three years with a team. If a player plays longer than three years with one team he is an above average player and, thus, a core contributor to the team.

Idiosyncratic Measures

In addition to the common measures for systemic resources, there are numerous

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[11] This rule applies to players who are between 18 years old and 25 years old. Players who are older than

idiosyncratic statistical measures that can be used as measures of systemic resources. In baseball there are several defensive and two offensive statistics that can serve as proxies for a team's stock of systemic resources. In hockey, the relevant statistics measure a team's play while the team is shorthanded, while the team is on the power play, and while the team is at even-strength

Major League Baseball

The quality of a baseball team's defensive play is affected by the ability of the players to coordinate and communicate with each other. Although a manager can make defensive adjustments during a game, the players still must make the play to make an out. The players on a strong defensive team understand where their teammates should be and they act accordingly. Although baseball players do not need to expend great amounts of time coordinating their activities, it is necessary that all the players understand their roles when the ball is hit to them or to their teammates. Poor defensive play usually occurs when players do not properly follow through with predetermined routines and plans. Baseball teams that have a strong contingent of players who understand their defensive roles and how their defensive actions fit with the defensive roles of the other players in the field have more productive systemic resources.

Baseball systemic resources are not only found on the defensive side of the ball. A team will have more runs batted in (RBI's) and sacrifice flies if players understand their roles in the team's batting order. A manager places his best batters at the top of the batting line-up. Nevertheless, just because a player is asked to bat first does not mean that

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this when they sign their first contracts are not subject to this rule.

they should be trying to hit home runs. A lead-off batter is expected to make the opposing pitcher throw a high number of pitches so his teammates can see the quality of the pitcher's pitches. He is also expected to get on base and get into scoring position. The clean-up hitter is expected to drive in runs and, as a result, he is expected to have a high number of RBI's. Batters complement each other when they understand their roles and how the other players on the field complement their strengths.

To operationalize the baseball specific systemic resources I use the following proxies: defensive rating, defensive efficiency, errors, double plays, assists, passed balls, earned run average, putouts, RBI's and sacrifice flies. A team with a greater stock of productive systemic resources has higher defensive ratings, has higher defensive efficiency ratings, commits fewer errors, turns more double plays, makes more assists, has fewer passed balls, has a lower earned run average, has more team putouts, has more RBI's and has more sacrifice flies than their opponents.

National Hockey League

The productivity of the players on the ice is reflected by how well the team creates goals and how well the team prevents goals. Hockey teams usually compete against each other at even-strength (6 players, including goalies, from each team on the ice at the same time). A hockey team deploys its forwards in units called lines and its defensemen in units called pairings. Every player can play with players other than their line-mates throughout the game. When teams are at even-strength the objective is to have the same three forwards and the same two defensemen on the ice at the same time[12]. When the players on a line or in a pairing work well together this is an indication that these forwards and defensemen have built productive systemic resources. The teams whose players work well as a unit score more even-strength goals and prevent more even-strength goals than their opponents. A hockey team with greater stocks of productive systemic resources is better than their opponents at scoring and preventing even-strength goals. To operationalize this hockey specific systemic resource measure I use the number of even strength goals scored for and scored against from the previous season.

When a player commits a foul, his team is penalized. The penalty, in most situations, is the loss of the player's services for a specified period of time[13]. A team has a power play when it is able to ice more players than its opponent because of a penalty. A team is shorthanded when it has to ice a team with one or two fewer players than the allowed five skaters.

Hockey teams often create new line combinations because of the strategic importance of power play and penalty killing opportunities. A NHL team has two power play units that usually consist of the five to ten best offensive players on the team. A NHL team usually has two or three pairs of defensive forwards that combine with the defensemen as penalty killing units. If the players on a team are able to build on the

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[12] When a coach plays all his forward lines together for most of the game this is called "rolling all four lines". Coaches aim to do this early in a game so as to prevent their best players from tiring too early in a game.

[13] In the National Hockey League minor penalties are for 2 minutes in length. There are other instances when a penalty is either 5 or 10 minutes in length. In extreme cases a referee has the discretion to call a penalty shot or remove a player from the game.

strengths of the other players on the power play and penalty killing units, this indicates that these players have developed a strong systemic resource. A team that has a higher power play percentage and a higher penalty killing percentage than its opponents has a greater stock of systemic resources. To operationalize this hockey specific systemic resource measure I use the team's power play and penalty killing percentage from the previous season.

While teams kill penalties there are opportunities for players to take advantage of defensive lapses in the opponent's power play units. Some teams are better than others at this facet of the game. There are times when a player killing a penalty makes a skilled play to score a short-handed goal. Most times the player that scores a shorthand goal does so because of his ability to work well with the other members of the unit. In contrast, a team that does not allow many shorthanded goals against ices a power play unit that not only attempts to score goals but also is conscious of the value of preventing goals while it has a manpower advantage. Hockey teams that have penalty-killing units that score more goals than their opponents have greater stocks of systemic resources than their opponents. Hockey teams that allow fewer goals during a manpower advantage also have a greater stock of systemic resources than their opponents. To operationalize this hockey specific systemic resource measure I use the number of shorthanded goals scored for and against a team from the previous season.

Interaction Variables

The effect of coaching on a team's systemic resource bundle is tested. Building on Berman et al. (2002) and Smart and Wolfe (2000) who demonstrated that coaching has an effect on team systemic resources, I test whether coaching skill has a differential effect on systemic resources in simple and complex organizations.

A coach/manager with more knowledge about the sport will be able to create and implement a strategy to beat his opponents. This sport related skill would be expected to improve the team's processes. The effect of a coach/manager's sport related skill can be recognized when a team's systemic resources are more productive in a complex rather than in a simple organizations. This expected result is predicted because an improvement in a team's processes should be more productive in complex rather than simple organizations.

If, on the other hand, the coach/manager's player management skills allow him to use his players in the situations where they were most likely to succeed, then a coach/manager's player management skills can affect the play of the players on the team. It would be expected that a team's systemic resources would show improvement and be more productive in simple rather than complex organizations. This is predicted because an improvement in the productivity of a team's players will have a greater impact on the performance of simple rather than complex organizations. To operationalize this measure I multiply the five coaching variables, career games coached, career victories, career winning percentage, games coached with the team, consecutive games coached with the team and winning percentage with the team, by each of the systemic resource variables for both sports.

Control Variables

There are a variety of other factors that can affect a team's ability to win a game.

To take these factors into account, a number of control variable from the various sports are included in each statistical model. The variables are categorized as variables common to both hockey and baseball and baseball specific control variables. Each of the different control variables is described below.

Shared Control Variables

Home team effect

A variable that affects a team's performance is the location of the game. A number of studies indicate that the home team has an advantage (e.g., Courneya & Carron, 1992; Schwartz & Barsky, 1977; Smith, Ciacciarelli, Serizan, & Lamber, 2000) or a disadvantage (e.g., Baumeister & Steinhilber, 1984; Wright & Voyer, 1995). The home team advantage or disadvantage factor is controlled for through the design of the study because only home team results are used as the measure of team performance. This control variable measure is operationalized as the intercept of the regression model for both hockey and baseball.

Player age

A variable that might affect a team's performance is the average age of the players on the team. It is necessary to control for the average age of a team for two reasons. The first is that as players age their skills begin to deteriorate (Berman et al., 2002). A team with older players faces the possibility that poor team performance is the result of a reduction in the level of team skill because of the increasing age of the players on the team. A team with a large number of young players is subject to variations in performance because of inexperience. A young team is unfamiliar with what is expected of players as professionals. A team's "liability of newness" is controlled for to ensure that the effect of team resources on performance is measured correctly.

In baseball I operationalize the age effect by using a weighted average of the age of batters and pitchers at the start of the season. A weighted average is used to de-emphasize the contributions of seldom-used players and pitchers. The average age of a batter is weighted by the number of at bats plus the number of games the batter played during the season. The average age of a pitcher is weighted on the basis of the number of games started, the number of games they appeared in and the number of saves they had throughout the year[14]. This formula gives starting pitchers greater weight than relievers by virtue of the number of games they start.

A non-weighted age measure is used for hockey teams because most players participate equally during a game. The average age of the team is calculated by collecting the birth dates of each player on the team's roster at the start of the season. Each player's age is calculated and summed. This aggregated age score is then divided by the number of players on the roster at the start of the season. To operationalize this measure I calculate the average age of the players on each team at the start of each season.

Baseball Control Variables

Offensive statistics

A wide variety of variables are used as control variables to measure the effects of

[14] The actual formula for pitchers average age is 3*Games Started + Games + Saves.

discrete and systemic resources on team performance. First, there are various offensive team measures that can influence the effects of the resources on team performance. These offensive variables are related to the number of runs that a team scores. These variables are the aggregate of the performance of individual players. There is a question, however, if these variables are merely the sum of individual performances. An argument can be made that a team's offensive performance is the result of coaching (Pfeffer & Davis-Blake, 1986), or tacit knowledge (Berman et al., 2002). To ensure that the independent variables measure the effect of discrete and systemic resources on team performance, these variables are included to control for an individual batter's performance. To operationalize the offensive control measures I use at bats, hits for, walks for, stolen bases for, home runs for, and times players on the team were hit-by-a-pitch from the previous season.

Pitching statistics

The effects of individual pitching performances are controlled. These defensive measures are the aggregated performance of each of the pitchers used by each team the previous season. These controls are used to ensure that the full effects of the various team resources are being measured. To operationalize the pitching control measures I use hits against, walks against, complete games for, saves for, shutouts for, and home runs against from the previous season.

Stadium factors

Two final baseball specific control variables are the batter's park factor and the pitcher's park factor. Both park factors measure whether or not the ballpark where the team plays its home games favours the batter or the pitcher[15]. A score of 100 indicates that the home team's stadium offers no advantage to the batter or the pitcher. A score below 100 indicates that the stadium favours pitchers over batters. In contrast, a score over 100 indicates that the ballpark is likely to favour batters rather than pitchers. These variables control for the various park effects that could influence team performance. For example, the pitchers who play for the Colorado Rockies are at a disadvantage because the team plays in a hitter friendly park that is well above sea level. The statistics of the Rockies pitchers', such as ERA and hits allowed, are often above the league average. Yet, it is debatable if the pitching staff is below average in talent. Including the park factors into the models accounts for variations in different ballparks.

Differences between ballparks also affect how managers create their line-ups. Teams that visit hitter's ballparks (e.g., The Ballpark at Arlington, Coors Field) will likely have more power hitters in the line-up to take advantage of the dimensions of the stadium. When teams visit Dodger Stadium or Oriole Park at Camden Yards managers might schedule a fly ball pitcher because it is less likely that the opponent will be able to hit the ball out of the park because of the field's dimensions. To ensure that some variables are not skewed because of the venue of the team's home games, both variables are included in the statistical models. <u>To operationalize the ballpark effects I use both the pitcher park factor and the batter park factor from the previous year</u>.

Model Specification

Model 1 is premised on an assertion found in both the sport economics and

[15] The specific calculations that are used to determine both BPF and PPF can be found at http://web.archive.org/web/19980208211458/totalbaseball.com/story/event/record/lifetime/glossary.htm

SHRM literature. Both literatures indicate that organizational talent has a significant effect on performance. The sport economic literature argues that team performance is a function of a team's ability to purchase more playing talent (Quirk & Fort, 1997; Scully, 1995).The SHRM literature asserts that an organization's HCP can be the source of a competitive advantage. Teams with more money should be able to hire more talented players to create an inimitable HCP.

There are, however, factors other than payroll that can and do affect team performance. Model 1 indicates that a combination of discrete resources, systemic resources and the interaction between systemic and discrete resources will explain differential performances amongst baseball and hockey teams.

Model 1: Generic model

$$\mathbf{W_{it} = \alpha + \beta_1\, DR_{it} + \beta_2\, SR_{it} + \beta_3\, DR_{it} * SR_{it} + \beta_4\, Controls + \varepsilon_{it}}$$

Below are the specific models I use to test the effects of discrete resources, systemic resources, resource interactions and HR strategy in baseball and hockey.[16]

Model 2: Differences between discrete and systemic resources in baseball and hockey

$$\mathbf{W_{it} = \alpha + \beta_1\, P_{it} + \beta_2 TO_{it} + \beta_3\, HD_{it} + \beta_4\, BD_{it} + \beta_5\, HD_{it} * P_{it} + \beta_6\, BD_{it} * P_{it} + B_7\, HD_{it} * TO_{it} + \beta_8\, BD_{it} * TO_{it} + \varepsilon_{it}}$$

I use Model 2 as a preliminary test of Hypothesis 1 and 2. A probit analysis is used to test the differential effects of discrete resources and systemic resources on game-by-game wins and losses in baseball and hockey. The sample size is 29447 data points. The data set is comprised of 21510 data points from baseball and 7937 data points from hockey.

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and at http://www.baseball-reference.com/about/parkadjust.shtml retrieved January 2006.

[16] The nomenclature for the symbols of the different variables is found in Table 2.

Model 3: Differences between human capital and human process HR strategies in baseball and hockey

$$W_{it} = \alpha + \beta_1 HC_{it} + \beta_2 HP_{it} + \beta_3 HD_{it} + \beta_4 BD_{it} + \beta_5 HD_{it} * HC_{it} + \beta_6 BD_{it} * HC_{it} + \beta_7 HD_{it} * HP_{it} + \beta_8 BD_{it} * HP_{it} + \varepsilon_{it}$$

I use Model 3 as a test of Hypothesis 3 and 4. A probit analysis is used to test the differential effects of a HC HR strategy and a HP HR strategy on game-by-game wins and losses in baseball and hockey. The sample size is 29447 data points. This is comprised of 21510 data points from baseball and 7937 data points from hockey.

Model 4: Discrete and systemic resources in baseball

$$W_{it} = \alpha + \beta_1 TO_{it} + \beta_2 TW_{it} + \beta_3 DP_{it} + \beta_4 DEF_{it} + \beta_5 DER_{it} + \beta_6 AST_{it} + \beta_7 PU_{it} + \beta_8 S_{it} + \beta_9 PB_{it} + \beta_{10} RBI_{it} + \beta_{11} ERA_{it} + \beta_{12} P_{it} + \beta_{13} CG_{it} + \beta_{14} CV_{it} + \beta_{15} CWPT_{it} + \beta_{16} MY_{it} + \beta_{17} CW_{it} + \beta_{18} GT_{it} + \beta_{19} WPWT_{it} + \beta_{20} HC_{it} + \beta_{21} HP_{it} + \beta_{22} AS_{it} + \beta_{23} \text{Controls} + \varepsilon_{it}$$

I use Model 4 to further test Hypothesis 1 and 2. A probit analysis is used to test the effects of specific discrete and systemic resources on game-by-game wins and losses in baseball. The sample size is 21510 data points.

Model 5: Discrete and systemic resources in hockey

$$W_{it} = \alpha + \beta_1 TO_{it} + \beta_2 TW_{it} + \beta_3 PPP_{it} + \beta_4 PKP_{it} + \beta_5 EVGF_{it} + \beta_6 EVGA_{it} + \beta_7 SHGF_{it} + \beta_8 SHGA_{it} + \beta_9 P_{it} + \beta_{10} CG_{it} + \beta_{11} CV_{it} + \beta_{12} CWPT_{it} + \beta_{13} MY_{it} + \beta_{14} CW_{it} + \beta_{15} GT_{it} + \beta_{16} WPWT_{it} + \beta_{17} HC_{it} + \beta_{18} HP_{it} + \beta_{19} AS_{it} + \beta_{20} \text{Controls} + \varepsilon_{it}$$

I use Model 5 to further test Hypothesis 1 and 2. A probit analysis is used to test the effects of specific discrete and systemic resources on game-by-game wins and losses in hockey. The sample size is 7937 data points.

Model 6:Interaction effects of coaching on systemic resources in baseball

$$W_{it} = \alpha + \beta_1 TO_{it} + \beta_2 TW_{it} + \beta_3 DP_{it} + \beta_4 E_{it} + \beta_5 DEF_{it} + \beta_6 DER_{it} + \beta_7 AST_{it} + \beta_8 PU_{it} + \beta_9 S_{it} + \beta_{10} PB_{it} + \beta_{11} RBI_{it} + \beta_{12} ERA_{it} + \beta_{13} P_{it} + \beta_{14} CG_{it} + \beta_{15} CV_{it} + \beta_{16} CWPT_{it} + \beta_{17} MY_{it} + \beta_{18} CW_{it} + \beta_{19} GT_{it} + \beta_{20} WPWT_{it} + \beta_{21} HC_{it} + \beta_{22} HP_{it} + \beta_{23} AS_{it} + \beta_{24} \text{Coaching Resources}_{it} * SR_{it} + \beta_{25} \text{Controls} + \varepsilon_{it}$$

Model 7: Interaction effects of coaching on systemic resources in hockey

$$W_{it} = \alpha + \beta_1 TO_{it} + \beta_2 TW_{it} + \beta_3 PPP_{it} + \beta_4 PKP_{it} + \beta_5 EVGF_{it} + \beta_6 EVGA_{it} + \beta_7 SHGF_{it} + \beta_8 SHGA_{it} + \beta_9 P_{it} + \beta_{10} CG_{it} + \beta_{11} CV_{it} + \beta_{12} CWPT_{it} + \beta_{13} MY_{it} + \beta_{14} CW_{it} + \beta_{15} GT_{it} + \beta_{16} WPWT_{it} + \beta_{17} HC_{it} + \beta_{18} HP_{it} + \beta_{19} AS_{it} + \beta_{20} \text{Coaching Resources}_{it} * SR_{it} + \beta_{21} \text{Controls} + \varepsilon_{it}$$

I use Model 6 and 7 to test Hypothesis 5. A probit analysis is used to test the effects of the interaction between discrete and systemic resource on game-by-game wins and losses in baseball and hockey. The sample size for baseball is 21510 and for hockey the sample size is 7937 data points.

The process for conducting the probit analysis was as follows. First, the data for each home team game was collected and coded as either a 1 for a home team win or 0 for a home team loss. The relevant data for each independent variable in the models was collected for both the home team and the visiting team that they played. The difference between each independent variable was then determined. For example, when the 2004 New York Mets played a home game against the Atlanta Braves their payrolls were compared. The difference between the Mets and the Braves payrolls was calculated. This score was entered into LIMDEP as the payroll variable for this game. This process was conducted for every independent variable for each game in the data set. This method ensured that the home team Mets would never be compared to the visiting team Mets. In other words, each game in every season for both the NHL and MLB is counted only once.

Summary

I use probit regression models to test the moderating effect that task interdependence has on different organizational resources. The research sites I use are the National Hockey League and Major League Baseball. The research design is cross-sectional. The independent variable is game-by-game home team wins or losses. The independent variables are categorized as systemic resources, discrete resource, HR strategies or interaction measures. In the next chapter I discuss the results from each of the models.

CHAPTER IV

Results

Table 3 and 4 present the descriptive statistics and correlation coefficients for hockey and baseball respectively. The correlation matrices provide evidence that the different resource types are correlated with each other. Discrete resources are highly correlated with other discrete resources. Systemic resources are highly correlated with other systemic resources.

In Table 3 the results show that hockey team wins are correlated with six of the eight systemic resource variables. Four of these variables had correlations greater than 0.3. Hockey team wins were not as highly correlated with discrete resources. Of the nine discrete resource variables all nine were correlated with season wins, however, only 2 variables, team payroll and number of all-stars, had correlations higher than 0.3.

In Table 4 the results show that baseball team wins are correlated with eight of the eleven systemic resource measures. All eight variables had correlations higher than 0.3. Of the nine discrete resource measures all nine were correlated with baseball team wins but only four of the measures had correlations above 0.3. The correlations in Table 3 suggest that there is some support for Hypothesis 2. The correlations in Table 4 suggest that there is limited support for Hypothesis 1.

The results in Table 5 provide support for Hypothesis 2, 3 and 4. The models show the relationship between game-by-game performance and the effects of discrete resources, systemic resources, and HR strategy on both hockey and baseball. In Model 1 the constant in the equation is positive and significant ($b = 0.09$, $p < .001$). This demonstrates that a home team in baseball has a significant advantage over the visiting team. In Model 2 the constant in the equation is also positive and significant ($b = 0.16$, $p < .001$). This result also indicates that the home team in hockey has a significant advantage as the home team. The difference between the two constants is also positive and significant ($b = 0.07$, $p < .001$) which indicates that hockey teams have a greater home team advantage than do home teams in baseball. This is an interesting finding. A possible explanation for this difference is that the MLB season is twice as long (162 games/year) as the NHL season (82 games/year). This allows more opportunity for MLB team performance to regress to the mean. Scheduling in MLB could be another reason for this difference. A visiting MLB team will play the home team in a series of consecutive games. This allows the visiting team to arrive in the city and eventually get accustomed to the surroundings. The players can get into a routine that may limit the home team effect. In the NHL a visiting team usually plays only one game in the opposing team's city. This does not allow the players to get acclimated to the city or to a change in time zones. This could have a significant effect on a visiting team's performance in the NHL.

In Model 1 the team payroll measure is positive and significant ($b = 0.18$, $p < .001$). This demonstrates that baseball teams that have high payrolls tend to win more than their opponents with lower payrolls. In Model 2 the payroll measure is also positive and significant ($b = 0.29$, $p < .001$). This result demonstrates that hockey teams with high payrolls tend to win more than their lower salaried opponents. These results are not unexpected. The different types of task interdependence are additive (Thompson, 1967; Van de Ven et al., 1976). It is expected that discrete resources will be productive in both simple and complex organizations. These results demonstrate that discrete resources have a positive effect on the performance of both simple and complex organizations. What is somewhat surprising is that discrete resources are more productive in the NHL. The difference between the two payroll measures is positive and significant ($b = 0.11$, $p < .001$). This indicates that payroll size is of greater importance to hockey teams than it is to baseball teams. This result does not provide support for Hypothesis 1.

One explanation for this result is a rule change that was implemented for the 1999/2000 season. The NHL decided to eliminate one skater from each team during regular season overtime. This rule change was designed so that more games would be decided in overtime. Eliminating a skater from both teams during the overtime opened the ice up to more skilled players. These highly skilled, high salaried players had more opportunity to win games for their teams. As a result, games that previously would have ended in ties now ended in wins or losses. Skill players were given an opportunity to win games for their team. This rule change during the sample period could be the reason why salary is more important to hockey teams.

In Model 1 the turnover measure is negative and significant ($b = -0.48$, $p < .001$). In Model 2 the turnover measure is also negative and significant ($b = -0.66$, $p < .001$). These results indicate that more team turnover has a significant negative impact on team performance. The difference between the two turnover measures is negative and significant ($b = -0.17$, $p < .1$). This indicates that turnover has a greater negative effect on NHL teams than it does MLB teams. These results support Hypothesis 2.

A surprising result is that turnover, and not payroll, is of greater significance to team performance in MLB. There are a number of explanations for this result but two appear most likely. The first is that complementarities among the work units of simple organizations are more important to organizational performance than hypothesized. The second is that the turnover measure is not just measuring the complementarities that develop between individuals on a team. It is possible that the turnover measure is also measuring a net loss of player talent from poor, small-market teams to wealthy, large-market teams.

From 1997 to 2004, wealthy, large-market teams made it a regular practice to acquire star players from poor, small-market teams that would not or could not meet the salary demands of their star players. In Major League Baseball, the New York Yankees signed Jason Giambi as a free agent before the start of the 2002 season. Giambi's previous performance with the Oakland Athletics made him too costly for the Athletics to pay his salary. As a result, the Athletics lost a valuable asset in the free agent market. Although the Athletics' performance the following season suggests that they were able to adequately compensate for the loss of Giambi's talent, other teams were not as fortunate. This could explain why turnover has a significant negative effect on MLB team performance.

Models 3 and 4 of Table 5 present the results for the effects of a team's HR strategy on simple and complex organizations. These results offer support for Hypothesis 3 and 4. In Model 3 a HC HR strategy measure has a positive and significant effect in baseball ($b = 0.84$, $p < .001$). This indicates that baseball teams that implement a strategy to improve the team's HCP through player acquisitions will win more games than teams that do not. In Model 4 a HC HR strategy has a positive and significant effect in hockey (b = 0.63, $p < .001$). This indicates that hockey teams that implement a strategy to improve the team's HCP through player acquisitions have a tendency to win more games than their competitors. The difference between a HC HR strategy in baseball and hockey is also positive and significant (b = 0.21, $p < .1$). This indicates that a strategy of building the HCP through the acquisition of players is a more productive HR strategy in MLB than it is in the NHL. This finding supports Hypothesis 3.

In Model 3 a HP HR strategy is insignificant. This indicates that building human processes in a baseball team has no significant effect on game-by-game performance. In Model 4 a HP HR strategy has a positive and significant effect on the performance of hockey teams (b = 0.26, $p < .001$). The difference between the two HR strategies is also positive and significant (b = 0.31, $p < .001$). This result demonstrates that a HP HR strategy is more productive for hockey teams than it is for baseball teams. These results support Hypothesis 3 and 4 and indicate that the fit of an organization's strategy is significantly affected by the way that work flows between the units of an organization.

The results discussed above offer preliminary evidence that different resource types are more productive in simple and complex organizations. Yet, these results only indicate that there are differences between the productivity of different resources in simple and complex organizations. To further determine if there is more support for Hypothesis 1 and 2 it is necessary to examine if other discrete and systemic resources are more effective under the different conditions of task interdependence.

Resource productivity in complex organizations

Tables 6, 7 and 8 present the results that test Hypothesis 2. Model 1 in Table 6 tests the effects of discrete and systemic resources on the performance of complex organizations. There are eight variables that are used as proxies for a NHL team's systemic resources. Of the eight variables four were significant. A NHL team's even-strength performance is the most significant factor in producing game-by-game wins. Teams that score more even strength goals for ($b = 2.9E\text{-}03$, $p < .001$) and allow fewer even strength goals against ($b = -3.4E\text{-}03$, $p < .001$) have the most game-by-game success. These results may appear somewhat obvious. Teams that score more than their opponents will win games. Nevertheless, professional hockey teams focus much of their attention on honing and mastering the team's power play efficiency (Habib, 2002). These results suggest that a team that can build the best even-strength processes amongst its players is most likely to win on a game-by-game basis.

Another systemic resource that is an important factor in the production of team wins is team turnover ($b = -0.28$, $p < .05$), This indicates that a team with less turnover will have more game-by-game success. A team that has less player turnover than its opponents is likely to have developed better team processes. The tacit knowledge (Berman et al., 2002) that develops is the result of players of the team understanding how they function as a group. The players learn to recognize the strengths and weaknesses of their co-workers and, ideally, the players will complement each other.

Of note is that tenure with the team is not significant. This measure, however, is highly correlated with team turnover ($r = 0.61$, $p< .01$). To determine if the tenure measure has an effect separate from team turnover, Model 1 was run again without the turnover measure[17]. The result ($b = -0.18$, $p < .1$) indicates that team tenure also has a

[17] The results from this equation can be found in Appendix E in Table 22.

significant effect on the performance of NHL team performance. This supports the belief that complementarities develop when a core group of players play together longer.

It is also interesting that teams with a higher penalty killing percentage ($b = 0.29$, $p < .1$) will be more successful. This is surprising not just because penalty killing percentage was significant but because team power play percentage was not. As noted previously there is a significant amount of attention placed on team power play systems. The results suggest that NHL teams would be more successful if the team focused more on penalty killing and not the power play.

There are nine proxies that are used to measure the productivity of discrete resources in complex organizations. Of the nine proxies only four were significant. Team payroll is a significant factor in the production of game-by-game wins ($b = 0.26$, $p < .01$). As discussed previously, this is not surprising because of the additive characteristics of task interdependence.

Another discrete resource that significantly affects the production of game-by-game is the number of all-stars from the previous season a team had on the roster at the start of the season ($b = 0.03$, $p < .05$). This indicates that a team with more talented players will be more successful on a game-by-game basis. A coach who has won a coach of the year award in the past ($b = 0.05$, $p < .05$) is also a significant factor in the production of team wins. This indicates that a team that employs a coach with better sport related skills will have an advantage during the game. A coach who has a better winning percentage with a team is at a disadvantage (-0.13, $p < .05$). This result may suggest that there is a point where a coach's player management skills are no longer effective. This supports Berman et al. (2002) assertion about the limited effectiveness of a coach after a certain tenure and the negative effect this has on a team's performance.

Taken together, the results from Table 6 provide some support for Hypothesis 2. There are an equal amount of significant variables from each resource category. Yet, it is the systemic resources that are most significant in the model. Both even-strength goals for and goals against are the most significant variables in the model. As well, when turnover is removed from the model team tenure is also significant. Taken as a whole, the results from Tables 6 and 22 indicate that systemic resources are more productive than discrete resources in complex organizations. This suggests that the complementarities hockey teams develop that improve the team's even strength play are the most productive resources a NHL team can build.

Resource productivity in simple organizations

Model 1 in Table 7 tests the effects of discrete and systemic resources in simple organizations. There are eleven proxies that measure the effects of systemic resources in simple organizations. Of the eleven variables only three are significant. The results indicate that a baseball team with less team turnover will win more frequently than its opponents ($b = -0.33$, $p < .001$). The two other systemic resources that significantly affect baseball team performance are passed balls ($b = -2.7E-03$, $p < .05$) and sacrifice flies ($b = 1.5E-03$, $p < .1$). These results indicate that teams with more sacrifice flies and fewer passed balls will win more games than their opponents.

There are nine proxies that measure the effects of discrete resources in simple organizations. Of the nine variables only one, coach career win percentage ($b = -0.13$, $p < .05$), is significant. These results indicate that discrete resources are not particularly productive in baseball teams. One measure that is significant is the HC HR strategy measure ($b = 0.43$, $p < .01$). This measure is highly correlated with payroll ($r = 0.74$, $p < .01$). Model 1 was run again without this measure. This was done to test if the HC HR strategy measure is interfering with the effects of the other discrete resources especially team payroll[18].

The results demonstrate that the HC HR strategy interferes with the effect of the model. Without the strategy measure a number of discrete resources become significant. Team payroll is positive and highly significant ($b = 0.09$, $p < .001$). This indicates that the higher a team's payroll the more likely it is that the team will win the game. This result is consistent with the results in Table 5.

There are two other variables that are significant when the HC HR strategy measure is absent from the model. The first is the manager's career winning percentage. The results indicate that a team with a manager with a higher career winning percentage is less likely to win the game ($b = -0.11$, $p < .05$). The other measure is career managerial victories ($b = 3.6E\text{-}04$, $p < .1$). This result indicates that a team that employs a manager that has more career wins is more likely to win the game. These results can be considered contradictory. One explanation for this result is that coaches with less experience can have higher winning percentages than other managers with more game experience. A manager with a large number of career victories indicates that the manager has a great deal of sport related skill. These results indicate that sport related skill has a significant effect on the performance of baseball teams. The results from Table 7 provide some evidence that discrete resources are more productive in simple organizations than in complex organizations.

[18] The results of this equation are found in Appendix E. in Table 25

The previous results provide some support for Hypothesis 1 and 2. Nevertheless there are some limitations with the previous models. The most telling is that the sport specific proxies used to measure systemic resources are vastly different. To address this possible criticism a principal components analysis is employed[19].

The results from Table 8 support Hypothesis 2. The results in Model 1 and 2 demonstrate that systemic resources in hockey ($b = 0.09$, $p < 0.01$) are more productive than systemic resources in baseball ($b = 0.02$, $p < .001$). These results also show that discrete resources in baseball ($b = 0.08$, $p < 0.01$) are more productive than discrete resources in hockey ($b = 0.07$, $p < .001$). There is a significant difference between the effects of systemic resources on game-by-game performance in baseball and hockey ($b = 0.07$, $p < .001$). These results support Hypothesis 2. In contrast, there is no significant difference between the effects of discrete resources on the performance of simple and complex organization. These results demonstrate that discrete resources are of equal importance to baseball and hockey teams. This result does not support Hypothesis 1. This result, however, is not surprising. These results indicate that the additive characteristics of task interdependence affect which resources are productive in simple and complex organizations.

Interactions

It has been noted that coaches and managers can have a significant effect on player and team performance (e.g., Berman et al., 2002; Singell Jr., 1993; Smart & Wolfe, 2000). What has not been specifically examined is what type of coaching skill has

[19] A more detailed explanation of a principal components analysis and the data reduction results for the NHL and MLB are provided in Appendix F.

a significant effect on the productivity of a team's systemic resources. The following is an explanation of the results that test Hypothesis 5.

The coaching effect

The results in Table 9 provide partial some support for Hypothesis 5. In Model 1 the interaction between coaching and systemic resources is insignificant. This indicates that coaching skill does not significantly improve the systemic resources of NHL teams. This result does not support Hypothesis 5. In Model 2 the interaction between coaching and systemic resources is positive and significant ($b = 0.03$, $p < .01$). This demonstrates that the coaching and the systemic resources of a baseball team complement each other. This result supports Hypothesis 5.

What these results do not indicate is why coaching has an effect on baseball team performance and not on hockey team performance. Tables 10 to 14 indicate whether a NHL coach's sport related skills or player management skills have an effect on a team's performance. The majority of the results in these tables are insignificant. Only three of the 40 interaction variables are significant. The only sport related skill variable that is significant is the interaction between a coach's career win percentage and short-handed goals for ($b = 0.03$, $p < .1$). The only player management variables that are significant are a coach's win percentage with the team and even strength goals for ($b = -0.01$, $p < .05$) and a coach's win percentage with the team and the team's power play percentage ($b = 4.35$, $p < .05$). These results appear to indicate that a coach's player management skills have more effect on a NHL team's systemic resources. Yet, taken as a whole, the results from Tables 9 to 14 indicate that coaching skill does not significantly affect NHL systemic resource productivity and, thus, the team's game-by-game performance.

Tables 15 through 19 present evidence that different coaching skills have an effect on a baseball team's game-by-game performance. In Tables 15, 16 and 17 eleven out of 33 interaction terms tested were significant. These results suggest that the manager's sport related skills help him manage and improve the productivity of his team's systemic resources. In contrast, a manager's player management skills do not appear to have a significant effect on a team's systemic resources. Of the twenty-two interaction terms tested in Tables 18 and 19 only one variable was significant. These results suggest that a manager's player management skills are not particularly effective at improving the productivity of a team's systemic resources.

The difference between the sports regarding the importance of coaching and the associated skills that are important to coaches and managers is somewhat surprising. I assumed that coaching would improve the productivity of a hockey team's processes when, in fact, it appears that coaching has almost no effect on a team's game-by-game performance. I also assumed that managers would improve the play of baseball players because they would know how best to use their assets. This assumption also appears to be misguided.

In hindsight, however, the game-by-game impact that a manager can have in baseball is greater than a coach can have in hockey. A manager's sport related skills are used when he changes pitchers, positions the infield and calls a pitcher's pitches. In baseball the game is relatively static. Most plays in baseball are routine. A manager who has more sport related skill is more likely to recognize what has worked well in the past and implement "orthodox moves". In hockey a coach has limited intra-game control. The coach can get the right players on the ice. The game, however, is fluid. There is more unpredictability to the game of hockey because of the sport's task interdependence. The unpredictability of the game dictates that player management decisions have less impact on the eventual outcome of the game. As well, the intra-game effect of a coach's sport related skills are limited because he needs the players to implement the strategy and system of play. If the players are incapable or unwilling to follow the instructions of the coach the effect of his sport related skills is reduced.

The results can also be interpreted in other ways. The first is to read these results as an indication that coaching skill has, at best, a limited effect on the performance of a hockey team. This is one possibility. The potential impact a coach can have on the outcome of a game is limited because coaches are not on the ice while a game is in progress. Nevertheless, coaches are responsible for certain decisions throughout the game. The coach makes the final decision about how best to use his assets to improve the team's intra-game performance. To suggest that a coach's decisions do not affect the outcome of a game minimizes the impact that a coach has on the performance of his team.

These results may also indicate that coaching involves more than just having a repository of individual skills. The proxies used to test coaching ability are limited because they only measure the outcomes of the games. What is not measured is how well the coach planned, organized, controlled, or led his team before or after the game. These measures do not capture how a team won or lost the game. A coach could have been out coached but, because of some turn of fate, he won the game. The coarseness of the proxies makes it difficult to definitively argue that coaching does not significantly impact the systemic resources of a complex organization.

These results may also indicate that the effects of coaching are subtle and hard to quantify. What these interaction results do not measure is how well a coach teaches or trains the players on the team. Because the most visible part of a coach's job is the on-ice/on-field performance of the team, other facets of the job are sometimes forgotten. Perhaps coaches should be judged on their skills in developing the team's HCP. As well, the impact of a coach may not be recognized on a game-by-game basis. Measuring the ability of a coach may require a different unit of analysis. It is possible that coaching ability is better measured by team improvement on an annual or semi-annual basis.

CHAPTER V

Discussion, Conclusion, Limitations, Strengths and Future Research

Discussion

The results of this study demonstrate that task interdependence has a moderating effect on the productivity of organizational resources. The results show that discrete resources are productive in both simple and complex organizations. The results also show that systemic resources are more productive in complex organizations. Other significant findings are that a human capital (HC) HR strategy is more productive in simple organizations while a human process (HP) HR strategy is more productive in complex organizations. Finally, the interaction between discrete and systemic resources is productive in simple but not complex organizations. Each of these findings and the implications of these findings will be further discussed below.

Baseball and Hockey

The results of this study do not support the hypothesized productivity of discrete resources in simple organizations. The results demonstrate that discrete resources are equally important for baseball and hockey teams. What this result does indicate, however, is that baseball teams with higher player payrolls will win more games than their opponents. This occurs because a baseball team is a collection of individuals working independently to achieve a larger goal. The players work together to achieve the goal of producing a win. A baseball team needs to have better players than their opponents to achieve this goal on a regular basis. The easiest way for a baseball team to acquire better players is to lure them away from other teams or to keep them on the team by paying them more than their rivals. This approach is effective because baseball teams usually win because of aggregated individual performances. These results are important because they demonstrate that identifying and acquiring the most productive players possible will lead to the greatest game-by-game gains for a baseball team.

The results of this study offer support for the hypothesized productivity of systemic resources in complex organizations. The results demonstrate that systemic resources are more productive for hockey teams when compared to baseball teams. This means that a hockey team is more likely to win if they maintain a consistent roster; if they score more even-strength goals and if they prevent more even-strength goals than their opponents. Hockey players need to rely on each other to score goals and to prevent goals. The longer teammates play together, the better they are able to complement each other. This is reflected in the way that teams play at even-strength. Teams with better three man lines or five man units will have more success when hockey teams play at even strength.

These results are important because they demonstrate that team success is the result of the complementary productivity of the team's assets. Although team payroll has a significant effect on team performance, the team's processes are more productive in producing game-by-game wins. Also of note is that a team's power play is not a significant factor in determining whether or not a team wins or loses. This result is somewhat surprising considering the emphasis that teams place on team power play performance. These results are also important because the evidence suggests that hockey teams are better served by focusing their efforts on even strength play. This could have an effect on the way teams coach their special teams. Instead of creating a power play unit, teams can improve their performance by playing their even strength lines or units while on the power play.

The results of this study offer support for the hypothesized productivity of a team's HC HR strategy in simple organizations. A HC HR strategy is more productive in baseball than in hockey. This means that a baseball GM will build a better team if his main focus is finding and acquiring the best players available. This raises the question about which type of players are most productive for professional baseball teams? From the results it appears that those players that can produce runs independently should be the most sought after. Baseball GM's should attempt to identify and acquire those players that can significantly affect a team's game-by-game performance. This supports the anecdotal evidence that it is possible to buy a winning baseball team.

Some baseball teams have demonstrated that acquiring marquee players is not the only way to build a winning team. Each player has a particular role to play on a baseball team and coordination amongst the players is fairly low. There is little need for players to develop complementarities with each other. Baseball players are, for the most part, interchangeable resources. The Oakland Athletics have recognized that players are interchangeable resources. The Athletics have found that two or three, lower salaried players are often as productive as one, highly paid player[20]. As Billy Beane, GM of the Athletics said "[t]he important this is not to recreate the individual....The important thing is to recreate the *aggregate*" (Lewis, 2003, p. 141). The implication of this is that baseball teams can build a competitive advantage if they can better identify and acquire cheaper players whose skills substitute for an expensive player. If GM's can spend less on talent in one area because they have identified a substitute player, then they can bolster their team in an area where they are not as strong. Player evaluation takes on even greater importance when the goal is to replace an already productive player with others.

The results of this study also offer support for the hypothesized productivity of a team's HP HR strategy in complex organizations. A HP HR strategy is more productive in hockey than in baseball. For hockey teams this means that GM's have to decide if a player fits with the organization. These results are also important because they demonstrate that a strong HP HR strategy can be the source of a competitive advantage. A hockey team with strong human processes can use their players in a way that is akin to the way baseball teams use their players. For example, at the start of the 2005/06 NHL season the Buffalo Sabres were not expected to be an elite team. The team had not performed well in the previous seasons and most of the players on the team were not marquee players. Nevertheless, the Sabres have been one of the most successful teams throughout the 2005/06 NHL season. The Sabres' accomplishment is even more surprising considering that the team incurred a number of injuries throughout the year. Why were the Sabres so successful? One reason can be traced to the team's activities when the players were locked out during the 2004/05 NHL season. Because the Sabres were not playing, the coaching staff of the Sabres directed their attention to the Rochester Americans, the Sabres' American Hockey League farm team. The goal was to implement a system of play at the minor league level that was similar to the system that was to be used by the Sabres during the NHL season. The Sabres' human process HR strategy has allowed the team to build a competitive advantage.

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[20] The Athletics signed three players, Scott Hatteberg, David Justice, and Jeremy Giambi to replace Jason

This result is important because it demonstrates that a wide pay dispersion can positively affect the performance of a NHL team. This result is not what was expected. These results indicate that teams with a wide pay dispersion will be more successful than team with a narrow pay dispersion. This could suggest that process and system are not important to NHL teams. The results from other models, however, do not bear this out. Another plausible argument is that some teams were working under a self-imposed salary cap before the 2005/06 season. The four expansion teams (Nashville-1998, Atlanta-1999, Columbus and Minnesota-2000) were all near the bottom in their Herfindahl scores. These teams made a concerted effort to build their teams through the draft. This takes time and this meant that these teams were near the bottom in the standings. This time lag effect could explain why the results indicate that teams with wide pay dispersions are more successful in hockey.

Another issue to note is that the Herfindahl score in both sports captures the dispersion of salary on the team but not across the league. A high Herfindahl score indicates that there are one or two players on a team that take up a substantial portion of a team's salary. For example, the Detroit Tigers had an exceptionally high Herfindahl score during the mid 90's because Cecil Fielder took up a large portion of the team's salary. In contrast, the Yankee teams of the late 90's had a relatively low Herfindahl score despite having a star laden roster. A high Herfindahl score indicates that teams have spent a large portion of their salary on one or two players. It does not indicate how many quality players a team has on its roster. As the Yankee example demonstrates, a team could have a low Herfindahl score but still field a team replete with superstars at every position.

Giambi for the 2002 MLB season.

The results of this study also offer some support for the hypothesized interaction effects of an organization's discrete and systemic resources on team performance. In baseball, the sport related skills of the manager had some effect on a team's systemic resources. In hockey, however, there is limited evidence that coaching skill has a significant effect on the productivity of an organization's systemic resources. These results are important because they indicate that task interdependence affects the impact that a coach/manager can have during a game. I anticipated that a coach's sport related skill would have a significant effect on the human processes of hockey teams because they are complex organizations. A hockey coach could, arguably, improve the productivity of the team because the sport related skill he has acquired over time allows him to develop a superior game plan. What interferes with the coach's plans is the unpredictability of the game. A coach creates a game plan that the team is expected to implement. How well the team implements that plan is unpredictable. As well, how a team reacts to another team's game plan is also unpredictable. Intra-game a hockey coach is at the mercy of his players and the flow of the game.

A manager in baseball has more control over the intra-game results of his team because the game is more predictable. This is also why a manager's sport related skill has a significant effect on team performance. A manager who has been in more game specific situations is more likely to know how to manage the situation so that best outcome is most likely to occur. Although luck does play a part in the results of a baseball game (Koppett, 2004), baseball managers can limit the effects that luck has on the outcome of the game because of the sport's task interdependence.

Conclusion

I extend the RBV literature by demonstrating that task interdependence moderates the productivity of a firm's discrete and systemic resources. This finding is important because it shows that not all resources are equally productive to all organizations. Systemic resources are more productive in complex organizations rather than in simple organizations. Complex organizations that are able to build and to develop complementarities amongst their work units are more successful than their competitors. The implication is that complex organizations should focus most of their strategic attention inward toward the development of systemic resources that are hard to build and imitate.

Discrete resources are productive in both simple and complex organizations. Simple organizations that are able to acquire the most productive discrete resources, however, are more successful than their competitors. The implication is that simple organizations should focus most of their strategic attention toward the acquisition of discrete resources that are protected by ownership rights. A simple organization that chooses to build its human processes should recognize that this approach might not be a prudent course of action. The manager of a simple organization also has to recognize if their organization has the ability to build human processes.

Another implication of this study is that not all HR strategies are equally effective for all organizations. The evidence indicates that a firm's HR strategy is affected by a firm's task interdependence. Simple and complex organizations are unable to similarly exploit a HC or a HP HR strategy. This does not indicate that simple organizations should not attempt to build and develop a human process advantage (Boxall, 1996). This indicates that building and then implementing human processes may not prove to be as productive as a strategy predicated on acquiring assets for the HCP. Another implication of this study is that a human process advantage can be built in complex organizations. The gains that are made by building and cultivating human processes will be most obvious in complex organizations. The task interdependence of a firm will affect whether or not human capital or human process HR strategy is most productive at building a competitive advantage.

Furthermore, both a HC and a HP HR strategy can be the source of a competitive advantage. Wright et al. (2001) argue that a firm will not develop a sustainable competitive advantage without a strong position in the firm's HCP, human processes, and employee relationships and behaviours. The evidence from this study indicates that if a firm is strong in only one of these human resource areas that this is enough to significantly affect the performance of a firm. Another implication of this study pertains to the development of human processes. Wright et al. (2001) argue that firms will have a competitive advantage if they build stable people management systems. Their position is that all firms can create productive people management systems because they are founded upon the firm's unique history and practices. These findings indicate that this argument is accurate, but only to a point. Not all firms can take advantage of the different processes that are built by the firm. The results of the study indicate that systemic resources are more productive in complex organizations. This suggests that the gains to be made by developing stable human processes are limited to firms that are either reciprocally or team interdependent.

This study also provides evidence that the interaction between discrete and systemic resources is limited in complex organizations. One of the advantages of reciprocal and team interdependence is that the work units need to interact with each other to produce outputs. And because the work units of complex organizations are tangential the potential for learning amongst the different work units is high. Nevertheless, the evidence shows that there are only limited gains in performance to be made from the interactions between discrete and systemic resources in complex organizations.

Limitations

This study tests whether or not the task interdependence affects firm performance. Because this is a theory-testing endeavour, there are some limitations to the study. These can be grouped into two main categories: methodology and data.

Methodology

It is interesting to note that not all systemic and discrete resources significantly affected team performance. One reason could be due to methodological issues. De Vaus (2001) identifies some potential methodological problems that can occur in cross-sectional research designs.

The first is whether a causal direction can be established. It is possible that the different measures used as proxies to test the effects of the different resources are not adequate. The statistics used in the models may not be effective measures of the resources that a baseball or hockey teams have in their possession. This is a common criticism that has been leveled at RBV research (e.g., Priem & Butler, 2001). Although the use of proxies is the only way to test the effects of systemic resources, it is still possible to determine causal direction in the study. A priori models were developed which provide a theoretical basis for the findings of the study (De Vaus, 2001). Although this does not definitively demonstrate that there is a causal link between, for example systemic resources and the performance of complex organizations, the findings of the study are consistent with the relevant theories and the a priori models.

Data

A limitation of the data is that the proxies measure the bundle of resources that teams possess at the start of the season. An assumption of this study is that a team with more productive resources at the start of the season will do better than their opponents. One difficulty is that the data used as proxies for the resources are not measuring the team in its current form. Sport teams usually make changes to the team between seasons. The effect of a change could have a substantial effect on the team's performance from the previous year. The beginning of the season was used as a common starting ground to determine if teams could build and maintain systemic resources from year to year. Although some of the data does not fully represent the team in its current form, the effect of systemic resources on team performance should be observable despite a change in the human capital pool.

Strengths

This is the first empirical study to examine if task interdependence affects an organization's performance. The study extends the RBV literature by integrating parts of organizational theory and SHRM with strategic management. The evidence from the study demonstrates that task interdependence significantly affects firm performance. The result is that an alternate explanation for differential firm performance is tested and supported.

Another strength of this study is that it demonstrates the value of employing different sites of research. Although research using sport teams and leagues is gaining more acceptance in management research (e.g., Wolfe et al., 2005), there is some question about the generalizability of the results to other organizations. These finding are applicable to organizations that use teams and groups. Whether it is a team of sales representatives, firefighters or software engineers, the findings from the study demonstrate that the way the work flows in an organization is a significant moderator of the productivity of a firm's resources. Thus, if the unit of analysis is identified and isolated in the research design, there is little reason to doubt the generalizability of the findings taken from research using sport organizations.

Future Research

Theoretical

There are a number of theoretical directions in which the research can go. One question is whether there are other firm resources or organizational capabilities that are affected by task interdependence? The distinction between the different resource types is broad. The categorization of resources types on the basis of productivity is only one way to make sense of the different activities of a business or sports team. Future research should investigate if task interdependence has a similar effect on other resource types.

Another theoretical question to investigate is whether there is an optimal mix of discrete and systemic resources that allows one firm to consistently outperform its rivals? There is some debate whether or not a firm can maintain a long-term competitive advantage (e.g., Barnett & Hansen, 1996; Jacobson, 1992). In sport there are a number of teams that have been able to remain at, or near, the top of the league standings for long periods of time. As well, this phenomenon is not restricted to baseball or hockey. There are teams in professional sports such as the San Antonio Spurs and the Detroit Pistons in the National Basketball Association and the New England Patriots, in the National Football League, that produce above average performances from year to year. Moreover, this is not limited to professional sport. In amateur sport the dynasty is far more common. The Duke Blue Devils in NCAA men's basketball and the University of Alberta Golden Bears and Pandas in Men's and Women's hockey are examples of teams that consistently win despite significant yearly turnover in the human capital pool. What have these teams, and not others, done to maintain their high level of performance? How is it possible for these teams to remain highly competitive year after year? Investigating these questions can offer insight into whether it is possible for an organization to build and maintain an optimal resource bundle that produces a long-term competitive advantage.

Related to the issue of an optimum resource bundle is the question of whether the productivity of a firm's resource bundle is time sensitive. Research has shown that resources decay and become obsolete (Berman et al., 2002). Others have demonstrated the effectiveness of adding and removing different organizational assets (Grusky, 1963) to improve team performance. Yet, research has not focused on whether or not there is a time dimension to the productivity of a particular resource bundle. It can be hypothesized that much like a product life cycle (Anderson & Zeithaml, 1984) and an industry life cycle (Klepper, 1997) there is a resource bundle life cycle. It is possible that the stage of the resource life cycle the firm is in could significantly affect the productivity of all its resources. As well, the moderating effects of a firm's task interdependence may be heightened or decreased by the stage of the resource life cycle. These questions are important to investigate to confirm the reliability of this study's results.

Another future research question deals with the external environment. Miller and Shamsie (1996) argue that resources are more productive in different external contexts. Similarly, some firm capabilities have been shown to be more effective under different environmental conditions (e.g., Eisenhardt, 1989; Eisenhardt & Martin, 2000). What has not been investigated is how the firm's task interdependence and the firm's external contexts affect resource productivity. Moreover, it has to be investigated if task interdependence and external contexts operate independently of each other. Future studies could examine whether an interaction between a firm's task interdependence and its external context affects the productivity of a firm's resources.

Finally, it needs to be determined if employee behaviours and relationships affect the results of the study. Wright et al. (2001) argue that a competitive advantage is the result of a firm's superior position in the human capital pool, human management systems, and employee behaviours and relationships. Future studies will have to determine if there is a significant advantage to be gained because of superior employee behaviours and relationships. Thus, the effect of psychological contracts (e.g., Rousseau, 1989), organizational citizenship behaviour (e.g., Organ, 1990), personality (e.g., Barrick & Mount, 1991), and motivation (e.g., Pinder, 1991/1984) are all potential moderators of the productivity of discrete and systemic resources. In concert with task interdependence, research that incorporates many of these factors will be able to paint a more complete picture of what variables moderate firm performance.

Empirical

There are four main empirical issues that come out of this investigation. First, a more detailed examination of the game-by-game data is needed. The salary data measured total team payroll at the start of the season. This data includes some players who are marginal performers or some players whose contracts remained on the team's books when they were not contributing members of the team. This problem may have overstated or understated the importance of discrete resources in both sports. A fine-grained statistical investigation is required to examine salary changes on a game-by-game basis. A study such as this allows for more specificity when testing the effects of coaching and managing on team performance. A study of game-by-game roster moves offers the potential for greater insight into how a coach or manager uses his discrete resources throughout the season. A longitudinal investigation such as this offers a look at the daily strategic decisions that take place in different organizations throughout a season.

Second, new measures of performance are required. Financial data is not readily available for professional sport teams. Although access to this data would be ideal, other measures are used to test the effect of task interdependence on resource productivity. As well, other measures are need to be used to test the effectiveness of coaching/managing and the effectiveness of different resource types. Future research should develop new measures to accurately capture the effects a firm's task interdependence has on its resource productivity.

Third, this study needs to be extended to test whether or not there are similar effects in other sporting contexts. Keidel (1984; 1987) and Van de Ven et al. (1976) argue that other sports (e.g., basketball and football) represent other types of task interdependence. These sites should be explored to determine if discrete and systemic resources are similarly productive in these contexts.

Finally, the use of statistical methods to test the effects of task interdependence on resource productivity only allows for a broad evaluation. The use of other empirical methods might provide more insight. Qualitative methods, such as case studies, may provide valuable information as to why one organization is different from the others. Yin (2003) argues that examining exemplars from a particular group can shed light onto the reasons for their differences. As well, a close investigation of poor performers can also provide researchers with some insight into what leads to a sustained competitive advantage. The use of other empirical techniques is necessary to confirm the results of this investigation.

Summary

This study found evidence that resource productivity differs depending on the task interdependence of the organization. The implication of this finding is that the type of task interdependence within a firm significantly affects firm performance. The evidence shows that discrete resources are productive in both simple and complex organizations while systemic resources are more productive in complex organizations. The effectiveness of a firm's HR strategy is also affected by its task interdependence. Finally, the evidence demonstrates that the interaction of firm resources has a significant effect on firm performance in simple organizations. These results indicate that managers should consider the effect of a firm's task interdependence when making strategic decisions that pertain to a firm resources and a firm's HR strategy.

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FIGURE 1: POOLED INTERDEPENDENCE

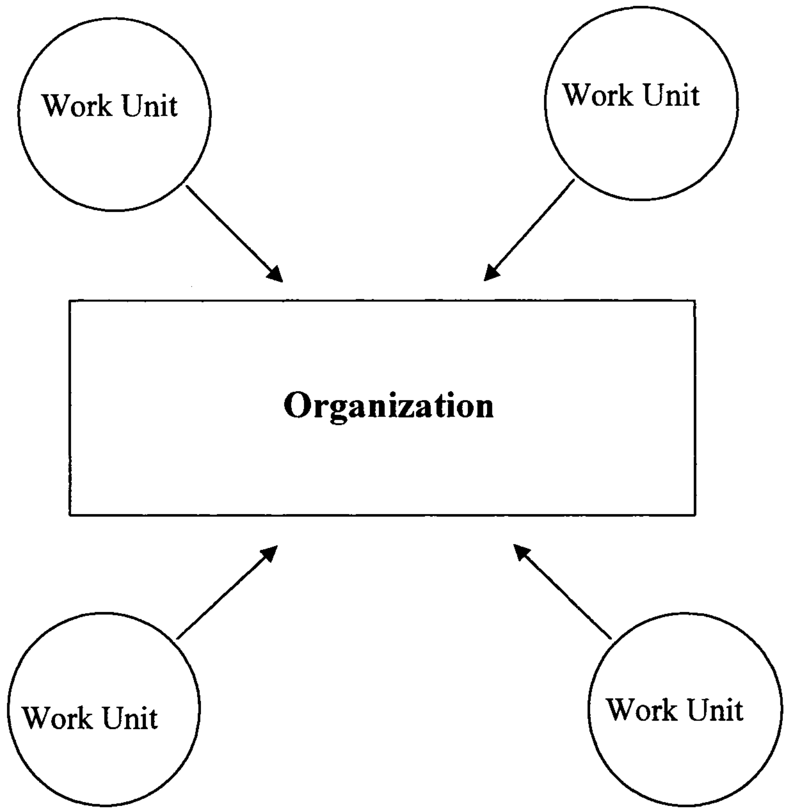

FIGURE 2: SEQUENTIAL INTERDEPENDENCE

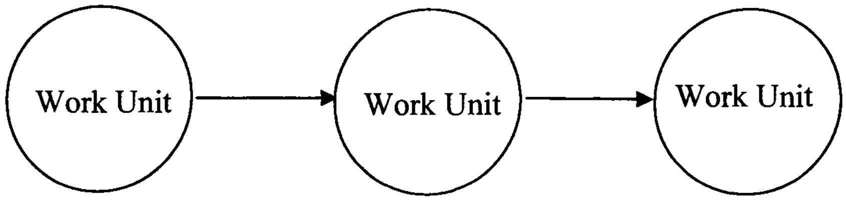

FIGURE 3: RECIPROCAL INTERDEPENDENCE

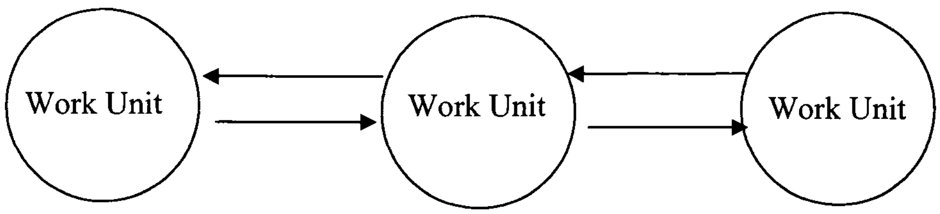

FIGURE 4: TEAM INTERDEPENDENCE

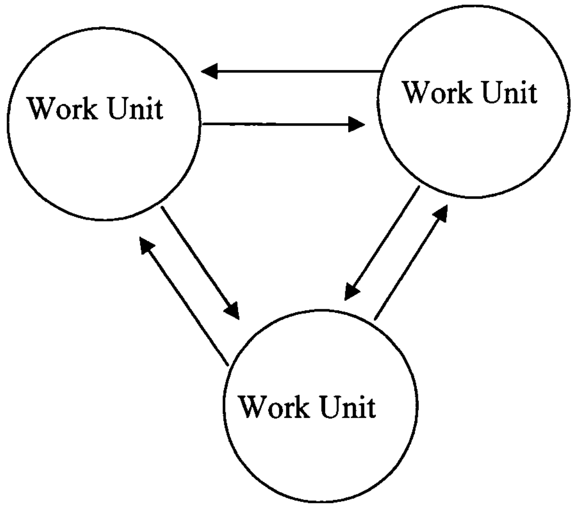

TABLE 1
Comparison of Types of Interdependence

	Pooled	Sequential	Reciprocal	Team
Work Unit Relationship	Non Contingent	Partially Contingent	Totally Dependent	Totally Dependent
Self-Sufficient?	Yes	No	No	No
Coordination Mechanisms	Routines	Plans	Mutual Adjustment	Group
Communication b/w Work Units	Low	Medium	High	High
Proximity	Distant	Close	Tangential	Tangential
Direction of work flow	Uni-directional	Uni-directional	Multi-directional	Multi-directional
Degree of coordination	Low	Medium	High	High

TABLE 2
Complete List and Definitions for Baseball and Hockey Variables

Variable Name	Sport	Variable Type	Resource Type	Definition	Symbol
Payroll	Both	Independent	Discrete	The size of team's payroll at the start of the season	P_{it}
Human Process HR Strategy	Both	Independent	Discrete	The sum of squares of all player salaries at the start of the season.	HP_{it}
Human Capital HR Strategy	Both	Independent	Discrete	Percentage of team that is in the top 20% of league salaries	HC_{it}
Career Game Coached	Both	Independent	Discrete	Total number of games coached in a career at the start of the season.	CG_{it}
Career Victories	Both	Independent	Discrete	Total number of wins a coach has in a career at the start of the season.	CV_{it}
Career Winning Percentage	Both	Independent	Discrete	Winning percentage of a coach over his career at the start of the season.	$CWPT_{it}$
Coaching Awards Won	Both	Independent	Discrete	Number of coaching awards won at the start of the season.	MY_{it}
Championships Won	Both	Independent	Discrete	Number of league championships coach has won at the start of the season.	CW_{it}
Turnover	Both	Independent	Systemic	The number of new players on a team's roster at the start of the season	TO_{it}
Team Tenure	Both	Independent	Systemic	The number of players on a team for 3 years or less at the start of the season.	TW_{it}
Games with the Team	Both	Independent	Discrete	Number of games a coach has been with a team as head coach.	GT_{it}
Winning percentage with the team	Both	Independent	Discrete	Winning percentage of a coach with a team as head coach.	$WPWT_{it}$
All-stars	Both	Independent	Discrete	Number of players who played in the league all-star game the previous year that are on a team's roster at the start of the season.	AS_{it}

Variable Name	Sport	Variable Type	Resource Type	Definition	Symbol
Power play Percentage	Hockey	Independent	Systemic	Percentage of number of times a team scores while the other team is shorthanded	PPP_{it}
Penalty Killing Percentage	Hockey	Independent	Systemic	Percentage of time team is not scored on while shorthanded	PKP_{it}
Even Strength goals for	Hockey	Independent	Systemic	Number of goals scored while teams play 5 on 5.	EVF_{it}
Even strength goals against	Hockey	Independent	Systemic	Number of goals allowed while teams play 5 on 5.	EVA_{it}
Shorthanded goals for	Hockey	Independent	Systemic	Number of goals scored while team is shorthanded.	SHF_{it}
Shorthanded goals against	Hockey	Independent	Systemic	Number of goals allowed while team is on the power play.	SHA_{it}
Average Age	Hockey	Control	N/A	Average age of the players on a team at the start of the season.	AG_{it}
Complete games	Baseball	Control	N/A	Number of complete games for the team.	CM_{it}
Shutouts	Baseball	Control	N/A	Number of shutouts for the team.	SO_{it}
Saves	Baseball	Control	N/A	Number of saves for the team.	SV_{it}
Hits Against	Baseball	Control	N/A	Number of hits against for the team.	HA_{it}
Home Runs Against	Baseball	Control	N/A	Number of home runs against the team.	HRA_{it}
Walks Against	Baseball	Control	N/A	Number of walks against the team.	BBA_{it}
Hits For	Baseball	Control	N/A	Number of hits for the team.	HF_{it}
Home Runs for	Baseball	Control	N/A	Number of home runs for the team.	HR_{it}
Walks For	Baseball	Control	N/A	Number of walks for the team.	BBF_{it}
Stolen Bases For	Baseball	Control	N/A	Number of stolen base for the team.	SB_{it}
Hit By Pitch	Baseball	Control	N/A	Number of times players were hit-by-a-pitch.	HBP_{it}
Sacrifice flies	Baseball	Independent	Systemic	Number of sacrifice flies by a team in a year.	S_{it}
Runs batted in	Baseball	Independent	Systemic	Number of runs batted in for the team.	RBI_{it}
Earned run average	Baseball	Independent	Systemic	Earn runs divided by number of innings pitched multiplied by 9.	ERA_{it}

Variable Name	Sport	Variable Type	Resource Type	Definition	Symbol
Putouts	Baseball	Independent	Systemic	A putout is credited to a fielder when he catches a fly ball or a line drive, whether fair or foul, catches a thrown ball which puts out a batter or runner, or tags a runner when the runner is off the base to which he legally is entitled.	PU_{it}
Assists	Baseball	Independent	Systemic	A fielder is credited with an assist any time he throws or deflects a batted or thrown ball in such a way that a putout results, or would have resulted except for a subsequent error by any fielder.	AST_{it}
Errors	Baseball	Independent	Systemic	A fielder is charged with an error whose wild throw permits a runner to reach a base safely, or advance to the next base, when in the scorer's judgment a good throw would have put out the runner or prevented him from advancing to the next base, or whose failure to stop, or try to stop, a batted or accurately thrown ball permits a runner to advance.	E_{it}
Double Plays	Baseball	Independent	Systemic	A fielder is credited with participation in a double play if he earns a putout or an assist in a play when two or three outs are recorded on a play before the play becomes dead, unless an error or misplay intervenes between putouts.	DP_{it}
Passed Balls	Baseball	Independent	Systemic	A catcher is charged with a passed ball when he fails to hold or to control a legally pitched ball that should have been held or controlled with ordinary effort, thereby permitting a runner or runners to advance.	PB_{it}

Variable Name	Sport	Variable Type	Resource Type	Definition	Symbol
Defensive Rating	Baseball	Independent	Systemic	Defensive Efficiency Rating is the ratio of team defensive outs recorded in defensive opportunities. To determine Defensive Efficiency Rating for a team, divide the total number of hits in play allowed (not including home runs) by the total number of defensive opportunities (all balls hit into play, not including home runs) and subtract from one: 1-((H-HR)/(PA-HR-BB-HBP-SO)).	DER_{it}
Defensive Efficiency	Baseball	Independent	Systemic	This measure estimates the number of batted balls turned into outs by a team. The estimate for plays made is based on outs minus double plays, caught stealing and outfield assists or total batters faced minus strikeouts, walks, HBP, Hits and errors times a factor.	DEF_{it}
Pitcher Park Factor	Baseball	Control	N/A	A measure that indicates how favourable a ballpark is to pitchers.	PPF_{it}
Batter Park Factor	Baseball	Control	N/A	A measure that indicates how favourable a ballpark is to pitchers.	BBF_{it}
Weighted Age of Batters	Baseball	Control	N/A	A weighted measure of the age of the batters on a team.	AGB_{it}
Weighted Age of Pitchers	Baseball	Control	N/A	A weighted measure of the age of the pitchers on a team.	AGP_{it}
Hockey Dummy Variable	Hockey	Dummy	N/A	A variable used to identify hockey specific variables.	HD_{it}
Baseball Dummy Variable	Baseball	Dummy	N/A	A variable used to identify baseball specific variables.	BD_{it}

TABLE 3
Hockey Descriptive Statistics and Correlations

	Variables	Mean	s.d.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	Wins	35.52	7.91																				
2	HP HR Strat	750.35	191.91	0.25[a]																			
3	HC HR Strat	0.2	0.11	0.31[a]	0.21[a]																		
4	Ten < 3 yrs	0.74	0.13	-0.41[a]	-0.17	-0.34[a]																	
5	TO	0.39	0.15	-0.40[a]	-0.13	-0.25[a]	0.61[a]																
6	ES GF	155.57	30.01	0.40[a]	0.26[a]	0.34[a]	-0.38[a]	-0.56[a]															
7	ES GA	155.57	31.95	-0.16[b]	-0.06	-0.08	0.14[b]	-0.12	0.43[a]														
8	PP %	0.16	0.04	0.33[a]	0.29[a]	0.38[a]	-0.34[a]	-0.46[a]	0.66[a]	0.3[a]													
9	PK %	0.82	0.12	0.26[a]	0.14[b]	0.26[a]	-0.35[a]	-0.6[a]	0.68[a]	0.53[a]	0.54[a]												
10	SH GF	8.74	3.97	0.06	0.06	0.11	-0.12	-0.23[a]	0.41[a]	0.28[a]	0.26[a]	0.26[a]											
11	SH GA	8.74	3.65	-0.07	0.08	-0.1	0.04	-0.1	0.18[a]	0.45[a]	0.16[b]	0.24[a]	0.2[a]										
12	Payroll	3.40E+07	1.28E+07	0.36[a]	0.34[a]	0.72[a]	-0.27[a]	-0.17[a]	0.23[a]	-0.19[a]	0.32[a]	0.24[a]	-0.04	-0.26[a]									
13	GmWT	142.39	142.3	0.19[a]	0.05	0.08	-0.32[a]	-0.33[a]	0.12	-0.16[b]	0.21[a]	0.18[a]	-0.02	-0.15[b]	0.21[a]								
14	W % WT	0.4	0.23	0.21[a]	0.14[b]	0.18[a]	-0.29[a]	-0.38[a]	0.29[a]	-0.17[a]	0.32[a]	0.27[a]	0.1	-0.18[a]	0.25[a]	0.58[a]							
15	Car gms	362.82	375.9	0.16[b]	0.04	0.18[a]	-0.21[a]	-0.11	0.07	-0.09	0.11	0.1	0.04	-0.09	0.21[a]	0.47[a]	0.31[a]						
16	Car wins	174.34	203.82	0.19[a]	0.06	0.21[a]	-0.23[a]	-0.12	0.09	-0.11	0.13	0.1	0.07	-0.1	0.24[a]	0.46[a]	0.31[a]	0.99[a]					
17	Car win %	0.46	0.19	0.15[b]	0.07	0.17[a]	-0.18[a]	-0.19[a]	0.13[b]	-0.15[b]	0.22[a]	0.15[b]	0.06	-0.09	0.2[a]	0.41[a]	0.71[a]	0.46[a]	0.44[a]				
18	Awards	0.35	0.7	0.18[a]	0.02	0.05	-0.09	-0.03	0.08	-0.08	0	0.05	0.01	-0.11	0.12	0.26[a]	0.17[b]	0.71[a]	0.71[a]	0.3[a]			
19	Champs	0.36	1.26	0.21[a]	0.08	0.22[a]	-0.26[a]	-0.14[b]	0.1	-0.09	0.14[b]	0.06	0.15[b]	-0.05	0.21[a]	0.33[a]	0.21[a]	0.71[a]	0.78[a]	0.24[a]	0.44[a]		
20	All-stars	1.56	1.16	0.47[a]	0.39[a]	0.42[a]	-0.43[a]	-0.35[a]	0.42[a]	-0.13[b]	0.49[a]	0.23[a]	0.19[a]	-0.13	0.42[a]	0.17[b]	0.27[a]	0.22[a]	0.26[a]	0.21[a]	0.14[b]	0.36[a]	
21	Age	27.45	1.18	0.23[a]	0.09	0.62[a]	-0.24[a]	-0.14[b]	0.06	-0.19[a]	0.2[a]	0.06	-0.09	-0.23[a]	0.61[a]	0.15[b]	0.13	0.22[a]	0.24[a]	0.12	0.11	0.22[a]	0.32[a]

[a] $p<0.01$

[b] $p<0.05$

Two-tailed tests

TABLE 4
Baseball Descriptive Statistics & Correlations

	Variables	Mean	s.d.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Wins	80.93	12.23																
2	Payroll	5.53E+07	2.57E+07	0.39[a]															
3	Turnover	0.45	0.12	-0.31[a]	-0.04														
4	Ten< 3 year	0.78	0.10	-0.31[a]	-0.18[a]	0.55[a]													
5	HP HR	913.60	249.56	-0.32[a]	-0.35[a]	0.25[a]	0.23[a]												
6	HC HR	0.20	0.10	0.48[a]	0.74[a]	-0.18[a]	-0.27[a]	-0.50[a]											
7	Hits for	1483.39	80.95	0.41[a]	0.11	-0.25[a]	-0.18[a]	-0.13[b]	0.28[a]										
8	HR for	176.92	34.31	0.43[a]	0.35[a]	-0.10	-0.09	-0.11	0.38[a]	0.43[a]									
9	W for	558.29	74.87	0.48[a]	0.14[b]	-0.17[a]	-0.10	-0.17[a]	0.31[a]	0.30[a]	0.45[a]								
10	SB for	102.22	33.23	0.04	-0.22[a]	-0.14[b]	-0.12	-0.04	-0.06	0.04	-0.22[a]	0.01							
11	HBP	56.14	14.39	0.07	0.12[b]	0.03	0.03	0.09	-0.10	-0.07	0.10	-0.09	-0.03						
12	Sac	47.70	9.49	0.36[a]	0.04	-0.15[b]	-0.10	-0.15[b]	0.17[a]	0.48[a]	0.09	0.27[a]	0.15[b]	-0.06					
13	RBI	733.29	107.93	0.34[a]	0.34[a]	-0.36[a]	-0.27[a]	-0.19[a]	0.32[a]	0.34[a]	0.40[a]	0.27[a]	-0.08	0.07	0.29[a]				
14	ERA	4.50	0.55	-0.64[a]	-0.25[a]	0.14[b]	0.20[a]	0.29[a]	-0.26[a]	0.19[a]	0.11	-0.08	-0.05	-0.06	-0.03	0.02			
15	CG for	7.90	4.38	0.13[b]	-0.18[a]	-0.07	-0.08	-0.02	0.00	0.07	-0.01	0.04	0.17[a]	-0.04	0.12[b]	0.00	-0.11		
16	SO for	7.10	3.89	0.43[a]	0.13[b]	-0.22[a]	-0.24[a]	-0.25[a]	0.22[a]	-0.08	-0.08	0.08	0.02	0.00	0.06	0.04	-0.58[a]	0.36[a]	
17	SVS for	40.52	7.56	0.68[a]	0.29[a]	-0.19[a]	-0.19[a]	-0.25[a]	0.38[a]	0.09	0.15[b]	0.21[a]	0.03	0.01	0.16[a]	0.16[b]	-0.53[a]	-0.18[a]	0.27[a]
18	H against	1483.39	89.69	-0.53[a]	-0.26[a]	0.09	0.13[b]	0.26[a]	-0.24[a]	0.24[a]	0.10	-0.03	-0.02	-0.05	0.01	0.06	0.87[a]	-0.09	-0.56[a]
19	HR against	176.92	26.21	-0.48[a]	-0.14[b]	0.12[b]	0.18[a]	0.25[a]	-0.20[a]	0.16[a]	0.10	-0.08	0.01	-0.01	-0.01	0.01	0.77[a]	-0.11	-0.49[a]
20	W against	558.26	68.44	-0.42[a]	-0.28[a]	0.09	0.26[a]	0.19[a]	-0.19[a]	0.05	0.10	0.08	-0.05	-0.15[b]	-0.07	-0.08	0.55[a]	-0.13[b]	-0.32[a]
21	PO	4332.69	39.93	0.50[a]	0.14[b]	-0.13[b]	-0.10	-0.16[b]	0.21[a]	0.18[a]	0.15[b]	0.28[a]	0.10	0.00	0.14[b]	-0.04	-0.49[a]	0.07	0.21[a]
22	Asst	1669.48	94.09	-0.09	-0.19[a]	0.12	0.10	0.10	-0.15[b]	-0.04	0.02	-0.05	-0.03	0.05	-0.09	-0.11	0.04	-0.03	-0.06
23	Err	112.45	17.45	-0.35[a]	-0.28[a]	0.05	0.17[a]	0.10	-0.22[a]	-0.19[a]	-0.08	-0.11	0.07	-0.05	-0.17[a]	-0.13[b]	0.22[a]	-0.04	-0.19[a]
24	DP's	169.76	54.11	-0.10	-0.15[b]	0.06	0.19[a]	-0.08	-0.09	0.14[b]	0.08	0.14[b]	0.10	-0.06	0.03	0.01	0.25[a]	-0.00	-0.12[b]
25	PB's	11.81	5.18	-0.11	0.01	0.09	0.05	-0.10	0.01	0.01	-0.12	-0.10	-0.09	-0.03	-0.05	-0.04	0.01	-0.01	-0.05
26	Def Rat	0.71	0.01	0.37[a]	0.16[a]	-0.00	-0.03	-0.10	0.10	-.22[a]	-0.11	-0.02	0.06	0.07	-0.00	-0.15[b]	-0.65[a]	0.01	0.42[a]
27	Def eff	0.69	0.01	0.41[a]	0.20[a]	-0.01	-0.06	-0.10	0.13[b]	-0.14[b]	-0.08	-0.00	0.05	0.07	0.04	-0.11	-0.63[a]	0.01	0.41[a]
28	PPF	100.17	5.97	-0.13[b]	-0.03	0.07	-0.06	0.07	-0.11	0.30[a]	0.15[b]	-0.15[b]	-0.03	0.03	0.04	0.14[b]	0.38[a]	-0.01	-0.18[a]
29	BPF	100.16	6.53	-0.10	-0.03	0.06	-0.07	0.06	-0.09	0.32[a]	0.17[a]	-0.14[b]	-0.04	0.02	0.05	0.16[a]	0.36[a]	0.01	-0.17[a]
30	BAT age	29.03	1.44	0.40[a]	0.61[a]	-0.15[b]	-0.18[a]	-0.49[a]	0.68[a]	0.19[a]	0.31[a]	0.39[a]	-0.11	-0.03	0.19[a]	0.28[a]	-0.21[a]	0.01	0.15[b]
31	PIT age	28.72	1.59	0.52[a]	0.67[a]	-0.14[b]	-0.15[b]	-0.42[a]	0.67[a]	0.23[a]	0.31[a]	0.36[a]	-0.10	0.01	0.20[a]	0.28[a]	-0.31[a]	-0.03	0.22[a]
32	All stars	2.26	1.57	0.61[a]	0.43[a]	-0.14[b]	-0.20[a]	-0.21[a]	0.45[a]	0.31[a]	0.31[a]	0.33[a]	0.04	0.04	0.21[a]	0.30[a]	-0.32[a]	0.12[b]	0.29[a]
33	CGMS	1007.23	877.31	0.32[a]	0.28[a]	-0.06	-0.07	-0.16[a]	0.30[a]	0.05	0.13[b]	0.17[a]	0.02	-0.05	0.06	0.16[a]	-0.25[a]	0.03	0.16[b]
34	Car win	515.69	464.04	0.34[a]	0.30[a]	-0.06	-0.07	-0.17[a]	0.32[a]	0.05	0.14[b]	0.17[a]	0.02	-0.04	0.07	0.16[a]	-0.27[a]	0.03	0.16[a]
35	Car win %	0.46	0.15	0.12[b]	0.03	-0.07	-0.06	-0.07	0.15[b]	0.05	0.05	0.09	0.01	-0.08	0.04	0.14[b]	-0.09	0.01	-0.02
36	Gm WT	440.70	491.50	0.19[a]	0.07	-0.18[a]	-0.25[a]	-0.12	0.09	0.04	-0.03	0.07	0.02	-0.09	0.05	0.13[b]	-0.17[a]	-0.04	0.14[b]
37	Win % WT	0.38	0.22	0.20[a]	0.11	-0.20[a]	-0.17[a]	-0.17[a]	0.15[b]	0.07	0.03	0.12	-0.01	-0.07	0.03	0.25[a]	-0.21[a]	0.03	0.09
38	Champ	0.30	0.71	0.24[a]	0.31[a]	-0.07	-0.19[a]	-0.09	0.29[a]	0.06	0.04	0.06	.16[a]	0.04	0.04	0.12[b]	-.16[a]	0.09	0.14[b]
39	Awards	0.63	0.88	0.29[a]	0.23[a]	-0.05	-0.03	-0.13[b]	0.22[a]	0.01	0.13[b]	0.13[b]	0.02	-0.06	0.06	0.01	-0.28[a]	-0.01	0.12

	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
17 SVS for																						
18 H against	-0.41[a]																					
19 HR against	-0.42[a]	0.62[a]																				
20 W against	-0.38[a]	0.32[a]	0.32[a]																			
21 PO	0.35[a]	-0.32[a]	-0.30[a]	-0.19[a]																		
22 Asst	-0.05	0.19[a]	-0.15[b]	0.12[b]	0.09																	
23 Err	-0.15[b]	0.28[a]	0.03	0.18[a]	-0.17[a]	0.25[a]																
24 DP's	-0.11	0.24[a]	0.14[b]	0.33[a]	-0.18[a]	0.16[a]	0.11															
25 PB's	-0.02	0.02	-0.08	-0.01	-0.04	-0.00	0.13[b]	-0.00														
26 Def Rat	0.31[a]	-0.81[a]	-0.25[a]	-0.29[a]	0.30[a]	-0.16[a]	-0.25[a]	-0.24[a]	-0.06													
27 Def eff	0.31[a]	-0.79[a]	-0.22[a]	-0.30[a]	0.30[a]	-0.19[a]	-0.45[a]	-0.23[a]	-0.08	0.97[a]												
28 PPF	-0.24[a]	0.36[a]	0.32[a]	0.11	-0.26[a]	0.19[a]	-0.04	0.08	0.05	-0.32	-0.28											
29 BPF	-0.22[a]	0.34[a]	0.30[a]	0.11	-0.24[a]	0.20[a]	-0.05	0.08	0.06	-0.31[a]	-0.27[a]	0.99[a]										
30 BAT age	0.24[a]	-0.23[a]	-0.12[b]	-0.12	0.21[a]	-0.11	-0.31[a]	-0.08	-0.09	0.10	0.16	-0.06	-0.05									
31 PIT ge	0.44[a]	-0.27[a]	-0.19[a]	-0.30[a]	0.22[a]	-0.19[a]	-0.24[a]	-0.10	0.04	0.19[a]	0.22[a]	-0.07	-0.06	0.62[a]								
32 All stars	0.41[a]	-0.28[a]	-0.26[a]	-0.31[a]	0.22[a]	-0.10	-0.23[a]	-0.09	-0.03	0.15[b]	0.19[a]	-0.10	-0.09	0.37[a]	0.45[a]							
33 Car gm	0.24[a]	-0.15[b]	-0.22[a]	-0.19[a]	0.09	-0.08	-0.02	0.01	-0.12[b]	0.12[b]	0.11	-0.12[b]	-0.12[b]	0.20[a]	0.31[a]	0.30[a]						
34 Car wins	0.25[a]	-0.17[a]	-0.23[a]	-0.19[a]	0.10	-0.07	-0.02	0.00	-0.12[b]	0.14[b]	0.13[b]	-0.13[b]	-0.13[b]	0.22[a]	0.32[a]	0.31[a]	1.00[a]					
35 Car win %	0.17[a]	-0.02	-0.12	-0.03	0.03	-0.06	0.07	0.03	0.00	0.00	-0.06	-0.08	-0.07	0.09	0.11	0.03	0.39[a]	0.40[a]				
36 Gm WT	0.19[a]	-0.05	-0.11	-0.27[a]	0.03	-0.08	0.01	-0.02	-0.11	0.03	0.02	-0.09	-0.09	0.06	0.11	0.18[a]	0.58[a]	0.59[a]	0.30[a]			
37 Win % WT	0.19[a]	-0.11	-0.17[a]	-0.18[a]	0.09	-0.09	0.02	-0.01	0.05	0.04	0.02	-0.07	-0.06	0.12[b]	0.2[a]	0.18[a]	0.34[a]	0.34[a]	0.52[a]	0.55[a]		
38 Champs	0.20[a]	-0.09	-0.12[b]	-0.27[a]	0.09	-0.26[a]	-0.06	-0.09	0.00	0.04	0.04	-0.08	-0.08	0.16[a]	0.28[a]	0.40[a]	0.61[a]	0.61[a]	0.17[a]	0.51[a]	0.26[a]	
39 Awards	0.17[a]	-0.24[a]	-0.23[a]	-0.15[b]	0.14[b]	-0.09	-0.03	-0.03	-0.16[b]	0.16[a]	0.15[b]	-0.15[b]	-0.15[b]	0.23[a]	0.16[a]	0.28[a]	0.71[a]	0.73[a]	0.29[a]	0.46[a]	0.26[a]	0.47[a]

[a]$p<0.01$

[b]$p<0.05$

Two-tailed tests

TABLE 5

Probit Models Testing the Difference between the Effects of Payroll Resources, Non-payroll Resources, and Team Strategy on Simple (MLB) and Complex (NHL) Organizations [*]

Variable	Model 1: Payroll and turnover in simple organizations (MLB)		Model 2: Payroll and turnover in complex organizations (NHL)		Difference		Model 3: Effects of HR strategy on simple organizations (MLB)		Model 4: Effects of HR strategy on complex organizations (NHL)		Difference	
Constant	0.09[b]	0.01	0.16[b]	0.01	0.07[b]	0.02	0.09[b]	0.01	0.16[b]	0.01	0.07[b]	0.02
Team payroll	0.18[b]	0.02	0.29[b]	0.04	0.11[b]	0.04						
Turnover	-0.48[b]	0.06	-0.66[b]	0.08	-0.17[a]	0.10						
HP strategy							-0.04	0.03	0.26[b]	0.05	0.31[b]	0.06
HC strategy							0.84[b]	0.07	0.63[b]	0.10	0.21[a]	0.12
Observations	21510		7937		29447		21510		7937		29447	
Chi Squared	263.70		217.53		499.13		236.01		106.09		359.99	
Log-likelihood	-14721.42		-5327.92		-20049.34		-14735.26		-5383.65		-20118.91	

[*] The dependent variable in all cases is home team game-by-game wins or losses. Unstandardized regression coefficients are shown with standard errors to the right.

[a] $p < .1$

[b] $p < .001$

TABLE 6
Probit Model Testing the Effects of Discrete Resources and Systemic Resources on the Performance of Complex Organizations (NHL) [a]

	Variable	Model 1	
	Constant	0.16[d]	0.01
Systemic Resources	Turnover	-0.28[b]	0.12
	Tenure < 3 years	-0.07	0.12
	Even strength goals for	2.9E-03[d]	6.4E-04
	Even strength goals against	-3.4E-03[d]	5.6E-04
	Power play percentage	0.31	0.44
	Penalty killing percentage	0.29[a]	0.17
	Shorthanded goals for	-3.8E-03	3.1E-03
	Shorthanded goals against	4.6E-03	3.5E-03
Discrete Resources	Payroll	0.26[c]	0.09
	All-stars on team	0.03[b]	0.01
	Games managed with the team	2.5E-05	1.0E-04
	Winning percentage with the team	-0.13[b]	0.06
	Games coached in career	-1.4E-04	3.3E-04
	Games won in career	1.7E-04	6.9E-04
	Career winning percentage	-2.0E-05	2.7E-04
	Coaching awards won	0.05[b]	0.02
	Championships won	0.01	0.02
SHRM Strategies	HP HR strategy	-8.8E-05	7.6E-05
	HC HR strategy	-0.44[b]	0.21
Control	Team age	-0.01	0.02
	Observations	7937	
	Chi Squared	327.06	
	Log-likelihood	-5273.16	

[a] The dependent variable in all cases is home team game-by-game wins or losses. Unstandardized regression coefficients are shown, with standard errors to the right.

[a] $p < .1$,
[b] $p < .05$
[c] $p < .01$
[d] $p < .001$

TABLE 7
Probit Models Testing the Effects of Discrete Resources and Systemic Resources on Team Performance in Simple Organizations (MLB) [a]

	Variable	Model 1	
	Constant	0.09[d]	0.01
Systemic Resources	Turnover	-0.33[d]	0.08
	Tenure <3 years'	-0.11	0.09
	Put Outs	-1.7E-04	3.1E-04
	Double plays	1.1E-04	3.7E-04
	Assists	-5.1E-05	9.2E-05
	Passed balls	-2.7E-03[b]	1.3E-03
	Defensive rating	0.33	2.15
	Defensive efficiency	-2.31	2.19
	Sacrifice flies	1.5E-03[a]	8.9E-04
	Runs batted in	-2.7E-05	2.6E-04
	Earned runs	0.03	0.05
Discrete Resources	Payroll	0.01	0.04
	Games coached in career	-1.1E-04	1.1E-04
	Games won in career	3.0E-04	2.1E-04
	Career winning percentage	-0.13[b]	0.05
	Consecutive games coach has been with the team	-1.1E-05	2.0E-05
	Coach winning percentage with the team	1.3E-03	0.04
	Coaching awards won	0.01	0.01
	Championships won	-0.02	0.01
	All-stars on team	0.01	0.01
SHRM Strategies	HP HR strategy	-5.8E-05[a]	3.2E-05
	HC HR strategy	0.43[c]	0.15
Control Variables	Team at bats	8.3E-04[c]	2.7E-04
	Hits for	-5.5E-04[b]	2.8E-04
	Home runs for	5.7E-04	3.9E-04
	Walks for	6.9E-04[d]	1.5E-04
	Stolen bases for	4.1E-06	2.3E-04
	Times hit by pitch	3.2E-05	4.9E-04
	Complete games for	-4.0E-03[b]	1.9E-03
	Shutouts for	1.5E-03	2.7E-03
	Saves for	6.9E-04	1.3E-03
	Hits against	-7.7E-04[c]	2.4E-04
	Home runs against	1.6E-04	4.7E-04
	Walks against	-3.3E-04[a]	1.7E-04
	Pitcher park factor	-0.01	0.01
	Batter park factor	0.01	0.01
	Weighted batter age	-0.04[d]	0.01
	Weighted pitcher age	2.8E-03	0.01
	Observations	21510	
	Chi-Squared	474.07	
	Log-likelihood	-14616.23	

a The dependent variable in all cases is home team game-by-game wins or losses. Unstandardized regression coefficients are shown, with standard errors to the right. [a] $p < .1$, [b] $p < .05$, [c] $p < .01$, [d] $p < .001$

TABLE 8

Principal Components Probit Models Testing the Difference between the Effects of Discrete Resources and Systemic Resources on Simple (NHL) & Complex (MLB) Organizations *

Variable	**Model 1: Complex organizations (NHL)**		**Model 2: Simple organizations (MLB)**		**Difference**	
Constant	0.16[a]	0.01	0.09[a]	0.01	0.07[a]	0.02
Discrete Resources	0.07[a]	0.01	0.08[a]	0.01	-0.01	0.01
Systemic Resources	0.09[a]	0.01	0.02[a]	0.01	0.07[a]	0.01
Observations	7937		21510		29447	
Chi Squared	161.53		209.79		389.21	
Log-likelihood	-5355.92		-14748.37		-20104.30	

* The dependent variable in all cases is home team game-by-game wins or losses. Unstandardized regression coefficients are shown with standard errors in parentheses.
[a] $p < .001$

TABLE 9
Principal Components Probit Models Testing the Difference between the Interaction Effects of Discrete & Systemic Resources on Simple (MLB) and Complex (NHL) Organizations *

Variable	Model 1: Complex organizations (NHL)		Model 2: Simple organizations (MLB)		Difference	
Constant	0.16[b]	0.01	0.09[b]	0.01	0.07[b]	0.02
Discrete Resources	0.07[b]	0.01	0.08[b]	0.01	0.01	0.01
Systemic Resources	0.10[b]	0.02	0.05[b]	0.01	0.05[a]	0.02
Coaching x Systemic	0.01	0.01	0.03[a]	0.01	-0.02	0.02
Observations	7937		21510		29447	
Chi Squared	161.97		194.99		396.32	
Log-likelihood	-5355.70		-14745.04		-20100.74	

* The dependent variable in all cases is home team game-by-game wins or losses. Unstandardized regression coefficients are shown with standard errors in parentheses.
[a] $p < .01$
[b] $p < .001$

TABLE 10

Probit Models Testing the Interaction Effects of Career Games Coached and Systemic Resources on Performance in Complex Organizations (NHL) [a]

	Variable	Model 1	
	Constant	0.15[d]	0.02
Systemic Resources	Turnover	-0.38[b]	0.17
	Tenure < 3 years	0.05	0.17
	Even strength goals for	2.8E-03[c]	9.1E-04
	Even strength goals against	-3.6E-03[d]	7.2E-04
	Power play percentage	0.05	0.64
	Penalty killing percentage	0.48[b]	0.23
	Shorthanded goals for	-3.8E-03	4.7E-03
	Shorthanded goals against	4.7E-03	3.6E-03
Discrete Resources	Payroll	0.23[b]	0.10
	All-stars on team	0.03[b]	0.01
	Games coached with the team	1.9E-05	1.1E-04
	Winning percentage with the team	-0.12[a]	0.06
	Career games coached	3.5E-04	6.6E-04
	Career wins	2.5E-04	7.3E-04
	Career winning percentage	-6.8E-05	2.8E-04
	Coaching awards won	0.06[b]	0.02
	Championships won	3.4E-03	0.02
SHRM Strategies	HP HR strategy	-7.8E-05	7.1E-05
	HC HR strategy	-0.38[a]	0.21
Interaction Variables	Career games coached x power play pct.	5.8E-04	1.2E-03
	Career games coached x penalty killing pct.	-8.7E-04	6.0E-04
	Career games coached x ES goals for	7.1E-07	1.8E-06
	Career games coached x ES goals against	6.9E-07	1.6E-06
	Career games coached x shorthanded goals for	-1.9E-06	9.1E-06
	Career games coached x shorthanded goals against	1.3E-07	1.5E-07
	Career games coached x turnover	2.9E-04	3.7E-04
	Career games coached x tenure < 3 years	-3.5E-04	3.4E-04
Control	Team age	-0.01	0.01
	Observations	7937	
	Chi Squared	331.47	
	Log-likelihood	-5270.95	

[a] The dependent variable in all cases is home team game-by-game wins or losses. Unstandardized regression coefficients are shown, with standard errors to the right.
[a] $p < .1$, [b] $p < .05$, [c] $p < .01$, [d] $p < .001$

TABLE 11

Probit Models Testing the Interaction Effects of Career Coaching Wins and Systemic Resources on Team Performance in Complex Organizations (NHL) [a]

	Variable	Model 1		
	Constant	0.15	d	0.02
Systemic Resources	Turnover	-0.36	b	0.17
	Tenure < 3 years	0.04		0.16
	Even strength goals for	2.9E-03	d	8.7E-04
	Even strength goals against	-3.6E-03	d	6.8E-04
	Power play percentage	0.11		0.61
	Penalty killing percentage	0.46	b	0.22
	Shorthanded goals for	-4.4E-03		4.5E-03
	Shorthanded goals against	4.6E-03		3.6E-03
Discrete Resources	Payroll	0.23	b	0.09
	All-stars on team	0.03	b	0.01
	Games coached with the team	1.1E-05		1.1E-04
	Winning percentage with the team	-0.12	a	0.06
	Career games coached	-1.7E-04		3.4E-04
	Career wins	1.5E-03		1.3E-03
	Career winning percentage	-6.9E-05		2.8E-04
	Coaching awards won	0.06	b	0.02
	Championships won	8.7E-04		0.02
SHRM Strategies	HP HR strategy	-7.7E-05		7.1E-05
	HC HR strategy	-0.38	a	0.21
Interaction Variables	Career wins x power play pct.	9.8E-04		2.3E-03
	Career wins x penalty killing pct.	-1.6E-03		1.2E-03
	Career wins x ES goals for	4.0E-07		3.4E-06
	Career wins x ES goals against	1.1E-06		3.0E-06
	Career wins x shorthanded goals for	-7.5E-07		1.8E-05
	Career wins x shorthanded goals against	2.2E-07		2.8E-07
	Career wins x turnover	4.2E-04		7.3E-04
	Career wins x tenure < 3 years	-7.1E-04		6.4E-04
Controls	Team age	-0.01		0.01
	Observations	7937		
	Chi Squared	331.19		
	Log-likelihood	-5271.09		

[a] The dependent variable in all cases is home team game-by-game wins or losses. Unstandardized regression coefficients are shown, with standard errors to the right.
[a] $p < .1$, [b] $p < .05$, [c] $p < .01$, [d] $p < .001$

TABLE 12
Probit Models Testing the Interaction Effects of Career Winning Percentage and Systemic Resources on Team Performance in Complex (NHL) Organizations [a]

	Variable	Model 1		
	Constant	0.17	d	0.01
Systemic Resources	Turnover	-0.46	a	0.25
	Tenure < 3 years	0.08		0.32
	Even strength goals for	3.5E-03	b	1.62E-03
	Even strength goals against	-4.0E-03	d	1.09E-03
	Power play percentage	-0.21		1.33
	Penalty killing percentage	0.59	a	0.33
	Shorthanded goals for	-0.02	b	0.01
	Shorthanded goals against	4.6E-03		3.63E-03
Discrete Resources	Payroll	0.28	c	0.09
	All-stars on team	0.03	b	0.01
	Games managed with the team	5.1E-05		1.04E-04
	Winning percentage with the team	-0.15	b	0.07
	Games coached in career	-1.6E-04		3.30E-04
	Games won in career	1.8E-04		6.98E-04
	Career winning percentage	0.33		0.69
	Coaching awards won	0.05	b	0.02
	Championships won	0.01		0.02
SHRM Strategies	HP HR strategy	-1.1E-04		7.03E-05
	HC HR strategy	-0.46	b	0.21
Interaction Variables	Career winning pct. x power play pct.	0.86		2.57
	Career winning pct. x penalty killing pct.	-0.86		0.67
	Career winning pct. x ES goals for	-9.5E-04		3.12E-03
	Career winning pct. x ES goals against	1.6E-03		2.12E-03
	Career winning pct. x shorthanded goals for	0.03	a	0.02
	Career winning pct. x shorthanded goals against	-2.0E-06		1.47E-06
	Career winning pct. x turnover	0.35		0.45
	Career winning pct. x tenure < 3 years	-0.31		0.60
Controls	Team age	-0.01		0.01
	Observations	7937		
	Chi Squared	336.74		
	Log-likelihood	-5268.32		

[a] The dependent variable in all cases is home team game-by-game wins or losses. Unstandardized regression coefficients are shown, with standard errors to the right.
[a] $p < .1$, [b] $p < .05$, [c] $p < .01$, [d] $p < .001$

TABLE 13
Probit Models Testing the Interaction Effects of Consecutive Games Managed with a Team and Systemic Resources on Team Performance in Complex NHL Organizations [a]

	Variable	Model 1		
	Constant	0.16	d	0.01
Systemic Resources	Turnover	-0.41	b	0.16
	Tenure < 3 years	0.04		0.18
	Even strength goals for	3.5E-03	d	8.6E-04
	Even strength goals against	-3.6E-03	d	7.6E-04
	Power play percentage	-0.31		0.64
	Penalty killing percentage	0.24		0.25
	Shorthanded goals for	-0.01		4.6E-03
	Shorthanded goals against	0.01	a	0.01
Discrete Resources	Payroll	0.22	b	0.09
	All-stars on team	0.03	b	0.01
	Games managed with the team	-1.6E-04		1.6E-03
	Winning percentage with the team	-0.10		0.06
	Games coached in career	2.5E-05		3.5E-04
	Games won in career	-1.8E-04		7.3E-04
	Career winning percentage	-2.4E-05		2.8E-04
	Coaching awards won	0.06	b	0.02
	Championships won	0.01		0.02
SHRM Strategies	HP HR strategy	-7.8E-05		7.0E-05
	HC HR strategy	-0.36	a	0.21
Interaction Variables	Games managed with team x power play pct.	0.01		3.2E-03
	Games managed with team x penalty killing pct.	4.9E-04		1.6E-03
	Games managed with team x ES goals for	-4.6E-06		4.6E-06
	Games managed with team x ES goals against	1.1E-06		4.8E-06
	Games managed with team x shorthanded goals for	8.7E-06		2.5E-05
	Games managed with team x shorthanded goals against	-4.0E-05		3.2E-05
	Games managed with team x turnover	1.0E-03		9.7E-04
	Games managed with team x tenure < 3 years	-9.3E-04		1.0E-03
Controls	Team age	-0.01		0.01
	Observations	7937		
	Chi Squared	333.34		
	Log-likelihood	-5270.02		

[a] The dependent variable in all cases is home team game-by-game wins or losses. Unstandardized regression coefficients are shown, with standard errors to the right.
[a] p < .1,[b] p < .05,[c], p < .01,[d] p < .001

TABLE 14
Probit Models Testing the Interaction Effects of Winning Percentage with a Team and Systemic Resources on Team Performance in Complex (NHL) Organizations [a]

	Variable	Model 1		
	Constant	0.16	d	0.01
Systemic Resources	Turnover	-0.20		0.22
	Tenure < 3 years	-0.20		0.27
	Even strength goals for	0.01	d	1.3E-03
	Even strength goals against	-2.7E-03	c	1.0E-03
	Power play percentage	-1.62	a	0.94
	Penalty killing percentage	0.15		0.29
	Shorthanded goals for	-0.01	a	0.01
	Shorthanded goals against	3.4E-03		0.01
Discrete Resources	Payroll	0.22	b	0.09
	All-stars on team	0.03	b	0.01
	Games managed with the team	-1.1E-05		1.0E-04
	Winning percentage with the team	-0.16		0.82
	Games coached in career	-1.9E-04		3.4E-04
	Games won in career	3.1E-04		7.2E-04
	Career winning percentage	1.3E-05		2.8E-04
	Coaching awards won	0.06	b	0.02
	Championships won	-4.2E-04		0.02
SHRM Strategies	HP HR strategy	-1.1E-04		7.1E-05
	HC HR strategy	-0.38	a	0.21
Interaction Variables	Win percentage with the team x power play pct.	4.35	b	1.87
	Win percentage with the team x penalty killing pct.	0.44		0.82
	Win percentage with the team x ES goals for	-0.01	b	2.7E-03
	Win percentage with the team x ES goals against	-1.4E-03		2.3E-03
	Win percentage with the team x shorthanded goals for	0.02		0.01
	Win percentage with the team x shorthanded goals against	4.7E-03		0.02
	Win percentage with the team x turnover	-0.19		0.51
	Win percentage with the team x tenure < 3 years	0.20		0.57
Controls	Team age	-0.01		0.01
	Observations	7937		
	Chi Squared	336.33		
	Log-likelihood	-5268.53		

[a] The dependent variable in all cases is home team game-by-game wins or losses. Unstandardized regression coefficients are shown, with standard errors to the right.
[a] $p < .1$, [b] $p < .05$, [c] $p < .01$, [d] $p < .001$

TABLE 15
Probit Models Testing the Interaction Effects of Career Games Managed and Systemic Resources on Team Performance in Simple (MLB) Organizations [a]

	Variable	Model 1		
	Constant	0.09	d	0.01
Systemic Resources	Turnover	-0.26	b	0.12
	Tenure <3 years	-0.06		0.13
	Put Outs	-1.4E-04		3.3E-04
	Double plays	1.6E-04		3.9E-04
	Assists	-1.6E-04		1.2E-04
	Passed balls	-0.01	c	2.2E-03
	Defensive rating	4.36		3.52
	Defensive efficiency	-6.51	a	3.58
	Sacrifice flies	-8.5E-04		1.3E-03
	Runs batted in	-2.7E-04		2.9E-04
	Earned runs	0.04		0.05
Discrete Resources	Payroll	8.9E-10		7.2E-10
	Games coached in career	2.5E-04		2.8E-04
	Games won in career	3.6E-04		2.4E-04
	Career winning percentage	-0.13	b	0.06
	Consecutive games coach has been with the team	-1.6E-05		2.1E-05
	Coach winning percentage with the team	0.01		0.04
	Coaching awards won	0.01		0.01
	Championships won	-0.03	b	0.01
	All-stars on team	3.8E-03		0.01
SHRM Strategies	HP HR strategy	-4.8E-05		3.3E-05
	HC HR strategy	0.36	b	0.15
Interaction Variables	Career games x sacrifice flies	2.7E-06	b	1.1E-06
	Career games x earned run average	-1.4E-05		1.6E-05
	Career games x runs batted in	1.6E-07		1.1E-07
	Career games x putouts	-1.1E-07		7.0E-08
	Career games x assists	1.1E-07		9.5E-08
	Career games x double plays	4.1E-10		1.7E-07
	Career games x passed balls	3.6E-06	a	1.9E-06
	Career games x defensive rating	-3.9E-03		3.1E-03
	Career games x defensive efficiency	3.6E-03		3.2E-03
	Career games x tenure < 3 years	-5.6E-05		1.0E-04
	Career games x turnover	-5.0E-05		9.2E-05

Control Variables	Team at bats	9.2E-04	c	2.8E-04
	Hits for	-5.3E-04	a	2.9E-04
	Home runs for	5.4E-04		4.0E-04
	Walks for	7.8E-04	d	1.5E-04
	Stolen bases for	1.7E-04		2.4E-04
	Times hit by pitch	2.0E-04		5.2E-04
	Complete games for	-4.3E-03	b	1.9E-03
	Shutouts for	7.1E-04		2.7E-03
	Saves for	3.5E-04		1.3E-03
	Hits against	-8.4E-04	d	2.4E-04
	Home runs against	1.9E-04		4.8E-04
	Walks against	-3.4E-04	a	1.8E-04
	Pitcher park factor	-0.01		0.01
	Batter park factor	0.01		0.01
	Weighted batter age	-0.04	d	0.01
	Weighted pitcher age	0.01		0.01
	Observations	21510		
	Chi-Squared	502.82		
	Log-likelihood	-14601.86		

[a] The dependent variable in all cases is home team game-by-game wins or losses. Unstandardized regression coefficients are shown, with standard errors to the right.

[a] $p < .1$

[b] $p < .05$

[c] $p < .01$

[d] $p < .001$

TABLE 16
Probit Models Testing the Interaction Effects of Career Wins and Systemic Resources on Team Performance in Simple (MLB) Organizations [a]

	Variable	Model 1		
	Constant	0.09	d	0.02
Systemic Resources	Turnover	-0.31	d	0.09
	Tenure <3 years	-0.03		0.12
	Put Outs	-1.3E-04		3.3E-04
	Double plays	1.4E-04		3.9E-04
	Assists	-1.6E-04		1.2E-04
	Passed balls	-0.01	c	2.1E-03
	Defensive rating	4.33		3.5
	Defensive efficiency	-6.53	a	3.5
	Sacrifice flies	-9.4E-04		1.2E-03
	Runs batted in	-2.5E-04		2.8E-04
	Earned runs	0.05		0.05
Discrete Resources	Payroll	9.0E-10		7.2E-10
	Games coached in career	-1.1E-04		1.2E-04
	Games won in career	9.9E-04	a	5.5E-04
	Career winning percentage	-0.12	b	0.06
	Consecutive games coach has been with the team	-1.7E-05		2.1E-05
	Coach winning percentage with the team	0.01		0.04
	Coaching awards won	0.01		0.01
	Championships won	-0.03	a	0.01
	All-stars on team	3.0E-03		0.01
SHRM Strategies	HP HR strategy	-4.9E-05		3.3E-05
	HC HR strategy	0.36	b	0.15
Interaction Variables	Career wins x sacrifice flies	5.4E-06	c	2.1E-06
	Career wins x earned run average	-3.1E-05		3.0E-05
	Career wins x runs batted in	3.0E-07		2.1E-07
	Career wins x putouts	-2.3E-07	a	1.3E-07
	Career wins x assists	2.4E-07		1.8E-07
	Career wins x double plays	4.1E-08		3.0E-07
	Career wins x passed balls	6.8E-06	a	3.8E-06
	Career wins x defensive rating	-0.01		0.01
	Career wins x defensive efficiency	0.01		0.01
	Career wins x tenure < 3 years	1.2E-05		7.2E-05
	Career wins x turnover	-1.7E-04		1.8E-04

Control Variables	Team at bats	9.1E-04	d	2.8E-04
	Hits for	-5.3E-04	a	2.8E-04
	Home runs for	5.2E-04		3.9E-04
	Walks for	7.7E-04	d	1.5E-04
	Stolen bases for	1.8E-04		2.4E-04
	Times hit by pitch	2.2E-04		5.2E-04
	Complete games for	-4.1E-03	b	1.9E-03
	Shutouts for	7.1E-04		2.7E-03
	Saves for	5.0E-04		1.3E-03
	Hits against	-8.5E-04	d	2.4E-04
	Home runs against	1.8E-04		4.8E-04
	Walks against	-3.5E-04	a	1.8E-04
	Pitcher park factor	-0.01		0.01
	Batter park factor	0.01		0.01
	Weighted batter age	-0.04	d	0.01
	Weighted pitcher age	4.8E-03		0.01
	Observations	21510		
	Chi-Squared	502.69		
	Log-likelihood	-14601.92		

[a] The dependent variable in all cases is home team game-by-game wins or losses. Unstandardized regression coefficients are shown, with standard errors in to the right.

[a] $p < .1$

[b] $p < .05$

[c] $p < .01$

[d] $p < .001$

TABLE 17

Probit Models Testing the Interaction Effects of Career Winning Percentage and Systemic Resources on Team Performance in Simple (MLB) Organizations [a]

	Variable	Model 1		
	Constant	0.07	c	0.03
Systemic Resources	Turnover	-0.31	d	0.09
	Tenure <3 years	0.08		0.27
	Put Outs	3.5E-04		3.7E-04
	Double plays	1.8E-03	c	6.3E-04
	Assists	-1.3E-03	d	3.0E-04
	Passed balls	-0.01	b	0.01
	Defensive rating	19.90		12.41
	Defensive efficiency	-21.91	a	12.39
	Sacrifice flies	-0.01	b	0.00
	Runs batted in	-4.9E-05		3.9E-04
	Earned runs	-0.06		0.07
Discrete Resources	Payroll	5.6E-10		7.1E-10
	Games coached in career	-2.6E-05		1.1E-04
	Games won in career	1.6E-04		2.2E-04
	Career winning percentage	0.52		0.61
	Consecutive games coach has been with the team	-1.9E-05		2.0E-05
	Coach winning percentage with the team	0.04		0.04
	Coaching awards won	0.01		0.01
	Championships won	-0.02	a	0.01
	All-stars on team	0.01		0.01
SHRM Strategies	HP HR strategy	-4.2E-05		3.4E-05
	HC HR strategy	0.45	c	0.15
Interaction Variables	Career winning pct. x sacrifice flies	0.02	c	0.01
	Career winning pct. x earned run average	0.21	a	0.12
	Career winning pct. x runs batted in	-2.1E-04		6.7E-04
	Career winning pct. x putouts	-1.3E-03	c	4.4E-04
	Career winning pct. x assists	2.7E-03	d	6.1E-04
	Career winning pct. x double plays	-3.8E-03	d	1.1E-03
	Career winning pct. x passed balls	0.02	a	0.01
	Career winning pct. x defensive rating	-35.51		24.44
	Career winning pct. x defensive efficiency	35.71		24.30
	Career winning pct. x tenure < 3 years	-0.12		0.17
	Career winning pct. x turnover	-0.43		0.58

Control Variables	Team at bats	8.9E-04	c	2.8E-04
	Hits for	-5.6E-04	b	2.8E-04
	Home runs for	6.6E-04	a	3.9E-04
	Walks for	6.7E-04	d	1.6E-04
	Stolen bases for	1.5E-04		2.4E-04
	Times hit by pitch	1.0E-04		5.0E-04
	Complete games for	-3.9E-03	b	1.9E-03
	Shutouts for	1.2E-03		2.7E-03
	Saves for	1.2E-04		1.3E-03
	Hits against	-7.8E-04	c	2.5E-04
	Home runs against	-2.9E-05		4.9E-04
	Walks against	-3.4E-04	a	1.8E-04
	Pitcher park factor	-2.5E-03		0.01
	Batter park factor	1.6E-03		0.01
	Weighted batter age	-0.04	d	0.01
	Weighted pitcher age	-7.6E-04		0.01
	Observations	21510		
	Chi-Squared	507.48		
	Log-likelihood	-14599.53		

[a] The dependent variable in all cases is home team game-by-game wins or losses. Unstandardized regression coefficients are shown, with standard errors to the right.

[a] $p < .1$

[b] $p < .05$

[c] $p < .01$

[d] $p < .001$

TABLE 18
Probit Models Testing the Interaction Effects of Consecutive Games Coached with a team and Systemic Resources on Team Performance in Simple (MLB) Organizations [a]

	Variable	Model 1		
	Constant	0.09	d	0.01
Systemic Resources	Turnover	-0.28	c	0.11
	Tenure <3 years	-0.08		0.12
	Put Outs	-2.9E-04		3.2E-04
	Double plays	1.5E-05		3.9E-04
	Assists	-1.5E-04		1.1E-04
	Passed balls	-1.0E-03		1.9E-03
	Defensive rating	1.37		3.46
	Defensive efficiency	-3.36		3.48
	Sacrifice flies	1.7E-03		1.2E-03
	Runs batted in	-1.2E-04		2.8E-04
	Earned runs	0.05		0.05
Discrete Resources	Payroll	8.7E-10		7.0E-10
	Games coached in career	1.8E-05		1.2E-04
	Games won in career	5.0E-05		2.4E-04
	Career winning percentage	-0.12	b	0.06
	Consecutive games coach has been with the team	1.9E-04		3.8E-04
	Coach winning percentage with the team	0.01		0.04
	Coaching awards won	0.01		0.01
	Championships won	-0.01		0.01
	All-stars on team	0.01		0.01
SHRM Strategies	HP HR strategy	-6.9E-05	b	0.00
	HC HR strategy	0.35	b	0.15
Interaction Variables	Consecutive games coach with team x sacrifice flies	-3.2E-07		2.2E-06
	Consecutive games coach with team x earned run average	-2.9E-05		2.7E-05
	Consecutive games coach with team x runs batted in	1.1E-07		2.2E-07
	Consecutive games coach with team x putouts	-8.0E-08		1.1E-07
	Consecutive games coach with team x assists	2.7E-07		1.9E-07
	Consecutive games coach with team x double plays	1.1E-07		3.1E-07
	Consecutive games coach with team x passed balls	-5.0E-06		3.7E-06
	Consecutive games coach with team x defensive rating	-8.6E-04		0.01
	Consecutive games coach with team x defensive efficiency	8.7E-04		0.01
	Consecutive games coach with team x tenure < 3 years	-1.7E-04		1.8E-04

	Consecutive games coach with team x turnover	-1.5E-04		2.1E-04
Control Variables	Team at bats	1.0E-03	d	2.7E-04
	Hits for	-7.0E-04	b	2.8E-04
	Home runs for	4.8E-04		3.9E-04
	Walks for	7.6E-04	d	1.5E-04
	Stolen bases for	1.8E-05		2.3E-04
	Times hit by pitch	1.5E-04		5.1E-04
	Complete games for	-3.9E-03	b	1.9E-03
	Shutouts for	1.7E-03		2.8E-03
	Saves for	9.6E-04		1.3E-03
	Hits against	-8.0E-04	c	2.5E-04
	Home runs against	3.8E-04		5.0E-04
	Walks against	-3.6E-04	b	1.8E-04
	Pitcher park factor	-0.01		0.01
	Batter park factor	0.01		0.01
	Weighted batter age	-0.04	d	0.01
	Weighted pitcher age	-9.0E-04		0.01
	Observations	21510		
	Chi-Squared	485.93		
	Log-likelihood	-14610.30		

[a] The dependent variable in all cases is home team game-by-game wins or losses. Unstandardized regression coefficients are shown, with standard errors to the right.

[a] $p < .1$

[b] $p < .05$

[c] $p < .01$

[d] $p < .001$

TABLE 19
Probit Models Testing the Interaction Effects of Coach Winning Percentage with a team and Systemic Resources on Team Performance in Simple (MLB) Organizations [a]

	Variable	Model 1		
	Constant	0.09	d	0.01
Systemic Resources	Turnover	-0.14		0.17
	Tenure <3 years	0.09		0.19
	Put Outs	2.3E-05		3.2E-04
	Double plays	2.9E-04		4.4E-04
	Assists	-3.4E-04	b	1.6E-04
	Passed balls	-3.1E-03		2.9E-03
	Defensive rating	-4.38		5.73
	Defensive efficiency	2.46		5.70
	Sacrifice flies	9.9E-04		1.6E-03
	Runs batted in	-4.4E-05		3.4E-04
	Earned runs	-3.1E-03		0.05
Discrete Resources	Payroll	1.0E-09		7.2E-10
	Games coached in career	-5.1E-05		1.1E-04
	Games won in career	1.9E-04		2.2E-04
	Career winning percentage	-0.13	b	0.06
	Consecutive games coach has been with the team	-1.9E-05		2.1E-05
	Coach winning percentage with the team	-0.07		0.22
	Coaching awards won	0.01		0.01
	Championships won	-0.02		0.01
	All-stars on team	0.01	a	0.01
SHRM Strategies	HP HR strategy	-6.1E-05	a	3.4E-05
	HC HR strategy	0.28	a	0.15
Interaction Variables	Winning pct. with team x sacrifice flies	1.5E-03		3.6E-03
	Winning pct. with team x earned run average	0.10		0.06
	Winning pct. with team x runs batted in	-1.3E-04		4.9E-04
	Winning pct. with team x putouts	-2.8E-04		2.4E-04
	Winning pct. with team x assists	8.7E-04	b	3.5E-04
	Winning pct. with team x double plays	-7.3E-04		6.3E-04
	Winning pct. with team x passed balls	9.2E-06		0.01
	Winning pct. with team x defensive rating	12		12
	Winning pct. with team x defensive efficiency	-12		12
	Winning pct. with team x tenure < 3 years	-0.57		0.38
	Winning pct. with team x turnover	-0.57		0.41

Control Variables	Team at bats	8.2E-04	c	2.7E-04
	Hits for	-5.2E-04	a	2.8E-04
	Home runs for	5.1E-04		3.9E-04
	Walks for	6.9E-04	d	1.5E-04
	Stolen bases for	-4.5E-05		2.4E-04
	Times hit by pitch	-5.1E-05		5.0E-04
	Complete games for	-4.2E-03	b	1.9E-03
	Shutouts for	1.9E-03		2.7E-03
	Saves for	6.1E-04		1.3E-03
	Hits against	-7.5E-04	c	2.5E-04
	Home runs against	2.0E-04		5.0E-04
	Walks against	-3.1E-04	a	1.8E-04
	Pitcher park factor	-4.6E-03		0.01
	Batter park factor	4.3E-03		0.01
	Weighted batter age	-0.04	d	0.01
	Weighted pitcher age	3.6E-03		0.01
	Observations	21510		
	Chi-Squared	489.32		
	Log-likelihood	-14608.61		

a The dependent variable in all cases is home team game-by-game wins or losses. Unstandardized regression coefficients are shown, with standard errors to the right.

[a] $p < .1$

[b] $p < .05$

[c] $p < .01$

[d] $p < .001$

APPENDIX A

Resource Types

Broadly conceived, resources are "anything that could be thought of as a strength or weakness of a given firm" (Wernerfelt, 1984, p. 172). This definition, although accurate, is not particularly insightful for managers who are attempting to identify the firm's productive assets. As such, more specific definitions have been proposed. One that captures the breadth and importance of resources to superior firm performance defines resources as "tangible and intangible assets firms use to conceive of and implement their strategies" (Barney & Arikan, 2001, p. 138).

Resources are often classified on the basis of physical characteristics. Resources are classified by whether their asset traits are visible or invisible. Tangible resources are the most identifiable assets because they are readily identified and quantified. Tangible assets are the long-term, fixed and current assets of an organization(Fahy, 2000). Researchers have further classified tangible assets on the basis of physical attributes. Barney (1991) argues that physical resources (e.g., plant and equipment) are the assets that best fit in this category. Grant (1991) expands upon this list by adding technological and financial resources as other types of tangible assets that firms own and use. In contrast to tangible resources are intangible resources. Intangible (Michalisin, Smith, & Kline, 1997) or invisible (Itami & Roehl, 1987) resources are those assets that are hard to define, quantify and imitate. Some assets that fall into this category are human (e.g., training, expertise, judgment), organizational (e.g., reporting structures, formal and informal planning) (Barney, 1991), reputation (Grant, 1991), and culture (Michalisin et al., 1997).

Because tangible resources are easily identified, whether these resources can be a source of a competitive advantage is not clear. Black and Boal (1994) argue that contained resources, which are similar to tangible resources in that they are a simple network of resource factors that can be monetarily valued, are unlikely to lead to a competitive advantage. In contrast, Amit and Schoemaker (1993) argue that an asset merely has to be traded and scarce for it, tangible or not, to create a competitive advantage. Miller and Shamsie (1996) also argue that inimitablility, and not the physical characteristics of the asset, is the main factor in determining if a resource can produce a competitive advantage. In contrast to tangible resources, intangible resources are likely to help firms earn a competitive advantage. The ephemeral quality (Michalisin et al., 1997) of these assets makes them difficult to identify and imitate. This makes intangible resources a more likely source of a firm's competitive advantage.

Classifying resources by physical traits offers a broad picture of different resource types. Nevertheless, the tangible/intangible resource distinction is, too broad to be of great help. In fact such a broad classification of resources can obfuscate rather than clarify. For example, Hall (1992; 1993) and Miller and Shamsie (1996) both discuss the importance of patents. Although they agree that patents are productive resources, they disagree as to their status as a tangible or an intangible resource. This is not an insurmountable difficulty. What this example demonstrates, however, is that classifying resources on the basis of a resource's physical traits lacks precision.

There have been other attempts to further define the different types of resources that exist in organizations. Another way to classify firm assets is by utility. The resources of a firm are important because they create the building blocks of a firm's capabilities. Nevertheless, it is a firm's capabilities that produce a competitive advantage (Grant, 1991). Capabilities are the firm's ability to coordinate complex activities between individuals and the resources they use (Grant, 1991; Nelson, 1991; Nelson & Winter, 1982). Because firm routines are inimitable they lead to superior firm performance. Combinative capabilities are capabilities that, when combined with other, different capabilities, form new capabilities (Kogut & Zander, 1992). Dynamic capabilities are flexible and adaptive. The flexibility of these capabilities allows firms to accomplish their goals in highly uncertain and changing environments (Eisenhardt & Martin, 2000; Teece, Pisano, & Shuen, 1997).

A third stream of literature classifies assets as different types of skills. Firm competences (Lado, Boyd, & Wright, 1992; Prahalad & Hamel, 1990) are the skills that allow for "the coordinated deployment of assets in ways that help a firm achieve its goals" (Sanchez, 2004, p. 521). Sanchez further argues that competences must address the need to respond to dynamic environments, include the ability to manage the systemic nature of organizations, include an ability to manage the cognitive processes of an organization and include the ability to manage the holistic nature of the organization as an open system.

A fourth way of classifying assets is on the basis of their accumulation. Dierickx and Cool (1989) argue that resources are best discussed as either strategic asset stocks or strategic asset flows. Assets stocks are built through the accumulation of asset flows. Asset stocks are more stable and more difficult to imitate but they cannot be easily adjusted in the face of unexpected occurrences. Asset stocks are the resources that are built or accumulated by a firm. Like discrete resources, assets stocks are most useful to a firm when they are inimitable. Dierickx and Cool argue that asset stocks are inimitable when it is time consuming to accumulate these resources, when large amounts of the stocks are needed, when these stocks are interconnected, when the stocks decay slowly and when there is causal ambiguity associated with the accumulation of these stocks. Asset flows are less stable but they can be changed instantaneously.

Other research classifies resources depending on the way that they combine with other resources to create a competitive advantage. Black and Boal (1994) argue that resources are the bundling of different asset stocks and asset flows because firms are a bundle of resources (Wernerfelt, 1984). It is the relationship between the different stocks and flows that create either contained resources or system resources.

APPENDIX B

Types of Interdependence

Pooled interdependence

In simplest organizations work moves between work units using pooled task interdependence. Pooled interdependence describes a non-contingent relationship between the different work units of an organization. Each work unit is a separate entity that operates with little or no regard for the other units of the organization. Each work unit is self-sufficient and does not rely on other work units for any component of work. Structurally, work does not flow between different work units. The only relationship the different units have with each other is as a group of independent units working to achieve a common organizational goal. This relationship is visually represented in Figure 2.

The non-contingent relationship between pooled interdependent work units does not necessitate any coordination between the work units. Sophisticated methods of coordinating organizational operations are unnecessary in organizations that are not highly interconnected because their actions are, for the most part, repetitive and stable. Each work unit operates independently. The work of one unit is not dependent on the work of another. There is little or no need to coordinate the efforts of the different units. Consequently, coordinating organizational operations in simple organizations is relatively uncomplicated.

Simple organizations, however, do require some coordinating mechanism to control their work units. The non-contingent nature of the work in these organizations means that work can be controlled using routines. These routines are the standardized rules and procedures that are applicable throughout an organization. Standardization also implies that the rules and procedures of the organization can be applied equally and consistently across the work units because the work is similar and, often, repetitive. It is for this reason that simple organizations use standardized rules and procedures as coordinating mechanisms to control their work units.

Using standardized rules and procedures as coordination mechanisms creates different requirements for communication in simple organizations. In pooled interdependent organizations, communication between work units is not a priority. The non-contingent nature of the organization's activities means that a work unit can complete its tasks without knowing about the activities of another work unit. As a result, there is little need for communication between the units.

Where the units are physically located is also not of major importance for simple organizations. The proximity of work units is not of primary concern because work units are independent and there is little need to communicate with each other to coordinate activities. To function effectively, work units in these organizations do not have to be physically close to each other. Thus, theoretically, work units can be quite geographically dispersed without impacting the efficiency and effectiveness of the organization's operations.

Pooled interdependence is also the least expensive form of interdependence to coordinate. The independence of each work unit and the ability to use standardized rules and procedures allows organizations to spend relatively small amounts of money on coordination. Coordination is inexpensive because work does not flow between the work units and routines are used to monitor and control organizational action.

A geographically organized company with regional offices is a good example of an organization that uses pooled interdependence. To achieve the organization's goals, each regional office operates independently in their geographic area. There is little need to coordinate with the head office because the activities of the different offices are not highly interconnected. Extensive communication and control methods are also not needed because the actions and decisions of the each regional office can be easily coordinated. Simple methods such as standardized rules and procedures are employed to ensure that each office operates in an efficient and effective manner. As a result, pooled interdependence is an inexpensive way to maintain and coordinate the actions of the different offices without compromising efficiency or effectiveness.

Sequential interdependence

As the simplest organizations become moderately more complex, work moves to different organizational work units through sequential task interdependence. Sequential interdependence describes the potentially contingent relationship between the different work units of an organization. This potentially contingent relationship is characteristic of simple organizations that require more coordination to efficiently and effectively run their operations. Within this relationship some work units, depending on their place within the relationship, are reliant upon other work units for their inputs. The output of one work unit becomes the input of another work unit. The order and direction of the workflow to other units is constant and predetermined. In other words, the workflow between units is both sequential and unidirectional. This relationship is visually represented in Figure 3.

Sequentially interdependent organizations require more coordination than pooled interdependent organizations. There is a specified order in the way in which the work must flow. The partially contingent nature of the work means that the actions of one unit in the sequence of the workflow will affect the entire relationship. Thus, if difficulties or problems arise with any of the work units in the relationship, then the entire sequence must be revisited and altered. Revisiting organizational actions is not a difficult task. The manner in which each work unit is supposed to relate to the others can be easily identified. Therefore, difficulties with the relationship can be easily adjusted.

The partially contingent relationship shared between sequentially interdependent work units necessitates the use of specific coordinating mechanisms. Instead of using standardized rules and procedures, the most effective mechanism that can be used to coordinate sequential interdependence is a plan. More precisely, schedules are plans that outline when tasks are to be accomplished. These schedules are used to promote organizational efficiency and effectiveness. Schedules provide organizations and their work units with greater flexibility than standardized rules and procedures.

Communication between sequentially interdependent work units also differs when compared to non-contingent workflow relationships. The partially contingent relationship between sequentially interdependent work units requires that the work units communicate with each other more frequently. Moreover, the nature of the workflow requires that schedules are set and that there is agreement about these schedules among the work units. Although the communication requirements are not extensive, they are more substantial than what is required in a pooled interdependent organization.

Another distinguishing feature of sequential interdependence is that work units have to be in close physical proximity to each other. As organizations become increasingly interconnected their operations become increasingly heterogeneous. As such, organizational activities become harder to coordinate. Limiting the distance between work units helps mitigate the difficulties associated with coordination. This does not mean that sequentially interdependent work units are necessarily physically adjacent to each other. It does mean, however, that the coordination of sequentially interdependent work units can be facilitated if the organization's work units are located in close proximity to each other.

Furthermore, organizational costs increase as organizations become less homogeneous. Sequentially interdependent work units are somewhat similar but there are, by definition, differences between the work units. Rules and procedures do not apply across all the different work units. The result is that each work unit has to interact with the other units to which it is connected. This increases the costs associated with operating a more complex organization.

An assembly line is the most salient example of sequential interdependence. The relationship between the units on an assembly line is partially contingent. The output of one line worker becomes the input of the next. The work moves in only one direction. Any deviation creates problems. Schedules are used to coordinate the activities of each member of the line. This makes the need for communication amongst line workers more important. As such, the line workers are physically located closer to each other to facilitate communication. This emphasis on coordination causes organizational costs rise to meet the demands associated with maintaining organizational efficiency and effectiveness.

Reciprocal & team interdependence

Reciprocal and team interdependence are two types of task interdependence that are characteristic of complex organizations. Reciprocal and team interdependence describe fully contingent relationships between the different work units in a complex organization. Reciprocal and team interdependence differ only in the time it takes for work to flow between the different work units. If the outputs of one work unit simultaneously become the input of another, this is an example of team interdependence. If, on the other hand, there is a lag in the flow of work between work units, this is an example of reciprocal interdependence. Despite this minor difference, there are a great number of similarities between both types of interdependence. As such they will be discussed together.

In complex organizations work operations are highly interconnected and require a great deal of coordination. Moreover, the work units are totally dependent on each other. The output from one work unit becomes the input for another and vice versa. This relationship is different from sequential interdependence in that the relationship between the work units is not predetermined or unidirectional. The work flow is unpredictable and it can move in any direction between the organizational work units.

The unpredictable, multidirectional flow of work necessitates greater coordination of the work units. The workflow is arranged so that the work of each unit is contingent on the work of the other units. As a result, problems can occur. The potential for failure creates a sense of uncertainty around the work relationships within the organization. Uncertainty is generated because the failure of a single work unit to produce suitable outputs can cause the entire workflow to be damaged. If one relationship fails, then all the relationships within the work unit must be examined. This is a difficult task because the sources of work unit difficulties are not necessarily easily identifiable. Identifying the cause of organizational problems involves an examination of every work unit to determine where a flaw exists. This can be a costly proposition.

Specific coordinating mechanisms are used to prevent problems from occurring in complex organizations. Instead of standardized rules or schedules, reciprocally interdependent organizations use mutual adjustment to coordinate work unit activities. Mutual adjustment is a process where work units exchange information during the completion of the task at hand. This provides the work units with flexibility. This flexibility makes a reciprocally interdependent relationship particularly well suited to adapt to organizational and environmental changes.

In situations of team interdependence work is coordinated through the use of groups. Group coordination takes the form of scheduled and unscheduled meetings. Like mutual adjustment, group coordination provides work units with a substantial amount of flexibility in order to deal with the uncertainty that comes with a fully contingent work situation.

Communication is of the utmost importance to most effectively use both mutual adjustment and group coordination as coordinating mechanisms. The work units involved in these interdependent relationship are, by necessity, required to communicate with every other work unit. For mutual adjustment and group coordination to be effective, the decisions that are being made have to be communicated to all the work units. Communication needs to be frequent and, often, face-to-face.

Organizational work units have to be in close proximity to each other for mutual adjustment and group coordination to be effective. To clearly and effectively communicate organizational decisions to the work units, the work units need to be close to, if not tangential to, each other. Work units are located near each other not only to facilitate communication but also to reduce costs. As complex organizations grow and increasing numbers of work units are added to the organization, it is more difficult and more expensive to coordinate (Thompson, 1967). Of note, however, is that proximity does not necessarily need to be physical. Virtual proximity, through the use of videoconferencing and other means, can suffice. What should be noted is that there is a closeness of communication that can be improved by physical proximity.

To keep connected and efficient, complex organizations locate their work units near each other. But, to make effective decisions, reciprocal and team interdependent work units have to be able to make independent choices. The autonomy of these units helps facilitate their coordination. Without this independence, group decisions can be questioned and overridden. This can negate the effectiveness of mutual adjustment and group coordination.

In sum, reciprocal and team interdependence are difficult to coordinate. The most efficient coordination methods are mutual adjustment and group coordination. There is a premium on communication when using these coordination methods. As a result, work units are grouped together, often tangentially, to reduce the possibility of misunderstandings. Employing either mutual adjustment or group coordination is more costly than other approaches. Nevertheless, the increased flexibility gained by organizations using either one of these coordination methods often offsets the organization's increased expenses.

Coordination

It has long been argued that organizational interdependence affects organizational coordination. Thompson (1967) and others (e.g., McCann & Galbraith, 1981) argue that as organizations become increasingly complex there is an increased need to coordinate the actions and behaviours of each different work unit. Thompson's early forays in this area produced broad categories to classify each coordinating mechanism. Empirical research has examined the factors that contribute to an organization's choice of coordinating mechanism.

The type of organizational interdependence is a significant factor in determining which coordination mechanisms is most efficient and effective. Van de Ven et al. (1976) found that as workflow interdependence increases from simple to complex so does the reliance on different modes of coordination. Complex organizations most often use scheduled meetings, a team mode of coordination. They also found that the use of all coordination mechanisms, except rules and plans, increases as organizations became more complex. The increased use of different coordination mechanism is additive. This finding supports Thompson's assertion that task interdependence is additive. As well, Van de Ven et al. (1976) found that the average use of most coordination mechanisms increases as interdependence shifts from pooled to reciprocal. This finding held in all instances except for the use of rules and procedures.

Although evidence suggests that interdependence impacts the coordinating mechanisms used by organizations, other research contradicts these findings. Mohr (1971) found that there was little correlation between interdependence and the participativeness of supervision. Similarly, Victor (1990) determined that interdependence alone is not a significant managerial factor when deciding on the use of a particular coordinating mechanism.

Despite some contradictory evidence, other research confirms that there is a connection between interdependence and coordination mechanisms. Gittell (2001) argues that relational coordination affects organizational performance. Her results demonstrate that relational coordination, which is similar to mutual adjustment, is most appropriate for organizations that are highly interdependent. Moreover, she found that coordination mechanisms that are aligned with the organization's structure improve organizational performance.

Another contributing factor to an organization's use of a particular coordinating mechanism is tied to the amount and type of uncertainty within an organization (Adler, 1995; March & Simon, 1958). Gittell (2002) identifies three types of uncertainty that are commonly discussed in the organizational literature: environmental, task, and input.

Van de Ven et al. (1976) found that rules and procedures are consistently used by organizations displaying characteristics of all forms of interdependence. Nonetheless, routines are used mainly in situations of low task uncertainty. As tasks become less certain, routines are used with less frequency. This occurs because of the need to make more mutual adjustments. This does not mean that routines and procedures are eschewed. As organizations become more complex and interconnected, other coordinating mechanisms become more effective. Thus, complex organizations use routines less than other coordinating mechanisms.

A prevailing thought in organizational theory is that sophisticated coordinating mechanisms will negate organizational uncertainty. Gittell (2002) argues that routines are especially effective in situations of input uncertainty. Her results from a study of the health care industry demonstrate that all coordinating mechanisms improve performance in complex organizations by improving relational coordination. Of note is that routines are particularly effective when there is input uncertainty within the organization. Routines were found to enhance the interaction of individuals in the organization by providing the participants with common information and processes to deal with uncertainty. This creates a work environment where relational coordination is enhanced.

Another factor that impacts the way organizations coordinate their activities is the importance organizations place on inter-unit communication. The changing nature of work has led organizations to become more diverse and organic. As a result, the need for supervision declines. The belief is that performance improves with less supervision because workers are increasingly self-directed. This has led to the widening of managerial spans of control. Gittell (2001) argues that wide spans of control do not necessarily improve performance in complex organizations. Her results indicate that narrow spans of control positively impact performance. This occurs because narrow spans of control strengthen the group processes that make relational coordination effective. This leads to increased performance. Relational coordination mediates the negative effect that broad spans of control have on group processes and organizational performance. As well, narrow spans of control allow for greater opportunities for feedback and coaching. The opportunity for feedback lead to positive outcomes (Gittell, 2000).

The previous discussion focuses on the main reason why organizations employ specific coordinating mechanisms. Although there isn't complete agreement, the prevailing thought is that as organizations become more interdependent, coordination mechanisms will increase in complexity. Organizational uncertainty also influences the type of coordinating mechanisms used in an organization. The more uncertainty there is around inputs and tasks the more likely that complex coordinating mechanisms will be used.

APPENDIX C

The basics of baseball

Baseball is a peculiar sport in that the offense and defense of the game take place in two distinct and separate manners. The goal for a baseball team is to score more runs than its opponents. To score runs players have to touch three bases and home plate. Offensive players reach base when they get a hit, a walk, or are hit by a pitch. The defensive team tries to prevent the offensive players from reaching base by making outs. The defensive players are positioned around the baseball diamond and in the field of play. Outs are made by defensive players unassisted or with the help of other players. Outs occur when a player strikes out (when a player swings and misses the ball pitched by the pitcher three times), when a player flies out (a defensive player catches a hit ball before it hits the ground), or when a player grounds out (a defensive player, in possession of the ball, touches a base before the offensive player). When a defensive team makes three outs, the offensive team stops batting and becomes the defensive team.

The offensive part of the game occurs when a team comes to bat. Each player is slotted into a particular batting order. This means that each player, except for the pitcher in some leagues[21], faces the opposition's pitcher in a particular order. The batting order is created by the team manager based on his expert opinion as to the most advantageous position for the player to face the opponent's pitcher. For example, the first hitter in a team's batting order, the lead off hitter, is placed in this position most likely because of the player's ability to get on base, to look at a number of pitches before swinging, and

[21] In some professional and amateur leagues a player called the Designated Hitter (DH) is assigned the role of hitting for the pitcher. This player does not play defense during the game and is strictly an offensive player.

to steal bases. In contrast, the fourth batter in the line-up, the clean-up hitter, is placed in this position because of the player's ability to hit home runs and to hit the ball when runners are on base. As the previous description indicates, the logic governing who hits in the lead off position is different from the logic that guides who will be the fourth hitter in the batting order.

Also of note, is that players are only allowed to face the pitcher in the order in which they are placed in the batting order. Moreover, a player's position in the batting order cannot be changed. The batting order is set except when a manager makes offensive or defensive substitutions. When a player is removed from the game, however, he is unable to reenter. Thus, the decision to substitute players and where they enter into the batting order are not made lightly.

APPENDIX D

The basics of hockey

In contrast to baseball, the sport of hockey is much less rigid in the way that teams play offense and defense. At any one time, only six players from one team are on the ice. Each team ices five skaters and one goalie. Of the five skaters, three players are forwards, the offensive players on the team, and the other two are defensemen, the defensive players on the team. Although each player is assigned either an offensive or defensive role, the play on the ice is such that players constantly change positions depending on the play. As well, all players on the ice, except the goalies, are constantly changing, as they grow tired. As opposed to baseball where substitutions are rare and strategic, player substitutions in hockey are the norm.

APPENDIX E

Other Statistical Tables

TABLE 20
Probit Model Testing the Relationship between Discrete Resources and Performance in Complex Organizations (NHL) [a]

Variable	Model 1		
Constant	0.16	d	0.01
Payroll	0.40	d	0.09
HP HR strategy	-6.9E-05		6.7E-05
HC HR strategy	-0.35	a	0.20
Games coached in career	-3.9E-04		3.1E-04
Games won in career	6.2E-04		6.6E-04
Career winning percentage	1.6E-04		2.7E-04
Games managed with the team	2.2E-04	b	9.7E-05
Winning percentage with the team	0.03		0.06
Coaching awards won	0.06	c	0.02
Championships won	-0.01		0.02
All-stars on team	0.06	d	0.01
Team age	-0.02	a	0.01
Observations	7937		
Chi Squared	224.02		
Log-likelihood	-5324.68		

[a] The dependent variable in all cases is home team game-by-game wins or losses.
Unstandardized regression coefficients are shown, with standard errors to the right
[a] $p < .1$
[b] $p < .05$
[d] $p < .001$

TABLE 21
Probit Model Testing the Relationship between Systemic Resources and Performance in Complex (NHL) Organizations [a]

Variable	Model 1		
Constant	0.16	d	0.01
Turnover	-0.20	a	0.11
Tenure <3 years	-0.17		0.11
Even strength goals for	3.5E-03	d	5.9E-04
Even strength goals against	-3.6E-03	d	4.9E-04
Power play percentage	0.54		0.40
Penalty killing percentage	0.28	a	0.17
Shorthanded goals for	-2.7E-03		3.0E-03
Shorthanded goals against	3.5E-03		3.4E-03
Average player age	0.01		0.01
Observations	7937		
Chi Squared	289.77		
Log-likelihood	-5291.81		

[a] The dependent variable in all cases is home team game-by-game wins or losses. Unstandardized regression coefficients are shown, with standard errors to the right.
[a] $p < .1$
[d] $p < .001$

TABLE 22

Probit Model Testing the Effects of Discrete Resources and Systemic Resources on the Performance of Complex Organizations (NHL) without turnover [a]

	Variable	Model 1		
	Constant	0.16	d	0.01
Systemic Resources	Tenure < 3 years	-0.18	a	0.10
	Even strength goals for	3.1E-03	d	6.3E-04
	Even strength goals against	-3.6E-03	d	5.4E-04
	Power play percentage	0.24		0.44
	Penalty killing percentage	0.45	c	0.16
	Shorthanded goals for	-3.7E-03		3.0E-03
	Shorthanded goals against	4.9E-03		3.5E-03
Discrete Resources	Payroll	0.26	c	0.09
	All-stars on team	0.03	b	0.01
	Games managed with the team	5.2E-05		1.0E-04
	Winning percentage with the team	-0.11	a	0.06
	Games coached in career	-1.2E-04		3.2E-04
	Games won in career	1.1E-04		6.9E-04
	Career winning percentage	4.2E-05		2.7E-04
	Coaching awards won	0.05	b	0.02
	Championships won	0.01		0.02
SHRM Strategies	HP HR strategy	-9.3E-05		6.9E-05
	HC HR strategy	-0.48	b	0.21
Control	Team age	-4.4E-03		0.01
	Observations	7937		
	Chi Squared	321.52		
	Log-likelihood	-5275.93		

[a] The dependent variable in all cases is home team game-by-game wins or losses. Unstandardized regression coefficients are shown, with standard errors to the right.

[a] $p < .1$

[b] $p < .05$

[c] $p < .01$

[d] $p < .001$

TABLE 23
Probit Model Testing the Relationship between Discrete Resources and Performance in Simple (MLB) Organizations [a]

Variable	Model 1		
Constant	0.09	d	0.01
Payroll	-4.3E-03		0.04
HP HR strategy	-4.8E-05		3.2E-05
HC HR strategy	0.58	d	0.15
Games coached in career	-5.7E-05		1.1E-04
Games won in career	1.6E-04		2.0E-04
Career winning percentage	-0.13	b	0.05
Games managed with the team	6.9E-06		1.9E-05
Winning percentage with the team	-0.01		0.04
Coaching awards won	0.02	a	0.01
Championships won	-0.02		0.01
All-stars on team	0.01		0.01
Team at bats	3.1E-04	d	6.8E-05
Hits for	3.4E-05		1.3E-04
Home runs for	5.7E-04	b	2.6E-04
Walks for	6.4E-04	d	1.2E-04
Stolen bases for	1.1E-04		2.1E-04
Times hit by pitch	2.8E-04		4.8E-04
Complete games for	-4.1E-03	b	1.8E-03
Shutouts for	9.1E-04		2.6E-03
Saves for	1.6E-04		1.2E-03
Hits against	-5.0E-04	d	1.2E-04
Home runs against	-1.3E-04		3.5E-04
Walks against	-2.5E-04	b	1.3E-04
Pitcher park factor	-4.6E-03		0.01
Batter park factor	4.0E-03		0.01
Weighted batters age	-0.04	d	0.01
Weighted pitchers age	1.3E-03		0.01
Observations	21510		
Chi-Squared	436.18		
Log-likelihood	-14635.18		

[a] The dependent variable in all cases is home team game-by-game wins or losses. Unstandardized regression coefficients are shown, with standard errors to the right. [a] $p < .1$, [b] $p < .05$, [d] $p < .001$

TABLE 24
Probit Model Testing the Relationship between Systemic Resources and Performance in Simple (MLB) Organizations [a]

Variable	Model 1		
Constant	0.09	d	0.01
Turnover	-0.38	d	0.08
Tenure < 3 years	-0.07		0.09
Put Outs	-2.7E-04		3.1E-04
Double plays	9.0E-05		3.7E-04
Assists	-7.1E-05		8.7E-05
Passed balls	-2.3E-03	a	1.2E-03
Defensive rating	1.5		2.1
Defensive efficiency	-2.5		2.1
Sacrifice flies	1.5E-03	a	8.8E-04
Runs batted in	-1.1E-04		2.6E-04
Earned runs	-0.01		0.04
Team at bats	5.7E-04	b	2.6E-04
Hits for	-1.8E-04		2.7E-04
Home runs for	1.3E-03	d	3.6E-04
Walks for	5.1E-04	d	1.5E-04
Stolen bases for	-2.1E-05		2.2E-04
Times hit by pitch	-1.8E-04		4.8E-04
Complete games for	-4.8E-03	c	1.8E-03
Shutouts for	2.5E-03		2.6E-03
Saves for	-6.3E-04		1.3E-03
Hits against	-5.5E-04	b	2.3E-04
Home runs against	-1.5E-04		4.5E-04
Walks against	-3.0E-04	a	1.7E-04
Pitcher park factor	-0.01		0.01
Batter park factor	0.01		0.01
Weighted batter age	-0.02	d	0.01
Weighted pitcher age	0.02	c	0.01
All-stars on team	0.01	b	0.01
Observations	21510		
Chi-Squared	405.39		
Log-likelihood	-14650.57		

[a] The dependent variable in all cases is home team game-by-game wins or losses. Unstandardized regression coefficients are shown, with standard errors to the right.
[a] $p < .1$, [b] $p < .05$, [c] $p < .01$, [d] $p < .001$

TABLE 25

Probit Models Testing the Effects of Discrete and Systemic Resources on Team Performance in Simple Organizations (MLB) without the HCA HR strategy [a]

	Variable	Model 1		
	Constant	0.09	d	8.6E-03
Systemic Resources	Turnover	-0.37	d	0.08
	Tenure <3 years	-0.11		0.09
	Put Outs	-1.7E-04		3.1E-04
	Double plays	8.0E-05		3.7E-04
	Assists	-3.2E-05		9.2E-05
	Passed balls	-2.6E-03	b	1.3E-03
	Defensive rating	0.59		2.1
	Defensive efficiency	-2.6		2.2
	Sacrifice flies	1.6E-03	a	8.9E-04
	Runs batted in	-4.8E-05		2.6E-04
	Earned runs	4.2E-02		4.6E-02
Discrete Resources	Payroll	0.09	d	2.6E-02
	Games coached in career	-1.4E-04		1.1E-04
	Games won in career	3.6E-04	a	2.1E-04
	Career winning percentage	-0.11	b	0.05
	Consecutive games coach with the team	-1.2E-05		2.0E-05
	Coach winning percentage with the team	-9.0E-03		4.0E-02
	Coaching awards won	8.4E-03		1.2E-02
	Championships won	-1.6E-02		1.3E-02
	All-stars on team	5.6E-03		5.9E-03
SHRM Strategies	HP HR strategy	-7.6E-05	b	3.2E-05
Control Variables	Team at bats	8.1E-04	c	2.7E-04
	Hits for	-5.1E-04	a	2.8E-04
	Home runs for	6.1E-04		3.9E-04
	Walks for	6.9E-04	d	1.5E-04
	Stolen bases for	-4.6E-05		2.3E-04
	Times hit by pitch	1.9E-06		4.9E-04
	Complete games for	-4.2E-03	b	1.9E-03
	Shutouts for	2.1E-03		2.6E-03
	Saves for	8.1E-04		1.3E-03
	Hits against	-7.8E-04	c	2.4E-04
	Home runs against	2.8E-04		4.7E-04
	Walks against	-3.9E-04	b	1.7E-04
	Pitcher park factor	-9.8E-03		8.6E-03
	Batter park factor	8.8E-03		7.9E-03
	Weighted batter age	-3.5E-02	d	6.4E-03
	Weighted pitcher age	4.2E-03		6.3E-03
	Observations	21510		
	Chi-Squared	474.07		
	Log-likelihood	-14616.23		

a The dependent variable in all cases is home team game-by-game wins or losses. Unstandardized regression coefficients are shown, with standard errors to the right. [a] $p < .1$, [b] $p < .05$, [c] $p < .01$, [d] $p < .001$

APPENDIX F
Principal Components Analysis

The sport of baseball is an excellent example of a simple organization. The sport of hockey is an excellent example of a complex organization. To measure the effects of different resource types in these different organizations common measures have to be found. This presents a problem because the sports record different statistics to measure the output of each of the work units on a team.

To solve this problem I use a statistical method called principal components analysis. A principal components analysis is a data reduction method that is used to combine two or more variables into a single variable (Daultrey, 1976; Jackson, 1991). The factors are determined by first examining the covariance of the different variables of the study. The variables that account for the greatest amount of variance between the variables are aggregated into a factor. The number of factors is equal to the number of variables that are included in the equation. Each aggregated factor is weighted according to the proportion of variance that it explains. The first factor accounts for most of the variance among the variables. The next factor accounts for the second most variance among the variables and so on. The different factors are uncorrelated with each other.

Each factor is assigned a factor weight. The factor weight is a standardized number that is assigned to a variable so that a factor score can be determined for each variable. A factor score is the weighted sum of the values of the variables that explains the greatest amount of variance in the sample. An eigenvalue is calculated for each factor. An eigenvalue is a numerical representation of the amount of common variance accounted for by each factor. For example, an eigenvalue of 1 indicates that a factor represents the equivalent of one variable from the sample. Factors with higher eigenvalues have extracted a larger percentage of the variance from the variables.

To confirm that there are differences between the different systemic resources the data had to be reduced to a single variable. The baseball data is comprised of 21510 data points. There are 11 discrete and 11 systemic resource variables. Data for the 11 discrete and systemic resource measures were collected for both home and away teams. The variables for home team discrete resources, home team systemic resources, visiting team discrete resources, and visiting team systemic resources were separately entered into SPSS and analyzed[22]. The analysis is un-rotated because data reduction and not the interpretation of the components is the main reason for the procedure (Kleinbaum & Kupper, 1978). The results from this procedure are listed in Table 26 and 27.

The results in Table 26 show that there are 3 baseball home team discrete resource factors with eigenvalues over one[23]. Factor one explains 41.49 % of the variance in the 11 home team discrete resource variables. In total the 3 factors account for 69.40 % of the variance in the home team discrete resource variables. The results in Table 26 also show that there are 4 baseball home team systemic resource factors that have eigenvalues over one. Factor one explained 44.65 % of the variance between the 11 home team systemic resource variables. In total the four factors explain 77.50 % of the variance in the home team systemic resource variables.

In Table 27, there are 3 visiting team discrete resource factors that have

[22] I also used factor loadings a single set of factor loadings for home and away games. The factor loadings were virtually identical. As such, I decided to go with the disaggregated loadings described below.

eigenvalues over one. Factor one explains 41.59 % of the variance in the 11 visiting team discrete resource variables. In total the 3 factors account for 69.65 % of the variance in the visiting team discrete resource variables. Also in Table 27, there are 3 visiting team systemic resource factors that have eigenvalues over one. Factor one explains 46.01 % of the variance in the 11 visiting team systemic resource variables. In total, the 3 factors explain 69.24 % of the variance in the visiting team systemic resource variables.

The hockey data is comprised of 7937 data points. There are 11 discrete and 8 systemic resource variables. Data for the 11 discrete and the 8 systemic resource measures were collected for both home and away teams. The variables for home team discrete resources, home team systemic resources, visiting team discrete resources, and visiting team systemic resources were separately entered into SPSS and factor analyzed. The results from this procedure are listed in Table 28 and 29.

The results in Table 28 show that there are 3 hockey home team discrete resource factors with eigenvalues over one. Factor one explains 36.85 % of the variance in the 11 home team discrete resource variables. In total the 3 factors account for 65.31 % of the variance in the home team discrete resource variables. The results in Table 28 also show that there are 2 hockey home team systemic resource factors that have eigenvalues over one. Factor one explains 44.06 % of the variance between the 8 home team systemic resource variables. In total the 2 factors explain 63.75 % of the variance in the home team systemic resource variables.

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[23] Selecting factors in this way is consistent with the Kaiser rule (Kaiser, 1960)

In Table 29, there are 3 hockey visiting team discrete resource factors that have eigenvalues over one. Factor one explains 36.24 % of the variance in the 11 visiting team discrete resource variables. In total the 3 factors account for 64.96 % of the variance in the visiting team discrete resource variables. Also in Table 29, there are 2 visiting team systemic resource factors that have eigenvalues over one. Factor one explains 44.67 % of the variance in the 8 visiting team systemic resource variables. In total, the 2 factors explain 63.92 % of the variance in the visiting team systemic resource variables.

The factor scores for each of the game-by-game results was calculated and then entered into LIMDEP. A probit analysis using the factor scores was conducted[24]. These results demonstrate that systemic resources are more productive in complex organizations than in simple organizations.

The same procedure was followed for the coaching resource data. There are 7 coaching variables for baseball. Data for the 7 coaching resource measures were collected for both home and away teams. The variables for home team coaching resources and visiting coaching resources were entered into SPSS and factor analyzed. The results from this procedure are listed in Tables 30 and 31.

The results in Table 30 show that there are 2 baseball home team coaching resource factors with eigenvalues over one. Factor one explains 56.80 % of the variance in the 7 home team coaching resource variables. In total the 2 factors account for 73.23 % of the variance in the home team coaching resource variables. The results in Table 30

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[24] Only one factor was used in the principal components analysis. The other factors were examined. The addition of the additional factors did not improve the model.

also show that there are 2 baseball visiting team coaching resource factors that have eigenvalues over one. Factor one explains 56.94 % of the variance between the 7 visiting team coaching resource variables. In total the 2 factors explain 73.50 % of the variance in the visiting team coaching resource variables.

There are 7 coaching variables for hockey. Data for the 7 coaching resource measures were collected for both home and away teams. The variables for home team coaching resources and visiting coaching resources were entered into SPSS and factor analyzed. The results from this procedure are listed in Tables 32 and 33.

In Table 32, there are 2 hockey home team coaching resource factors that have eigenvalues over one. Factor one explains 51.93 % of the variance in the 7 home team coaching resource variables. In total the 2 factors account for 69.21 % of the variance in the home team coaching resource variables. In Table 33, there are 2 visiting team coaching resource factors that have eigenvalues over one. Factor one explains 51.32 % of the variance in the 7 visiting team coaching resource variables. In total, the 2 factors explain 68.75 % of the variance in the visiting team systemic resource variables.

The factor scores for each of the game-by-game results were calculated. The factor scores for a team's systemic resources and the factor scores for a team's coaching resources were multiplied by each other. These values were then entered into LIMDEP. A probit analysis using the multiplied factor scores was conducted[25]. These results demonstrate that the interaction of systemic resources and coaching resources is productive in simple organizations.

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[25] Only one factor was used in the principal components analysis. The other factors were examined. The addition of the additional factors did not improve the model.

TABLE 26

Principal Components Analysis Extraction Sum of Squares Loadings with Eigenvalues over 1 for the Discrete and Systemic resources of Home Teams in Simple (MLB) Organizations [a]

	Discrete Resources			Systemic Resources		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.56	41.49	41.49	4.91	44.65	44.65
2	1.91	17.34	58.82	1.51	13.69	58.35
3	1.16	10.58	69.40	1.10	10.04	68.38
4				1.00	9.12	77.50

[a] Extraction Method: Principal Component Analysis without rotation.

TABLE 27

Principal Components Analysis Extraction Sum of Squares Loadings with Eigenvalues over 1 for the Discrete and Systemic resources of Visiting Teams in Simple (MLB) Organizations [a]

	Discrete Resources			Systemic Resources		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.58	41.59	41.59	5.06	46.01	46.01
2	1.91	17.39	58.98	1.47	13.40	59.41
3	1.17	10.67	69.65	1.08	9.83	69.24

[a] Extraction Method: Principal Component Analysis without rotation.

TABLE 28
Principal Components Analysis Extraction Sum of Squares Loadings with Eigenvalues over 1 for the Discrete and Systemic resources of Home Teams in Complex (NHL) Organizations [a]

	Discrete Resources			Systemic Resources		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.05	36.85	36.85	3.52	44.06	44.06
2	1.95	17.71	54.56	1.56	19.45	63.75
3	1.18	11.75	65.31			

[a] Extraction Method: Principal Component Analysis without rotation.

TABLE 29
Principal Components Analysis Extraction Sum of Squares Loadings with Eigenvalues over 1 for the Discrete and Systemic resources of Visiting Teams in Complex (NHL) Organizations [a]

	Discrete Resources			Systemic Resources		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.99	36.24	36.24	3.57	44.67	44.67
2	1.97	17.92	54.16	1.54	19.25	63.92
3	1.19	10.80	64.96			

[a] Extraction Method: Principal Component Analysis without rotation.

TABLE 30

Principal Components Analysis Extraction Sum of Squares Loadings with Eigenvalues over 1 for the Coaching resources of Home Teams in Simple (MLB) Organizations [a]

	Coaching Resources		
Component	Total	% of Variance	Cumulative %
1	3.98	56.80	56.80
2	1.15	16.43	73.23

[a] Extraction Method: Principal Component Analysis without rotation.

TABLE 31

Principal Components Analysis Extraction Sum of Squares Loadings with Eigenvalues over 1 for the Coaching resources of Visiting Teams in Simple (MLB) Organizations [a]

	Coaching Resources		
Component	Total	% of Variance	Cumulative %
1	3.99	56.94	56.94
2	1.16	16.56	73.50

[a] Extraction Method: Principal Component Analysis without rotation.

TABLE 32
Principal Components Analysis Extraction Sum of Squares Loadings with Eigenvalues over 1 for the Coaching resources of Home Teams in Complex (NHL) Organizations [a]

Coaching Resources			
Component	Total	% of Variance	Cumulative %
1	3.64	51.93	51.93
2	1.21	17.28	69.21

[a] Extraction Method: Principal Component Analysis without rotation.

TABLE 33
Principal Components Analysis Extraction Sum of Squares Loadings with Eigenvalues over 1 for the Coaching resources of Visiting Teams in Complex (NHL) Organizations [a]

Coaching Resources			
Component	Total	% of Variance	Cumulative %
1	3.59	51.32	51.32
2	1.22	17.43	68.75

[a] Extraction Method: Principal Component Analysis without rotation.