AN ABSTRACT OF THE DISSERTATION OF

Elisabeth D. Maxwell for the degree of Doctor of Philosophy in Public Health presented on December 9, 2011.

Title: Refining a More Complete Theory of Environment, Safety, and Health Management Strategy Using Case Studies

Abstract approved:_____

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Environment, safety and health (ESH) research has a strong tradition of conducting research in manufacturing to improve workplace ESH conditions and has tied its management strategy and technical practices to many significant priorities: illness and injury prevention, environmental sustainability, corporate social responsibility, compliance with regulatory and insurance requirements, and dealing with NGO (non-governmental organization) pressures. ESH research rarely examines ESH management strategy in the broader context of business/operations. This oversight makes it difficult to make accurate recommendations for practice and regulation because ESH researchers and business/operations researchers tend to function as if the other does not exist with the very great possibility that key relationships remain undiscovered. In this study, case study methods were used with five manufacturing facilities in the Pacific Northwest to evaluate the usefulness of the Development Levels Rating System (DLRS). Data were collected using interviews, site tours, and publicly available records. Within case and cross-case analysis were used to analyze the data. Consistent patterns were found in how the facilities structured, organized, and financed the ESH function. Moreover, important insights were found regarding the facilities' levels of ESH management strategy and their levels of risk. The results support the DLRS model as being useful in assessing ESH management strategy in relation to a facility's level of risk. Moreover, several new pathways were uncovered including: the significance of multi-stakeholder approaches

in EHS and operations research; the importance of joint management strategies; and the faulty nature of compliance-based ESH management strategies. Future research should be considered to test the DLRS tool using focus groups and quantitative methods. This study was approved by the Institutional Review Board (IRB).

Refining a More Complete Theory of Environment, Safety, and Health Management Strategy Using Case Studies

by

Elisabeth D. Maxwell

A DISSERTATION

submitted to

Oregon State University

in partial fulfillment of
the requirements for the
degree of

Doctor of Philosophy

Presented December 9, 2011

Commencement June 2012

Doctor of Philosophy dissertation of Elisabeth D. Maxwell presented on December 9, 2011.

APPROVED:

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Dean of the Graduate School

I understand that my dissertation will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my dissertation to any reader upon request.

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Elisabeth D. Maxwell, Author

ACKNOWLEDGEMENTS

I wish to express my sincere appreciation and gratitude to Dr. Anthony Veltri for his enduring support and patient assistance in the pursuit of my doctoral degree. His unflagging belief that I could complete my degree helped make it possible. He truly is the most inspirational teacher and mentor with whom I have had the privilege to work.

I would also like to thank my parents for their support throughout what must have seemed like endless years of school. A special thank you to my husband, Chris, and my children, Aurora and Quinlin, for the sacrifices they made along the way in order for me to complete my education. This was a team effort and I could not have done it without my cheerleaders at home.

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LIST OF ABBREVIATIONS

ASSE: American Society of Safety Engineers

DCBS: Department of Consumer and Business Services

DEQ: Department of Environmental Quality (Oregon)

DLRS: Developmental Levels Rating System

ESH: Environment, Safety, and Health

EPA: Environmental Protection Agency

ER MOD: Experience Rating Modification

HAP: Hazardous Air Pollutant

IRB: Institutional Review Board

LEED: Leadership in Energy and Environmental Design

LUST: Leaking Underground Storage Tank

NAEM: National Association of Environmental Management

NEHA: National Environmental Health Association

NGO: Non-Governmental Organization

NIOSH: National Institute of Occupational Safety and Health

NSC: National Safety Council

OSHA: Occupational Safety and Health Administration

OSU: Oregon State University

R/D: Research and Development

Refining a More Complete Theory of Environment, Safety, and Health Management Strategy Using Case Studies

Chapter 1

Introduction

Environment, safety and health (ESH) research has a strong tradition of conducting research in manufacturing to improve workplace ESH conditions and has tied it's management strategy and technical practices to many significant priorities: illness and injury prevention, environmental sustainability, corporate social responsibility, compliance with regulatory and insurance requirements, and dealing with NGO (non-governmental organization) pressures (Levy et al., 2006). However, the ESH research literature is weak in a critical priority that could enhance our understanding of how to improve workplace ESH strategy, practices, and outcomes. ESH research rarely explicitly examines ESH management strategy in the broader context of business/operations. ESH research is constrained by this limited perspective. This oversight makes prescriptions for practice and regulation difficult because ESH researchers and business/operations researchers tend to function as if the other does not exist with the very great possibility that key relationships remain undiscovered. Adding a strategic management perspective tied to business/operations could allow novel insights that increase our understanding of how to improve worker safety and health and environmental sustainability.

A prevailing concern in the ESH literature and of some business researchers is that ESH strategy should be linked to the business and operating strategy of the firm, but most times is not (Ward et. al., 1995; Klassen & Whybark, 1999). However, both the ESH and business literature do not specify what this means, how to go about it, or how to examine ESH management strategy, organizational structure, and financing arrangements in the broader context of business/operations. This gap in the research literature has left ESH specialists with fragmented and unrealistic approaches that have been predominately driven by regulatory concerns when attempting to examine, formulate, and link ESH and business/operations strategy.

It has long been assumed that ESH regulations and business goals are in conflict and therefore, regulations had to be stringent and strictly enforced to enhance ESH outcomes (Porter & van der Linde, 1995). In essence, the prevailing belief that managers must be forced to create safe and environmentally driven workplaces has guided how ESH professionals and government regulators do their jobs. The business incentive for compliance has traditionally been avoidance of financial penalties by regulatory authorities and maintaining a license to operate. However, some business literature, especially the operations literature, suggests that well-run organizations could make improvements in meeting business goals by emphasizing ESH as part of an overall business/operational strategy (Porter, 1995; Corbett & Klassen, 2006; Das et al., 2008; Tompa et al., 2009). This type of strategy could utilize an ESH perspective as a criterion for making business and operating decisions, and business/operating perspectives could become a criterion for making ESH decisions.

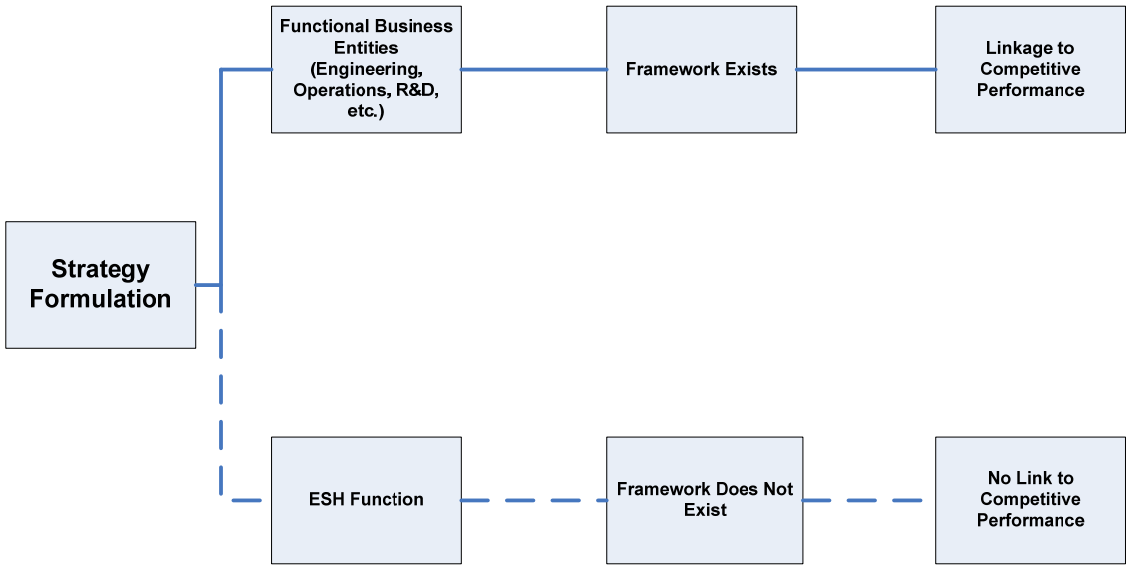
As long as ESH is still viewed as a bothersome cost of doing business, the recent recognition of the importance of ESH in some parts of the business community is inadequate to change actual practice. Poorly managed ESH activities clearly cost business and society dearly (including the individual impacts for workers, families and communities harmed by firms that implement poor ESH strategies and practices), but ESH is still often perceived to be in conflict with the goal of adding value or maximizing profit making most managers wary of doing more than meeting regulatory requirements (Asche & Aven, 2004; Kleindorfer et al., 2005). There is growing interest in investing in companies with better ESH records and in indexes that provide an assessment of ESH functions in businesses. This may provide an incentive to laggards to improve their own ESH performance, but these indexes cannot provide insight into how to improve ESH strategy or how to link strategy to the organization's other goals.

This research is in response to the numerous calls to better understand the linkage of ESH strategy in the broader context of business/operations (Ward, et al., 1995; American Society of Safety Engineers, 2002; European Agency for Safety at Work, 2004; Kleindorfer et al., 2005; National Institute of Occupational Safety and

Health, 2009; World Resources Institute, 2011). Examining ESH strategy in the broader context of business/operations could uncover novel insights into how ESH strategy is related to other organizational goals. These well-defined relationships may then allow for better prescriptions to improve ESH practices and outcomes. Moreover, this research is an initial attempt to expand the scope of ESH research beyond its traditional priorities, to include a strategic management perspective.

Figure 1.1 depicts what is generally known and unknown about ESH and business strategies. In addition, by employing a multi stakeholder perspective with the level of analysis centered on an individual manufacturing plant or facility, this exploratory research empirically examines the relationships between ESH management strategy, selected performance outcomes, and the organization's exposure to risk.

Figure 1.1 What is Known and (Generally) Unknown About ESH and Business Strategy



Chapter 2

Literature Review

Background of the ESH field

The ESH field is well-known for conducting investigations in manufacturing to ameliorate and prevent occupational and environmental hazards. Traditionally, ESH has tied its management strategy and technical practices to prescribed priorities. Occupational illness and injury prevention long have been a hallmark of the ESH profession. The oldest safety society in the United States, the American Association of Safety Engineers (ASSE), began in 1911 and today is a robust, active organization in the ESH field with over 32,000 members (ASSE, 2011). The National Safety Council (NSC) began in 1913 and is concerned with worker, traffic, and individual safety (NSC, 2011). In addition, the National Environmental Health Association (NEHA) was established in California in 1937 and is concerned with providing continuing education for environmental health professionals (NEHA, 2011). Furthermore, the National Association of Environmental Management (NAEM) is a professional association concerned with the advancement of environmental stewardship, creation of safe and healthy workplaces, and the promotion of global sustainability (NAEM, 2011). Moreover, a simultaneous search of the terms 'occupational safety' and 'manufacturing' in just one academic database (*Academic Search Premier*) revealed 2790 peer-reviewed articles. A simultaneous search for the terms, 'environmental health' and 'manufacturing' located 7287 peer-reviewed articles. This limited search demonstrates that there are quite a number of ESH research studies that have been conducted in the realm of manufacturing.

Environmental sustainability has come under the purview of the ESH field and encompasses the idea that industry should reduce or eliminate the use and creation of substances or processes which are thought to be hazardous to human health and/or the environment (Manley, Anastas, & Cue, 2008). Corporate social responsibility can be defined in many ways, but essentially encompasses actions firms take to further a social good that is not necessarily within their interests, is not required by law, and

which is often connected to ESH domains (McWilliams & Siegel, 2001). Compliance with regulatory and insurance requirements has been an integral part of the ESH field since its inception. Anticipating, responding to, and sometimes even working with NGO pressures many times falls under the umbrella of ESH because oftentimes the issues are ESH issues, such as community water quality, clean air, keeping natural areas pristine, and monitoring disease incidence in communities in proximity to certain types of manufacturing.

Risk Assessment, Hazard Analysis, and ESH

An integral part of the ESH field, both in research and for professional practitioners, is hazard analysis and risk assessment (Jensen, 2007). Hazard analysis involves prioritizing hazards by reviewing the potential consequences of a certain activity, ranging from negligible consequences to fatal consequences. It also involves assessing the probability of the hazard occurring. Once these have been assessed, an informed decision can be made as to how to deal with the hazard. This is often referred to as the Hierarchy of Controls and involves the following:

- Elimination
  - Review whether the hazard can be eliminated entirely
- Substitution
  - Review whether there is another less hazardous option such as a different chemical that might be used
- Modification
  - Review if the design of the work station or plant can be modified to resolve the hazard
- Isolation
  - Review if the hazard can be isolated and prevent contact with people or the environment
- Engineering Controls
  - Review whether a hazard can be resolved through engineering
- Administrative Controls
  - Review whether a hazard can be resolved through written protocols or management systems such as manipulation of work schedules
- Personal Protective Equipment (PPE)
  - Review if PPE can resolve the hazard (NIOSH, 2011)

These are referred to as the Hierarchy of Controls because they are pursued in the order listed above. An example of this is that eliminating a hazard is a safer option than depending on workers to wear recommended PPE. Risk analysis encompasses severity, probability, and exposure. Severity can range from no potential through catastrophe. Probability can range from impossible to very likely. Exposure is assessed from no exposure to above average exposure. Accounting for severity, probability, and exposure can then provide an assessment of risk in many ESH situations (Reese, 2003). Risk can then be categorized as high, substantial, possible, or slight (Reese, 2003). Various iterations of risk assessment and hazard analysis are used on a daily basis in manufacturing settings to keep workers safe and prevent harm to the environment. Risk assessment and hazard analysis are also recommended by regulatory agencies such as the Occupational Safety and Health Administration (OSHA) and the Environmental Protection Agency (EPA) as efficacious methods to control ESH risks (NIOSH, 2011).

Significance and impact of the ESH field

Poor ESH management strategies have far-reaching effects for the individual workers harmed, for their families, for communities, and for the economic health of the United States in general. Although the current study does not purport to have a direct effect on ESH incidence statistics, it seems relevant to report the scope of ESH issues. In the United States in 2010 (the most recent year for which data is available), 3,063,400 million people suffered workplace related accidents and illnesses with nearly one million of those incidents leading to time lost from work. Of even greater concern, 4547 fatal accidents occurred in workplace settings that year in the United States (Bureau of Labor Statistics, 2010). Occupational injury and illness costs businesses in the United States an estimated $170 billion annually (OSHA, 2011). These figures only reflect reported incidents and do not include several categories of workers such as: workers who suffer from long term health problems due to their employment (and for which it is never determined how the disease or injury occurred); seasonal workers; migrant workers; workers who engage in a series of short-term or temporary employment situations; and illegal workers who have no recompense when

harmed. In addition, occupational injury and illness rates are much higher in the developing world (Rosenstock et al., 2006). Furthermore, there is a large scope of environmental health issues that are the direct result of how business is conducted. In 2010, EPA collected more than $110 million in penalties and obtained commitments for an estimated $12 billion for pollution controls and environmental projects. Also in 2010, EPA initiated 346 environmental crimes cases and assessed $41 million in fines and restitution (EPA, 2010). With large numbers of workers being hurt or killed in occupational settings and with substantial harms to the environment, there should be a wealth of combined ESH and manufacturing research.

Business and ESH strategies

Strategy consists of the efforts put into giving a business "superior financial performance" (Hunt, 1999). It also, "…outlines how management sees the organization achieving its overall objectives and goals" (O'Malley, 2001). Business strategy formulation has long been studied to find the best ways to increase profitability for firms (Cohen & Cyert, 1973). In the business field, there has been a tradition of studying what exactly comprises the definition of strategy and which theories most accurately describe it (Bracker, 1980; Chaffee, 1985; Mintzberg & Waters, 1985). Research has been conducted into how strategy is thought about and constructed (Sveiby, 2001). Indeed, theorists have put great effort into studying different ways to think about strategy, such as the 'resource-based' strategy of the business (Hunt, 1999). Moreover, business strategy theorists have put research efforts into the issues or contingencies that affect strategy formulation (Ginsberg & Venkatraman, 1985). In the business field, strategy formulation is studied to guide entrepreneurship from new business start-ups to new ventures within existing companies or the renewal of existing products or services (Dess, Lumpkin, & McKee, 1999).

Considerable work has been done on how to talk about the link between strategy and competitive performance, different types of competition, and which theories describe the link best (Barney, 1986). Miles and Snow (1978) described four

strategy types: defender, prospector, analyzer, and reactor. Each type pursues a certain activity and occupies a structure that determines its behavior. Strategy and its link to competitive performance have been well-studied in the business field, including how it functions in a variety of different markets (Mason, 2007; Amoako-Gyampah & Acquaah, 2008; Zott & Amit, 2008). Business theorists have studied the environmental and social implications of business/operational strategy and whether increasing the financial performance of the firm always has to be at the cost of social goods such as environmental, occupational, and community health (Porter, 1985; Hunt, 1999).

Other disciplines related to business have made significant contributions to their individual fields in order to guide practitioners, as well. For example, the field of information systems has a rich history of strategy formulation and implementation that contributes to competitive performance (Salmela & Spil, 2002). Operations management also has a strong background in strategic formulation (Adam & Swamidass, 1989). Manufacturing strategy has been intensely studied (Nemetz & Fry, 1988; Platts, 1994; Swink & Way, 1995; Voss, 1995). It has even gone so far as to separate the discussion of manufacturing strategy into separate areas of 'process' and 'content' (Leong, Snyder, & Ward, 1990; Sminia, 2009). Maintenance strategy has been studied to discover the best strategic maintenance plans (Bevilacqua & Braglia, 2000).

Michael Porter has spent his career researching business strategies (1985). Porter describes three generic strategies: *cost leadership, differentiation,* and *focus* to characterize strategic positions. Cost leadership involves a firm creating competitive advantage with cost-sensitive consumers—having the best price. Differentiation means creating a unique market position with consumers. An example of this is a firm such as Apple which has created a massive amount of brand loyalty. Focus refers to the market a firm decides to focus on such as Walmart focusing on a mass market. Smaller business may choose a more targeted market to match their product or services to consumers. He has also posited that all of a firm's activities, "…are the basic units of competitive advantage" which provide the firm with advantage or

disadvantage in competing with rivals (Porter, 1985). In Porter's view, ESH is one activity that regularly impacts a firm's ability to compete. Therefore, he encouraged companies to look at ESH issues as opportunities for innovation. In his study of 181 companies that had to make changes in response to ESH regulation, he found that only one business incurred any costs as a result of the regulated changes. In Porter's resource-based view of competition in business, he asserted that any materials lost as pollution, and especially any that resulted in clean-up efforts, were lost profits and eroded competitive advantage for the business. Porter's theory was that businesses that were able to deal effectively with strict ESH regulations through innovation and creativity would discover ways to offset the costs in other ways, and thereby make their businesses truly competitive. Businesses that resisted ESH regulations and only implemented the required bare minimum standards were not competitive in Porter's view.

Forest Reinhardt (1998) also contributed to the strategy literature in an important way. He stated that the question was not does it make sense to be *green* (successful in the ESH arena), but what are the circumstances where it might pay to be green? Reinhardt provided several examples of companies that made more environmentally-conscious business efforts that were successful by giving the company a greater competitive advantage over their competitors. One example is the Starkist company that had to decide how or if to respond to consumer and NGO criticisms when it was discovered that dolphins were being killed during tuna harvesting. Starkist performed a market analysis and found that consumers were willing to spend more on a can of tuna fish if it was labeled 'dolphin-friendly' meaning that no dolphins were killed in the harvest. Starkist decided to change their requirements for the fisheries they bought tuna from and they ended up being more competitive than other tuna brands because of this decision. Reinhardt also provided the example of Patagonia outdoor wear as a company that made a decision to use a more environmentally-friendly material and resulted in a better competitive niche for the company. Patagonia wanted to introduce a more eco-friendly material for their outerwear line. They performed a market analysis and found that their customers were not very price-sensitive, meaning their customers did not worry about the cost, did not

mind the change to a new material, and would remain loyal to the brand. Patagonia was able to use a more eco-friendly material and maintain their competitive advantage at the same time. Reinhardt showed that there are definitely times when it makes competitive sense for companies to choose an environmentally friendly path.

Corporate social responsibility has provided a different way to view business strategy and ESH issues. Alta Gracia is a division of Knights Apparel that manufactures collegiate sportswear with a stated mission of corporate social responsibility. Joseph Bozich, the head of Knights Apparel, has stated, "We're hoping to prove that doing good can be good business, that they're not mutually exclusive" (New York Times, 2010). The line of Alta Gracia collegiate clothing was a conscious response to NGO and college students' criticism of collegiate apparel made by other companies that utilized unfair labor practices in developing countries. Alta Gracia pays its workers three and half times the regular minimum wage in the Dominican Republic—calling it a 'living wage.' Alta Gracia defines a 'living wage' as one that allows workers to provide adequate food, clean water, clothing, shelter, health care, child care, and education for themselves and their families (Alta Gracia, 2011). In addition, Alta Gracia has worked closely with the Worker Rights Consortium, a group of universities that advocate for the idea that factories making college-logo apparel should use fair labor practices, such as paying a living wage, paying for overtime, provision of sick time, and providing safe working environments. The business strategy has been that college students will pay a little more for a university sweatshirt or t-shirt if they know it was manufactured using fair labor. Other collegiate apparel manufacturers have taken note of Alta Gracia's progress to determine if this type of strategy will be successful (New York Times, 2010).

In any business, there is an expectation that the business will show a return on its investments, and that any strategy should be able to be justified; in other words demonstrate why it was undertaken and what it provided in exchange for the expenditure in resources. The one function that seems to be exempt from this has been ESH. ESH strategies are often undertaken and completed in isolation from other business functions, with no expectation that they contribute to other strategies of the

firm, and with little evaluation of their success or lack thereof. In recent years, there has been a new idea that discovering new routes of strategy for ESH that are connected with other business strategies could enhance the understanding of how to improve workplace ESH strategy, practices, and outcomes (Menon & Menon, 1997). Moreover, in the ESH academic field there has been discussion of this area as under-represented in research (Ward, et al., 1995; American Society of Safety Engineers, 2002; European Agency for Safety at Work, 2004; Kleindorfer et al., 2005; National Institute of Occupational Safety and Health, 2009; World Resources Institute, 2011). As far back as 1996, Brown wrote a seminal paper highlighting the need for research on ESH management in manufacturing settings.

Other organizational specialists have professional guidance in the formulation linking their individual strategy to firm competitiveness and assessing its contribution to firm competitiveness. However, specialists in ESH have not received comparable guidance in the professional literature (Adler, McDonald, and MacDonald, 1992; Kiernan, 1993; Porter, 1998). One limitation of ESH strategy is that models have been published with little or no evaluation or validation. Another limitation of ESH strategy is that it tends to be constructed around reacting to pressures from outside concerns (*i.e., government agencies, insurance carriers, NGO's*) with little attention to linking it to the firm's competitive business strategy (Roome, 1992; Brown, 1994). The emphasis on formulating and linking ESH strategy to the firm's competitive strategy should not be interpreted to mean that there is an intention to de-emphasize the importance of compliance with the pressures from outside concerns (Hunt & Auster, 1990). Attention to outside concerns is a significant part of ESH strategy and formulating an ESH strategy that is linked to the competitive strategy of the firm is not intended to replace this critical consideration. The ESH function has a history of utilizing strategy that is formulated based primarily on compliance concerns and has therefore, encountered barriers in being integrated with the overall goals of firm competitiveness (Hunt & Auster, 1990; Brown, 1994; Sharma, 2000; Singh, 2000).

Previous significant ESH research

One theory put forth by Hunt and Auster (1990) was a proposed stage system for evaluating corporate environmental management programs. The stages range from Stage One 'no protection' to Stage Five 'maximum protection' with various ways of assessing the level of ESH management. However, nowhere in the study did they report that they used any method for validating the system or tried to describe any relationship to a performance outcome. Another theory is the Resource-Based View of the firm (Hart, 1995). This theory takes into account the competitive advantage of certain ESH functions in a firm, such as minimization of emissions or life-cycle costs. However, the theory was not translated into a usable tool for ESH professionals or validated. One study that did attempt to validate the Hunt and Auster theory and several others that had not been tested previously was by Henriques & Sadorsky, (1999). However, this study focused solely on the firm's perceptions of a single managerial stakeholder and not on ESH strategy in relation to business/operational strategy. Another study that investigated environmental strategies being used by managers at small firms in Britain found that there were several approaches to dealing with environmental issues including: strategic, piecemeal, accidental, and omitted (Tilley, 1999). This study also did not provide a usable framework or tool for further investigation or use in the ESH field.

ESH management strategy should be a critical business issue, yet it is generally ignored in both the ESH and operational management literature. The ESH literature, which has had numerous calls to include a business perspective (Ward, et al., 1995; American Society of Safety Engineers, 2002; European Agency for Safety at Work, 2004; Kleindorfer et al., 2005; National Institute of Occupational Safety and Health, 2009; World Resources Institute, 2011). sends mixed messages, with some authors proposing that ESH research needs to be linked to achieving other organizational goals (Singh, 2000; Kleindorfer, et al., 2004) while other authors conclude that an emphasis on ESH will make it harder to achieve other organizational goals (Walley & Whitehead, 1994). However, continuing to conduct ESH and manufacturing research separately spreads confusion and makes solving critical problems more difficult.

ESH and Manufacturing Trade-offs

A prevailing idea in the ESH profession and in business, as well, is that many times attempts to improve business/operational outcomes occur at the expense of ESH outcomes because shortcuts have to be taken in ESH to make the system more efficient or productive (Zohar, 2000). Frequently, it is thought that there is an inherent trade-off in manufacturing and other business types between increased profits, valued by managers and owners, and decreased ESH incidents, valued most by workers (Pate-Cornell & Murphy 1996; Zohar 2002; Zohar & Luria 2005). When talking to ESH practitioners in the field, it is quite common to hear anecdotes about busy seasons, busy times of the year or a large order that causes a short-term increase in productivity and at the same time an increase in ESH incidents or near misses. The perception is that these can be risky times for workers or for an incident to occur. Some researchers have hypothesized that workers can either avoid errors that can lead to ESH incidents or near misses, or can increase production, but they cannot do both (Ford & Tetrick, 2008). Moreover, this persistent idea of there being a fixed trade-off between high productivity and optimal ESH provides the structure for how companies develop ESH practices and for how the government creates and enforces regulations.

The trade-off perspective assumes that operational outcomes are not inadvertently put at risk. This perspective has also guided much of the ESH literature, but has been untested for the most part. However, there is recent research in operations management that suggests when organizations take shortcuts on ESH issues, they may also put other organizational outcomes such as quality at risk (Das et al., 2008). There have also been some studies in the manufacturing and ESH literature that suggest that a reduction in ESH efforts may harm both outcomes (Das et al., 2008; Tompa et al., 2009). In business research, there has been a contention for some time that any operational system that minimizes inefficiencies may also be more environmentally sustainable (Porter, 1995; Corbett & Klassen, 2006). Smallman & John (2001) found that more sophisticated firms viewed ESH as part of their competitive strategy and that less sophisticated firms still viewed it as a cost. One of their recommendations was that requiring a return on ESH investments might be beneficial to operations *and* ESH.

Moreover, Filer and Golbe (2003) found that more profitable firms are safer places to work than struggling firms. Jaffe et al. (1995) found little evidence to support the contention that environmental regulations have had adverse effects on competitiveness. Moreover, it has even been thought that it may be competitively sound to create an environment where managers proactively see environmental issues as opportunities for growth before being forced to comply by regulations, (Porter, 1995; Sharma, 2000).

Combined operational and ESH research

There are several research studies that link operations or manufacturing and ESH. Brown et al., (2000) connected safe work behaviors with managerial attitudes. Researchers have shown that disagreements over safe work behaviors may be a result of different ESH perceptions of managers and workers (Prussia et al., 2003). Quality outcomes have been shown to be connected with differences in ESH perceptions between managers and workers (Das et al., 2008). ESH performance has been depicted as being related to operational outcomes through an interaction with environmental performance (Pagell & Gobeli, 2009).

Although operations and ESH research occur many times in the same setting with the same workers (a plant or facility), researchers in these two fields draw very different conclusions. It has long been an entrenched part of ESH research that increases in production will inevitably result in greater ESH issues for a facility. It is a prevailing idea in operations research that making a facility safer will result in a sacrifice in productivity and ultimately in competitiveness. In this piecemeal method of research activity between these two disciplines many vital areas are left unexplored which could significantly inform both. The ultimate goal of ESH research is to create tools that can be widely used by key decision-makers to create optimally safe work environments and environmentally sustainable practices. The ultimate goal of operations research is to create tools that can be widely used by key decision-makers to make an optimally competitive work setting. There is a need to explore whether these two goals are truly exclusive of one another.

The role of ESH regulations

If the assumption is valid that ESH regulations and business goals are in conflict, then regulations should be rigorous and strictly enforced to enhance ESH outcomes (Porter & van der Linde, 1995). Historically, it has been the case that many managers and business owners have been forced to create safe workplaces and protect the environment through regulations. The business incentive has been the avoidance of costly fines and maintaining a license to operate. However, new thoughts have started to emerge that well-run organizations may be able to have optimal ESH conditions *and* competitive productivity. If the incentive for ESH could be aligned with other managerial goals, then there would be non-compliance based reasons to create safe workplaces. If this attitude became the norm, then the business incentive for ESH would be aligned with other operational goals, creating non-regulatory incentives for improved ESH conditions, both occupationally and environmentally (Porter & van der Linde, 1995). This would not diminish the need for regulation and enforcement, but would indicate that additional pathways to enhancing ESH proficiency exist. This could result in win-win solutions (both ESH and business goals successfully met) becoming a foundation for the organization's ESH and business strategy. Until research simultaneously examines ESH practice and outcomes and business practices and outcomes, it is impossible to make fully informed recommendations.

Many manufacturing organizations consider compliance with ESH regulations as the goal with the assumption that regulations impose costs and constrain operations (Walley & Whitehead, 1994; Reinhardt, 1999). Even more concerning, manufacturing organizations tend to assume that if they are in compliance with all applicable regulations, then their work environment is safe and healthy (Pagell et al., 2011). Oftentimes, this is not the case (Rosenman et al., 2006). If the pursuit of ESH outcomes could be aligned with the pursuit of business outcomes, then going beyond regulation would not only be viable, but would be the best choice for informed managers and owners.

ESH and operational/business linkages

The recent recognition of the need to integrate ESH strategy into manufacturing strategy does not seem to have translated into changes in how many managers view the ESH function within their own organizations. Part of the explanation for this may be that currently research does not exist to shore up the idea, either in the ESH field or in the manufacturing field. The empirical evidence suggests that most organizations still view ESH from a regulatory/compliance perspective rather than looking for ways to address ESH within the larger context of creating competitive advantage (Colbert, 2006). Epstein and Roy (2003) found that most companies do not make a strategic connection between ESH outcomes and manufacturing performance, indicating there is a research gap in discovering what the linkages are between ESH and the competitive performance function of the firm (Figure 1.1).

At the internal level, the operative notion of an approach for linking ESH strategy to the firm's competitive strategy is financially appealing. Internal finance specialists, design and process engineers and operational managers are extremely interested in being provided an ESH strategy that is most likely to contribute to the firm's business fundamentals (*i.e., revenue and earnings growth, quality of management, free cash flow generation*). However, they are somewhat skeptical of the results of assessments that provide data such as the number of compliance audits performed, behavior-based training provided, and perception surveys conducted. A stronger case can be made when actual data linked to costs are collected, interpreted, and analyzed.

Externally, there is evidence that the business community is starting to notice the value of ESH. The external financial community, specifically, many investment bankers, view ESH performance as a proxy for other firm business performance behaviors that tend to enhance the overall competitive performance for a firm (Feldman & Soyka, 1997; Carter & Veltri 1999). Although the evidence-based research results of this claim are not conclusive, a distinct group of firms promote a

business perspective when looking at how the ESH strategy could be important for increasing competitiveness. It may be that assessments of ESH strategy linked to firm competitiveness will become a standard part of the way a firm promotes its competitive business performance and may affect its attractiveness in the external financial marketplace. The investment community is beginning to understand the costs and benefits of ESH strategy and has developed stock indexes such as the Dow Jones Sustainability Group Indexes and Innovest EcoValue 21™. Furthermore, numerous websites and investment firms list stocks and companies that have superior ESH records (Inovest, 2011; Sustainability-index.com, 2011). These indexes provide institutional and retail investors with a financial and social interpretation of the ESH practices and outcomes of a firm. In addition, the investment banking community sometimes views ESH performance as a proxy for other firm business performance, working on the assumption that the behaviors that lead to superior ESH outcomes tend to enhance the overall competitive performance for a firm (Carter & Veltri, 1999; Dentchev, 2004).

The relationship of stakeholders to ESH and manufacturing

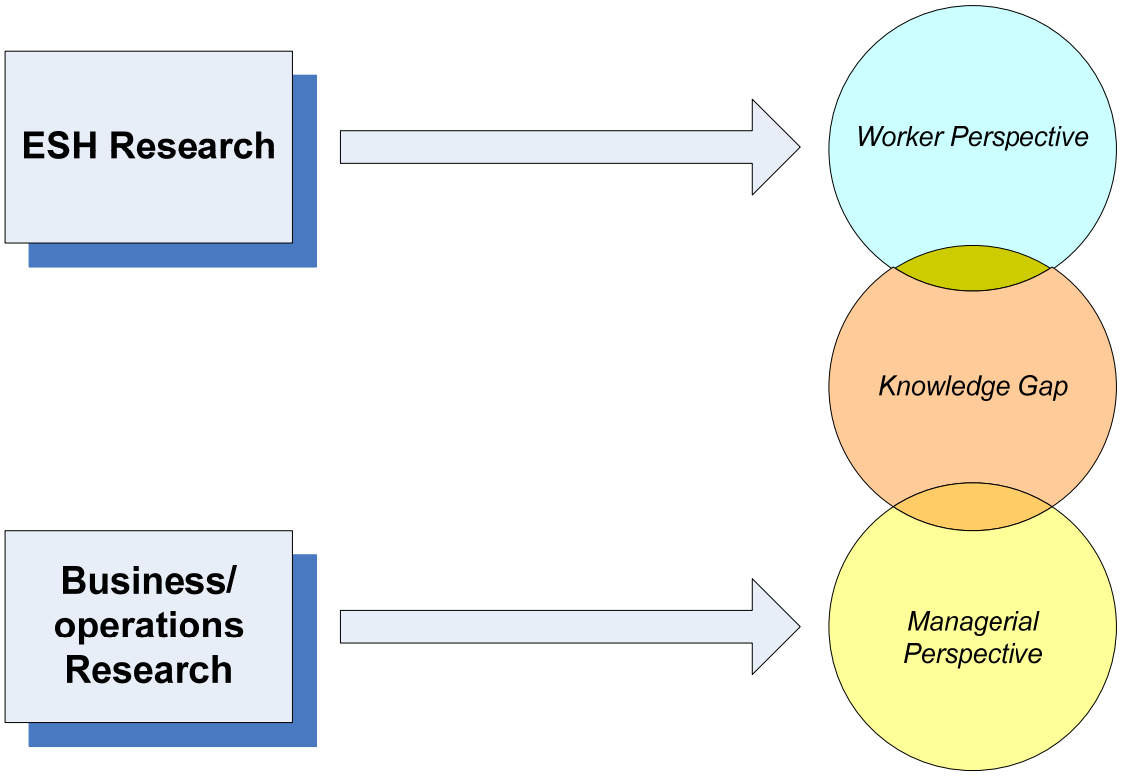
The role of stakeholders has been a prevalent concept in both business and ESH. In the operational/business field, stakeholders have been defined as an individual or group that can affect the organization or be affected by that organization (Freeman, 1984). In the ESH field several types of stakeholders have been identified including regulators, organizational stakeholders, members of the community, and the media (Henriques & Sadorsky, 1999). Regulators and insurers have stakes in protecting the safety of the people employed. Organizational stakeholders include customers, employees, suppliers and shareholders and certainly have a stake in ESH issues and in the success of the business. Community members have a stake in maintenance of jobs in the community, while at the same time having assurance that businesses do not create environmental hazards or unsafe working conditions.

In the business field, stakeholders have been defined at times a bit differently. Gago and Antolin (2004) created a broad definition and defined stakeholders as corporate, government, business associations, customers, the local community, the

global community, future generations, employees, environmentalist groups, the media, and suppliers. Other researchers on stakeholder theory have posited that it is more important to consider factors about the stakeholders and not what category they might occupy. Attributes commonly considered regarding stakeholders are power, legitimacy, and urgency (Mitchell et al., 1997). More resources are invested in addressing stakeholders with the power to impose their will on a firm. Moreover, only legitimate stakeholders will have attention paid to their concerns. Urgency encompasses both how urgent the stakeholders feel their need is and how long they perceive the firm takes to address the issue. All of these factors are assessed together and have become known as stakeholder saliency. The more attributes stakeholders possess, the higher their saliency.

There are a number of different stakeholders that can be involved when considering ESH issues and manufacturing. Whether they are defined by category or by attribute, different stakeholders have different concerns and viewpoints. For this reason, there has been a trend in the business field to conduct studies looking at multiple stakeholder perspectives, although many studies are still conducted solely from managerial or operational perspectives. However, much of ESH research has still been conducted from the worker's point of view, and thereby has only provided a single stakeholder perspective. Conducting research from the worker's perspective has created barriers in the ESH field to understanding business outcomes and linkages to competitiveness. It has also created a gap in effectively addressing ESH issues because it is not the workers who make the ultimate decisions regarding ESH strategy, but managers, executives, and owners (Figure 2.1).

Figure 2.1 Knowledge Gap Between ESH and Business/Operations Research



Case study research

Yin (2009) defines the case study method as, "…an empirical inquiry that investigates a contemporary phenomenon in-depth and within its real-life context…" Miles and Huberman (1994) define case study research in the context of, "…a phenomenon of some sort occurring in a bounded context…" In other words, a case study defines what will be studied and what will not. According to Yin (2009), case studies have the following five components:

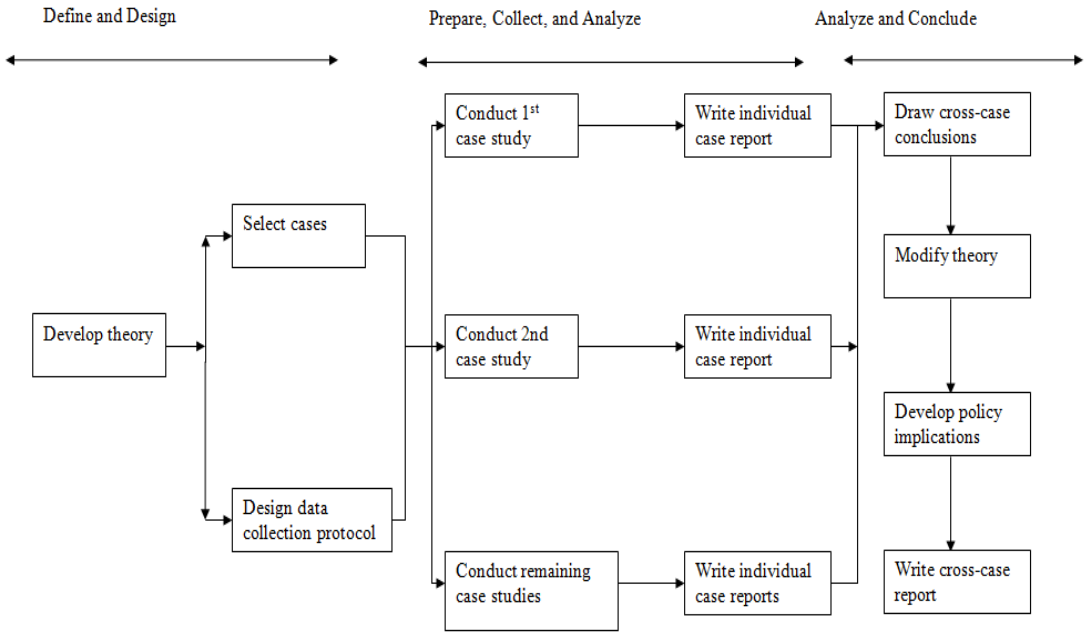
- A study's questions
- Its propositions, if any
- Its units of analysis
- The logic linking the data to the propositions

- The criteria for interpreting the findings

It is appropriate to utilize case study research methods when little is known about a phenomenon and when current perspectives seem inadequate with little empirical evidence (Yin, 2009). Case study methods are also deemed appropriate when the area of inquiry is a new research area (McCutcheon & Meridith, 1993; Yin 2009). In addition, "The case study is preferred in examining contemporary events, but when the relevant behaviors cannot be manipulated" (Yin, 2009).

The case study method follows a pathway where a theory is developed, cases are selected, and a data collection protocol is designed (Yin, 2009) (Figure 2.2). Cases are completed one at a time, briefly analyzed, and written up (within case analysis). After all cases have been completed, they are compared to one another (cross-case analysis) and the data are interpreted. The goal is to determine if the original theory is supported by the case research and if any new themes have emerged. Moreover, case study research lends itself well to early, exploratory research (Meredith, 1998).

Figure 2.2 Case Study Method (Yin, 2009)



Qualitative theory building research is an iterative process (Eisenhardt, 1989; Miles & Huberman, 1994; Yin, 2009). Case study research is an important method in generating new theory and/or extending theories (Meredith, 1992). Each case is generally treated as a replication (Yin, 2009). Some experts have suggested that data collection and analysis be done simultaneously (Eisenhardt, 1989). This provides researchers the advantage of being able to incorporate new themes that emerge and also refine and improve site visits and interviews. Case studies rely on historical evidence, but also include interviews and direct observations (Yin, 2009). Case study methodology also, "…benefits from the prior development of theoretical propositions to guide data collection and analysis" (Yin, 2009).

Strengths and weaknesses of case study research

Case study methodology has several strengths to recommend it (Table 2.1). "The case study's unique strength is its ability to deal with a full variety of evidence—documents, artifacts, interviews, and observations…" (Yin, 2009). A case study allows the researcher(s) to incorporate many different types of data with a focused eye to emergent themes and/or unanticipated findings. In addition, Eisenhardt (1989) describes the likelihood of 'generating novel theory' as one of the strengths of case study methods. In addition, it is thought to be a strength of case study research that it occurs in natural settings where understanding can be stimulated through actual observations in the field (Meredith, 1998). Researchers using this type of methodology also appreciate the richness of data that can be garnered (Meredith, 1998).

Table 2.1 Sources of Evidence with Strengths and Weaknesses for Case Studies (Yin, 2009)

Source of Evidence	**Definition or Example**	**Strengths**	**Weaknesses**
*Documentation**	Letters, memos, email Agendas, announcements, meeting minutes, other reports Progress reports, other internal records Formal studies of the same subject News articles and reports	Stable—can be reviewed repeatedly Unobtrusive—not created as a result of the case study Exact—contains exact names, references, and details of an event Broad coverage—long span of time, many events, many settings	Retrievability—can be difficult to find Biased selectivity, if collection is incomplete Reporting bias—reflects (unknown) bias of author Access—may be deliberately withheld
*Archival records**	Government files with public access Reports made available to the public	Same as documentation Precise and usually quantitative	Same as documentation Accessibility due to privacy reasons

	Other survey data		
*Interviews**	Focused interview—interview is conducted according to a prescribed set of questions, although new topics may be explored as they arise. Usually audio recorded and transcribed.	Targeted—focuses directly on case study topics Insightful—provides perceived causal inferences and explanations	Bias due to poorly articulated questions Response bias Inaccuracies due to poor recall Reflexivity—interviewee gives what interviewer wants to hear
*Direct observations**	Interviewer makes direct observations during the interview and site visit.	Reality—covers events in real time Contextual—covers context of 'case'	Time-consuming Selectivity—broad coverage difficult without a team of observers Reflexivity—event may proceed differently because it is being observed Cost—hours needed by human observers
Participant-observation	Observer participates in the events being studied.	Same as direct observations Insightful into interpersonal behavior and motives	Same as direct observations Bias due to participant-observer's manipulation of events
Physical artifacts	A technological device, tool, instrument, a work of art, of some other physical evidence.	Insightful into cultural features Insightful into technical operations	Selectivity Availability

*Used in this study

There are also concerns that have been raised in regard to case study methodology (Table 2.1). Yin (2009) describes the main concerns as the following: lack of rigor; providing little basis for scientific generalization; being time-consuming; generation of massive unreadable documents; and an inability to address causality. A lack of rigor can be addressed by having a research protocol for interviews conducted in the study. In addition, keeping a database of interviews conducted and the documents collected on each case allows another researcher to replicate the research. As for providing little basis for scientific generalization, Yin (2009) proposes two responses to this criticism. The first is that case studies produce results that are generalizeable to theoretical propositions, not to a population or universe. Yin's second response is that the goal of conducting much research is to expand theories, not to enumerate frequencies. All research can take much longer than anticipated and result in massive amounts of unreadable documents and data. Case study research conducted with a reasonable plan and adhering to suggested methods can be conducted in a realistic time-frame. Researchers regularly summarize large amounts of research into understandable tables, figures, conference proceedings, academic presentations, and journal papers. Another criticism of case study methodology is that it does not address causality. While this is true, many types of research do not address causality. Case studies can be viewed as adjuncts to experiments, rather than alternatives to them (Yin, 2009). Data gathered during case study research may become the seed for subsequent research that can provide evidence for causality.

To strengthen the methodology for case studies, there are multiple recommendations. It is recommended to research multiple cases because, "The evidence from multiple cases is often considered more compelling, and the overall study is therefore regarded as being more robust" (Yin, 2009). It is also recommended to select cases to either predict similar results to one another or contrasting results. It is also recommended that the researcher state the conditions under which a particular phenomenon is likely to be found, thereby creating a replication of the cases (Pagell & Wu, 2009).

There are many types of sources of evidence in case studies (Table 2.1). Documentation can contain letters, memos, email, agendas, announcements, meeting minutes, progress reports, other internal records, formal studies of the same subject, news articles and other reports. There are several strengths of documentation evidence. Documents are stable and can be viewed repeatedly. They are also are not created as a result of the study. They are exact and contain names, references, and details of events. They can have broad coverage over a long span of time, with descriptions of many events and settings. Archival records are another type of documentation and have many of the same strengths as documentation. However, documents and archival records can also have weaknesses. Records can be difficult to find. There can also be biased selectivity in that is unknown if any document or set of documents is complete. In addition, there can be reporting bias from authors of documents which is unknown to the researcher. Documents can also be deliberately withheld or inaccessible to researchers, providing an incomplete view of the topic.

Interviews are another important source of evidence in case study research. Focused interviews are conducted according to a prescribed set of questions, although new topics may be explored as they arise. These interviews are usually audio recorded and transcribed as part of the research. There are several strengths of this source of evidence. Targeted interviews focus directly on the case study topics and can be insightful, providing perceived causal inferences and explanations from the subjects. However, there are weaknesses with interviews, as well. There can be bias due to poorly articulated questions. There can also be response bias on the part of the subjects in that a subject may report what he or she believes the researcher wants to hear, or even misunderstand what has been asked. Subjects can also report circumstances in a more favorable light because of fear of negative repercussions for reporting the truth. Subjects can also report inaccuracies due to poor recall. Interviews were one of the primary sources of information for this study.

Observation is also an important part of case study research. Observations consist of what interviewers see for themselves during site visits or interviews. There

are several strengths from this source of evidence. The researcher is able to observe events in real time and within the context of the actual case. This source also has several weaknesses. It can be time-consuming to conduct observations. It can also be difficult without a team of observers. In addition, an event may proceed differently because of the presence of observers. Participant observation is another form of observation. Physical artifacts are also another source of evidence.

There are three principles of data collection in case study methodology (Yin, 2009). The first is the use of multiple sources of evidence, such as the ones outlined in Table 2.1. This is explicitly known as *triangulation* which is the use of multiple sources of evidence in order to provide verification of the evidence for the phenomena under study (Eisenhardt, 1989; Miles & Huberman;, 1994; Yin, 2009). Yin (Figure 2.3) describes this as 'converging lines of inquiry' when several sources of evidence corroborate each other. This can address construct validity because the multiple sources of evidence essentially provide multiple measures of the same phenomena (Yin, 2009). The second principle is to create a case study database which consists of the data and the report of the data. Principle three is to maintain a chain of evidence.

Figure 2.3 Convergence of Evidence (Yin, 2009)

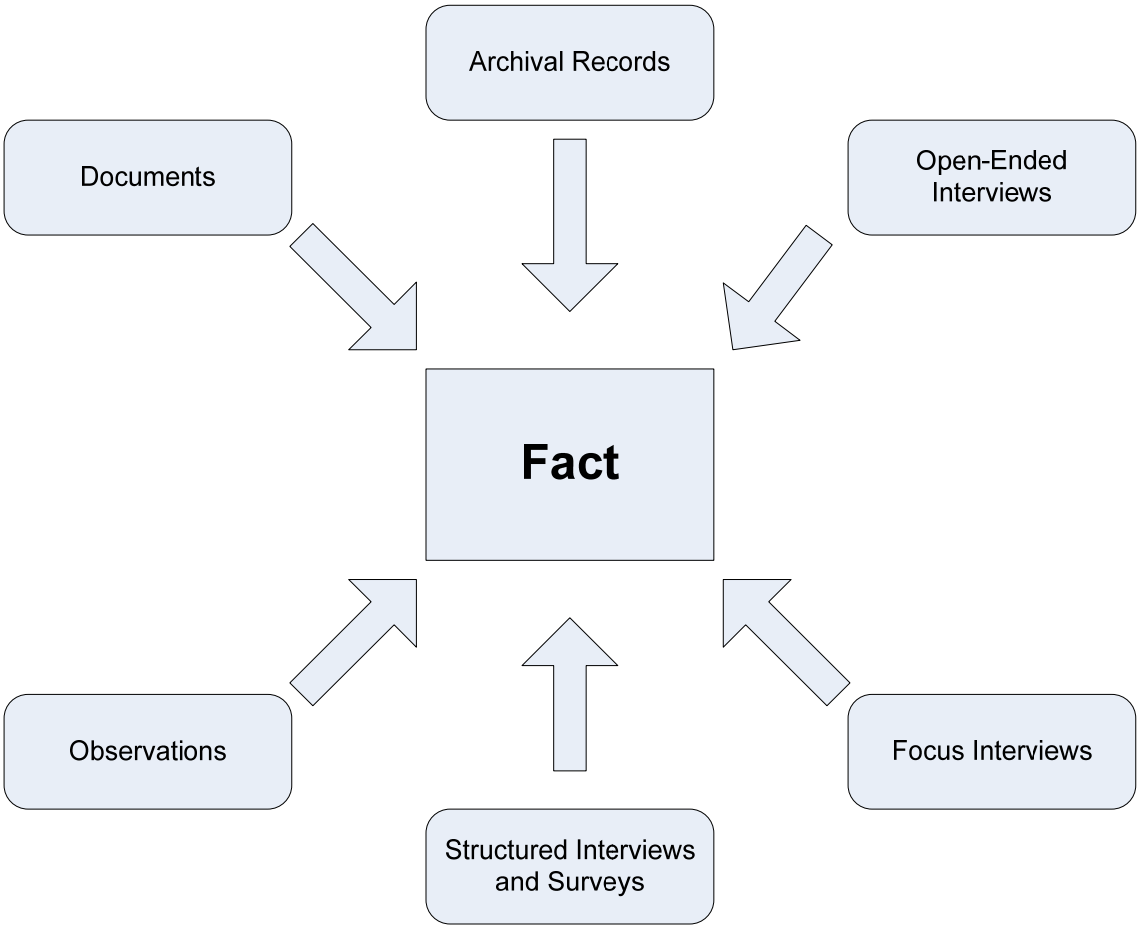


Table 2.2. Recommended Ways of Organizing Case Study Data

Researcher	Method	Used in this study
Huberman (1994)	Putting information into different arrays	√
	Making a matrix of categories and placing the evidence within such categories	√
	Creating data displays—flowcharts and other graphics—for examining the data	√
	Tabulating the frequency of different events	√
	Examining the complexity of such tabulations and their relationships by calculating second-order numbers such as means and variances	
	Putting information in chronological order or using some other temporal scheme	
Yin (2009)	Pattern matching compares an empirically based pattern with a predicted one (or with several alternative predictions)	√
	Explanation building analyzes the case study data by building an explanation about the case.	√
	Time-series analysis	
	Logic models deliberately	

	describing a complex chain of events over an extended period of time.	
	Cross-case synthesis is comparison of similarities and differences between cases.	√

Huberman recommends several methods for analyzing case study data (Table 2.2). One is putting information into different arrays. Another is making a matrix of categories and placing the evidence within such categories. He also suggests creating data displays for examining the data. Yin (2009) recommends several methods for organizing and making sense of case study data. Pattern matching is one that compares an empirically based pattern with a predicted one (or with several alternative predictions). Explanation building is a method where the case study data is analyzed by building an explanation about the case. Yin (2009) also asserts that high quality analysis will involve showing attention to all available evidence, addressing all major rival interpretations, as well as the most significant parts of the case, and using the researcher's own prior, expert knowledge of the case study.

There are several recommendations for controlling the effects of a priori beliefs when conducting case study research. It is recommended that field notes be written up prior to any attempt at categorizing or coding. At least two researchers should review the notes and resolve any differences. Field notes should be transcribed, edited and reviewed by all assigned researchers. Within and cross case analysis can then be conducted. It is recommended to reduce the data by constructing tables, models and figures (Table 2.3).

Table 2.3 Controlling for the Effects of a Priori Beliefs

Protocol	**Additions to Primary Protocol**	**Used in this study or not**
Field notes written up prior to any attempts at categorizing or coding		**Yes**
A secondary researcher reviewed the notes	Any discrepancies were cleared up by contacting the respondents for clarification	**Yes**
Field notes were then transcribed, edited and checked by the secondary researcher	Add anything new or interesting to the future protocols	**Yes**
Between case analysis: consisted of looking for patterns across the various organizations		**Yes**
Reduction of the data and displaying it in a meaningful manner	Data reduction done by categorization of ways that the intent to strategize, organize and finance ESH appears related to how it actually is.	**Yes**

(Miles & Huberman, 1994; Yin, 2009)

Case study research is a common research design used in the ESH, manufacturing and business fields. In the ESH field, case study methodology has been used to study computer-aided ergonomics in the early stages of work station design (Feyen et al., 2000). Case study research has also been conducted on safety climate in the construction industry (Fang, Chen, & Wong, 2006). Case study research has been used to study computer-integrated manufacturing systems (Gerwin & Tarondeau, 1982). Case study research has also been used in ESH to assess certain safety functions utilizing previously untested models (Harms-Ringdahl, 2003). Walton et al. (1998) conducted research on environmental management in the supply chain using a

design with five cases. There have been several studies on supply chain management using case study methods (Wu & Choi, 2005; Pagell & Wu, 2009). Voss et al. (2002) found that case study research has been, "…one of the most powerful research methods in operations management…" In addition, case study research can be used to discover new areas for research or theory development. It can also be used for theory building, theory testing, and refinement of existing theories in operations (Handfield & Melnyk, 1998). Pagell (2004) executed a study using case study methodology in order to build a model of internal integration across operations, purchasing and logistics. Table 2.4 shows some recent studies in operations management where case study research was used (adapted from a table in Voss et al. 2002).

Table 2.4 Recent Examples of Case-Based Research in Operations Management

Study	Number of cases	Purpose
Narashimhan & Jayaram (1998)	1	Theory building
Lamming et al. (2000)	16	Theory building
Pagall & Krause (1999)	30	Theory building
Boyer & McDermott (1999)	7	Theory testing
McLachlin (1997)	6	Theory testing
Meredith & Vineyard (1993)	3	Theory refinement
Hyer et al. (1999)	1	Theory refinement
Ahlstrom et al. (1998)	15	Theory extension

Voss et al. (2002)

Validity and reliability issues in case study research

Validity can be defined as the extent to which a research procedure provides a correct answer and reliability as the extent to which the procedure provides the same answer no matter how and when it is carried out (Kirk & Miller, 1986). Table 2.5 depicts different types of validity and reliability and how they can be addressed in case study research. Construct validity involves identifying the correct operational measures for the concepts being studied. Internal validity seeks to establish a causal

relationship between variables. External validity defines the domain to which a study's findings can be generalized. Reliability demonstrates that the operations of a study can be repeated with the same results.

Table 2.5 Case Study Validity and Reliability

Tests	**Case Study Tactic**	**Phase of Research**
Construct Validity Identifying correct operational measures for the concepts being studied	Use multiple sources of evidence Establish chain of evidence Have key informants review draft case study report	Data collection
Internal Validity Seeking to establish a causal relationship, whereby certain conditions are believed to lead to other conditions, as distinguished from spurious relationships	Do pattern matching Do explanation building Address rival explanations Use logic models	Data analysis
External Validity Defining the domain to which a study's findings can be generalized	Use theory in single-case studies Use replication logic in multiple-case studies	Research design
Reliability Demonstrating that the operations of a study—such as the data collection procedures—can be repeated with the same results.	Use case study protocol Develop case study database	Data collection

(Yin, 2009)

Construct validity is controlled for during the data collection and the composition stages of research (Table 2.5). The use of multiple sources of evidence and the establishment of a chain of evidence increases the construct validity of a study (Voss et al., 2002; Yin, 2009). Construct validity is also referred to as a part of theoretical validity and refers to the validity of the concepts being studied (Maxwell, 1992). Moreover, a construct can also have discriminant validity if it can be differentiated from other constructs (Leonard-Barton, 1990). Construct validity can

also be strengthened by using multiple sources of evidence—similar results can give evidence for convergent validity.

Moreover, Maxwell (1992) refers to two types of descriptive validity in qualitative research: primary and secondary. Primary descriptive validity consists of the accuracy with which a researcher is able to report what he/she saw, heard, etc. Secondary descriptive validity is the accuracy of events reported to a researcher, but that he/she did not observe first hand. In addition, it is important to refine the definition of a particular construct to build evidence. This "…occurs through constant comparison between data and constructs so that accumulating evidence from diverse sources converges on a single, well-defined construct." (Eisenhardt, 1989). Internal validity is an issue for case study research involving causality. Case studies in general lack external validity (Eisenhardt, 1989; McCutcheon & Meridith, 1993). Yin (2009), however, states that external validity can be addressed through replication. In addition, when using a multiple case study methodology, if two or more cases yield the same findings and do not support rival findings, then reliability is increased (Meredith, 1992). The use of multiple cases that show consistent results can strengthen the precision, validity and stability of findings (Miles & Huberman, 1994). Reliability can be addressed by using a case study protocol with a semi-structured interview tool and the use of a case study database where the questions and subjects' responses are catalogued and coded, so that the study's operations can be repeated with the same results (Meredith, 1998; Yin, 2009).

Some qualitative researchers believe that the focus in this type of research is on understanding the phenomena involved and not on generalizing to universals (Maxwell, 1992; Meredith, 1998). Merriam (1998) said that the interest for researchers in case study research is, "…insight, discovery, and interpretation rather than hypothesis testing…" Merriam also stated that case studies should increase the understanding of the phenomenon being studied and should do the following:

- Explain the phenomena being studied
- Discuss and evaluate alternatives

- Evaluate, summarize, and draw possible conclusions (Merriam, 1998)

All of these functions help to increase the understanding of the phenomena in question and add to the field of study.

Evaluation of case study research

In conducting case study research, there is a question as to how case study research methods should be evaluated. Pfeffer (1982) suggests that good theory is parsimonious, testable, and logically coherent. Yin (2009) also recommends reviewing whether the investigators have followed a careful analytical procedure. Case study evidence should also be evaluated by looking at whether it supports the theory being offered. Ideally, case study research should result in new insights in the field. Eisenhardt (1989) also recommends asking the following questions when evaluating case study research:

- Have the investigators followed a careful analytical procedure?
- Does the evidence support the theory?
- Have the investigators ruled out rival explanations?
- Has the research resulted in new insights in the field?

These questions assist in the evaluation of whether a case study has accurately refined a theory or even generated new theories about the phenomenon being studied.

Current Study

This research is in response to the numerous calls to better understand the linkage of ESH strategy to the competitive strategy of the firm (Ward, et al., 1995; American Society of Safety Engineers, 2002; European Agency for Safety at Work, 2004; Kleindorfer et al., 2005; National Institute of Occupational Safety and Health, 2009; World Resources Institute, 2011).

Chapter 3
Methods

The primary objective of this research study was to refine and validate a tool to evaluate the ESH function's contribution to the business concerns in manufacturing. The following conceptual framework was proposed which profiled levels and pathways of ESH strategy available and being used by manufacturing businesses. The Developmental Levels Rating System (DLRS) evaluated the ESH function within manufacturing firms in the following categories:

- Strategy Formulation
- Organization Structure
- Financing Strategy

Research Question

The primary research question of the study was to see if the rating system accurately profiled the different types of businesses and whether it might be able to provide an evidence-based tool for ESH managers to use in order to align the ESH strategy with the business strategy of the firm (Figure 3.1).

Figure 3.1 Developmental Levels Rating System (DLRS)

Model Development and Framework

Elements of a Firm's ESH Management Strategy:

1. Strategy Formulation: The manner in which the firm intends on confronting and managing ESH issues.
2. Organization Structure: The manner in which the firm structures ESH strategy within the organization of the firm.
3. Financing Strategy: The manner in which the firm funds ESH strategy.

Developmental Levels of ESH Management Strategy Within A Firm:

Level 1 (Reactive)	Strategic posture is to respond to ESH issues as they occur.
Level 2 (Static)	Strategic posture is to respond to ESH issues based on the prevailing regulatory requirements.
Level 3 (Active)	Strategic posture is to accept and internalize ESH issues and extend broad management and technical effort.
Level 4 (Dynamic)	Strategic posture is to focus on the competitive value of ESH practices.

See Appendix A for more detailed explanations of each element and level.

Materials and Methods

The current study is based in part upon a previously published study which is located in Appendix D (Veltri & Maxwell, 2008).

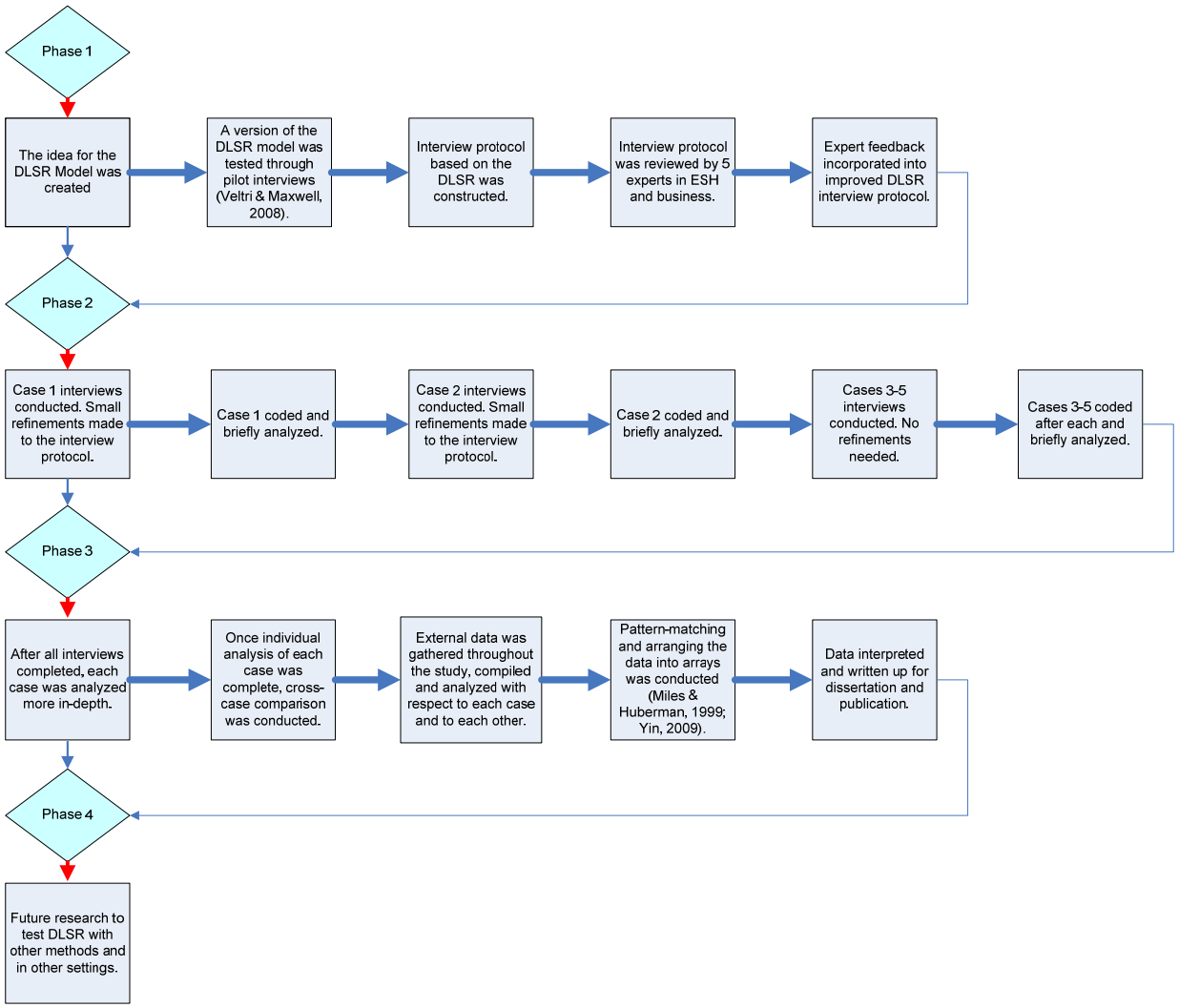
Currently, there have been few robust studies that have researched the linkages between ESH and manufacturing strategies. Therefore, the questions in this study were: how are ESH strategy, organization, and financing related to each other and how are all of these related to the selected outcomes? The proposition in this study was that the manner in which organizations strategically manage, structure, and finance the ESH function can impact ESH outcomes, and most likely business outcomes, as well. The unit of analysis was the manufacturing factory site. Pattern matching, cross-case comparison, and explanation building were the analysis methods. The criteria for

interpreting the findings in this study were to identify and address rival explanations. The results may be considered stronger if two or more cases support the same theory, but do not appear to support an equally plausible rival theory (Yin, 2009).

Research Phases

In this study, the interview protocol was created on the basis of previously published research (Figure. 3.2). In addition, the interview protocol was reviewed by five experts in the ESH and business field for accuracy and clarity of the questions. Moreover, suggestions and feedback received from these experts were reviewed by the two primary researchers and incorporated into an improved interview protocol. Case interviews were then conducted according to the interview protocol (See Appendix C). Each case interview was digitally recorded, transcribed, coded, and briefly analyzed after each interview. After all case interviews were completed for all cases, full analysis of each case was completed. Subsequently, cross case comparisons were done between the cases. Secondary data gathered from various regulatory agencies was then incorporated into the analysis to obtain an assessment of each facility's level of risk from ESH issues. Arranging the data into arrays, pattern matching, and explanation building and were then conducted.

Figure 3.2 Research Phases



Sample selection

In theory testing and theory refinement research, it is suggested to use random sampling of the population of interest (Cook & Campbell, 1979). However, in case study research the sample can be purposeful with some theoretical underpinnings (Eisenhardt, 1989; Miles & Huberman, 1994). The primary goal of this research was to explore how valid the proposed strategic framework was. Therefore, the selected

sample was comprised of manufacturing companies of various sizes that had already participated in an ESH research study in the recent past of a similar nature.

Yin (2009) suggests using between two and six replications, depending on how complex the issue being studied is. Eisenhardt (1989) reports that the recommended number of cases varies, but: "…a number between 4 and 10 cases usually works well." Fewer than 4 cases can be difficult to generate theory with much complexity and is likely to be unconvincing, whereas more than 10 cases can become difficult to cope with the complexity and volume of the data. In this study, the selection of five cases fits into these recommendations. In addition, it was thought that the phenomenon would be found in a variety of manufacturing business structures in Oregon. This also assisted in comparing the five companies because they operate in the same regulatory environment and with the same oversight such as Oregon OSHA. Ten companies were contacted and five agreed to participate in this study. Five of the companies contacted never responded to telephone or email contact. All five companies that participated in the study had some type of ESH strategy and/or protocol embedded in the strategic plan of the company.

Interview protocol

A semi-structured interview protocol was used at all of the organizations (Eisenhardt, 1989). The questions were formulated based upon previously published research (Veltri & Maxwell, 2008). In addition, the interview protocol was pilot tested with five ESH and business experts for refinements and clarification of the questions. This feedback was evaluated and incorporated into the interview questions. The sample was constructed to include companies of different sizes and industries within manufacturing, ranging from food to wood products. Therefore, a semi-structured protocol provided the flexibility to focus on what was unique and similar at each of the companies.

The interviews lasted from 60-90 minutes and included a facility tour. After each site visit, the digital interview files were transcribed and field notes were edited, and checked for accuracy. The transcribed notes were then given to a second researcher to check for any inaccuracies or issues of clarity. In addition, the interviewer also took notes to record impressions, context, and any other relevant information. Any new or interesting areas that arose from the data were added to the protocol for subsequent cases.

Data collection

The research design was based on the recommendations of experts in case study research (Eisenhardt, 1989; Miles & Huberman, 1994; Handfield & Melnyk, 1998; Yin, 2009). The three principles of data collection in case study methodology were utilized in this study (Yin, 2009). Multiple sources of evidence were gathered to create converging lines of inquiry or *triangulation*. A case study database was created which consisted of the data and interpretations of the data. Moreover, a chain of evidence was also maintained.

The initial protocol called for interviews with respondents who would have a unique perspective about ESH strategy, structure, financing, and outcomes. Initially, the protocol was to obtain interviews with the Operations Manager, a Human Resources (HR) representative, the ESH specialist, a line worker, and a Union representative. However, in the course of preliminary telephone and email contacts, it was discovered that the respondent companies did not have this structure. For example, in several companies, the ESH position and HR position were occupied by the same employee. No companies contacted had union representation. Two companies had predominantly Spanish-speaking line workers. In addition, resistance was encountered with all companies to interviewing line workers. The stated reason for this was not wanting to take workers away from their work and some possible suspicion regarding the interviewer's motives. However, several line workers were able to be interviewed in a more informal setting during plant tours.

Because of these initial challenges to adhering to the initial protocol, the protocol was altered to reflect what was obtainable. This is one of the reasons that Yin recommends taking an adaptive and flexible approach to case study research, as it is rare for case study research to proceed exactly as planned before entering the field or interviewing subjects (Yin, 2009). Therefore, from 2-3 interviews were conducted internally at the companies and then 5-8 secondary data sources were obtained externally from environmental and occupational regulators (OSHA, EPA, Department of Environmental Quality (DEQ), etc.) and NGOs. In addition, these secondary sources also serve as a form of triangulation to compare the statements of the internal stakeholders (Yin, 2009). Moreover, the secondary data provided the assessment of risk for each case.

Facility tours were part of the data collection effort. Internal consistency was ensured by taking plant tours. This provided contextual information and in-depth understanding of the plant processes and helped with triangulation (Wu & Choi, 2005). Moreover, line employees, engineers, and other managers were routinely interviewed on a more informal basis while touring a facility. Although this data was not digitally recorded, it was included in the notes on each case facility and sometimes was quite relevant in reinforcing other data. This also served as another form of triangulation—gathering other pieces of data to shore up or disprove data collected in more formal, recorded interviews (Yin, 2009). Plant tours provided the opportunity to observe if the interview reports were consistent with what actually occurred on the manufacturing floor. Finally, data were also gathered from publicly available sources when available. Web sites, published articles, and reports from NGOs and regulators all formed part of the secondary data collected for each organization. Secondary data was obtained from various government regulating agencies such as EPA, OSHA, state agencies, and local NGOs. No one agency was able to provide records on all cases.

Another part of triangulation that mitigates biases and enhances reliability and validity involves combining observations from multiple researchers, data from

multiple sources and/or different types of data (Jick, 1979; Eisenhardt, 1989; Yin, 2009). The use of multiple researchers helps to control for the biases of any one individual researcher. Although it was not possible to conduct the interviews in teams, a second researcher reviewed the transcribed notes, debriefed with the primary researcher, and provided suggestions for clarifications and subsequent interviews/site visits. The use of multiple respondents and multiple types of data mitigated the biases of a single respondent and increased the potential of accurately capturing the respondents' perceptions.

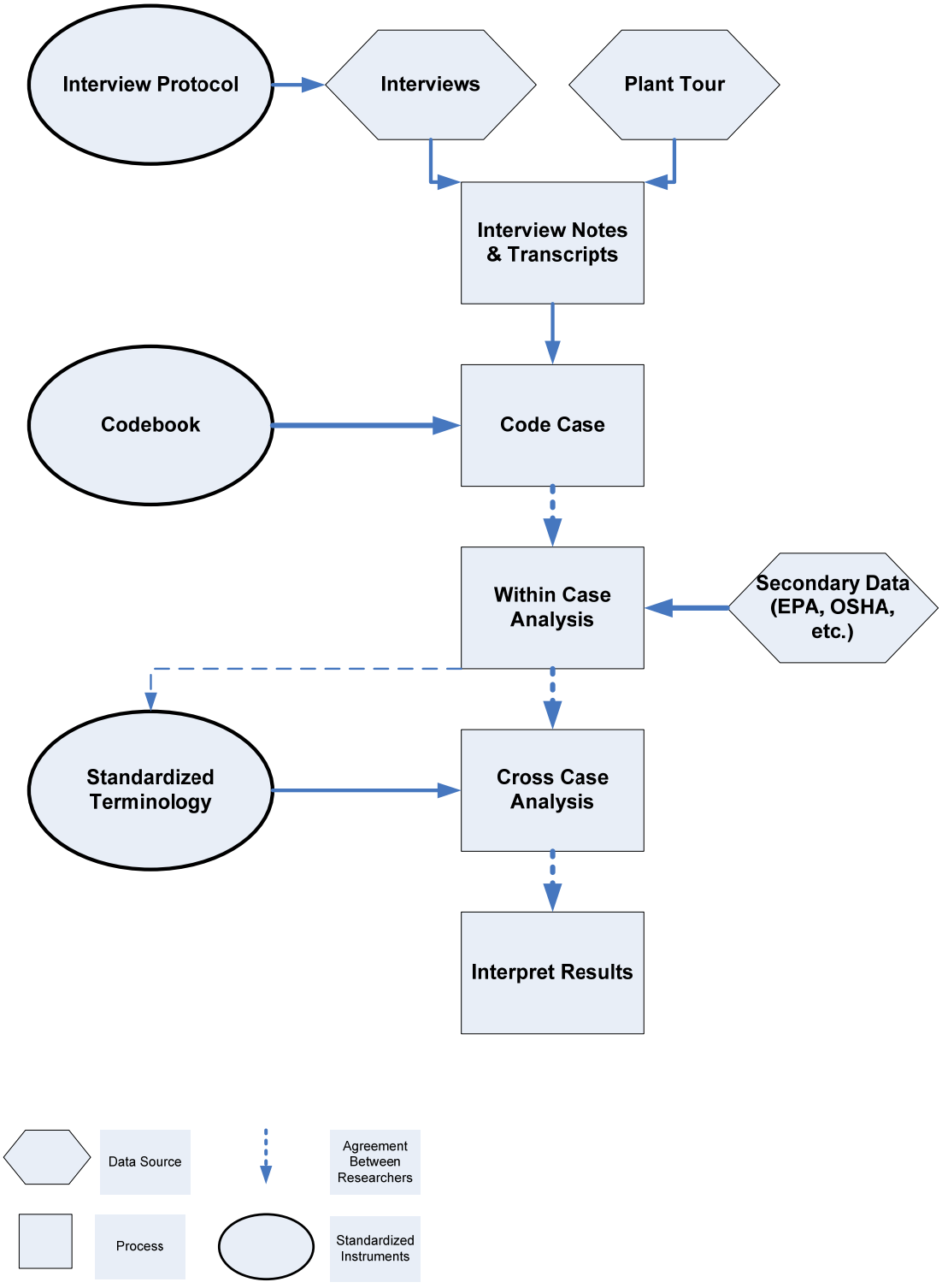
In addition, background information was also requested for all the sites where interviews took place (organizational charts, mission statements, public reports, etc.). Gathering information from multiple respondents and sources, as well as the site visits, allowed the researchers to mitigate many potential sources of bias. For example, interviewing several employees at each facility provided different perspectives on the same incidents or policies at the company. Triangulation allows for any inconsistencies to be followed up on and for greater confidence in the data that appear to be consistent.

Coding

Coding was based on the transcripts, interviewer notes, and secondary data (Figure 3.3). Coding included the construction of a code book. The code book defined terminology and constructs in a consistent way including the scoring scheme based on the financial, organizational, and strategy elements of the DLRS model. When there were inconsistencies between the data sources, respondents were contacted for clarification. This was done via telephone and email. After transcription, the data were coded into the categories and scored. Another researcher assisted with coding issues and inconsistencies were discussed and agreed upon. This process increases the validity of the coding process. Two primary components of data analysis were within and cross-case analysis. Within case analysis helped to examine the ESH management strategy as it was broken into its component elements: strategy, organization, and financing. The cross-case analysis served as a form of replication where the

constructs of interest were compared between cases to determine patterns and explanations (Yin, 2009).

Figure 3.3 Coding and Analysis Process



In case study research issues of validity and reliability must be addressed (Table 3.1). Construct validity was addressed during the data collection stage of this study. Multiple sources of evidence and a chain of evidence increased the construct validity of this study. The multiple sources of evidence consisted of several interviews, plant tours, and secondary data gathered (OSHA, EPA, Department of Consumer and Business Services (DCBS), NGO's, web searches, etc.). As stated previously, the interview questions were also reviewed by a group of five ESH and business experts in the ESH and business field and their feedback was incorporated into the interview protocol before going into the field. Internal validity is an issue for case study research involving causality which this study does not attempt to address.

Table 3.1 Case Study Validity and Reliability Methods Used

Tests	**Case Study Tactic**	**Phase of Research**
Construct Validity Identify correct operational measures for the concepts being studied	Use multiple sources of evidence √ Establish chain of evidence √	Data collection
Internal Validity Seek to establish a causal relationship, whereby certain conditions are believed to lead to other conditions, as distinguished from spurious relationships	Do pattern matching √ Do explanation building √ Address rival explanations √	Data analysis
External Validity Define the domain to which a study's findings can be generalized	Use replication logic in multiple-case studies √	Research design
Reliability Demonstrate that the operations of a study—such as the data collection procedures—can be repeated with the same results.	Use case study protocol √ Develop case study database √	Data collection

√: Tactic used in this study

Although case studies in general lack external validity, it can be addressed through replication. In the current study, each case was a replication of the others. A phenomenon found in all five cases may point the way for future research to address issues of causality and generalizability. Although these five cases cannot be used to

generalize to a larger population, they can be used to form the basis for future research and the types of firms that might be selected to either replicate these findings or test the findings in very different settings. The issue of reliability was addressed in this study by using a case study protocol with a semi-structured interview tool and the use of a case study database where the questions and subjects' responses were catalogued and coded.

Chapter 4
Results

Level of analysis

This research was conducted at the plant level at the manufacturing site. Since the interest was in how the intention to strategize, organize, and finance ESH was related to how it actually was strategized, organized and financed, the plant level seemed the most appropriate level of analysis. See Appendix A for more detailed explanations of each element of the DLSR and its corresponding level.

Data Analysis

The five cases all consisted of manufacturing plants (Table 4.1). Case 1 was a small factory that manufactured customized horse trailers. The plant had some on-site ESH functions. Case 2 was a medium-sized facility that manufactured particle board. This facility had a full-time safety manager and a full-time environmental manager. Case 3 was a mid-sized plant that produced fire-fighting tents and equipment. The plant had an onsite ESH director who also served as the plant's engineer. Case 4 was a medium-sized facility that manufactured paint products for industrial and individual usage. This facility had three full-time ESH professionals. Case 5 was a large plant that manufactured food products, and also had three full-time ESH staff. All cases were non-union.

Table 4.1 Company Profiles

Company	Company profile	Products	On-site ESH	Union	Plant tour	Triangulation information obtained
Company 1	Small company	Customized horse trailers	Yes	No	Yes	Yes
Company 2	Medium sized	Particle board	Yes	No	Yes	Yes
Company 3	Small to mid-sized company	Fire-fighting tents and equipment	Yes	No	Yes	Yes
Company 4	Medium sized company	Industrial and home use paints	Yes	No	Yes	Yes
Company 5	Large company	Refrigerated and frozen food products	Yes	No	Yes	Yes

See Appendix E for detailed Case Reports

Case 1 had 15 employees at the plant site (Table 4.2). It had no air quality permits and had no violations on record with EPA. The Department of Consumer and Business Services (DCBS) reported 9 claims between 2000—2005 with a total time loss or days paid of 1721. This was an average of 191.2 days per claim. The total amount of medical paid by closure during this period of time was $196,768 with an average paid by claim of $21,863 (Appendix B). The company reported having an Experience Rating Modification (ER Mod) of less than 1, although there was not a way to verify this since the facility was self-insured. OSHA reported one 'other than serious violation.' This may be an incident where an employee was seriously injured by a saw which was described by the owner. When contacted, several local environmental organizations reported no records or concerns about this company or any environmental issues. The company website did not contain any environmental information such as an environmental mission statement, statement of commitment to the environment, statement of environmental awareness, or an outline of their environmental program.

Case 2 had 78 employees at the plant (Table 4.2). The company had an extensive part of their company website devoted to their environmental concerns. They had an Environmental Policy Statement, a list of their product certifications, a list of their sustainable projects, and their commitment to Leadership in Energy and Environmental Design (LEED) Green Building Rating System Credit Support. Because this company manufactured wood products, they were under more public and government scrutiny for emissions and the kind of wood products (sustainable or not) they used.

In 2005 the facility was issued one Notice of Non-Compliance (NON No. 3002) for operating MEC-1 rotary dryer such that dryer inlet temperature exceeded a 24-hour average operating temperature of 600 degrees F (a requirement of the Subpart DDDD Plywood MACT) by the local air quality regulating agency. Because the facility had been diligent in meeting the Subpart DDDD compliance dates and requirements, the furnish (wood fiber material) to MEC-1 was by definition "dry" at the time of the temperature excursion (green is considered of 30% moisture or greater) and that activity was not on the basis of circumventing the DDDD requirements for drying green material, NON 3002 was closed with no further enforcement action.

Table 4.2 Summary Data of All Cases

	Number of Employees	***ESH information on business website***	***OSHA reports***	***ER Mod***	***Environmental reports***	***NGO reports of ease of working with; prompt action to address ESH issues***
Case 1	15	No	1 other than serious violation	Reported less than 1.0	No air quality permits No EPA records located	No information reported, either positive or negative
Case 2	78	Yes	3 citations issued; 4 serious violations; 2 other than serious violations	1.07 7% worse than the industry average	Issued one Notice of Non-Compliance (NON No. 3002) for operating MEC-1 rotary dryer such that dryer inlet temperature exceeded a 24-hour average operating temperature	Reported to be responsive and easy to work with to resolve issues
Case 3	85	No	The facility has not had an inspection in several years, but the last one was completely clean and no citations were	0.83 17% better than the industry average	No air quality permits No EPA records located	No information reported, either positive or negative

			given.			
Case 4	94	Yes	The facility had an OSHA inspection within the last year and $500 in fines were given for non-serious offenses	1.04 4% worse than the industry average	Three Notices of Non-Compliance have been issued since 1995	Reported to be responsive and easy to work with to resolve issues
Case 5	250+	No	3 citations issued; 2 serious violations; 1 other than serious violation	Refused to release	Leaking Underground Storage Tank (LUST): 1998 Report of a leaking diesel tank 2000 Cleanup complete; only soil contamination No air quality permits	Reported to be responsive and easy to work with to resolve issues

See Appendix B for DCBS data on each case.

The company's enforcement history was reported by the local air quality permitting agency to be generally considered average and that the company had made strides to maintain compliance and improve any noted issues. EPA was contacted and reported having no records on this facility or company. OSHA reported three citations have been issued. This facility had four serious violations and two other than serious violations.

This facility's ER MOD was 1.07 which is 7% worse than the industry average. It was reported by the safety manager that this number reflects both of the company's two manufacturing facilities. It was reported that the facility not visited has not implemented an ESH program and had a worse safety record than the facility which had implemented the program. Therefore, it was reasonable to think that the actual ER MOD for this facility alone was probably lower than 1.07. DCBS reported that between 2004-2008 there were 10 claims with a total of 527 days paid which was an average of 52.7 days per claim. The total amount of medical paid by closure during this time period was $182,730 with an average of $18,273 paid per claim.

Eighty-five plant employees worked at the Case 3 facility (Table 4.2). When contacted, several local environmental organizations reported no records or concerns about this company and any environmental issues. The company website did not contain any environmental information such as an environmental mission statement, statement of commitment to the environment, statement of environmental awareness, or an outline of their environmental program. This business also had no air quality permits and had no violations on record with EPA.

This facility's ER MOD was reported to be 0.83 which is 17% better than the industry average. OSHA reported the facility had not had an inspection in several years, but during the last one no citations were given. DCBS reported that during 2004-08 there were 11 claims with a total of 412 days paid which was an average of

37.5 days per claim. There was a total of $21,624 medical paid by closure with an average of $1966 paid per claim.

Case 4 had 94 employees at the site (Table 4.2). The company website had an extensive section devoted to its environmental concerns and commitment to staying within compliance with all local, state, and federal regulating agencies. The website also provided information about the installation of the facility's biofilter process and how it had improved their air emissions. The local air quality regulating agency reported a non-compliance citation issued in 2006 for exceeding 9 tons per year of a single Hazardous Air Pollutant (HAP) emission. Toluene was the HAP in question. A civil penalty of $6000 was paid in full. The same agency also reported a non-compliance citation issued in 1995 for installing and operating equipment without notifying the air permit authority first.

EPA public records contained a fine in the amount of $5103 for violations of the Clean Air Act. The fine was paid in full and all cited issues were resolved. EPA records indicate that the business owners and ESH personnel were cooperative with the inspection, results, remediation, and resolution of the fine. This facility's ER Mod was 1.04 which is 4% worse than the industry average. In addition, OSHA reported the facility had an OSHA inspection within the last year and $500 in fines were given for non-serious offenses. DCBS reported that during 2004-08 there were 10 claims with a total of 181 days paid which was an average of 18.1 days per claim. There was $31,346 medical paid by closure during this time period with an average of $3135 paid per claim.

Over 250 employees work at the site profiled in Case 5 (Table 4.2). An internet search yielded a report from the company's insurance provider outlining the company's progressive 'Return-to-Work' program. This was a program where the company worked closely with their insurance carrier to assist injured workers in returning to work quickly (in consultation with medical expertise) and/or assisting

workers with a modified return to work. This report stated that this program helped reduce claims.

The company website did not contain any environmental information such as an environmental mission statement, statement of commitment to the environment, statement of environmental awareness, or an outline of their environmental program. The state air quality permitting agency reported that this company had no air quality permits issued. The state environmental quality agency reported that this facility had one Leaking Underground Storage Tank (LUST) in 1998. This consisted of a leaking diesel tank affecting only soil at the site facility. In 2000, the cleanup was complete. The agency reported no other records of violations against this facility. EPA was contacted and reported having no records on this facility or company.

In 2009 this facility was cited for an OSHA violation of OAR 437-001-0760 (1) (b)(A), for not taking reasonable means to require employees to work and act in a safe and healthful manner; and for violation of OAR 437-001-0760(1) (a), for failing to train employees in the proper use of ladders. The fine was $10,000 for a Serious violation. The citations and fine stemmed from an incident where an employee was directed by his supervisor to climb a ladder alone and unhook pipes overhead. The employee fell and broke his ankle.

Also in 2009 this facility was cited for an OSHA violation of 29 CRF 1910.1200(h)(3)(iii), for not including employee training on how to protect themselves from chemical hazards stemming from an incident where an employee was seriously burned from exposure to a chemical while cleaning. The fine was $900 for a Serious violation. DCBS reported that during 2004-08 there were 55 claims with a total of 2849 days paid which was an average of 51.8 days per claim. There was a total of $364,502 medical paid by closure with an average of $6627 paid per claim.

Within Case Analysis

Within case analysis is a process of data reduction and data management (Miles & Huberman, 1994). For this research there were six to ten pages of transcripts per organization, plus site visit notes, and any publicly available information. The goal of the within case analysis was to structure, define, reduce, and make sense of these varied pieces of information. The within case analysis had several main components. The first component was to understand how the ESH function was structured at each facility. The second component was to understand how people being interviewed viewed their ESH management strategy. The third component was to look at each element of the DLSR (strategy, organization, and financial) and provide a score relating to the level (reactive, static, active, or dynamic) (Table 4.6). The last component was to compare the score with secondary data that was gathered.

Cross Case Analysis

The cross case analysis was concerned with identifying patterns across the various organizations. It was facilitated by using a variety of tools to reduce the amount of data and to display the data in a meaningful fashion (Miles & Huberman 1994; Yin, 2009). Data reduction was primarily done through categorization and pattern matching. The end result of the within case analysis was the index scores of the DLRS for each case. Factors associated with each level were also analyzed. In order to facilitate the cross case analysis, the cases were compared to one another and their levels of risk were assessed using the secondary data scores. The data were then arranged and rearranged in various configurations to search for patterns and explanations. Tables 4.3., 4.4, and 4.5 depict only the data gathered from the interviews of subjects at each site.

Table 4.3 Cross Case Analysis *Strategy* Element

		Reactive(1)	***Static(2)***	***Active(3)***	***Dynamic(4)***	
	STRATEGY					
1	Awareness of organizational stakeholders of the extent and magnitude of safety or environmental issues	**C3**	**C1**	**C1** **C2 (2)** **C4 (2)** **C5 (2)**		
2	Kinds of efforts made to reduce ESH impacts	**C3**	**C4 (2)**	**C1 (2)** **C2 (2)** **C5**	**C5**	
3	Hazard Controls	**C3**	**C1 (2)** **C4(2)**	**C2 (2)** **C5**	**C5**	
4	Issues that take precedence over addressing ESH issues		**C1** **C5**	**C1** **C2 (3)** **C3 (2)** **C4 (2)**	**C5**	
5	ESH compliance strategy	**C3**	**C1 (2)** **C3** **C5**	**C2** **C4 (2)** **C5**	**C2**	
6	Approach to government or insurance sanctions in regard to ESH issues	**C3**	**C1 (2)** **C2** **C4 (2)**	**C2** **C5 (2)**		
7	Upfront design engineering utilized		**C1** **C2** **C3** **C5**	**C2** **C5**		
8	Relationship of ESH strategy to business strategy	**C3**	**C3** **C4 (2)** **C5**	**C1** **C2 (3)** **C5**		
						Index
	Totals Case 1 (C1)	0	9 x 2 each =	5 x 3 each = 15	0	33/14 = **2.36**

			18			
	Totals Case 2 (C2)	0	2 x 2 each = 4	15 x 3 each = 45	1 x 4 each = 4	53/18 = **2.94**
	Totals Case 3 (C3)	6 x 1 each = 6	3 x 2 each = 6	2 x 3 each = 6	0	18/11 = **1.64**
	Totals Case 4 (C4)	0	8 x 2 each = 16	6 x 3 each = 18	0	34/14 = **2.43**
	Totals Case 5 (C5)	0	4 x 2 each = 8	9 x 3 each = 27	3 x 4 each = 12	47/16 = **2.94**

Score was divided by the number of answer given to obtain the index score.

In the Strategy dimension of the DLSR (Table 4.3), the cases attained a variety of scores with Cases 2 and 5 attaining high Static scores. Cases 1 and 4 were in the mid-range Static dimension. Case 3 was the only one in the Reactive dimension (1.64).

Table 4.4 Cross Case Analysis *Organizational* Element

		Reactive(1)	***Static(2)***	***Active(3)***	***Dynamic(4)***	
	ORGANIZATION					
1	Type of ESH authority		**C2 (2) C3 C4 (2) C5**	**C5**		
2	How ESH was structured in the organization		**C1 (2) C3 C4 (2) C5 (2)**	**C2 (2)**		
3	Who the ESH function reported to		**C2 (2) C3 C4 (2) C5 (2)**			
4	Who met to discuss and plan for ESH issues		**C1 (2) C3 C4 (2) C5**	**C2 (2) C5**		
5	How organizational structure was	**C1 C3**	**C2 C4 (2)**	**C2**		

	affected by compliance issues		**C5 (2)**			
6	How compliance issues were addressed	**C3**	**C1 (2)** **C2 (2)** **C4 (2)**	**C5 (2)**		
7	Who handled regulatory and enforcement issues	**C3**	**C1 (2)** **C4 (2)** **C5(2)**	**C2 (2)**		
8	How new regulations were implemented	**C1** **C3**	**C2**	**C2** **C4 (2)** **C5 (2)**		
9	Thought given to going beyond compliance	**C1** **C3**	**C1**	**C2 (2)** **C4 (2)** **C5 (2)**		
10	Efforts made to anticipate new compliance issues and have a plan before they were enacted	**C1 (2)** **C3**		**C2 (2)** **C4 (2)** **C5 (2)**		
11	Connectedness of ESH department to core business units in the firm	**C5**	**C2(2)** **C3** **C5**			
12	How competitive performance plans impacted the organization of the ESH function	**C3** **C4 (2)** **C5**	**C1** **C2 (2)** **C5**			
13	How the ESH function interacted with Research and Development (R/D)		**C3** **C5**	**C2 (2)** **C5**		
14	Corporate wide ESH policy		**C1** **C2** **C4 (2)**	**C2** **C5 (2)**		

15	Risk identification, assessment, and control initiatives	**C1** **C3**	**C4 (2)**	**C2 (2)** **C5 (2)**		
16	Contingent liability reduction	**C1** **C3**	**C4 (2)** **C5 (2)**	**C2 (2)**		
17	Enhancing regulatory compliance	**C3**	**C1** **C2** **C4 (2)** **C5 (2)**	**C2**		
18	Consideration of what would cause the most risk and cost burdens	**C1** **C2** **C3** **C4 (2)** **C5**	**C2**	**C5**		
19	How spending was allocated to address risk and cost burdens	**C1** **C3** **C5 (2)**				
20	Consideration given to any activities which were risky enough to eliminate	**C1 (2)** **C3** **C4 (2)**	**C2** **C5 (2)**	**C2**		
21	Utilization of different ESH scenarios with costs of controls to determine the best course of action	**C1** **C3** **C4 (2)** **C5**	**C2** **C5**			
22	Connectedness of ESH department with other departments		**C3** **C4 (2)** **C5**	**C2 (2)** **C5**		
23	Involvement with shaping public policies	**C3** **C4 (2)** **C5**	**C1** **C2** **C5**	**C2**		
						Index

	Totals Case 1 (C1)	12 x 1 each = 12	13 x 2 each = 26	0	0	38/25 = **1.52**
	Totals Case 2 (C2)	1 x 1 each = 1	18 x 2 each = 36	24 x 3 each = 72	0	109/43 = **2.53**
	Totals Case 3 (C3)	15 x 1 each = 15	7 x 2 each = 14	0	0	29/22 = **1.32**
	Totals Case 4 (C4)	10 x 1 each = 10	24 x 2 each = 48	6 x 3 each = 18	0	76/40 = **1.90**
	Totals Case 5 (C5)	7 + @ 1 each = 7	22 + @ 2 each = 44	17 + @ 3 each = 51	0	102/46 = **2.22**

In the Organizational construct (Table 4.4), two of the cases scored in the Static dimension (Case 2 and Case 5). While three cases had indexes in the Reactive dimension (Cases 1, 3, 4).

Table 4.5 Cross Case Analysis *Financial* Element

		Reactive(1)	***Static(2)***	***Active(3)***	***Dynamic(4)***	
	FINANCIAL					
1	Efforts expended to enhance the efficiency and effectiveness of the ESH function	**C1 C3 C5**	**C5**			
2	Connectedness of financial strategies and ESH strategies	**C1 C2 (2) C3 C5**	**C5**			
3	Contribution of ESH strategy to competitiveness	**C3 C5**	**C1 C5**	**C2(3)**		
4	Characterization of the strategy for financing ESH investments	**C3 (2) C4 (2)**	**C1 C2 (2) C5**	**C2 C5**		

5	ESH fund attainment for ESH activities	**C1 C2 (2) C3 (2) C4 (2)**	**C5 (2)**			
6	Kinds of issues ESH expended funds on	**C1 C3**	**C5**			
7	Performance of economic analysis of ESH issues	**C1 C2 (2) C3 C4 (2) C5 (2)**				
8	Comparable ESH funding with others in similar industry		**C1 C2 (2) C3 C4 (2) C5**	**C5**		
9	Use of integrated and concurrent design engineering	**C1 C4 (2) C5**	**C3 C5**	**C2 (2)**		
10	Use of cost-benefit analysis in related to ESH investments	**C1 C2 (2) C3 C4 (2) C5**	**C5**			
11	How costs of ESH incidents were charged	**C1 C3 C4 (2)**	**C2 (2) C5 (2)**			
12	Characterization of the strategy for financing ESH investments	**C1 C2 (2) C3 C4 (2)**	**C5**	**C5**		
13	How long financial resources and capital approved for	**C1 C2 (2) C3 C4 (2) C5 (2)**				
						Index

	Totals Case 1 (C1)	10 x 1 each = 10	3 x 2 each = 6	0	0	16/13 = **1.23**
	Totals Case 2 (C2)	12 x 1 each = 12	6 x 2 each = 12	6 x 3 each = 18	0	42/24 = **1.75**
	Totals Case 3 (C3)	13 x 1 each = 13	2 x 2 each = 4	0	0	17/15 = **1.13**
	Totals Case 4 (C4)	16 x 1 each = 16	2 x 2 each = 4	0	0	20/18 = **1.11**
	Totals Case 5 (C5)	9x 1 each = 9	13 x 2 each = 26	3 x 3 each = 9	0	44/25 = **1.76**

All five cases scored an index of between 1.11 and 1.76 (Table 4.5). This means that essentially all the cases were operating within the Reactive dimension of the DLSR in the financial element. Case 5 was close to the Static dimension, whereas Case 4 was very near the bottom of the Reactive dimension.

Table 4.6 shows the summary levels of each case compared to each other, solely based on the internal subject interviews. The summary levels were calculated by taking the total scores in all categories and dividing it by the number of answers provided (Table 4.7). For example, Case 2 had a total score of 204 across all three categories with 85 answers given by subjects. Therefore, 204/85 yields 2.40 for a summary score and a level of Static. Cases 1, 3 and 4 obtained scores in the Reactive range across all elements. Case 3 was the lowest with a summary score of 1.33. Cases 2 and 5 had summary scores in the Static range.

Table 4.6 Summary Scores

	Case 1	**Case 2**	**Case 3**	**Case 4**	**Case 5**
Strategy Score	2.36	2.94	1.64	2.43	2.94
Organization Score	1.52	2.53	1.32	1.90	2.22
Financial Score	1.23	1.75	1.13	1.11	1.76
Summary Score	1.67	2.40	1.33	1.81	2.22

Table 4.7 Example of Score Calculation

Strategy Score	Organization Score	Financial Score	Summary Score
53/18 = 2.94	109/43 = 2.53	42/24 = 1.75	204/85 = **2.40**

Table 4.8 depicts the secondary data gathered during the study. The top portion of Table 4.8 shows how the secondary data were scored. For example, having no ESH information on a company's website yielded a score of 1 and a risk rating of High, whereas a company with several webpages devoted to ESH activities yielded a score of 4 and a risk rating of Slight. The lower portion of the table shows how each case actually scored in each secondary data category. Cases 1, 2 and 5 were assessed to have substantial risk and Cases 3 and 4 were assessed to have possible risk.

Table 4.8 Secondary Data Scoring Matrix

DLSR Score	Risk Ranking	ESH information listed on website	OSHA	EPA	Air quality orgs	DCBS	ER Mod	NGO or other agency reports of ease of working with and/or responsiveness to issue	
1	**High**	None	4 or more violations	4 or more violations	4 or more violations	More than 150 days paid on average per claim	10-20% worse	Reported to be difficult or unresponsive	
2	**Substantial**	Brief mention of ESH activities	2-3 violations	2-3 violations	2-3 violations	100-149 days paid on average per claim	1-9% worse	Reported some difficulty in working with	
3	**Possible**	ESH mission statement and moderate amount of ESH activities	1 violation	1 violation	1 violation	50-99 days paid on average per claim	1-9% better	Little difficulty in working with	
4	**Slight**	ESH mission statement and large amount of webpage devoted to ESH activities	0 violations	0 violations	0 violations	1-49 days paid on average per claim	10-20 % better	Reported to be easy to work with and responsive	
Cases									**Summary Score/risk**

									ranking
1		1	3	4	4	1	NA	NA	2.60
									Substantial risk
2		4	1	4	3	3	2	3	2.86
									Substantial risk
3		1	4	4	4	4	4	NA	3.50
									Possible risk
4		4	3	3	2	4	2	4	3.14
									Possible risk
5		1	2	4	4	3	NA	NA	2.80
									Substantial risk

Table 4.9 shows the difference in scores between DLSR and secondary data scores. Cases 2 and 5 remained in the same level. Case 1 had a difference of one level. Cases 3 and 4 had a difference of two levels.

Table 4.9 DLSR Scores Compared to Secondary Data Scores

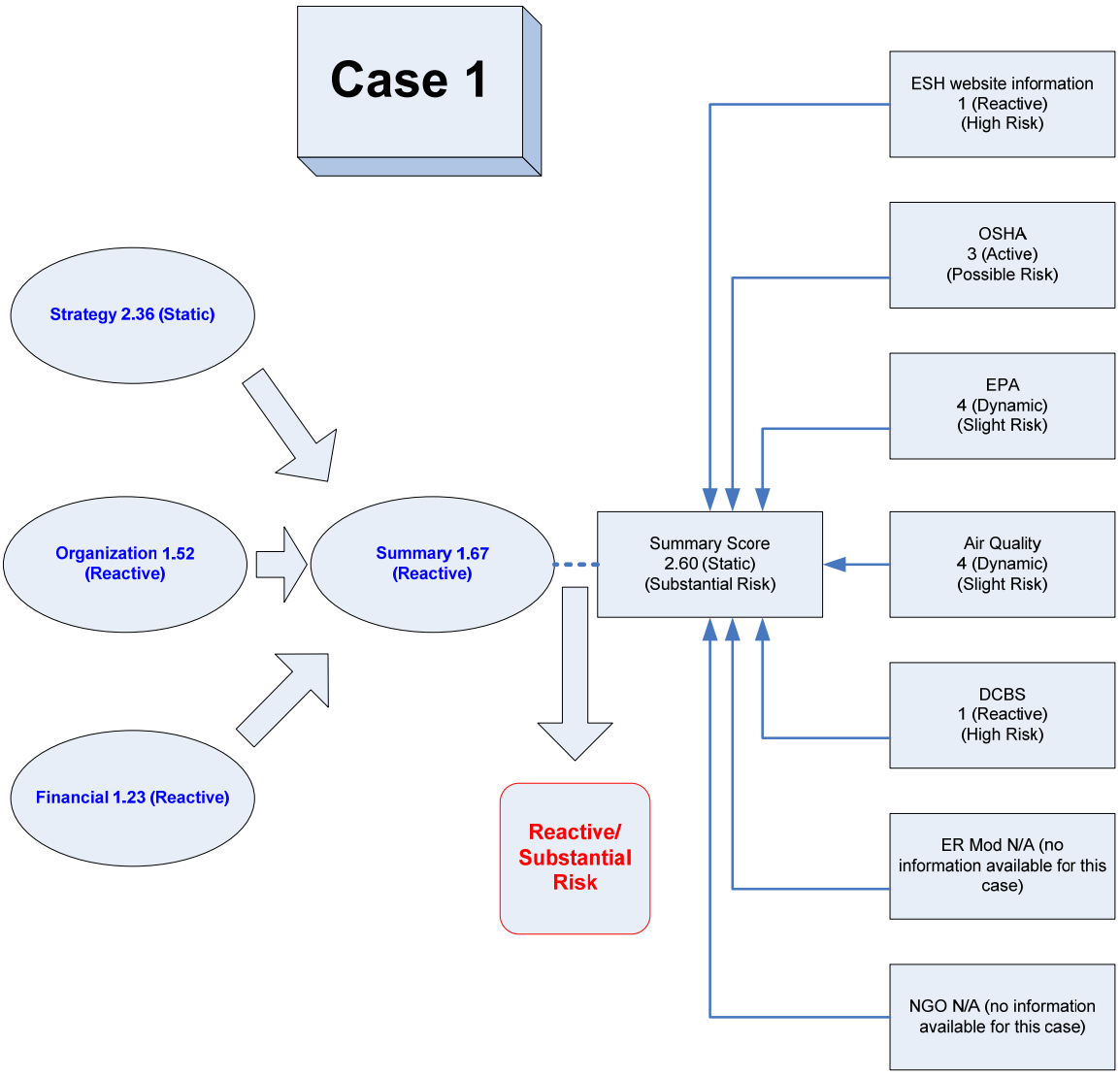
	Case 1	**Case 2**	**Case 3**	**Case 4**	**Case 5**
DLSR score	1.67	2.40	1.33	1.81	2.22
Secondary data score	2.60	2.86	3.50	3.14	2.80
Difference in score	0.93	0.46	2.17	1.33	0.58

Chapter 5
Discussion

The analysis suggests that the DLRS model is a useful tool in providing a new approach to assessing the ESH function in relation to business goals. The model provides an assessment of the level at which the ESH function operates, and more importantly an evaluation of how it is prepared to deal with the level of risk the company faces. In this chapter, an explication will be provided detailing findings that have emerged based on the DLRS model.

Figure 5.1 shows that Case 1 was evaluated to have a summary score of 1.67 using the DLSR model. This means that the facility was operating in a Reactive fashion in regard to ESH issues. In the Strategy element several factors corresponded with the Reactive level, such as minimum compliance with government regulations and minimal awareness of ESH issues. In the Organizational element, factors were identified such as, responding to ESH issues as they came up and isolation from other departments. In the Financial element, factors emerged such as financing ESH issues as they arose and budgeting for ESH less than others in a comparable industry. An example of this from the interviews was one respondent who said, “We pay for things as they come up. So far it’s worked for us.” In addition, when asked about their overall ESH strategy, several respondents gave a one word answer of, “Comply.” However, there is evidence in the research literature that has shown that the emphasis on regulatory compliance may provide many businesses with a false sense of security (Pagell et al., 2011; Rosenman et al., 2006). Compliance does not ensure that all ESH issues have been adequately controlled.

Figure 5.1 Case 1 DLSR and Risk Profile



Cases 2 and 5 were assessed to have summary scores at the Static level (2) using the DLSR model (Figures 5.2 and 5.3). Using secondary data, cases 2 and 5 were assessed to have Substantial Risk. Having both scores at the same level (2) potentially means that their ESH function may have been prepared to meet the level of risk they could experience. At the Static level the Strategy element showed that respondents tended to view ESH as a cost that had to be paid, but did not add any financial benefit to the business. One respondent stated, "Anticipate and prevent as much as possible. Pay for what happens when we have to."

Figure 5.2 Case 2 DLSR and Risk Profile

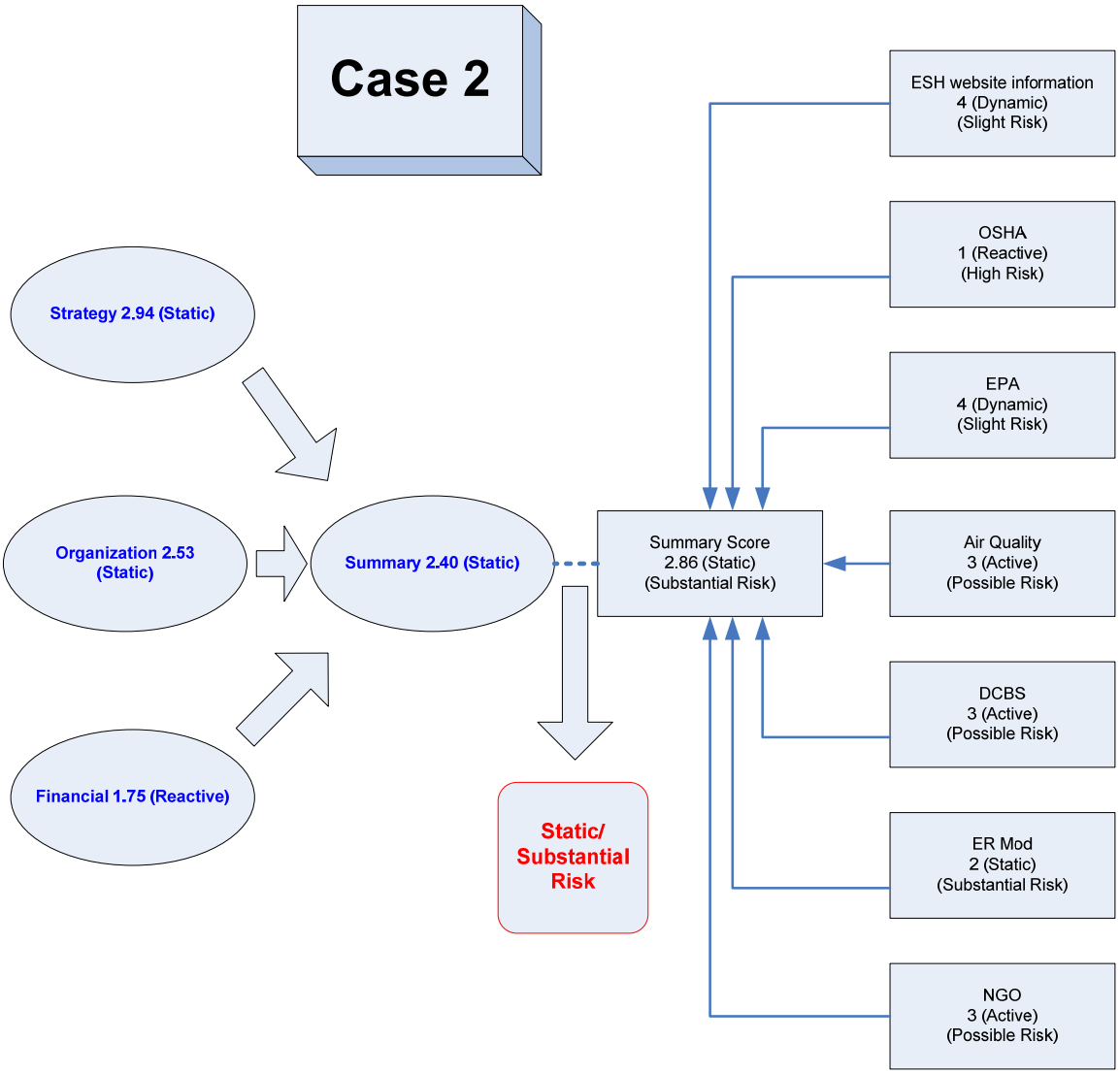
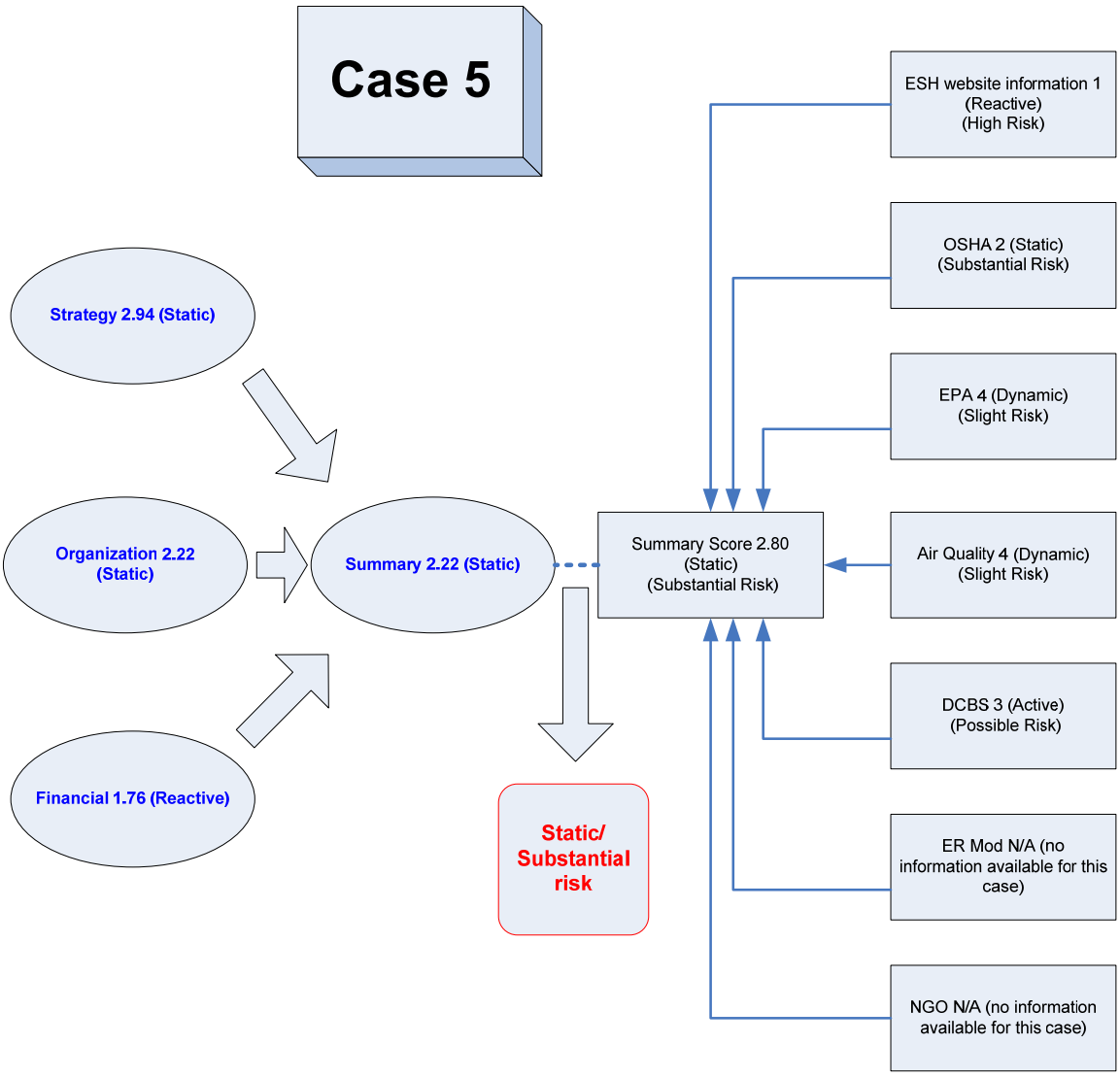


Figure 5.3 Case 5 DLSR and Risk Profile



Respondents at this level also thought that there were times when production took precedence over ESH issues. One respondent stated, "You can't shut down the line every time you see something." The Organizational element revealed that some thought was given to going beyond compliance and that the ESH function had some authority to make interventions and changes. At this level there was usually some type of company-wide ESH plan or protocol in place. Some factories had a plan provided to them by their insurer to promote individual worker safety and/or prevent harms to

the environment. One company had a contract that workers signed called the Caring Worker contract where there was agreement to intervene with fellow workers if unsafe behavior was observed and to non-defensively react if the worker was talked to about his/her unsafe behaviors. One worker described the following:

> I think the best thing that works is we can tell each other and not only that we're expected to tell someone if something don't look right, no anger, no hurt feelings, just hey the job needs to be done right and no one getting hurt so we all go home at the end of the day and that's the most important part.

The Financial element showed that there was some ESH budgeting, but it was still under-funded. Some efforts were made to enhance ESH efficiency and effectiveness. At this level, some respondents stated that ESH might somehow contribute to the company's competitiveness, but with little detail about how this might happen. An ESH professional stated the following:

> We don't have our own budget and I like it that way. If we had a budget, we'd have to stay under it or be in trouble for going over. This way, we get what we need and no one pays attention to what it costs.

This statement is a poignant example of one of the old, but still very present pathways in the ESH profession: make do and hope for the best.

Cases 3 and 4 were assessed to have summary scores at the Reactive level using the DLSR model (Figures 5.4 and 5.5). They both also were assessed to have Possible Risk, scoring in the 3 range. These manufacturing facilities may be unprepared to deal with their level of potential risk. Although the level of risk is not as dangerous as it could be, their reactive stance could be problematic for many ESH issues that could arise.

Figure 5.4 Case 3 DLSR and Risk Profile

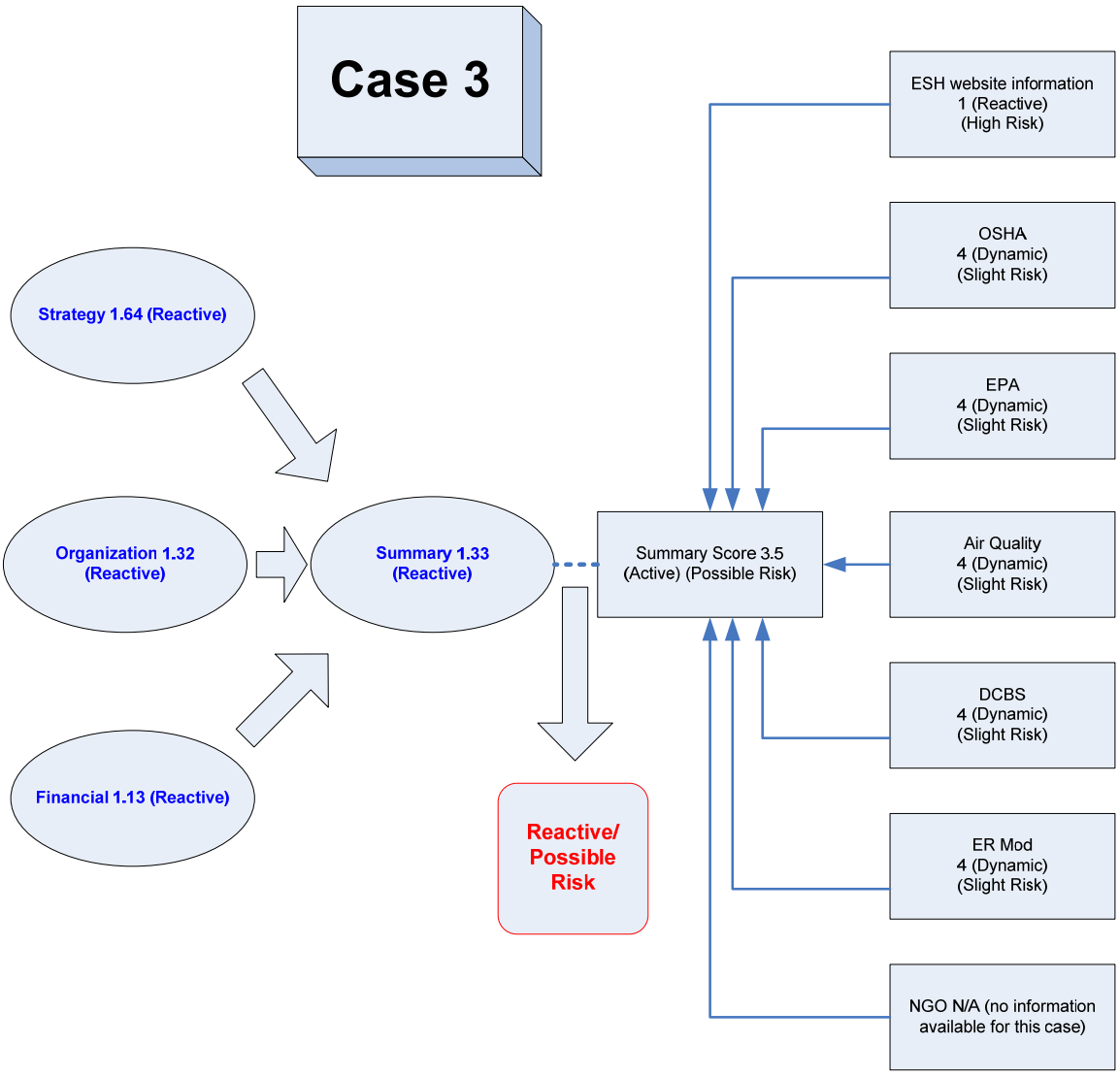


Figure 5.5 Case 4 DLSR and Risk Profile

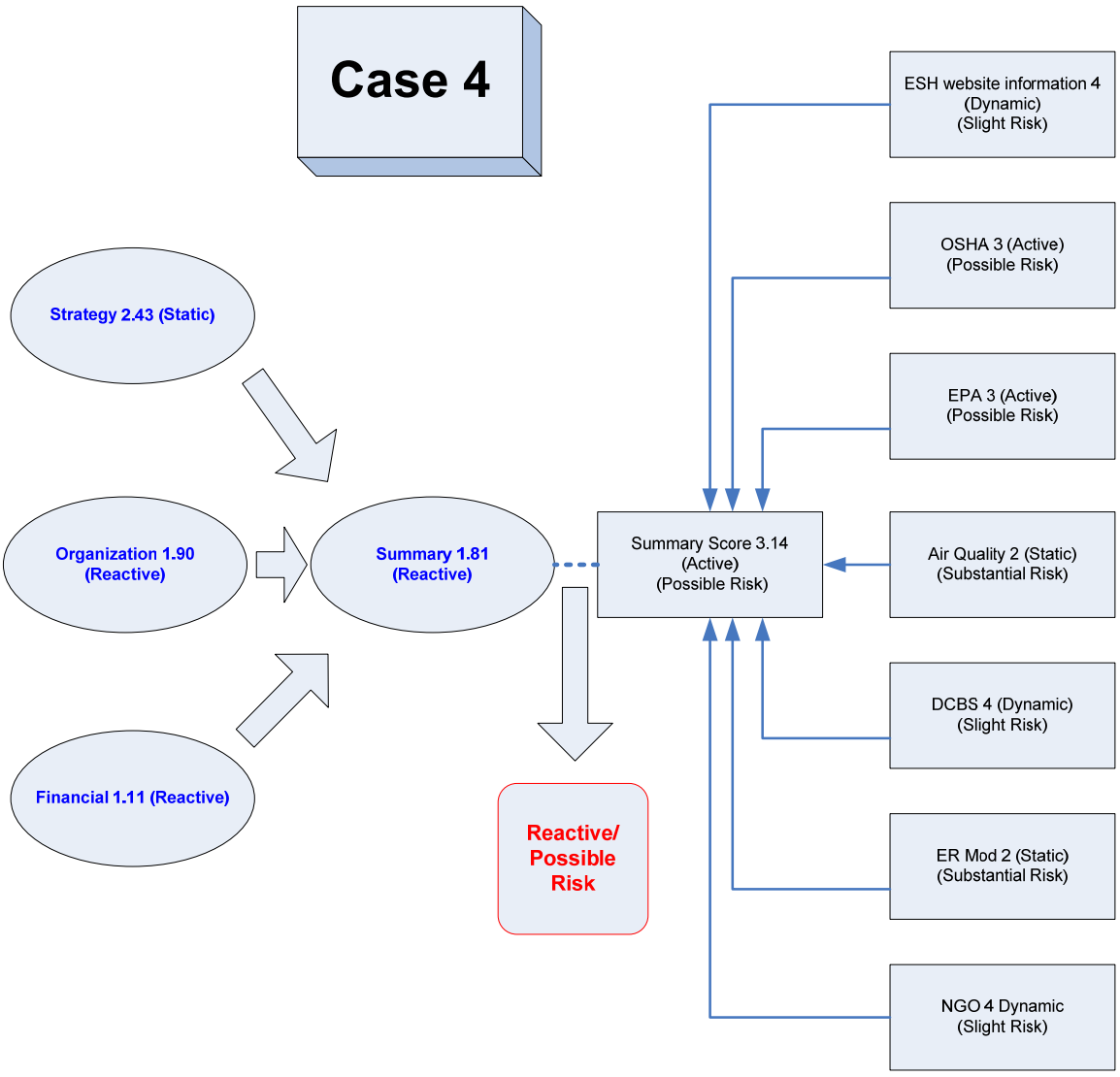


Figure 5.6 and Table 5.1 show pattern matching as one of the methods utilized to interpret the results. Every case received a smaller index score on their financial construct; and a slightly larger score on their organization construct; and the largest score on their strategy construct, showing a distinct pattern across all cases. This may be due to the fact that most organizations put the greatest effort, resources, and thought into their ESH management strategy, slightly less into how their ESH function fits into the organization, and the least into how their ESH functions are financed. An example of this is Case 2 where the management at the manufacturing facility expended quite a lot of time, effort, and resources into enacting an ESH program called the RADAR system which they obtained from their insurance company. RADAR stood for 'recognize the risk, assess the situation, develop a safety work plan, act safely and report it.' The RADAR system reminded workers each time they performed a job to check whether the job was safe and whether anything had changed since the last time they performed the job. The program included documentation where employees and supervisors had to check off each RADAR step and sign and date that the entire process was completed. Having this program still yielded Case 2 a high Static score on the Strategy dimension. This facility also had two on-site ESH professionals and some evidence of approaching ESH issues as a team with other departments. Factors such as these provided them a mid 2 score in the Organization Dimension. However, when the Financial Dimension was reviewed, they scored in the Reactive level with their basic philosophy being to, 'pay as things come up.' A similar pattern was noted across all cases. These results are not unexpected as there has been a long history in the ESH field of inadequate financing of the ESH function and its related activities (Hunt & Auster, 1990; Linhard, 2005).

Figure 5.6 Pattern Matching Model of DLSR Results

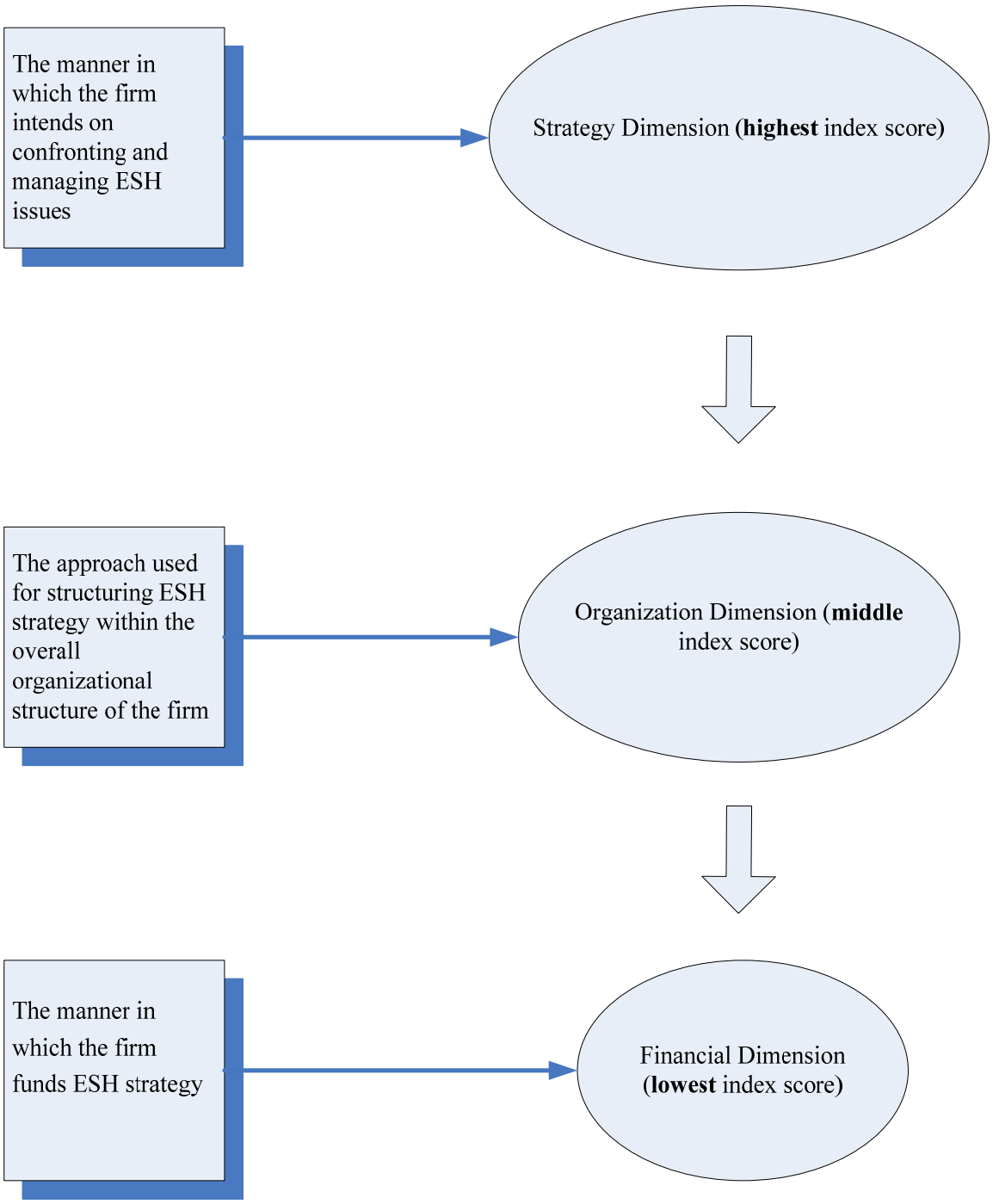


Table 5.1 Pattern of DLSR Scores

	Case 1	Case 2	Case 3	Case 4	Case 5
Strategy Score	2.36	2.94	1.64	2.43	2.94
Organization Score	1.52	2.53	1.32	1.90	2.22
Financial Score	1.23	1.75	1.13	1.11	1.76

Consideration of rival explanations is one analysis method used in case study research as a way to increase reliability. In this study, there are several rival explanations for all cases having summary scores from the DLRS in the Reactive and Static range; and having a distinct pattern in the elements (highest score in strategy, lower in organization, lowest in financial). One explanation could be that there is some unknown difference between these five cases who agreed to participate in this study and the five cases who never responded. One piece of evidence which disproves this rival explanation is that these five cases covered a broad range of manufacturing types from food, paint, particle board, tents, to horse trailers. There is also no similarity between them in number of employees or how their ESH functions were configured. One recommendation from case study theorists is to use purposeful sampling and either choose cases that can be expected to possess the phenomenon of interest or ones that may not. The cases is this study depict several different types of manufacturing settings and the results were still consistent. This lends support to the evidence that the DLRS model accurately describes many types of manufacturing.

Although attempts were made to review the data according to case characteristics to determine if there appeared to be patterns present which were associated with certain types of scores, this did not appear to be the case (Table 5.2). Being Reactive in the DLSR score did not mean that a certain secondary data score could be expected. For example, Case 1 scored in the Reactive (1) dimension and was then assessed to be in the Static (2) range in secondary data, whereas, Cases 3 and 4 were also Reactive (1), but were assessed to be in the Active (3) range for secondary data scores. Moreover, having some type of ESH management program in place such as the Caring Worker contract or the RADAR program was not linked to a certain level of DLSR score. No linkages were found between DLSR score and having on-site ESH staff, the number of ESH staff present, the number of employees, type of ownership, attitude toward ESH, or industry type. Initially, this could be construed as problematic for the usefulness of the DLSR model. However, not finding a pattern of characteristics linked to the DLSR scores may mean that its usefulness is significant across different types of manufacturing facilities, and perhaps even beyond manufacturing.

Table 5.2 Pattern Matching with Case Characteristics

Case	DLSR Summary Score	Secondary Data Score	ESH manage-ment program in place	On site ESH	How Many ESH Staff	# of employees	Owner ship Type	Attitude toward ESH	Industry
Case 1	1.67	2.60	Y	N	0	15	Family	Favorable, but concerned about costs	Horse trailers
Case 2	2.40	2.86	Y	Y	2	78	Family	Positive, non-defensive	Particle board
Case 3	1.33	3.50	N	Y	½	85	Family	Annoying, but necessary	Tents
Case 4	1.81	3.14	N	Y	3	94	Corp.	Positive, non-defensive	Paint
Case 5	2.22	2.80	N	Y	3	250+	Family	Defensive/fearful	Food

Y= Yes; N= No

How well ESH functions are managed is commonly evaluated using regulatory agency records, NGO attention, the facility's ER Mod rating, and days paid per claim when workers experience injuries. These are the same records used in this study to profile a facility's risk (along with several others). For example, when asked how well a facility manages its ESH function, it is common to hear a response that refers to a recent OSHA inspection or lack of regulatory fines from the local air quality organization or EPA. Regarding what type of ESH issues the facility faced, one respondent in this study stated,

> I'd say we don't have any. I just tell my workers to use their common sense and that will help them avoid most problems and so far it has. We have a very good record and we don't compromise safety to get our products out the door.

This case (Case 3) scored Reactively in all three dimensions of the DLSR with an overall score of 1.33, while their risk score was Possible (3). If the managers and owners only looked at the individual parts of their risk scores (OSHA, EPA, ER Mod, etc.), they might believe that they were sufficiently prepared to manage their risk. Yet there is a two level difference between how they were prepared to manage their risk and their actual risk. Assessing both scores and comparing them provided a more complete and accurate picture of how the facility was prepared to control possible risks.

Finding 1

Comparing a manufacturing facility's DLRS score to the facility's level of risk is useful in evaluating how well the facility is equipped to manage and control ESH issues.

Case 1 is a noteworthy example of how it is useful to compare a manufacturing facility's DLRS score with the facility's level of risk (Table 5.3). This facility was managing their ESH issues in a Reactive fashion, and yet was assessed to have Substantial Risk that could be experienced by the facility. Moreover, the dimensions of Case 1 show that they put the most effort into their EHS management strategy, less

into how it interacted organizationally, and the least into how they financed it. If a tool existed that could show manufacturing facility managers and owners a picture of how they were prepared to manage their ESH issues in relation to their level of risk, they might be convinced to put effort and resources into achieving an ESH management level that was more consistent with their level of risk. For Case 1, it can be shown that making some adjustments in the organizational and financial dimensions could bump their overall DLRS score into the Static range which would be in line with their level of risk.

Table 5.3 DLSR scores compared to secondary data scores

	Case 1	**Case 2**	**Case 3**	**Case 4**	**Case 5**
DLSR score	1.67	2.40	1.33	1.81	2.22
Secondary data score	2.60	2.86	3.50	3.14	2.80
Difference in score	0.93	0.46	2.17	1.33	0.58

For Cases 2 and 5, their overall DLRS scores were in the same level as their risk levels. Managers and owners of these facilities might decide that not much more effort or resources were needed to enhance their ESH management strategy. However, another useful part of the DLRS tool is that if they did want to improve in the ESH domain, it is easily seen that the financial dimension is the one that is not in line with the others. For situations like Cases 3 and 4, being Reactive might not be as concerning to managers and owners because their risk level is Slight. However, having information that their facilities were operating in a Reactive fashion might be of concern, and perhaps even enough of a concern to prompt changes even if only minor ones.

Findings 2-4

Comparing a manufacturing facility's DLRS score to the facility's level of risk is potentially useful in assessing overall competitiveness.

Being in compliance with all applicable regulations does not necessarily mean that all ESH issues are adequately controlled.

Incorporating the DLRS model could positively impact business and ESH strategies.

Manufacturing facilities face risk from many sources (Table 5.4). All of these sources of risk represent potential significant financial losses for a facility if they occur. Businesses can lose money and their reputation if regulatory action is taken against them due to an occupational injury or environmental impact. NGO pressures and negative media coverage can also represent a significant drain on a business in the form of time and resources spent deciding how or if to respond. All of these issues can then affect how a facility's customers view the business in relation to how their ESH issues are managed. Moreover, a high ER Mod rating can mean that a business will pay higher insurance premiums because their level of risk in insuring them is higher than others in a comparable industry. Worker's compensation claims can also represent significant potential financial loss to a business.

Table 5.4 Issues That Present Increased or Decreased Risk to Manufacturing Facilities

Increased Risk	**Decreased Risk**
Regulatory fines	No regulatory fines
NGO pressures	No NGO pressures
Negative media coverage of ESH record	No media coverage of ESH record Positive media coverage of EHS record
Decrease in customer loyalty or confidence due to a poor ESH reputation	Maintenance or increase in customer loyalty or confidence due to a good ESH reputation
High ER Mod rating	Low ER Mod rating
High number or worker's compensation claims	Low number of worker's compensation claims

All of the cases in this study were assessed to be Reactive or Static in their ESH management strategies. There is no evidence in the literature or from this study showing that the ESH function is commonly linked to business outcomes. There is also no evidence that regulations contribute to successful ESH management strategies. All of these cases operate in the United States where there are numerous regulatory agencies at the federal, state, and local levels. Yet each case was still operating at a Reactive or Static level. This lends credence to the idea that efficacious ESH management strategies may need to be based on something other than regulatory compliance. Moreover, as stated previously, basing the ESH function on regulatory measures gives management a false sense of security in that they believe if they are in compliance, then their ESH issues are adequately controlled. Several cases in this study had respondents who stated they had not received any significant fines after OSHA inspections or that their ER Mod was low, when at the same time, they scored Reactively using the DLSR. This is an indication that adhering to applicable regulations does not mean a manufacturing facility is adequately managing its risk.

For Case 1, the assessment of their risk as Substantial while their ESH management strategy was Reactive represents a potentially catastrophic financial loss to the company. In reality, it would not take more than one risk to manifest itself for the company to go out of business. Having the knowledge that their ESH management strategy is an entire level below their level of risk has competitive implications for the company. Moreover, when evaluating resource allocation it seems important for managers and owners to be aware of the pattern across all cases where the most effort appeared to be put into constructing ESH strategy, less on where it fit into the organization, and the least on how much funding was allocated to it. None of the cases demonstrated that the budgeting for ESH was thought about or evaluated. There was no evidence of efforts given to measuring how much an ESH solution cost, and many times not even whether it addressed the original problem. Peter Drucker, the eminent management theorist is credited with saying, “What gets measured gets managed.” The implication that is relevant for manufacturing managers, owners, and ESH personnel is that because the ESH financial dimension is not usually measured, it may not be sufficiently managed either.

For Cases 2 and 5, having DLRS scores in the same level as their risk could mean that they are in a position to put resources and effort into what Michael Porter (1995) called 'opportunities for innovation.' A hypothetical example of this is that a facility that manufactures food products might create a type of knee guard that protected workers from injury. One respondent for Case 5 stated,

> We've had problems sometimes with automated machines that get designed and they don't consult us first. I go look at it and say hey, there's no knee guard here or it's set up so that person is going to walk under a conveyer belt instead of around it. It's getting better that the engineers consider us, but I wouldn't say it's a team approach yet.

If the facility engineers and EHS staff worked together, they might innovatively create a new kind of knee guard. There is a potential for adding to the facility's competitive advantage by then selling that knee guard to other food manufacturing facilities and then off-setting some ESH costs. Because the facility's ESH management strategy was in line with its level of risk, there could be time and resources for such innovations. The same is true for situations like Cases 3and 4 where having a Reactive ESH management strategy may not be as problematic because their risk level is Slight. For these managers and owners, it could then become an informed choice about whether to maintain their ESH function where it was, make efforts to improve it, and/or seek ways to innovate that could contribute to the facility's competitive advantage.

Finding 5

Use of the DLRS model could significantly impact those most vulnerable to poorly managed ESH issues.

Workers experience significant harm and sometimes even fatalities due to poorly managed ESH issues. The environment is also negatively impacted by how businesses manage their EHS issues. This model provides a new way for manufacturing facilities to assess the efficacy of their ESH function in relation to the amount of risk they face. The DLRS model offers the potential for a user-friendly method to obtain a picture of how a facility manages its ESH function in relation to the risk it faces. As stated above, having the knowledge that a facility is operating

Reactively while facing Substantial Risk is useful for managers and owners, so that they can make informed decisions about where and how to apply resources and effort. Although it is not the contention here that this model could purport to reduce accident frequency or EPA fines, assisting businesses in their decision-making regarding improvements to the management of their ESH function has the potential to impact safer work settings and more sustainable environmental practices that go beyond regulatory requirements.

Finding 6

This study adds new insights to the body of ESH management strategy research.

Although there have been quite a number of ESH researchers who have proposed theoretical models to evaluate EHS management strategies, few have conducted actual field studies. While this study is qualitative in nature utilizing case study methodology, it has added new insights to the body of ESH management strategy research and has gone beyond existing research. The DLRS model was theorized based on previous research and a previously published study (Veltri & Maxwell, 2008). One way to move this stream of ESH research forward was to test the DLRS model in an exploratory fashion to determine if the basic principles seemed to function in the theorized way. The literature and the theory suggested that manufacturing facilities put most of their effort and resources into their ESH strategy, and less into the way it fits into the organization, and the least into how it is financed. The results from these five cases provide more evidence that this is the case. As Eisenhardt (1998) and Yin (2009) suggest, a consistency found across all cases in case study research contributes to the soundness of the finding.

Findings 7-9

This research highlights some reasons why a multi-stakeholder approach is important.

This research provides insight into whether improved ESH results in competitive losses for a firm, or whether ESH proficiency must be sacrificed when there are increased operational demands.

This research adds to the body of combined operational and ESH research.

This study viewed the ESH function from the perspective of the ESH professional, but also from non-ESH professionals such as managers, owners, and executives. Previous EHS research has focused on a single stakeholder, usually the worker. In turn regulators have also tended to focus on workers and worker practices to create regulations. This is understandable since workers experience much of the impact of poorly managed ESH issues that can result in injury and even death. However, the part that has been missing is that it is not the workers who make decisions about where and how effort is expended on ESH issues. It is the managers, executives, and owners who make these far-reaching decisions. Omitting their perspective has created a gap in the ESH research. In this study, a multi-stakeholder approach was used. Although the study did not achieve as broad a census of stakeholders as planned due to the facility employment configurations, it still obtained the critical perspectives of EHS managers, operational managers, owners, and executives which has been missing from the ESH management research.

Operational research has tended to focus on the management perspective which has left out the worker perspective. As can be seen in Figure 5.7 there are critical gaps between the perspectives of different stakeholders such as workers and managers. Figure 5.8 shows how the gaps in this knowledge could be minimized by taking a multi-stakeholder approach when conducting research in manufacturing facilities on EHS and operational management strategies. It may be that manufacturing facilities could improve how they manage their EHS and operational functions by combining them into a joint system of management. This can potentially address the trade-off argument in that an organization could work through the EHS and operational functions to improve both safety and operational performance simultaneously. The literature supports the idea that reduced ESH efforts can result in reduced operational and ESH outcomes; and that increased ESH efforts can result in improved ESH and operational outcomes. In other words, a safer work environment may also be a more productive one. Moreover, some manufacturing managers and owners recognize this as well with one respondent stating,

> Well it goes hand in hand, just the same as if you're running a safe and clean environment, you're going to build more. To be

> around, you have to make money too. If you're running a safe environment with focused workers whether it's on the product or on safety, it's gonna translate into more production.

Joint management systems could streamline how the ESH and operation functions work cooperatively.

Figure 5.7 Knowledge Gap Between ESH and Business/Operations Research

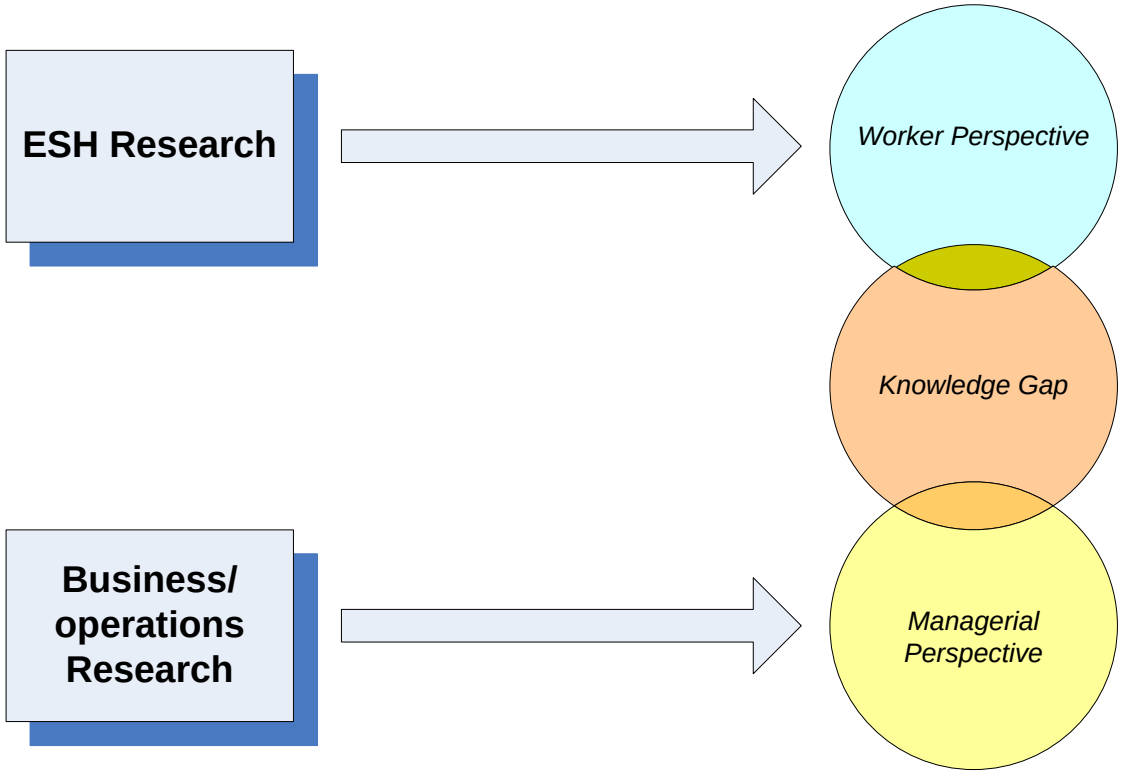
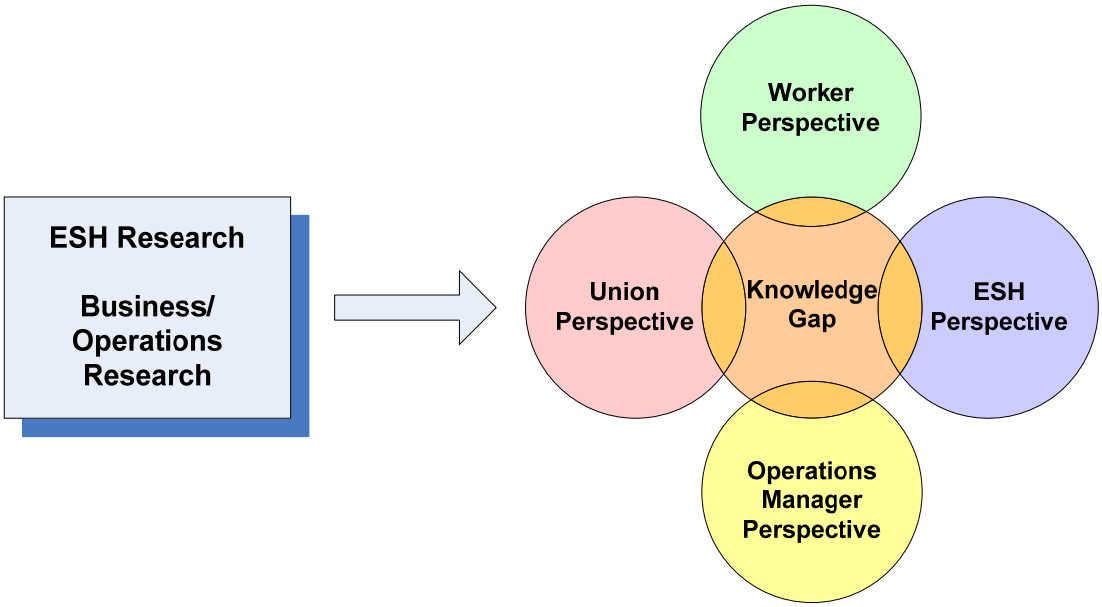


Figure 5.8 Minimized Knowledge Gap Between ESH and Business/Operations Research



Finding 10

This research provides some insight into some of the barriers to having a proficient ESH function in a manufacturing facility.

There are many elements of a successful ESH program in manufacturing, as well as other types of businesses. One element of a proficient ESH function is management level commitment to the ESH function. This should involve senior level support as well as mid-level management. This can be reflected in how the ESH management strategy is configured, where it fits into the organization, and how it financed. This study showed a consistent pattern in that most effort and resources were

put into ESH strategy, less into ESH organization, and the least into how it was financed. One respondent stated, “Some of our upper management is seeing the benefits of having a safe, well-trained workforce, but it’s a work in progress and we’re not there all the time.” All cases in this study had DLRS scores in the Reactive and Static range which indicates that this piece of a successful ESH program was not met in these five cases.

Another element of a successful ESH program is employee involvement in the ESH function and its activities. There should be a safety committee with representation from all levels of the workplace. Having employees feel that they participate in and have responsibility for hazard recognition is also important to a proficient ESH program. All cases in this study showed some evidence of employee involvement in their ESH function, although there was a wide range of how this was manifested. Having positive union relationships is also an element of a successful ESH program, although none of the cases in this study had union involvement. There should be an extensive orientation of new workers to all types of potentially hazardous ESH issues present in the facility. All workers should also be educated about the facility’s EHS policy. Moreover, it is not enough to only train workers when they first start working at a facility. Subsequent trainings should also occur regarding any new hazards linked to products or processes at the manufacturing facility. Re-training is also a significant part of optimal EHS programs so that long-term employees do not become complacent working with long-standing ESH issues.

Hazard identification is critically important to a successful ESH program. There must be continuous recognition of existing and new hazards for optimal ESH protection. Evaluation of the extent and magnitude of hazards is also part of preeminent ESH programs. As discussed earlier, a hazard control system such as the Hierarchy of Controls is an integral part of an exemplary ESH program, as well. In this study all cases showed evidence of having some types of hazard identification and control efforts. Again, there was variability in how this was approached by different facilities. Accident investigations are also an important part of well-run EHS

programs. This is necessary to understand the cause of incidents and near misses in order to prevent their reoccurrence. Accountability at all levels of management for how well the ESH function is managed is also important in having a good ESH program. Evaluation of how well ESH solutions address ESH problems is also important, and based on these five cases studies appears to happen infrequently and not on any formalized basis.

New Pathways Suggested by this Research

The first new pathway that is suggested by DLRS model is its usefulness in assessing ESH management strategy in relation to a facility's level of risk (Table 5.5). This is a new approach to assessing EHS management strategy that has the potential to be an important tool for manufacturing facilities. It also provides a new way for operational management to assess their DLRS level and give consideration to funding a higher level to better manage their risk. An important aspect of the DLRS model is that it provides a way for managers to simultaneously evaluate their level as compared to their level of risk and plan how to move to the next level. Future research should be considered regarding further refinement of the DLRS model using mixed methods or quantitative methods. Another new pathway suggested by this research is the use of multi-stakeholder approaches when conducting ESH and operational research in manufacturing settings (Table 5.5). This research highlighted a gap in the existing ESH and operations literature due to reliance on single stakeholder perspectives. Therefore, consideration in future ESH and operations research should be given to using a multi-stakeholder methodology in order to narrow this gap in research knowledge.

Table 5.5 New Pathways Indicated as a Result of this Research Study

Pathway	Significance	Implications for Future Research
DLRS model is useful in assessing ESH management strategy in relation to a facility's level of risk	This is a new approach to assessing EHS management strategy Provides a new way for operational management to assess their DLRS level and consider funding a higher level	Creation of a tool based on the DLRS model to be studied using mixed methods or quantitative methods
A multi-stakeholder approach is preferable to single stakeholder approaches	Highlights a gap in the research	Future research on the DLRS should consider multi-stakeholder methods
Joint management strategies can provide success in the ESH and operational domains	Provides evidence for incorporating the ESH function with other managerial functions, instead of the traditional method of keeping ESH isolated from other functions	Research comparing joint management systems with separate management systems should be considered
Being in compliance with all applicable regulations does not necessarily mean that all ESH issues are adequately controlled	Provides evidence that going beyond compliance is important	Research comparing organizations that minimally comply with ones that go beyond compliance should be considered

Another new pathway that has emerged from this research is that joint management strategies can help optimize outcomes in both the ESH and operational domains (Table 5.5). This is significant in that it provides evidence for incorporating the ESH function with other managerial functions, instead of the traditional manner of isolating the ESH function from other functions. Future research comparing joint management systems with separate management systems should be considered. The last new pathway that has come out of this research is that being in compliance with all applicable regulations does not necessarily mean that all ESH issues are adequately controlled (Table 5.5). The results of this research have provided evidence that going beyond compliance is important because minimal compliance with applicable

regulations does not necessarily ensure that all ESH issues are sufficiently controlled. Research is indicated that compares organizations that minimally comply with ones that go beyond compliance.

Table 5.7 and Table 5.8 depict an example of how the DLRS tool could potentially be used in manufacturing settings to evaluate ESH management strategy in relation to a facility's level of risk. The document as it is depicted here takes up 5 pages which is most likely too long to be of use in a manufacturing setting. However, the tool could be tested with one or more focus groups to determine areas that could be omitted or condensed to make it more usable. The DLRS tool has important potential to provide a new way of assessing the ESH management strategy in manufacturing environments.

Table 5.6 Development Level Rating System Tool
(Mock up for potential use in a future study)

		Reactive 1	Static 2	Active 3	Dynamic 4
	STRATEGY				
1	Awareness of organizational stakeholders of the extent and magnitude of safety or environmental issues				
2	Kinds of efforts made to reduce ESH impacts				
3	Hazard Controls				
4	Issues that take precedence over addressing ESH issues				
5	ESH compliance strategy				
6	Approach to government or insurance sanctions in regard to ESH issues				
7	Upfront design engineering utilized				
8	Relation of ESH strategy to business strategy				
	Strategy Total (Add points in all columns together. Then divide by the number of questions answered.)				
	ORGANIZATION				
1	Type of ESH authority				
2	How ESH is structured in the organization				
3	Who the ESH function reports to				
4	Who meets to discuss and plan for ESH issues				
5	How organizational structure is affected by compliance issues				

6	How compliance issues are addressed				
7	Who handles regulatory and enforcement issues				
8	How new regulations are implemented				
9	Is thought given to going beyond compliance				
10	Efforts made to anticipate new compliance issues and have a plan before they are enacted				
11	Connectedness of ESH department to core business units in the firm				
12	How competitive performance plans impacts the organization of the ESH function				
13	How the ESH function interacts with R/D				
14	Corporate wide ESH policy				
15	Risk identification, assessment, and control initiatives				
16	Contingent liability reduction				
17	Enhancing regulatory compliance				
18	Consideration of what will cause the most risk and cost burdens				
19	How spending is allocated to address risk and cost burdens				
20	Consideration given to any activities which are risky enough to eliminate				
21	Utilization of different ESH scenarios with costs of controls to determine the				

	best course of action				
22	Connectedness of ESH department with other departments				
23	Involvement with shaping public policies				
	Organization Total (Add points in all columns together. Then divide by the number of questions answered.)				
	FINANCIAL				
1	Efforts expended to enhance the efficiency and effectiveness of the ESH function				
2	Connectedness of business strategies and ESH strategies				
3	Contribution of ESH strategy contribute to competitiveness				
4	Characterization of the strategy for financing ESH investments				
5	ESH fund attainment for ESH activities				
6	Kinds of issues ESH expends funds on				
7	Performance of economic analysis of ESH issues				
8	Comparable ESH funding with others in similar industry				
9	Use of integrated and concurrent design engineering				
10	Use of cost-benefit analysis in related to ESH investments				
11	How costs of ESH incidents are charged				
12	Characterization of the strategy for				

	financing ESH investments				
13	How long financial resources and capital approved for				
	Financial Total (Add points in all columns together. Then divide by the number of questions answered.)				

To obtain a total DLRS score, add total number of points from all three sections; then divide by the number of questions answered.

1.00-1.99	Reactive
2.00-2.99	Static
3.00-3.99	Active
4.00	Dynamic

Table 5.7 Level of Risk
(Mock up for potential use in a future study)

Score	ESH information listed on website	OSHA	EPA	Air quality orgs	DCBS	ER Mod	NGO or other agency reports of ease of working with and/or responsiveness to issue
1	None	4 or more violations	4 or more violations	4 or more violations	More than 150 days paid on average per claim	10-20% worse	Reported to be difficult or unresponsive
2	Brief mention of ESH activities	2-3 violations	2-3 violations	2-3 violations	100-149 days paid on average per claim	1-9% worse	Reported some difficulty in working with
3	ESH mission statement and moderate amount of ESH activities	1 violation	1 violation	1 violation	50-99 days paid on average per claim	1-9% better	Little difficulty in working with
4	ESH mission statement and large amount of webpage devoted to ESH activities	0 violations	0 violations	0 violations	1-49 days paid on average per claim	10-20 % better	Reported to be easy to work with and responsive

Risk Ranking	
1.00-1.99	High
2.00-2.99	Substantial
3.00-3.99	Possible
4.00	Slight

Chapter 6
Conclusion

The purpose of this exploratory research was to determine if the DLRS model accurately profiled the different types of businesses in the study and whether it might be able to provide an evidence-based tool for ESH managers to use in order to align the ESH strategy with the business strategy of the firm. There is evidence to support both. Existing ESH studies have tended to offer ESH management strategy theory in an untested fashion with little field work involved. Furthermore, extant EHS research in manufacturing has usually been conducted from a single stakeholder point of view with little attention paid to other stakeholders such as operational managers or owners. Moreover, much of operational/business research has been conducted on operational management issues with the omission of the ESH perspective. This study has gone beyond the existing research in both fields by conducting field research on the DLRS model; by utilizing a multi-stakeholder approach; and by consideration of ESH and operational managerial perspectives.

The analysis suggests that there are many ways that ESH management strategy could create improved linkages with the competitive performance of manufacturing facilities. It was found that using the DLRS model to compare a manufacturing facility's DLRS score with the facility's level of risk was useful in evaluating how well the facility was equipped to manage and control ESH issues. Informing all levels of management at manufacturing facilities, including ESH and operational management, that their level of ESH management strategy is an entire level below their level of risk has potential implications for the overall competitive advantage of the facility. Being unaware of how ill-equipped or how well-equipped a manufacturing facility is to manage their ESH issues and risk is potentially catastrophic for everyone involved including individual workers, the environment, and the ability of the business to remain viable.

The analysis also suggests that incorporating the DLRS model into existing ESH management strategy could positively impact business and ESH strategies. One

strength of the model is that it provides separate scores of strategy, organization, and financing, as well as the summary score. Another important part of the model is that it allows managers to evaluate their level of ESH management strategy, compare it to their level of risk, and at the same time plan how to increase their level. Therefore, if a management team wanted to determine how they could move their ESH management strategy toward a higher level, they could easily determine if there was one area where improvements would help improve their score. More importantly they could then improve their ability to sufficiently meet their level of risk.

This research highlights some reasons why a multi-stakeholder approach is important. Both streams of ESH and business/operations research have omitted significant perspectives from their respective domains. This research was an attempt to include the ESH management perspective and other levels of operational management at each facility. For all five cases in this study, this was achieved. This is a significant departure from both fields and sets a precedent that using a multi-stakeholder approach provides insight into the operational and ESH management strategies at manufacturing facilities (Figure 6.1).

Figure 6.1 Possible Links Between EHS Management Strategy and Competitive Performance

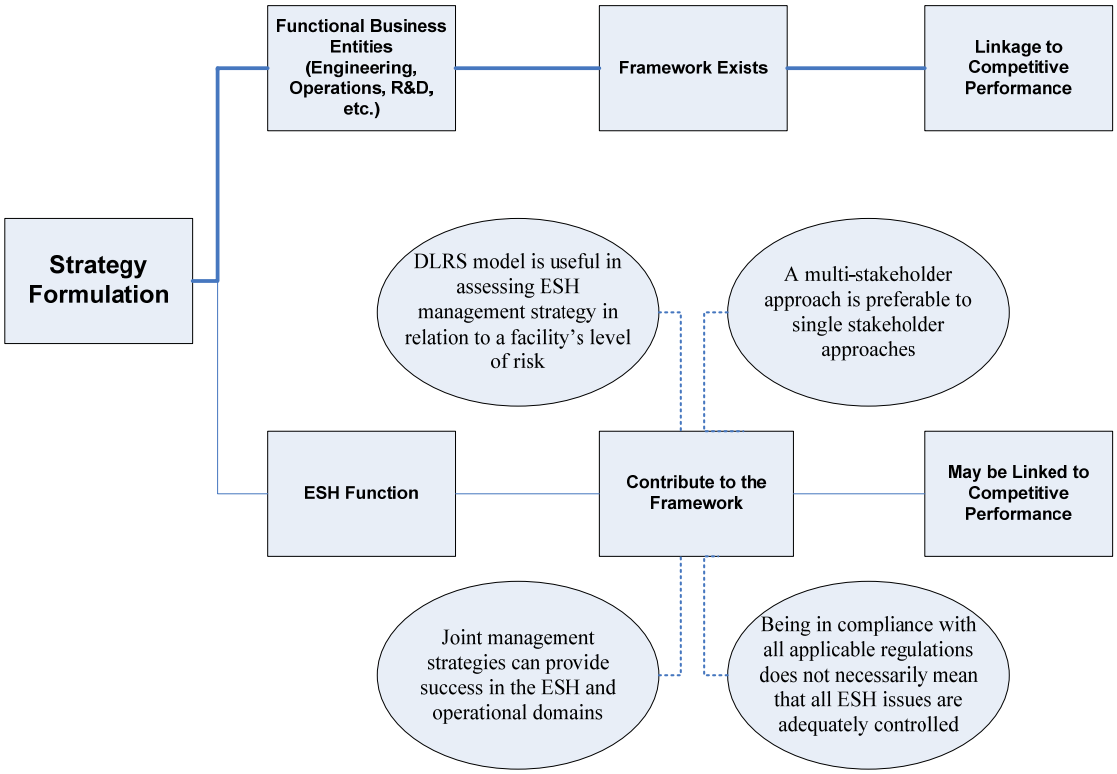


Figure 6.1 depicts how this research has added to the body of operational and ESH research. This research suggests that manufacturing facilities could improve how they manage their EHS and operational functions by combining them into a joint system of management. A joint management system could allow for the shared planning, monitoring, and evaluation of both ESH and operational management. The research literature and this study suggest that facilities either manage both ESH and operational functions well or both poorly. Joint management systems could help facilities improve ESH and operational performance simultaneously.

This research also suggests that manufacturing facilities that are in compliance with all applicable government regulations may not have adequately controlled ESH issues. It has long been thought that minimal compliance with regulations should be

enough to keep workers safe and protect the environment. Comparison of the DLRS scores and the facilities' levels of risk show that this may not be the case. Risk evaluation in this study was based on common ways that risk is evaluated by businesses and ESH professionals such as EPA fines, OSHA infractions, ER Mod scores, etc. It was found that the risk assessment did not match the facilities' level of ESH management strategy. No facility scored higher than a 2 (Static), indicating that some facilities may be able to meet their level of risk, but there is room for improvement. Moreover, there may also be room for excellence. This research begs the question as to whether being adequate in EHS management strategy is enough, when the consequences of poorly managed ESH functions can be so disastrous. The DLRS model essentially provides a snapshot of a moment in the life of a facility. Strategies can change based on changes in the management team, the market, the overall business model of the facility, etc. If a facility was adequately meeting their level of risk when they were assessed, it does not mean they are adequately meeting it today. Therefore, it might be advisable for managers and owners to consider making attempts to move their facilities to a higher level of ESH management strategy so that they have more safeguards in place if circumstances change unexpectedly. Moreover, knowing that their level of risk is sufficiently met can also create room for innovation which can then contribute to the competitiveness of the business.

This research has some limitations. In utilizing a multi-stakeholder approach, consideration was not given to stakeholder saliency. Different stakeholders possess different levels of the attributes of power, legitimacy, and urgency (Mitchell et al., 1997). In this study the different levels of power were not assessed between ESH management, operational management, or owners. Common sense would dictate that owners most likely have more power than any type of manager, but this was not specifically investigated or analyzed in this study. Legitimacy was also not evaluated in this study between different stakeholders. There was some evidence that ESH personnel in some facilities did not feel they had the authority to intervene with workers when unsafe practices were observed. This would indicate that they have less legitimacy in those facilities than an operations manager or owner, but this was not

specifically evaluated. It is likely that urgency is experienced differently by different stakeholders. An ESH manager probably experiences a different level of urgency regarding an observed EHS issue than does an operations manager or owner. However, this was not evaluated in this study, so it is unclear if that is truly the case.

Another limitation of this research was that the relationships between different stakeholders were not evaluated. Some anecdotal evidence was gathered during site tours, but was not factored into the data analysis. Specific data were gathered regarding where the ESH function was positioned organizationally in the facilities' management structure. Some respondents offered information regarding whether they thought of themselves as working as a team with other facility managers. However, these relationships were not fully explicated and are not part of the results. This piece may be important to include in future studies of the DLRS model, and especially future studies using a multi-stakeholder approach.

Another limitation is that it was not possible to use multiple researchers in conducting the interviews and site tours. Yin (2009) recommends the use of multiple researchers to control for the biases of one individual researcher. It is recommended that future studies using case study methodology utilize multiple researchers whenever possible. It is also limiting to rely on respondent reports which can include bias. Respondents can have faulty memories of events which can induce bias into their reports. They can also answer in a socially desirable way. In this study, it was known before going into the field that it was likely respondents might represent their ESH activities in a more favorable light. This was one of the reasons multiple respondents were interviewed at each facility and that secondary data were gathered. These approaches assist in triangulating the evidence and mitigate some of the bias that is inherent in interviews.

There are several recommendations as a result of this research. Further study of the DLRS model is recommended. The use of case study research methodology has extended and broadened this stream of research. However, future consideration should

be given to using focus groups to refine the model into a usable format which could then be studied further in manufacturing settings. It would be potentially useful to create a hard copy document that could be used in manufacturing facilities and digital formats to be used in office settings. It is also recommended to use a multi-stakeholder approach in future ESH and operational research, as it provides a more complete picture of both fields and their management strategies. Research into whether joint management systems can create improved ESH and operational/business outcomes is recommended, as well. Lastly, it is recommended that future research be conducted on whether ESH regulations enhance the competitive advantage of manufacturing facilities; and whether an ESH management strategy that relies solely on compliance adequately controls ESH issues.

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Appendices

Appendix A

Specific Elements and Levels of the DLRS Model

Strategic Formulation

The manner in which the firm intends on confronting and managing ESH issues.

Level 1: Reactive:

Strategy formulated at this level can be characterized as somewhat indiscreet and scanty with response to ESH issues occurring after a harmful incident happens or the organization is mandated to do so.

Organizational stakeholders tend to be unaware of the extent and magnitude of ESH issues and unconcerned about formulating any strategy to confront and manage ESH issues. There are more pressing demands on the business agenda of the firm than to recognize the ESH challenge facing the business. No conscious or deliberate efforts to reduce ESH impacts are made, because the firm does not want to, does not think it needs to, or is not aware of its economic effects. The organization generally will undertake discreet and remedial action only when threatened by government and/or insurance sanctions.

Since meager consideration and effort is made in the strategy formulation process, a 'get by with what you can' mentality exists, usually resulting in very narrow and incremental solutions to ESH issues. The firm excuses itself from taking any prudent action because of financial, technological, and human capital deficiencies. Even though the firm may not possess a formal strategy, it can nonetheless still be categorized as possessing an ESH strategy. For example, doing nothing is a strategy in itself, whether it is a deliberate decision or not.

Level 2: Static:

Strategy formulated at this level can be characterized as mostly dependent and driven by ESH regulations imposed by agencies of government, insurance carriers, and NGOs interest groups, usually without regard to how these responses strategically fit and contribute to the competitive aspects of the firm.

Organizational stakeholders' awareness of the extent and magnitude of ESH issues is somewhat limited and they tend to be passive and detached from formulating any strategy to confront and manage ESH issues. The organization sees its strategy formulation process strictly from a compliance perspective. Compliance with regulatory standards tends to be considered as an inevitable ongoing threat that negatively impacts productivity and erodes competitiveness and plays a very small part of each business operating decision. The organization promotes a 'play by the rules and everything will be alright' mentality Many times ESH professionals are told not to draw any attention by being non-compliant and to keep the organization out of trouble so it can compete.

Because scanty attempts chiefly focused on maintaining compliance are made in the strategy formulation process, a strategic intent that describes the organization's intermediate and long-term ESH vision is absent. A mission statement exists and is primarily focused on compliance and incident reduction. The strategic plan is comprised of a small portfolio of short-term technical initiatives principally driven by compliance issues and incidents that have affected key internal operating units.

Level 3: Active:

Strategy formulated at this level can be characterized as pushing for the detection and correction of current and anticipated ESH issues, usually with attention to how these issues impact the competitive and regulatory performance standards of the firm. ESH strategy is generally permanent and ongoing, but not always fully integrated into the business aspects of the firm.

Organizational stakeholders are aware of the extent and magnitude of ESH issues and they understand how a well-constructed, financed, and integrated ESH strategy can help in improving operational performance. They look at ESH issues and regulations affecting the organization not as unnecessary cost burdens, but as opportunities to reduce short and long term risk and contingent liability.

Genuine attempts are made in formulating strategy and verifying that it strategically fits with the competitive performance strategy of the firm on an annual basis. The strategic intent is to adapt imaginatively and effectively to ESH issues and new regulatory agency compliance changes and to improve the management of risk and contingent liability, while reducing the outlays associated with accidents/incidents, lawsuits and boycotts. The mission statement includes preventing the causes of loss producing incidents and minimizing their effects. The strategic plan is comprised of a well-balanced blend of short- and long-term objectives that tend to meet the needs and expectations of key internal organizational clients.

Level 4: Dynamic:

Strategy formulated at this level can be characterized as enhancing the long term economic aspects of the firm. ESH issues are considered at the earliest possible stage in the life cycle design of products, services, technologies and processes, usually with attention to how they strategically strengthen the firm's business fundamentals (e.g., revenue and earnings growth, quality of management, free cash flow generation) and on how they enhance societal expectations for sustainable resource development.

Organizational stakeholders tend to fashion ESH needs as a criterion for making business decisions and business needs become a criterion for making ESH decisions. There is understanding that solid performance in this area tends to serve as a proxy for other corporate business behaviors, which tend to produce good business performance.

The strategy formulation process is taken seriously and embedded in the overall competitive business strategy of the firm. The strategic intent is to constantly build

competencies and capabilities ahead of needs and to lead the firm in its sustainable resource development and use practices. The mission statement is focused on preparing, protecting and preserving the firm's resources and spotting opportunities for revenue growth in sustainable new products and technologies. Strategic plans tend to have a clear fit with the firm's business objectives, focused on a set of high-leverage developmental and reform initiatives and reforms that are characterized substantively while delivering a unique mix of economic value. Organizations at this level frame ESH improvement in terms of resource productivity and protection.

Organization Structure

The intended approach used for structuring ESH strategy within the overall organizational structure of the firm.

Level 1 -Reactive:

The organization structure at this level can be characterized as an unspecified arrangement that tends to be shaped only when the organization is confronted with orders by government agencies and/or insurance carriers to arrange conditions within the organization to control existing ESH issues. When facing orders, companies at this level generally comply reluctantly, a 'get by with what you can' mentality prevails. This type of structure tends to tackle single ESH issues, affecting processes, only when they arise or when it suits organizational stakeholders to make a response.

Direction for structuring ESH strategy tends to be principally provided by external regulatory agencies, insurance carriers and internal committees. Responsibility for structuring activities tends to be assigned to an ESH coordinator/collateral duty specialist with limited authority usually employing a command and control structure. Efforts are focused on controlling exposures to hazardous that exist and reporting back to stakeholders what was done.

An organizational positioning arrangement for ESH is non-existent within the organization chart of the firm.

Level 2 –Static:

The organization structure at this level can be characterized as a functional staff arrangement that tends to be shaped by regulatory compliance priorities. When facing existing and new regulatory and/or enforcement actions, companies at this level react by letting only their ESH personnel handle it. However, it is not organized in a manner that properly structures and assimilates other ESH strategies and technical activities into existing business structures. This type of structure is organizationally connected only to the firm's processes encountering regulatory compliance problems.

Direction for structuring ESH strategy tends to be principally provided by internal inspections/incident investigations and external regulatory agency and insurance carriers. Responsibility for structuring ESH organization is assigned to a small-centralized group of ESH specialists positioned and dispersed in the organization's core production/processing areas. Efforts are focused on providing technical advice on regulatory compliance matters (*i.e., understanding the intent and purpose of compliance activities that affect ESH and in selecting from legislation those standards that are most applicable to work activities performed under their jurisdiction*) and controlling exposures to hazards affecting the core production/processing areas.

The organizational positioning arrangement is undistinguished and buried within the organizational chart of the firm. The function tends to report to a mid-level operational manager.

Level 3- Active

The organization structure at this level can be characterized as a line-staff arrangement that tends to be shaped by existing exposures to hazards, long-term contingent liabilities resulting from past operations, and new regulatory priorities expected to affect the organization. When confronting these issues, companies at this level bring ESH, legal, and operational staffs together to find effective and efficient solutions. This type of structure is organizationally connected to the core business units within

the organization encountering existing and/or potential risk, danger, and loss to the resources that they control.

Direction for structuring ESH strategy tends to be principally driven by the internal needs and expectations of core business unit managers derived from corporate wide audits and information from design and process engineers, and external consultants. Responsibility for structuring strategy is assigned to a moderate sized team of ESH specialists possessing a wide array of technical competencies and capabilities, with powers to integrate activities vertically and laterally within the organization. Efforts are focused on developing corporate wide policy, constructing risk identification, assessment and control initiatives, contingent liability reduction, enhancing regulatory compliance and fostering ESH responsibility among employees and external suppliers by encouraging their initiative to support ESH initiatives through training activities.

The organizational positioning arrangement is somewhat distinguished and arranged on the same level as other major producing and servicing business units within the organizational chart of the firm. The function tends to report to a vice-president involved in operations and/or finance.

Level 4- Dynamic:

The organization structure at this level can be characterized as a hybrid solutions-based business arrangement that tends to be shaped by the competitive performance plans of the organization. When facing new major and strict regulations, companies at this level review their activities (products, technologies, processes, services) asking such questions as:

- What activities are causing the most risk and cost burdens?
- Are the activities in high enough demand to justify spending resources to re-engineer and modify?
- Are any of the activities creating ESH problems, unprofitable enough to eliminate?

These companies then determine the cost of controls under different scenarios and conduct risk and economic analysis to find the best solutions. Dynamic companies look at major new regulations in a new light. Instead of viewing them as an unnecessary cost burden, they see them as an opportunity to make production more efficient. This type of structure is organizationally connected to the firm's products, technologies, processes and services contributing to ESH risk and cost burdens.

Direction for structuring strategy tends to be principally driven by the competitive performance strategy of the organization, by internal and external operations research studies, corporate audits, risk and cost assessments, and special task force studies. Responsibility for structuring strategy is assigned to a superimposed multi-level and interdisciplinary team of internal and external ESH specialists having dual allegiance to a particular ESH assignment and to their organizational business unit area. These specialists possess a wide array of strategic management and technical competencies and capabilities with power to extend and structure business management strategies in ways that connect ESH practices to the organization's business fundamentals. Major attention is focused on determining ways to enhance compliance with requirements authorized by governmental regulatory agencies and insurance carriers, counteract existing and potential risk to resource problems affecting the firm, reduce long-term contingent liabilities, and to lead the organization in activities that sustain the organization and its resources. In addition, these specialists contribute constructively to the shaping of public policy based on sound business and scientific principles. The ESH function constantly reframes ESH issues into business and technological problems. This results in the organization's ability to cooperate more fully with internal and external networks, thereby finding solutions to problems that do not alter technology or production systems to any great extent.

The organizational positioning arrangement is well distinguished, is internally and externally structured into the business strategy process of the organization, and reports to a senior-level executive.

Financing Arrangement

The manner in which the firm intends on funding ESH strategy.

Level 1 Reactive

Strategy for financing the firm's ESH investments at this level can be characterized as a reactive and resistive arrangement. Access to financial resources is based solely on correcting violations cited by government regulatory agencies and mandates from insurance carriers. Additional financial resources needed for providing technical day to day ESH services are provided when it financially suits the company. Tools for performing economic analysis of ESH issues do not exist, because the firm does not want to, does not think it needs to, or is not aware of the potential cost impact of failing to counteract these issues.

Level 2 Static

Strategy for financing the firm's ESH investments at this level can be characterized as an informal arrangement. A mentality of funding only as much as others in their industry sector are funding is strongly adhered to. An informal 'pay as you go' funding mentality exists; invest to counteract issues only when trying to reduce the outlays associated with injury/illness and environmental incidents. Investments, undertaken for preventing occupational injuries, illnesses, and environmental incidents and compliance with regulations, generally do not compete for access to financial resources. However, access to financial resources needed to confront and manage more technically discriminating ESH issues depends upon the capabilities of the firms' ESH specialists to assemble internal coalitions of support in order to compete for funding. These technical discriminating prevention initiatives tend to have no clear criteria and pattern of funding, thus subjecting them to unpredictable funding outcomes. Tools for performing economic analysis of ESH investments are considered by internal organizational stakeholders to be qualitatively and quantitatively immaterial for competing with other investment allocation decision alternatives. ESH cost accounting practices focus on aggregating cost data causing

costs to be hidden in general overhead accounts and to be not included throughout the life cycle of the product, service, technology or process responsible for their generation. As a result, integrated and concurrent design engineering decision-making capabilities required for aggressively controlling ESH costs are limited and incomplete.

Level 3 Active

Strategy for financing the firm's ESH investments at this level can be characterized as an applied arrangement. Access to financial resources tends to be allocated when investment requests are intended to reduce risk to products, technologies, processes and services, enhance compliance with regulatory standards, reduce contingent liability caused by past operations, and minimize outlays associated with accidents, environmental incidents, lawsuits and boycotts. The funding level tends to be above others in their industry sector and included into the overall budget of the core business units obtaining the services. Tools for performing economic analysis of ESH investments are chiefly focused on cost-benefit analysis and payback and sometimes internal rate of return. Cost are accumulated either through the use of cost accounting systems or through the use of cost finding techniques and reported on a regular basis for management information purposes. The costs of incidents are charted and charged back to core business units and incorporated into the firm's budget process. However, profiling the cost and profitability of ESH issues affecting the organizations products, technologies, processes and services and integrating cost information into decision-making does not occur. This condition results in senior-level executives looking at ESH issues as non-business issues.

(Level 4 Dynamic)

Strategy for financing the firm's ESH investments at this level can be characterized as being self-sustaining. A strategically opportunistic funding position is taken which means having sufficient funding for the long-term, while having the financial wherewithal to remain flexible enough to resolve new issues and support research and development and other opportunities for innovation that, over time, will lead to

significant ESH performance gains while advancing measurable business goals. Business strategies and ESH changes are tightly interwoven; changes in products, technologies, processes and services affect ESH and changes in ESH issues and practices in turn force product, technology, process and service changes. Access to financial resources and capital is approved for 3 years (typically related to potential business contribution over the long and short term) and based on factors and circumstances that are causing the firm to fail in its efforts to protect and use resources productively and conditions/circumstances under which ESH pays. Senior level financial executives desire ESH strategy and activities to become financially self-sustaining and contribute measurably to company competitiveness. Tools for performing economic analysis of ESH investments provide reliable and timely information on the full cost burdens associated with the firm's products, technologies, processes and services over their productive and economic life cycle. Considerable thought is given to how to enhance the efficiency and effectiveness of ESH spending.

Appendix B

DCBS Data on the 5 Cases

	Case 1		**Case 2**		**Case 3**		**Case 4**		**Case 5**	
Years	2000-2005		2004-08		2004-08		2004-08		2004-08	
No. of claims	9 claims		10 claims		11 claims		10 claims		55 claims	
	Total	*Ave*	*Total*	*Ave*	*Total*	*Ave*	*Total*	*Ave*	*Total*	*Ave*
Time loss/days paid	1721	191.2	527	52.7	412	37.5	181	18.1	2849	51.8
Medical paid by closure	$196,768	$21,863	$182,730	$18,273	$21,624	$1966	$31,346	$3135	$364,502	$6627
Indemnity paid excluding fatal and PTD	$298,332	$33,148	$263,404	$26,340	$53,565	$4870	$8962	$896	$357,442	$6499
Time loss dollars paid	$98,992	$10,999	$35,917	$3592	$18,814	$1710	$8,249	$825	$88,865	$1616
Permanent partial disability paid	$88,431	$9826	$220,486	$22,049	$34,751	$3159	$713	$71	$245,476	$4463
Claim disposition agreement paid	$104,000	$11,556	$7000	$700					$21,300	$39
Disputed claim settlement paid	$5,000	*							$1800	$33
Vocational services	$1908									
Employer-at-Injury program paid	$6392	$710	$10,902	$1902						
Preferred Worker program paid	$128,345	$14,261	$44,525	$4453						

*Blank cells indicate $0 paid during this time period
See table below for definitions of terms in column 1.

Table Data Dictionary for Table 1.4 DCBS data						
DCBS assigned employer ID	**Record ID**	**Injury year**	**Resolution (CDA or closure year)**	**Claim type**	**Time loss/days paid**	**Medical paid by closure**
DCBS assigned employer ID	This DCBS-assigned number allows DCBS to verify data on individual claim records as needed.	Use this field to count accepted disabling claims for injury years. If an establishment has no records for a given injury year, then there were no accepted disabling claims for that year.	This is the year that the insurance company sets the liability for indemnity benefit payments on a claim and reports indemnity (generally, cash paid to the worker) and medical cost data to DCBS. All payments, even those actually made in prior years (most often, time loss), are assigned to this year. If a claim is resolved by claim disposition agreement (CDA), then most likely there will be no future indemnity payments. If a claim is resolved by closure, then the possibility exists that the claim could reopen in the future, resulting in future indemnity payments. For either resolution type, future medical payments may occur.	There are four values for this field. "Claim closed or settled" means that the claim is resolved and payment data have been reported. "Claim not resolved" means that the claim is still open (the worker is still recovering from the injury) and that no payment data have been reported.	This is the number of days that the time loss indemnity benefit is paid to the worker for time lost from work.	This is the non-indemnity benefit of medical services bills paid by the insurer on behalf of the injured worker by the time of claim closure or CDA. Medical benefits are paid by the insurer out of premiums collected from the employer.

Indemnity paid excluding fatal & PTD	Time loss dollars paid	Permanent partial disability paid	Claim disposition agreement paid	Disputed claim settlement paid	Vocational services and purchases paid	Employer-at-Injury program paid	Preferred Worker program paid
Indemnity benefits are cash benefits paid to the worker, plus vocational services and purchases paid on behalf of the worker. Indemnity is the sum of time loss dollars, permanent partial disability, claim disposition agreement, disputed claim settlement, and vocational services and purchases; fatality and permanent total disability (PTD) indemnity benefit costs are not reliably available to DCBS. Indemnity benefits are paid by the insurer out of premiums collected from the employer.	This indemnity benefit is paid while the worker recovers from the disabling injury.	This indemnity benefit compensates the worker for any permanent loss of use or function of body part(s) or system(s).	Upon agreement of the worker and the employer, this indemnity benefit is paid to settle all future rights to indemnity payments on an accepted claim. This may occur at any time.	Upon agreement of the worker and the employer, this indemnity benefit is paid to settle a denial by the insurer of benefits.	This indemnity benefit is paid on behalf of the worker with a claim severe enough to warrant retraining the worker for a new job.	This benefit is paid to the employer on behalf of the worker, to sustain or return the worker to light-duty or transitional work while the worker recovers from injury. It is paid from the Worker Benefit Fund, rather than insurance premiums.	This benefit is paid to the employer (for the most part) on behalf of the injured worker, to sustain or return the worker to modified or new work once the worker's permanent functional limitations are known. It is paid from the Worker Benefit Fund, rather than insurance premiums.

Appendix C

Interview Protocol

Project Title: Refining a More Complete Theory of Environment, Safety, and Health Management Strategy Using Case Studies
Principal Investigator: Anthony Veltri, Ed.D; OSU Department of Public Health
Co-Investigator(s): Elisabeth Maxwell, M.S.; Doctoral Candidate; OSU Department of Public Health

General Information:
Directions: Obtain from anyone. Could be obtained over the phone or via email previous to a site visit.

1) How many employees work at this plant?
2) How many employees work for your company?
3) What are the education levels of most employees?
4) What is the average age of employees?
5) Is there Union-representation? (percentage of workforce and what areas)
6) How many sister plants or similar units are there?
7) What is the age of this facility?
8) What are your product lines?
9) How do you define what industry you are in?
10) Who owns the business?

Strategy:
Only ask the questions relevant to the participant's job and knowledge. Mark NA if not applicable.

1. How aware are organizational stakeholders (i.e., senior level executives, managers, supervisors, workers) of the extent and magnitude of ESH issues (i.e., occupational injuries/illnesses, environmental incidents, long term contingent liability, regulatory problems, NGO concerns?

Possible follow-up: Are there differences regarding internal and external stakeholders?

a. How concerned are stakeholders with formulating strategy to confront and manage ESH issues?

2. What kinds of efforts are made to reduce ESH impacts? What kind of technical efforts are utilized

- ☐ Hazard controls
- ☐ Elimination
- ☐ Substitution
- ☐ Isolation
- ☐ Engineering
- ☐ Administrative controls
- ☐ PPE

Possible follow-up: Is there anything else you would say about your strategic plan in addressing ESH issues?

4. What issues take precedence over addressing ESH issues?

5. What is your ESH compliance strategy?
Follow up: How is it similar or different from how you comply with other regulatory compliance issues affecting the business?

6. How does your firm approach government or insurance sanctions in regard to ESH issues?

7. How is upfront design engineering utilized at your firm?

8. How does ESH performance relate to business performance at your firm?

Organization:

9. What kind of authority do ESH personnel have?

10. How does ESH strategy become structured at your firm?

11. What are ESH efforts focused on?
12. Who does the ESH function report to?

13. Who meets to discuss and plan for ESH issues?

14. How has your organization structure been affected by compliance issues?
By insurance issues?

15. How are compliance issues addressed?

16. Who handles regulatory and enforcement issues?

17. How do you see/implement new regulations?

18. Is thought given to going beyond compliance?
Are efforts made to anticipate new compliance issues and have a plan before they are enacted?

19. How is the ESH department connected to core business units in your firm?
How is ESH connected to the business fundamentals of your firm?

20. How is the ESH organization structure shaped by the competitive performance plans of your organization?

21. How does ESH interact with R/D?
Tell me about internal ESH auditing at your firm.

22. What efforts are focused on the following:
☐ Developing corporate wide policy;
☐ Constructing risk identification; assessment and control initiatives;

☐ Contingent liability reduction;
☐ Enhancing regulatory compliance and fostering ESH responsibility among employees and external suppliers by encouraging their initiative to support ESH initiatives through training activities.

23. How does your firm consider what will cause the most risk and cost burdens?
a. How is spending allocated to address them?

24. Is consideration given to any activities which may be risky enough to eliminate?

25. Does your firm utilize different EHS scenarios with costs of controls to determine what the best course of action is?

26. How does ESH work with other departments at your firm?

27. How is your firm involved with shaping public policies?

Financial

28. How are efforts expended to enhance the efficiency and effectiveness of ESH?

29. How are business strategies and ESH strategies connected at your firm?

30. How does ESH strategy contribute to your firm's competitiveness?

31. How would you characterize your firm's strategy for financing ESH investments?

32. How does the ESH department obtain funds for their activities?
Can you provide examples of the kinds of issues ESH expends funds on?

33. Does your firm perform economic analysis of ESH issues? Is yes, how is this done?

34. Is your ESH funding comparable to others in your industry?

35. How is integrated and concurrent design engineering used at your firm?

36. How is cost-benefit analysis used in related to ESH investments?

37. How are costs of ESH incidents charged?

38. How would you characterize the strategy for financing your firm's ESH investments?

39. How long are financial resources and capital approved for?

Evaluation, etc.:

40. How is ESH performance evaluated at your firm?

41. Does your firm use any of the following?
☐ JIT
☐ Lean Manufacturing

☐MIS
☐ Total Quality Management
☐Preventative maintenance

Supporting documentation:
ESH mission statement. *(Get a copy if possible.)*
Organizational chart
Any other company/business data they are willing to release

Appendix D

SAFETY, HEALTH AND ENVIRONMENTAL STRATEGIES AVAILABLE TO FIRMS AND BEING USED BY FIRMS: A CONCEPTUAL FRAMEWORK FOR FORMULATING STRATEGY

Anthony Veltri, Associate Professor
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Elisabeth Maxwell, M.S., Doctoral Student
Environment, Safety and Health Program,
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Introduction

Many private sector firms omit safety, health and environmental (SHE) management strategy from the competitive strategy of the firm. This leaves the SHE branch exempt from any expectation that the function confronts and manages its internal and external affairs strategically and with the perspective of showing its contribution to firm competitiveness. The prevailing complaint of many SHE specialists is that SHE strategy should be linked to the competitive strategy of the firm. However, few specify what this means and even fewer have specified how to go about it and how to assess its contribution to firm competitiveness. While many factors tend to contribute to this problem, it seems reasonable to believe that SHE specialists have had to satisfy themselves with fragmented and unreliable approaches when formulating strategy.

Despite the considerable literature available on strategy formulation (Adler, McDonald, and MacDonald, 1992; Kiernan, 1993; Porter, 1998;), linking strategy to firm competitiveness (Porter, 1998) and assessing its contribution to firm competitiveness (Porter, 1998) and its extensive use by other internal organizational specialists (*i.e., research and development, design and process engineering,*

operations management, finance, information management, and maintenance, transportation/distribution, etc.) specialists in SHE have not received comparable guidance in the professional literature. Typically, SHE strategy tends to be overly fashioned around reacting to pressures from outside concerns (*i.e., government agencies, insurance carriers, non-government organizations*) with little attention to linking it to the firm's competitive business strategy (Roome, 1992; Brown, 1994). The emphasis on formulating and linking SHE strategy to the firm's competitive strategy should not be interpreted to mean that there is any intention to de-emphasize the importance of formulating and linking strategy to strictly comply with the pressures from outside concerns (Hunt and Auster, 1990). Attention to outside concerns is assured to exist, as it rightly should, and formulating a SHE strategy that is linked to the competitive strategy of the firm is not intended to replace this critical consideration. However, a strategy that is formulated solely for compliance reasons tends to become suspect because this type of strategy is not expected to yield positive financial returns and is difficult to assess its contribution to firm competitiveness (Brown, 1994; Hunt and Auster, 1990; Sharma, 2000; Singh, 2000).

This new interest in alternative approaches that formulate and link SHE strategy to the competitive business strategy of the firm is being driven at both external and internal financial levels (Maxwell, Rothenberg, Briscoe and Marcus, 1997; Reinhardt, 1998). At the external level, the growing understanding of the potential business benefits derived from a SHE strategy that is competitive based has led to the construction of stock indexes such as the Dow Jones Sustainability Group Index 1999 and Innovest

EcoValue 21™ 1999. Moreover, numerous websites and investment firms are catering to their customers by listing stocks and companies that have superior SHE records (InvestorIdeas.com, 2008; SustainableBusiness.com, 2008). These indexes provide institutional and retail investors with a financial and social interpretation of the SHE practices of a firm. The external financial community, specifically investment bankers are starting to view SHE performance as a proxy for other firm business performance behaviors that tend to enhance the overall competitive performance for a firm (Feldman and Soyka, 1997; Carter and Veltri 1999). Although the evidenced-based research results of this claim are not substantial, a distinct group of firms are promoting a more business looking SHE strategy that could be important for increasing competitiveness. Perhaps, assessments of SHE strategy that are linked to firm competitiveness will become a standard part of the way a firm promotes its competitive business performance and may possibly affect its attractiveness in the external financial marketplace.

At the internal level, the operative notion of an approach for linking SHE strategy to the firm's competitive strategy is financially appealing. Internal finance specialists, design and process engineers and operational managers are extremely interested in being provided an SHE strategy that is most likely to contribute to the firm's business fundamentals (*i.e., revenue and earnings growth, quality of management, free cash flow generation*). However, they are somewhat skeptical of the results of assessments that provide data such as the number of compliance audits performed, behavior-based

training provided, and perception surveys conducted. They much prefer assessments of strategy that present data that specifically profiles cost and profitability potential.

Because internal and external stakeholders will rely on a firm's SHE strategy for understanding the intended course of action chosen by a firm in the context of its response to confronting and managing SHE issues, SHE practitioners must make available a newer kind of strategy that is linked to the firm's competitive strategy and most accurately reflects SHE contribution to the business fundamentals of the firm (Henriques and Sadorsky, 1999).

Showing a linkage between SHE strategy and the firm's competitive strategy is a complicated proposition with very real methodological issues such as how to collect, verify and report pertinent data that shows congruency. One way to correct this deficiency is extract the better features of models and methods used by management strategists that have successfully linked their strategy to firm competitiveness (Epstein and Roy, 2003; Hoffman, 2008; Klassen and Whybark, 1999).

Formulating a SHE strategy that is linked to the competitive strategy of the firm has generally evaded the practitioner and student in SHE management. While they may be well read in the technical principles and practices that guide decision-making and operating actions for the field, they seldom have studied and used principles and practices which underlie their strategic logic and competitive attractiveness and their books, journal articles and lectures merely mention these in passing. A review of the

professional literature finds that no approaches exist for formulating SHE strategy and linking it to the organization's competitive strategy. Because no clear guideposts exist, SHE specialists will continue to be lost when trying to formulate and link SHE strategy to the firm's competitive strategy. The authors have proposed a conceptual framework to jump start this under-researched area. Specifically, the proposed conceptual framework profiles levels and pathways of SHE strategy to consider.

Methodology

As part of others' studies focusing on strategic planning and economic analysis of SHE issues and practices (see Bibliography), we conducted preliminary interviews with 7 senior-level executives, 15 operations managers, 20 design and process engineers, 15 finance specialists and 25 safety, health and environmental specialists (n = 82), representing 29 medium to large U.S. based firms engaged in manufacturing, construction, distribution, and utilities. We urge caution in generalizing the results due to the preliminary nature of this investigation. After a discussion about the purpose and methodology involved in the research and confidentiality, individuals were asked open-ended questions specifically dealing with the SHE strategy formulation process. Strategy was defined in the interviews as 'the manner in which firms confront and manage SHE issues.' Examples of these questions are listed below:

(1) Describe the major elements that should be included when formulating strategy for confronting and managing SHE issues,

(2) Describe the existing level of SHE strategy currently being pursued by firms.

(3) Describe what would make a difference in improving the way SHE strategy is formulated.

Responses were arranged into a two-dimensional assessment scheme **(Figure 1)** for guiding decision-making capabilities. Generalizations and inferences made as a result of the study were based upon consideration of the following limitations:

(1) Responses may be influenced by the philosophical beliefs concerning SHE,
(2) Current position occupied
(3) Relevant management/organizational and SHE related experiences of respondents
(4) Discussion questions and the two-dimensional assessment scheme, used by the investigators, were not subject to evaluation before being considered by respondents.

The research was delimited to perceptions related to the SHE strategy formulation process and not perceptions related to strategy implementation and assessment. We also note that the intended purpose was not to test the model that was developed as a result of the interviews, but might be used at a later date for further research. This is also a limitation in the development of the conceptual framework. However, we argue this is a minor limitation because of the expertise of the respondents in the area of study and the capacity of the data to address a concern that is an under-researched topic and in dire need of study. Still, future research that perhaps utilizes a random sample should be directed at collecting data purely to address the usefulness of the model for guiding decision-making capabilities related to SHE strategy formulation process.

The following conceptual framework was constructed from the analysis of the 82 semi-structured discussions. The SHE strategy formulation process constituted the

major theme of each discussion and it is the analysis of this data that is evidenced in the following charts.

Model Development and Framework

Figure 1

Elements of a Firm's SHE Strategy:

4. Strategy Formulation: The manner in which the firm intends on confronting and managing occupational safety, health and environmental issues.

5. Organization Structure: The manner in which the firm intends on structuring occupational safety, health and environmental strategy within the organization structure of the firm.

6. Financing Strategy: The manner in which the firm intends on funding occupational safety, health and environmental strategy.

7. Technical Strategy: The manner in which the firm intends on creating and/or transferring and using technology to confront and manage occupational safety, health and environmental issues.

8. Management Information Strategy: The manner in which the firm intends collecting, using and providing occupational safety, health and environmental information to internal and external stakeholders.

9. Evaluation Strategy: The manner in which the firm intends on evaluating occupational safety, health and environmental practices.

Developmental Levels of SHE Strategy Within A Firm:

Level1. (Reactive)	Strategic posture is to respond to safety, health and environmental issues as they occur
Level2. (Static)	Strategic posture is to respond to safety, health and environmental issues based on the prevailing regulatory requirements
Level3. (Active)	Strategic posture is to accept and internalize safety, health and environmental issues and extend broad management and technical effort
Level4. (Dynamic)	Strategic posture is to focus on the competitive value of safety, health and environmental practices

Chart A

1. Strategic Formulation: *The manner in which the firm intends on confronting and managing SHE issues.*

Level 1: Reactive:

Strategy formulated at this level can be characterized as somewhat indiscreet and scanty with response to SHE issues occurring after a harmful incident happens or the organization is mandated to do so.

Organizational stakeholders tend to be unaware of the extent and magnitude of SHE issues and unconcerned about formulating any strategy to confront and manage SHE issues. There are more pressing demands on the business agenda of the firm than to recognize the SHE challenge facing the business. No conscious or deliberate efforts to reduce SHE impacts are made, because the firm does not want to, does not think it needs to, or is not aware of its economic effects. The organization generally will undertake discreet and remedial action only when threatened by government and/or insurance sanctions.

Since meager consideration and effort is made in the strategy formulation process, a 'get by with what you can' mentality exists, usually resulting in very narrow and incremental solutions to SHE issues. The firm excuses itself from taking any prudent action because of financial, technological, and human capital deficiencies. Even though the firm may not possess a formal strategy, it can nonetheless still be categorized as possessing a SHE strategy. For example, doing nothing is a strategy in itself, whether it is a deliberate decision or not.

Level 2: Static:

Strategy formulated at this level can be characterized as mostly dependent and driven by SHE regulations imposed by agencies of government, insurance carriers, and non-government interest groups, usually without regard to how these responses strategically fit and contribute to the competitive aspects of the firm.

Organizational stakeholders' awareness of the extent and magnitude of SHE issues is somewhat limited and they tend to be passive and detached from formulating any strategy to confront and manage SHE issues. The organization sees its strategy formulation process strictly from a compliance perspective. Compliance with regulatory standards tends to be considered as an inevitable on-going threat that negatively impacts productivity and erodes competitiveness and plays a very small part of each business operating decision. The organization promotes a play by the rules and everything will be all right mentality Many times SHE professionals are told not to draw any attention by being non-compliant and to keep the organization out of trouble so it can compete.

Because scanty attempts chiefly focused on maintaining compliance are made in the strategy formulation process, a strategic intent that describes the organization's intermediate and long-term SHE vision is absent. A mission statement exists and is primarily focused on compliance and incident reduction. The strategic plan is comprised of a small portfolio of short-term technical initiatives principally driven by compliance issues and incidents that have affected key internal operating units.

Level 3: Active:

Strategy formulated at this level can be characterized as pushing for the detection and correction of current and anticipated SHE issues, usually with attention to how these issues impact the competitive and regulatory performance standards of the firm. SHE strategy is generally permanent and ongoing, but not always fully integrated into the business aspects of the firm.

Organizational stakeholders are aware of the extent and magnitude of SHE issues and they understand how a well-constructed, financed, and integrated SHE strategy can help in improving operational performance. They look at SHE issues and regulations affecting the organization not as unnecessary cost burdens, but as opportunities to reduce short and long term risk and contingent liability.

Genuine attempts are made in formulating strategy and verifying that it strategically fits with the competitive performance strategy of the firm on an annual basis. The strategic intent is to adapt

imaginatively and effectively to SHE issues and new regulatory agency compliance changes and to improve the management of risk and contingent liability, while reducing the outlays associated with accidents/incidents, lawsuits and boycotts. The mission statement includes preventing the causes of loss producing incidents and minimizing their effects. The strategic plan is comprised of a well-balanced blend of short- and long-term objectives that tend to meet the needs and expectations of key internal organizational clients.

Level 4: Dynamic:

Strategy formulated at this level can be characterized as enhancing the long term economic aspects of the firm. SHE issues are considered at the earliest possible stage in the life cycle design of products, services, technologies and processes, usually with attention to how they strategically strengthen the firm's business fundamentals (e.g., revenue and earnings growth, quality of management, free cash flow generation) and on how they enhance societal expectations for sustainable resource development.

Organizational stakeholders tend to fashion SHE needs as a criterion for making business decisions and business needs become a criterion for making SHE decisions. There is understanding that solid performance in this area tends to serve as a proxy for other corporate business behaviors, which tend to produce good business performance.

The strategy formulation process is taken seriously and embedded in the overall competitive business strategy of the firm. The strategic intent is to constantly build competencies and capabilities ahead of needs and to lead the firm in its sustainable resource development and use practices. The mission statement is focused on preparing, protecting and preserving the firm's resources and spotting opportunities for revenue growth in sustainable new products and technologies. Strategic plans tend to have a clear fit with the firm's business objectives, focused on a set of high-leverage developmental and reform initiatives and reforms that are characterized substantively while delivering a unique mix of economic value. Organizations at this level frame SHE improvement in terms of resource productivity and protection.

Chart B

2. Organization Structure: *The intended approach used for structuring SHE strategy within the overall organizational structure of the firm.*

Level 1 -Reactive:

The organization structure at this level can be characterized as an unspecified arrangement that tends to be shaped only when the organization is confronted with orders by government agencies and/or insurance carriers to arrange conditions within the organization to control existing SHE issues. When facing orders, companies at this level generally comply reluctantly, a fix-operate-fix and 'get by with what you can' mentality prevails. This type of structure tends to tackle single SHE issues, affecting processes, only when they arise or when it suits organizational stakeholders to make a response.

Direction for structuring SHE strategy tends to be principally provided by external regulatory agencies, insurance carriers and internal committees. Responsibility for structuring activities tends to be assigned to a SHE coordinator/collateral duty specialist with limited authority usually employing a command and control structure. Efforts are focused on controlling exposures to hazardous that exist and reporting back to stakeholders what was done.

An organizational positioning arrangement for SHE is non-existent within the organization chart of the firm.

Level 2 –Static:

The organization structure at this level can be characterized as a functional-staff arrangement that tends to be shaped by regulatory compliance priorities. When facing existing and new regulatory and/or enforcement actions, companies at this level react by letting only their SHE staffs handle it. However, it is not organized in a manner that properly structures and assimilates other SHE strategies and technical activities into existing business structures. This type of structure is organizationally connected only to the firm's processes encountering regulatory compliance problems.

Direction for structuring SHE strategy tends to be principally provided by internal inspections/incident investigations and external regulatory agency and insurance carriers. Responsibility for structuring SHE organization is assigned to a small-centralized group of SHE specialists positioned and dispersed in the organization's core production/processing areas. Efforts are focused on providing technical advice on regulatory compliance matters (*i.e., understanding the intent and purpose of compliance activities that affect SHE and in selecting from legislation those standards that are most applicable to work activities performed under their jurisdiction*) and controlling exposures to hazards affecting the core production/processing areas.

The organizational positioning arrangement is undistinguished and buried within the organizational chart of the firm. The function tends to report to a mid-level operational manager.

Level 3- Active

The organization structure at this level can be characterized as a line-staff arrangement that tends to be shaped by existing exposures to hazards, long-term contingent liabilities resulting from past operations, and new regulatory priorities expected to affect the organization. When confronting these issues, companies at this level bring SHE, legal, and operational staffs together to find effective and efficient solutions. This type of structure is organizationally connected to the core business units within the organization encountering existing and/or potential risk, danger, and loss to the resources that they control.

Direction for structuring SHE strategy tends to be principally driven by the internal needs and expectations of core business unit managers derived from corporate wide audits and information from design and process engineers, and external consultants. Responsibility for structuring strategy is assigned to a moderate sized team of SHE specialists possessing a wide array of technical competencies and capabilities, with powers to integrate activities vertically and laterally within the organization. Efforts are focused on developing corporate wide policy, constructing risk identification, assessment and control initiatives, contingent liability reduction, enhancing regulatory compliance and fostering SHE responsibility among employees and external suppliers by encouraging their initiative to support SHE initiatives through training activities.

The organizational positioning arrangement is somewhat distinguished and arranged on the same level as other major producing and servicing business units within the organizational chart of the firm. The function tends to report to a vice-president involved in operations and/or finance.

Level 4- Dynamic:

The organization structure at this level can be characterized as a hybrid solutions-based business arrangement that tends to be shaped by the competitive performance plans of the organization. When facing new major and strict regulations, companies at this level review their activities (products, technologies, processes, services) asking such questions as:

- What activities are causing the most risk and cost burdens?
- Are the activities in high enough demand to justify spending resources to re-engineer and modify?

- Are any of the activities creating SHE problems, unprofitable enough to eliminate?

These companies then determine the cost of controls under different scenarios and conduct risk and economic analysis to find the best solutions. Dynamic companies look at major new regulations in a new light. Instead of viewing them as an unnecessary cost burden, they see them as an opportunity to make production more efficient. This type of structure is organizationally connected to the firm's products, technologies, processes and services contributing to SHE risk and cost burdens.

Direction for structuring strategy tends to be principally driven by the competitive performance strategy of the organization, by internal and external operations research studies, corporate audits, risk and cost assessments, and special task force studies. Responsibility for structuring strategy is assigned to a superimposed multi-level and interdisciplinary team of internal and external SHE specialists having dual allegiance to a particular SHE assignment and to their organizational business unit area. These specialists possess a wide array of strategic management and technical competencies and capabilities with power to extend and structure business management strategies in ways that connect SHE practices to the organization's business fundamentals. Major attention is focused on determining ways to enhance compliance with requirements authorized by governmental regulatory agencies and insurance carriers, counteract existing and potential risk to resource problems affecting the firm, reduce long-term contingent liabilities, and to lead the organization in activities that sustain the organization and its resources. In addition, these specialists contribute constructively to the shaping of public policy based on sound business and scientific principles. The SHE function constantly reframes SHE issues into business and technological problems. This results in the organization's ability to cooperate more fully with internal and external networks, thereby finding solutions to problems that do not alter technology or production systems to any great extent.

The organizational positioning arrangement is well distinguished, is internally and externally structured into the business strategy process of the organization, and reports to a senior-level executive.

Chart C

3. ***Financing Arrangement:*** *The manner in which the firm intends on funding SHE strategy.*

Level 1 Reactive

Strategy for financing the firm's SHE investments at this level can be characterized as a reactive and resistive arrangement. Access to financial resources is based solely on correcting violations cited by government regulatory agencies and mandates from insurance carriers. Additional financial resources needed for providing technical day to day SHE services are provided when it financially suits the company. Tools for performing economic analysis of SHE issues do not exist, because the firm does not want to, does not think it needs to, or is not aware of the potential cost impact of failing to counteract these issues.

Level 2 Static

Strategy for financing the firm's SHE investments at this level can be characterized as an informal arrangement. A mentality of funding only as much as others in their industry sector are funding is strongly adhered to. An informal-pay as you go funding mentality exists; invest to counteract issues only when trying to reduce the outlays associated with injury/illness and environmental incidents. Investments, undertaken for preventing occupational injuries, illnesses, and environmental incidents and compliance with regulations, generally do not compete for access to financial resources. However, access to financial resources needed to confront and manage more technically discriminating SHE issues depends upon the capabilities of the firms' SHE specialists to assemble internal coalitions of

support in order to compete for funding. These technical discriminating prevention initiatives tend to have no clear criteria and pattern of funding, thus subjecting them to unpredictable funding outcomes. Tools for performing economic analysis of SHE investments are considered by internal organizational stakeholders to be qualitatively and quantitatively immaterial for competing with other investment allocation decision alternatives. SHE cost accounting practices focus on aggregating cost data causing costs to be hidden in general overhead accounts and to be not included throughout the life cycle of the product, service, technology or process responsible for their generation. As a result, integrated and concurrent design engineering decision-making capabilities required for aggressively controlling SHE costs are limited and incomplete.

Level 3 Active

Strategy for financing the firm's SHE investments at this level can be characterized as an applied arrangement. Access to financial resources tends to be allocated when investment requests are intended to reduce risk to products, technologies, processes and services, enhance compliance with regulatory standards, reduce contingent liability caused by past operations, and minimize outlays associated with accidents, environmental incidents, lawsuits and boycotts. The funding level tends to be above others in their industry sector and included into the overall budget of the core business units obtaining the services. Tools for performing economic analysis of SHE investments are chiefly focused on cost-benefit analysis and payback and sometimes internal rate of return. Cost are accumulated either through the use of cost accounting systems or through the use of cost finding techniques and reported on a regular basis for management information purposes. The costs of incidents are charted and charged back to core business units and incorporated into the firm's budget process. However, profiling the cost and profitability of SHE issues affecting the organizations products, technologies, processes and services and integrating cost information into decision-making does not occur. This condition results in senior-level executives looking at SHE issues as non-business issues.

(Level 4 Dynamic)

Strategy for financing the firm's SHE investments at this level can be characterized as being self-sustaining and a down-to-business arrangement. A strategically opportunistic funding position is taken, this means having sufficient funding for the long-term, while having the financial wherewithal to remain flexible enough to solve new issues and support research and development and other opportunities for innovation that, over time, will lead to significant SHE performance gains while advancing measurable business goals. Business strategies and SHE changes are tightly interwoven; changes in products, technologies, processes and services affect SHE and changes in SHE issues and practices in turn force product, technology, process and service changes. Access to financial resources and capital is approved for 3 years (typically related to potential business contribution over the long and short term) and based on factors and circumstances that are causing the firm to fail in its efforts to protect and use resources productively and conditions/circumstances under which SHE pays. Senior level financial executives desire SHE strategy and activities to become financially self-sustaining and contribute measurably to company competitiveness. Tools for performing economic analysis of SHE investments provide reliable and timely information on the full cost burdens associated with the firm's products, technologies, processes and services over their productive and economic life cycle. Major thinking is performed on how to enhance the efficiency and effectiveness of SHE spending.

Chart D

4. Technical Strategy: The *manner in which the firm intends on creating and/or transferring and using technical tools for confronting and managing SHE issues.*

Level 1 (Reactive):

The technical strategy can be characterized as resistive and driven only when required to provide personnel protection equipment to employees. Access to technical resources is based solely on

correcting violations cited by government regulatory agencies and mandates from insurance carriers. Concern for providing day to day SHE technical services are provided when it financially suits the company.

Technical tools for confronting and managing SHE issues are lacking within the firm's products, technologies, processes and services. Technical tool use tends to be periodic and intermittent, with emphasis on general recognition, evaluation and control of SHE exposures to hazards affecting the firm.

The firm does not conduct any relevant training on how to confront and manage SHE issues facing the firm.

Level 2 (Static):

The technical strategy can be characterized as driven by technology changes to meet regulatory compliance problems. Only environment, safety and health technical tools that fulfill regulatory reporting requirements by state and federal administrations (i.e. MSDS software, Job Safety Analysis (JSA)) are used by the firm.

Technical tool use tends to be periodic and intermittent, with emphasis on general recognition, evaluation and control of environment, safety and health exposures to hazards affecting the firm.

Technical considerations are included in organizational R&D and project planning processes on an ad hoc or adaptive basis. These considerations are seldom a factor in determining if or which product is made and are primarily formulated in reaction to current and imminent urgent problems, compliance with regulatory requirements, or in response to explicit request from business customers. The firm sees no relevant market or strategic opportunity in developing environment, safety and health technical innovation and favors short-term solutions mainly through the adoption of end-of-pipe technologies.

Limited and basic technical training sessions are focused on meeting regulations and ensuring current and future compliance. Specialized technical training on environment, safety and health issues for engineering, design, and R&D personnel does not exist above that which is available to all employees. Additional attempts at environment, safety and health awareness in developing product, processes, procedures, and tools are not evident.

Level 3 (Active):

The technical strategy can be characterized as promoting technological change for production purposes (i.e. main business innovation). The firm has adopted a continuous and interval application of environment, safety and health assessment tools (i.e. Detailed Hazard Analysis (DHA), Product Line Analysis (PLA), Environmental Site Assessment (ESA)) to manage quantities of natural resources used, wastes produced, hazard exposure, and contingent liability). Tool attention is focused on current and future detection, interpretation, and modification of environment, safety and health impacts linked to operations. Management decision-making is dependent on these tools for providing information that initiates strategic action.

Environment, safety and health technical considerations are included in organizational R&D and project planning processes on an opportunistic basis. The firm monitors developments, changes, and trends in environment, safety and health technologies, but does not systematically and consistently incorporates it with R&D planning. The R&D function pursues technical development in elected regulatory-driven projects, projects aimed at improving environment, safety and health and business performance, and projects exploring new product/process opportunities. The firm has built a technical understanding and capacity for linking environment, safety and health innovation with improved organizational

competitiveness. Distinguished from traditional add-on 'end-of-pipe' controls, the new innovative initiatives undertaken encompass pollution prevention, toxic use reduction, and clean technology.

Dedicated technical training is conducted for all employees involved in product design, production processes, and resource utilization aspects. Management has recognized that a proactive approach to enhancing compliance is a knowledgeable, environmentally aware work force. Technically competent employees are expected to better position the company to deal with the regulatory framework and develop cost-effective solution when available.
The technical training is conducted internally (mentoring, on-the-job training) and externally (consultants, conferences, meetings, professional journals) and focuses on developing environment, safety and health awareness within the mindset and methodologies of the employees. Traditional job tasks are expanded to include environment, safety and health concerns so that they may be reflected in both design and operational criteria of the firm's technology.

Level 4 (Dynamic):

The technical strategy at this level can be characterized as routinely allocating resources to maintaining a technical knowledge foundation and developing core technologies and new tools for improving technical productivity. The firm has invested in an extensive compilation of ongoing environment, safety and health and economic tools (i.e. Life Cycle Analysis (LCA), Total Quality Assessment (TQA), Environmental Impact Assessment (EIA)) to investigate environmental, safety, health, financial, and social effects of the organizational processes and their impact on organizational competitiveness. Tool attention focuses on the comprehensive identification and modeling of: the risk, loss, dangers that resources are subjected to, quality and financial effects from environment, safety and health issues, future liabilities, and organizational sustainability. Management relies on the strategic choice of tools, strongly related to organizational environment, safety and health objectives, to support research and technology decisions and serve as a baseline to improve environment, safety and health performance and sustainable development practices.

The strategic consideration of environment, safety and health technical innovation is fully embedded and linked within R&D, project process planning, and business operations. These SHE considerations are seen in the overall broad organizational picture, and improved technical efficacy within them is recognized as a strategically potent means for obtaining competitive advantage. Environment, safety and health projects are viewed as key investments to the future of the company that will address resource threats and opportunities. Technical productivity enhancements are sought that balance strategic objectives with current needs by developing core technologies and new tools. The firm is recognized as continually surpassing industry benchmarks and setting the standard of technological environment, safety and health innovation. Initiatives focusing on technical change address multimedia pollution sources and reflect fundamental shifts in the design and reformulation of products and processes (Design for Environment, Health, and Safety).

Strategically tailored technical training programs are developed for all design, scientific, pre-production, production, and R&D functions to ensure a consistency with sustainable organizational development. Management has found it financially and competitively advantageous to stay ahead of regulations and competitors and respond to current public attitudes toward environment, safety and health issues through technical development. The technical training initiated by the firm occurs regardless of the existence of regulatory requirements and meets or exceeds the industry average. The majority of technical training programs are carried out internally (mentoring, job rotation, workshops, communities of practice) and are supplemented by external opportunities (universities, conferences, partnerships). Both explicit and tacit technical knowledge transfer of environment, safety and health issues and procedures within the organizational products, processes, and tools are integrated in the training for use in a common context. Trained employees are accountable for viewing and considering environment, safety and health matters equally with other product/process concerns (costs, marketability,) when performing all job tasks.

Chart E

5. Management Information Strategy: *The manner in which the firm provides information to internal and external parties on SHE strategy control and progress.*

Level 1 (Reactive):

The management information strategy at this level can be characterized as a highly incomplete and partial compilation of information pertaining to SHE issues within the firm. Previous insufficient data generation and recording activities are lacking which leads to a piecemeal collection of information. With a mentality of responding after the fact to SHE issues, there is a lack of focus on organizing existing information into a coherent and continuous outline. Often, important SHE information is only gathered and compiled by necessity after receipt of fines and mandates by regulatory agencies.

Organizational access of SHE information internally is confined to the point of origin of the data. Information available is not present beyond the actual process, department, or area in which it was generated. Communication of SHE strategy, control, and progress does not take place unless initiated in response to regulatory mandates threatening the stability of the company and will involve as few people/resources as possible. Additional information transfer of performance, issues, and concerns of the firm in this area are informal, unplanned and not expected of the employees, divisions, etc…

Reporting to the external environment does not take place because the firm does not want to, does not believe it needs to, or sees no potential benefit in disclosing the SHE performance level and status of its operations.

Level 2 (Static):

The management information strategy at this level can be characterized as a fragmented approach that centers on targeted areas within the firm. This focus concentrates on those processes and activities that dictate the regulatory and legal standing of the firm. Under this level, knowledge management of these areas aims to fulfill required reporting formats designated by occupational and environmental regulators.

Organizational access of SHE information is internally available as a limited number of hard-copy graphs, spreadsheets, figures, and tables. These documents are accessible within the department where it was generated and within the SHE function. The extent of the information covers only a limited number of regulated processes over specified time periods. This information composition is based upon simplicity and comparability between previous and present time intervals. Communication of SHE strategy, control, and progress is the responsibility of a core group of SHE specialists located in central operational areas encountering regulatory compliance concerns. Information is presented to mid-level management responsible for the particular department. Each individual overseeing the information collection of a specific operation, and subsequent reporting, works independently of similar employees in different areas. This ad-hoc arrangement creates a limited and vertical flow of information confined within each department.

Reporting to the external environment takes the form of annual organizational SHE reports relating to the firm's level of regulatory compliance. These hard-copy reports are limited in SHE information and are publicly available by request.

Level 3 (Active):

The management information strategy at this level can be characterized as an integrated approach that concentrates upon information from functions within the firm experiencing risk, danger, and loss. The firm believes that information from these areas has the same worth as operational information from

different department and can equally affect the competitiveness and profitability of the firm. The focus of the firm's SHE knowledge management is the early recognition and rectification of existing and future issues while keeping in mind how it contributes to the performance of the firm. Certain processes and activities within the firm are viewed as having a higher SHE cost and subsequent contingent liability. Information management efforts (collection, processing) are concentrated towards these areas that are deemed to hold the majority of the firm's SHE burden.

Organizational access of SHE information internally is provided through hard-copy documents from spreadsheet and text applications, databases, and the intranet/internet present as a complimentary supplement. SHE information is recorded and available from all performance entities (division, processes, etc…) and is displayed using a standardized format. This arrangement is based on easy comprehension and availability. Utilization of specialized software programs typically involves tools for complying with SHE laws and regulation (Health and Safety software, Environmental Cost Assessment software). Communication of SHE strategy, control, and progress is transmitted through lines of responsibility and accountability established throughout designated functions. This interaction along personnel takes the form of scheduled meetings and discussions that concentrate on how the information affects the competitive, financial, and regulatory status of the firm. Increasingly upper-level and senior level management are involved in the meetings and communication pathways, but this is not a permanent arrangement.

Reporting to the external environment is a repeated voluntary initiative stemming from the pressures of various groups that have a direct interest in the SHE performance of the firm. The firm has a desire to demonstrate a responsible and proactive attitude toward SHE issues in lieu of awareness from shareholders, banks, local communities, corporate customers, employees, and business analysts. Reports are published and available on-line, concurrently with the financial reporting of the firm and communicate SHE commitment, targets, and performance.

Level 4 (Dynamic):

The management information strategy at this level can be characterized as a holistic approach that balances and incorporates all relevant human, operational, organizational and technological components of the firm. Since SHE information, issues, concerns, and innovation are deeply rooted in the employees and framework of the organization, efforts must concurrently address all components of the firm as a single system, not as separate elements. The focus of the firm's SHE knowledge management is to create economic value and lead to increased organizational sustainability. The information and knowledge gained on SHE progress and control is not valuable unless you use it. Furthermore, it must be used where it has the greatest economic potential of spurring growth, eliminating liabilities, dangers, and losses, and consequently maintaining sustainability. The firm places a high emphasis on applying knowledge management (collection, processing, reporting) to higher risk business processes whose improvement will create a significant return on investment. This investment often takes the form of increased productivity or efficiency where the traditional burdens of accidents, environmental incidents, and resource losses are identified and can be minimized.

Organizational access of SHE information internally is composed of a combination of software applications, databases, and on-line sites that can be accessed from computer terminals throughout the organization. This system is based upon speed, user-friendliness, and inclusiveness. Information is processed and stored by employees with direct/indirect accountability and influence on particular activities. Various software programs that go beyond compliance are utilized to identify areas of improvement and speed the consolidation of relevant SHE information into reports based on a specific product, location, process, division, or time period. The use of these programs allows for more efficient and all-inclusive reports that draw attention to the regulatory and competitive stance of the company. These reports are made internally available primarily through intranets and the internet. Using these electronic mediums provides all levels of management access to a central database in which necessary SHE performance information is stored. Information is presented in diverse and interactive formats with multimedia and interactive formats. This allows for rapid access and releases the firm from the constraints of time and space associated with traditional forms of SHE management communication.

Communication of SHE strategy, control, and progress is conducted through regular and frequent meetings between a hybrid of employees at different levels and divisions of the firm. These multi-disciplinary meetings include designated representatives from the pertinent areas with a twofold duty to an SHE assignment and their department. Due to the awareness of how SHE performance and regulations affect the business decisions of the firm, senior level executives are a permanent, and necessary, fixture at the meetings.

Reporting to the external environment is given the same priority as the internal information system flow. To maintain a favorable reputation and enhance the attractiveness of the firm, public dissemination of SHE strategy, control, and progress is provided. This is accomplished through publishing, and providing on-line, specific SHE targets, identification of the lines of responsibility for SHE issues, program successes and limitations, and quantitative performance data. Performance improvements to the firm's SHE activities are also made public through targeted environmental communications to all stakeholders and the financial community.

Chart F

***6. Evaluation Strategy**: The manner in which the firm intends on evaluating SHE performance and sustainable resource development practices.*

Level 1 (Reactive):

Performance evaluation at this level can be characterized as a nonexistent process. The firm strongly believes that expenditures on SHE improvement represent costs that offer no corresponding benefits in terms of productivity, efficiency, liability, public perception, and competitiveness. Therefore, it makes no sense to evaluate a firm's SHE performance and how it reflects on its' overall business strategy.

SHE performance is not tracked or considered in the operational evaluations of the firm. There is an inability to define relevant activities, an inability to quantify efforts and funds spent on SHE actions, and an undefined relationship between these activities and their operational impacts. Attempts to evaluate single elements of the firm's SHE burden are only initiated in response to regulatory mandates and are not permanent.

Assessment and evaluation of the environmental management system and its components does not take place, as an already meager effort, structure, and activities comprise SHE program.

Level 2 (Static):

Performance evaluation at this level can be characterized as a process to identify and monitor only those processes that affect the regulatory compliance stance of the firm. There is a lack of belief in empirical evidence or analysis that organizational SHE activities impact the business success of the firm outside of the legal perspective. The driving force influencing the firm's evaluation methods are the increasingly stringent regulations regarding SHE impacts of the procedures, products, and production processes.

SHE performance is tracked through a set of indicators with a limited focus on failure rates and end-of-pipe controls for activities under regulatory control. These measures are limited to tracking costs, emissions, accidents, or other compliance related outputs, and fail to adequately determine the efficiency or effectiveness of the underlying process. This strictly focuses on the environmental burden of the firm and accidents/incidents to human resources.

Assessment and evaluation of the environmental management system and its components is conducted through a limited set of self-audits focused on technical compliance with laws and regulation. The audit process is not intended to monitor indicators of daily compliance as direct responsibility rests on

division managers, or their equivalent. Self-audits from these divisions are regularly carried out and are basically reports stating 'yes' or 'no' we are not in compliance. This system is not responsible for taking a holistic look at the organization's approach to SHE management or helping management devise better procedures to reduce SHE costs and impacts.

Level 3 (Active):

Performance evaluation at this level can be characterized as a process to anticipate, identify, and monitor all activities and processes within the firm that affect organizational resources. Management attitudes have evolved beyond a strict concern for compliance by realizing the potential of substantial financial benefits from improved SHE performance. The foremost driving force influencing the firm's evaluation techniques is a commitment to SHE stewardship to manage risks to resources, minimize accidents/incidents, and improve overall performance. Evaluation is viewed as a tool to accurately assess and recognize performance levels and potential areas of improvement.

SHE performance is tracked through numerous performance indicators throughout areas of operational systems, management systems, and the environment. Major attention is focused on choosing indicators that demonstrate continuous improvement, identify weak spots in the system, allow for more efficient distribution of resources, and provide a mechanism for assigning accountability for SHE risk, danger, and loss results. A high priority is placed on developing indicators for each organizational activity that reflects the goals, objectives, and targets, thus adding definition and support to corporate SHE policies. Tracking progress toward established goals serves to influence behavior by providing continual feedback, and requires reliable and consistent metrics to be assigned under the chosen indicator areas. Metrics, chosen for the broader indicator areas, are recorded qualitatively and quantitatively, and accurately portray amounts, costs, time, efficacy, and contingent liabilities. The firm also investigates and implements, to the greatest degree practicable, metrics representative of current best practices in the industry for use in benchmarking. Systematic comparison of industry performance benchmarks and best practices of competitors is looked at as an opportunity to provoke question about SHE performance and opportunities for improvement.

Assessment and evaluation of the environmental management system and its components is conducted through audits with an expanded scope beyond compliance to include risk assessments of unregulated activities. Focus is directed on how the firm's SHE systems identify the business process points that impact resources, measure the potential for damage, mitigate the risks represented, and initiate control. Audits are carried out according to risk-based factors including the complexity of the facility/operation, intricacy of the regulatory environment, past compliance performance, continuity of the personnel involved, elapsed time since last audit, and influences on the firm's financial standing. By assessing the effectiveness the business and SHE process systems manage environmental risk; this organizationally integrated audit series impacts the business cycle of the firm.

Level 4 (Dynamic):

Performance evaluation at this level can be characterized as an all-inclusive process to assess SHE implementation and outcome measures in organizational procedures, activities, and all resource utilizations to ensure maximum efficiency. The firm views SHE performance as a definitive area of competitive advantage and a gauge of the sustainability of the firm. The driving force behind the evaluation methodology is to increase profitability through sustainable development practices. The purpose of the performance evaluations is to change behavior to fit this organizational goal. The firm has realized that they can only effectively manage what they measure, therefore SHE evaluation has a permanent and highly integrated presence.

SHE performance is tracked through a combination of fundamental environmental and more strategic indicators that detail where they are, where they were, and where the firm wants to be. This mix of lagging and leading indicators allows management to prioritize past problems, address their most pressing issues, and seek business opportunities. The choice of indicators is driven by the firm's objectives, policies, goals, and the potential gain of competitive advantage with regard to significant

success factors, including profitability enhancement, regulatory positioning, market access, and stakeholder approval. This is accomplished through the designation of applicable metrics under the indicator areas that are relevant to economic competitiveness (i.e. resource consumption, waste recovery, compliance costs, etc.). Metrics are recorded qualitatively, quantitatively, absolutely, aggregated, and index/weighted for increased accountability, standardization, and comparability over time to produce trends, which can be benchmarked against other companies or industries. These metrics are recorded on balanced scorecards to help management keep pace with the sustainability of the firm from both an environmental and financial point of view. Developing scorecards for crucial SHE performance and business metrics help senior-level management track results, and also enables stakeholders to verify results in ways that can maintain the firm's reputation and sustainability. The balanced scorecard links the vision and strategy with the performance indicators and subsequent metrics to provide the basis for the strategic SHE measurement and management system.

Assessment of the environmental management system and its components is conducted through a comprehensive variety of audits, differing in type and frequency, to monitor overall compliance and determine the efficiency and effectiveness of the firm's ability to protect and use resources productively. These audits range from daily self-assessments to a detailed external audit. Self-audits consist of equipment inspections, job procedure checklists, and other routine practices conducted on a daily basis. Internal audits ensure compliance with company objectives, industry initiatives, and governmental regulations as well as to reduce current SHE costs and future liabilities. Furthermore, this internal system provides the basis for practical planning and control and the basis for external audits that rely heavily on information submitted by the firm. External audits provide senior management with independent verification and analysis of the competencies, capabilities, and deficiencies of the SHE program and confidence that all issues are being addressed. The enhanced, all-inclusive process results in a more proficiently integrated SHE program that reduces liability, prevents losses, reduces costs, fosters profits, and leads to increased sustainability of the firm.

SUMMARY

Firms will tend to make investments in SHE strategy for the same reasons they make other strategic investments; because they expect them to deliver positive financial returns, control for risk to organizational activities (*i.e., products, technologies, processes, services*) and reduce contingent liability resulting from past operations. SHE specialists should embrace that investment reality and incorporate that reasoning when formulating strategy. Moreover, determining the level of SHE strategy that a firm should pursue is the challenge for SHE managers. Use of the conceptual framework to guide decision-making and operating action capabilities should prove very useful.

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Appendix E

Detailed Case Study Reports

Case study 1

This case study was of a small to medium sized business located in the Pacific Northwest. The facility manufactured trailers for animals and equipment. When contacted by telephone for an interview request, the owner disclosed that due to the current economic downturn, his business was not doing well. He said that several years ago, he employed upwards of 90 employees and was now down to 15. He reported he was unsure if he would be able to remain in business much longer. Although, his business was experiencing these financial problems, he still agreed to the interview request and site visit.

The owner was interviewed in person. Their ESH program was structured around the 'Caring Worker' contract that employees sign when they come to work for the company. It is a system that employees agree to participate in where employees can remind each other about safe practices without anyone become defensive. The owner described trying to create a culture where the employees keep each other accountable. He reported this is his way of dealing with a business that cannot afford its own on-site ESH professional. He has to depend on every person who works there to maintain safe work practices for themselves and each other.

The site visit was consistent with what the owner reported about the safety and environmental aspects of the facility. Many safety factors were observed in evidence during the walk-through of the manufacturing facility. The following were observed by the researcher:

- Safety signs reminding employees to wear gloves, glasses; keep safety first; mind slips and trips; keep cords coiled above, etc.
- Cords were coiled above machinery
- Safety saws with the automated cut-off the owner described
- Gloves and safety glasses
- Two employees wearing sweatshirts with safety sayings and the company logo

- No messy equipment
- No unsealed chemicals, solvents, oils
- Clean work areas

It should be noted that although this was a planned appointment, the owner did not have a clear idea that most of the interview would be focused on safety. It did not appear that the facility had been prepared in advance to show a safer working environment. In addition, the owner noted that they had just had an OSHA inspection with no violations or infractions a few months prior.

A second interview was conducted with an employee at the facility. This employee performs any custom woodworking that is added to the interior of the trailers, such as cabinetry. The employee happened to be wearing a safety sweatshirt with the company logo on it. He reported he had won it several years ago at a company barbecue. He has worked at this facility for 6 years. His reports regarding safety were consistent with the owner's—that they try to create a safety-minded culture at the facility. He reported that it has always been very comfortable to remind other workers about possible safety issues and that when he is reminded, he is not defensive. He said this was because of the 'Caring Worker' contract they sign when they are hired. He also reported that they are reminded from time to time about this contract to keep the facility as safe as possible. One of the most poignant statements this worker made was, "I think the most important part is I've always felt like (owner's names) care about me and don't want me to get hurt or anyone else."

It was not possible to conduct an interview with Human Resources (HR), ESH, or a Union representative because none of these were present at this business. The owner and his co-owner have assumed the responsibilities of HR and ESH.

The overall impression of this business is that because the owner has a strong belief in safety, the workers do as well. This was also shown by the ubiquitous safety signs, the equipment properly stored, and clean shop that were observed. The safety culture is one where the owner is obviously trying to go beyond compliance, but is also hampered by the current economic situation. He would like to have an on-site

ESH professional, but cannot afford one right now. Their safety record appears to be impressive, considering how financially strapped they appear to be.

External Information

This business has no air quality permits and had no violations on record with Environmental Protection Agency. DCBS reported 9 claims between 2000—2005 with a total time loss or days paid of 1721. This is an average of 191.2 days per claim. The total amount of medical paid by closure during this period of time was $196,768 with an average paid by claim of $21,863 (Table 1.7). The company has no ER Mod as it was self-insured. OSHA reported one 'other than serious violation.' This may be the incident where an employee was seriously injured by a saw which was described by the owner. When contacted, several local environmental organizations reported no records or concerns about this company or any environmental issues (Table 1.6). The company website did not contain any environmental information such as an environmental mission statement, statement of commitment to the environment, statement of environmental awareness, or an outline of their environmental program. It should be noted that several months after these interviews were conducted, the company went out of business.

Case study 2

This case study is of a medium sized business located in the Pacific Northwest. The facility manufactures particle board. When contacted by telephone for an interview request, the human resources manager agreed to participate. She stated she is also the safety supervisor at this facility.

The HR/Safety manager was interviewed in person at a pre-planned appointment. She described their safety program as being structured around the RADAR system which they obtained from their insurance company. RADAR stands for 'recognize the risk, assess the situation, develop a safety work plan, act safely and report it.' The RADAR system reminds workers each time they perform a job to check whether the job is safe and whether anything has changed since the last time they performed the job. The program includes paper records where employees and

supervisors have to check off each RADAR step and sign and date that the entire process was completed. The HR/Safety manager reported that the facility has improved its safety record immensely since implementing the RADAR program. They have another facility in the state which has not implemented the program yet, and their safety record is still a concern to the company owners.

The site visit was consistent with what the HR/Safety manager reported about the safety and environmental aspects of the facility. Many safety factors were observed in evidence at this facility including the following:

- Safety signs reminding employees to wear gloves, glasses; keep safety first; mind slips and trips; remember to use the R.A.D.A.R system, etc.
- Cords were coiled above machinery
- Guarded machinery
- Gloves and safety glasses
- No messy equipment
- No unsealed chemicals, solvents, oils
- Clean work areas
- Use of gloves, safety glasses, hard hats, work boots, etc.
- No contractors or non-employees allowed in the plant without an escort and brief safety advisory

It should be noted that although this was a planned appointment, the HR/safety manager did not have a clear idea that most of the interview would be focused on safety. It did not appear that the facility had been prepared in advance to show a safer working environment. Moreover, the facility is large enough that it is not feasible that it could have been prepared in advance as there are too many employees and areas. It can be assumed that what was observed on the date in question is a fairly accurate picture of what the facility is like on any given day.

A second interview was conducted with the environmental manager of the facility. She reported working a lot on recycling issues of the facility. They reduced the amount of garbage the facility generates and increased the amount they recycle. This

was done to save money and because it is the environmentally responsible thing to do, according to her. The facility also installed a biofilter which has reduced emissions by 98%. They did this voluntarily, anticipating that it would help with future emissions standards. They have also started using catch basins. They have wastewater that comes from the biofilter. They now recycle it three times before discharging it. The environmental manager has made significant efforts toward working cooperatively with the local community, local NGOs and the local air quality permitting agency.

A third interview was conducted with the plant manager who is also the operations manager of this facility. He reported a company-wide commitment to worker safety and the environment. He reported that the company has a system in place to anticipate safety and environmental issues and that he will shut down the production line to find the root cause of an actual problem or impending problem in either of those areas. He also reported making efforts to ensure that workers know that he and other upper management care about them and their safety, not just because of how it affects the bottom line, but because they really care about their employees' health and safety.

Attempts were made to interview a line worker at this site, but did not meet with success. The Safety Manager did not feel she could take a line worker away from their work for an interview.

External Research

This company has an extensive part of their company website devoted to their environmental concerns. They have an Environmental Policy Statement, a list of their product certifications, a list of their sustainable projects, and their commitment to Leadership in Energy and Environmental Design (LEED) Green Building Rating System Credit Support (Table 1.3). Because this company manufactures wood products, they are automatically under more public and government scrutiny for emissions and what kind of wood products (sustainable or not) they use.

Environmental Data

In 2005 facility was issued one Notice of Non-Compliance (NON No. 3002) for operating MEC-1 rotary dryer such that dryer inlet temperature exceeded a 24-hour

average operating temperature of 600 degrees F (a requirement of the Subpart DDDD Plywood MACT) by the local air quality regulating agency. Because the facility had been diligent in meeting the Subpart DDDD compliance dates and requirements, the furnish (wood fiber material) to MEC-1 was by definition "dry" at the time of the temperature excursion (green is considered of 30% moisture or greater) and that activity was no on the basis of circumventing the DDDD requirements for drying green material, NON 3002 was closed with no further enforcement action. This issue was not reported during the course of the interviews (Table 1.6).

The company enforcement history was reported by the local air quality permitting agency to be generally considered average and that the company has made strides to maintain compliance and improve any noted issues. EPA was contacted and reported having no records on this facility or company.

Occupational Safety Data

OSHA reported three citations have been issued (Table 1.6). This facility has also had four serious violations and two other than serious violations. Some of these issues were referred to in the course of the interviews. It did not appear that efforts were made to not disclose this information.

This facility's ER MOD is 1.07 which is 7% worse than the industry average. It was reported by the safety manager that this number reflects both of the company's two manufacturing facilities. It was reported that the facility not visited has not implemented the RADAR program and has a worse safety record than the facility which has implemented RADAR. Therefore, it is reasonable to assume that the actual ER MOD for this facility alone is probably lower than 1.07 (Table 1.6).

DCBS Data

DCBS reported that between 2004-08 there were 10 claims with a total of 527 days paid which is an average of 52.7 days per claim. The total amount of medical paid by closure during this time period was $182,730 with an average of $18,273 paid per claim (Table 1.7).

Initial Summary

The overall impression of this business was that the safety manager, environmental manager, and operations manager are all committed to going beyond compliance. The safety manager is trying to create a safety-minded culture and is having limited success due to funding limitations. The environmental manager is working proactively with the community and other local environmental organizations to improve the company's community partnerships and image. The operations manager appears committed to supporting safety and environmental issues, while at the same time keeping the business profitable. However, the main barriers to this are that the safety and environmental managers do not have their own budgets and cannot spend money as they see fit on safety or environmental issues. They have a stated culture that is safety and environmentally-minded, but the owners and/or upper management hinder this by under-funding the safety and environmental functions. However, both managers stated that given the current economy, layoffs, and low production, they are making do with what they have and do not feel they can complain. The R.A.D.A.R. system appeared to be working and although only implemented two years previous, seems to be having a positive effect on safety incidents.

Case study 3

This case study is of a medium sized business located in the Pacific Northwest. The facility manufactures tents, hot water heaters, and fire protective clothing. When contacted by telephone for an interview request, the ESH manager agreed to participate.

The ESH manger was interviewed in person at a pre-planned appointment. The ESH manger also provided a tour of the facility. Some safety factors were observed in evidence at this facility including the following:

- Some safety signs reminding employees to wear gloves, glasses; mind slips and trips, etc.

- Cords were coiled above machinery
- Guarded machinery
- No messy equipment
- No unsealed chemicals, solvents, oils
- Use of gloves and safety glasses

In comparison to other site tours, this facility had fewer safety signs than others. The ESH manager pointed out a bulletin board in the break room that was behind a door where he reported he posts most of his ESH notices. There was one page of notes from the safety committee meeting posted, as well as 3-4 safety pamphlets. In the facility, there was a handmade poster board showing various months with the number of safety incidents reported.

The ESH manger reported that he is also an engineer with the company and that the ESH job was assigned to him. He does not have any formal training or degrees in the ESH field. He reported that safety is mostly 'common sense' and that he does not do much besides having employees sign an initial safety contract when they first start at the facility. He reported that many of their employees are non-English speaking. There were safety signs posted in Spanish.

A second interview was conducted with the Chief Financial Officer (CFO) of the facility. He reported that their approach to safety is to 'pay as we go.' He admitted that they have probably been pretty lucky in having no major safety or environmental incidents at their facility. However, he also stated that they are not willing to put preventive money into any ESH issues.

A brief employee interview was conducted without either manager. The ESH manager's description of the safety efforts at this facility was essentially verified. The employee expressed gratitude at having a job and reported feeling safe at work. She did not think there could be improvements in the safety at this facility. She was unaware of any workers being hurt while she had been at this facility which was 10 months at the time of the interview. This facility is non-Union.

External Research

When contacted, several local environmental organizations reported no records or concerns about this company and any environmental issues (Table 1.6). The company website did not contain any environmental information such as an environmental mission statement, statement of commitment to the environment, statement of environmental awareness, or an outline of their environmental program (Table 1.6).

Environmental Data

This business has no air quality permits and had no violations on record with Environmental Protection Agency (Table 1.6).

Occupational Safety Data

This facility's ER MOD is reported to be 0.83 which is 17% better than the industry average. OSHA reported the same safety record as the interviewees. The facility has not had an inspection in several years, but the last one was completely clean and no citations were given (Table 1.6).

DCBS Data

DCBS reported that during 2004-08 there were 11 claims with a total of 412 days paid which is an average of 37.5 days per claim. There was a total of $21,624 medical paid by closure with an average of $1966 paid per claim (Table 1.7).

Initial Summary

The overall impression of this business is that as the respondents stated, '…we've been lucky.' They have not had any major incidents and therefore, have not felt a need to put more efforts into their safety program. The ESH manager is not trained in the ESH field and relies on his employees' common sense to keep them safe. He also has a significant portion of his workforce who do not speak English as their primary language. They have made efforts to supply translated safety materials, but only in Spanish. This company seems like the very definition of 'Reactive.'

Case study 4

This case study is of a medium sized business located in the Pacific Northwest. The facility manufactures different types of paints, both liquids and powders, both for industrial use and for home owners as well. When contacted by telephone for an interview request, the ESH manager agreed to participate.

The ESH manager was interviewed in person at a pre-planned appointment. The ESH manger also provided a tour of the facility. Many safety factors were observed in evidence at this facility including the following:

- Many safety signs reminding employees to wear gloves, glasses; keep safety first; mind slips and trips, etc.
- Cords were coiled above machinery
- Guarded machinery
- Few unsealed chemicals, solvents, oils
- Fairly clean work areas
- Use of gloves, safety glasses, hard hats, work boots, hearing protection, respiratory masks, etc.

Because of the messy nature of this facility—paint—it did not appear as clean as some of the others visited. However, there was still plenty of evidence that this facility tries to pay close attention to safety.

The ESH manger reported that this company has an entire ESH department. There is one supervisor in the department and two workers who report to him. One ESH employee deals with local compliance issues. The other one deals with federal compliance issues and they both share any international compliance issues.

During the facility tour, the ESH manager talked about the installation of the facility's biofilter process and how it has made great improvements in their air emissions. She also reported that living in community where there are many environmental activists and concerned groups has forced the company to be proactive in their approach to environmental issues. They installed the filter without being mandated by the government. She reported the company is very interested in being a

good neighbor. The nature of their business causes many community concerns about breathing issues in the local community. She reported the company works hard to alleviate the concerns. Although the company is large, it is still owned by a family who lives in the community. She reported that they care how they are thought of and their impact on the local community.

A second interview was conducted with the ESH supervisor of the facility. He reported that this company takes a very proactive approach to environmental and safety issues. He has many contacts in the US who communicate impending changes in regulations, so that the company can anticipate and prepare. He reported being in the department for more than 20 years. Although neither of the ESH employees interviewed have degrees in the field, they both appeared very knowledgeable and proactive in their approach to ESH issues.

A brief employee interview was conducted during the site tour. This employee was reminded not to leave marbles on the floor as he filled paint cans as they can be a trip/slip hazard by the EHS manager. He appeared non-defensive. He was able to be interviewed alone and reported the facility as being safe and that he felt comfortable with the ESH employees. He reported it being safer than another company he worked for just previous to this one. He also reported having young children who live within a mile of the facility. He reported it does not seem to emit anything they can smell and he feels his family is safe. This facility is non-Union.

External Research

The company website has an extensive section devoted to its environmental concerns and commitment to staying within compliance with all local, state, and federal regulating agencies. The website also provides information about the installation of the facility's biofilter process and how it has improved their air emissions (Table 1.6).

Environmental Data

The local air quality regulating agency reported a non-compliance citation issued in 2006 for exceeding 9 tons per year single Hazardous Air Pollutant (HAP)

emission. Toluene was the HAP in question. Civil penalty of $6000 was paid in full. The same agency also reported a non-compliance citation issued 1995 for installing and operating equipment without notifying the air permit authority first (Table 1.6).

EPA public records contain a fine in the amount of $5103 for violations of the Clean Air Act. The fine was paid in full and all cited issues were resolved. EPA records indicate that the business owners and ESH personnel were cooperative with the inspection, results, remediation, and resolution of the fine (Table 1.6).

Occupational Safety Data

This facility's ER Mod is 1.04 which is 4% worse than the industry average. In addition, OSHS reports agreement between what the company interviewees reported and the OSHA reports. The facility had an OSHA inspection within the last year and $500 in fines were given for non-serious offenses (Table 1.6).

DCBS Data

DCBS reported that during 2004-08 there were 10 claims with a total of 181 days paid which is an average of 18.1 days per claim. There was $31,346 medical paid by closure during this time period with an average of $3135 paid per claim (Table 1.7).

Initial Summary

The overall impression of this business is that they have a long-standing ESH department that is well-integrated into the structure of the business. They reported having enough funding to more than adequately perform their jobs. They report taking an anticipatory approach to ESH issues and this appears to be verified through the site visit and records.

Case study 5

This case study is of a large business located in the Pacific Northwest. The facility manufactures different types of food products such as salsa, prepared salads, and other items for sale in the refrigerated sections of supermarkets. This business first

started in the 1950's as a small family business and has grown into a business that employs over 1600 people in several states. However, their company headquarters is located in the Pacific Northwest and this case report only concerns one of their manufacturing facilities. When contacted by telephone for an interview request, the ESH coordinator agreed to participate.

The ESH coordinator was interviewed in person at a pre-planned appointment. He also provided a tour of the facility. Many safety factors were observed in evidence at this facility including the following:

- Many safety signs reminding employees to wear gloves, glasses; keep safety first; mind slips and trips, etc.
- Cords were coiled above machinery
- Guarded machinery
- Clean work areas
- Use of gloves, safety glasses, hard hats, foot covers, clothing covers, hair nets, etc.

The ESH coordinator reported that this company has an entire ESH department. There is a Risk Manager, ESH supervisor, and the ESH coordinator. However, each of them assumes different responsibilities. For example, the ESH coordinator is responsible for storm water issues and the issues related to an adjacent wetland. The ESH supervisor is responsible for transportation issues, both environmental and safety. The Risk Manager communicates safety and environmental protocols to the other manufacturing sites owned by the company.

A site tour was conducted during the first interview as well. The facility had many signs reminding employees of various safety issues. During this tour, an employee was observed washing a delivery truck in the parking lot. The ESH coordinator pointed out how the soapy, dirty water was running through the parking lot and toward the adjacent wetland. When asked how he would deal with this issue, he said he would talk to the employee's direct supervisor later and they would decide together how to approach the employee. The ESH coordinator reported that employees have been

trained not to wash trucks in this manner and that there is an appropriate washing area in another part of the plant.

A second interview was conducted with the Risk Manager of the company. Most of her answers were similar in substance to what the first interview yielded. However, she refused to answer several questions which would have provided a more comprehensive understanding of the facility. For example, she refused to disclose the Experience Modification Rate (ER Mod) and the company's insurer is unable to disclose it. The ER Mod compares a company's workers' compensation claims experience to other employers of similar size operating in the same type of business. For example, if a company is at the industry average, their ER Mod would be a 1.0. If their experience is 20% better than average, the ER Mod would be a .80 or if it is 20% worse, then it would be 1.20 (Table 1.6)

External Research

An internet search yielded a report from the company's insurance provider outlining the company's progressive 'Return-to-Work' program. This is a program where the company has worked closely with their insurance carrier to assist injured workers in returning to work quickly (in consultation with medical expertise) and/or assisting workers with modified return to work. This report states that this program has helped reduce claims. This program was not reported in any internal interviews.

The company website does not contain any environmental information such as an environmental mission statement, statement of commitment to the environment, statement of environmental awareness, or an outline of their environmental program (Table 1.6).

Environmental Data

The state air quality permitting agency reported that this company has no air quality permits issued. The state environmental quality agency reported that this facility had one Leaking Underground Storage Tank (LUST) in 1998. This consisted of a leaking diesel tank affecting only soil at the site facility. In 2000, the cleanup was complete. The agency reports no other records of violations against this facility. This

information was not reported in any internal interviews. EPA was contacted and reported having no records on this facility or company (Table 1.6).

Occupational Safety Data

This facility was cited for violation of OAR 437-001-0760 (1) (b)(A), for not taking reasonable means to require employees to work and act in a safe and healthful manner; and for violation of OAR 437-001-0760(1) (a), for failing to train employee in the proper use of ladders. Fine = $10,000 for Serious violation (2009). The citations and fine stemmed from an incident where an employee was directed by his supervisor to climb a ladder alone and unhook pipes overhead. The employee fell and broke his ankle.

This facility was also cited for violation of 29 CRF 1910.1200(h)(3)(iii), for not including employee training on how to protect themselves from chemical hazards stemming from an incident where an employee was seriously burned from exposure to a chemical while cleaning. Fine = $900 for Serious violation (2009). None of these violations were reported in the internal interviews (Table 1.6).

DCBS Data

DCBS reported that during 2004-08 there were 55 claims with a total of 2849 days paid which is an average of 51.8 days per claim. There was a total of $364,502 medical paid by closure with an average of $6627 paid per claim (Table 1.7).

Initial Summary

The overall impression of this business is that they have an ESH department that is well-integrated into the structure of the business. They reported having enough funding to more than adequately perform their jobs. They reported taking an anticipatory approach to ESH issues. However, there are several issues that may negatively impact their ability to effectively address ESH issues. One is that they also have 9 other plants with no on-site ESH personnel. It would seem reasonable to assume that these plants may not be as effectively managed in the ESH domain. In addition, during the site visit an employee was observed causing soap and any dirt or

oils that might come off a truck to wash into the adjacent wetlands. This is a finable offense, yet the ESH coordinator did not intervene to stop it immediately, but allowed it to continue until the employee's supervisor could be contacted. The EHS coordinator noted several times throughout the interview that he was worried about 'stepping on toes' or offending workers or their line supervisors. This may indicate that the culture at this facility may weight production needs over ESH expertise.

Another issue is that both interviewees refused to answer questions that they presumably thought might appear to negatively impact the company's environmental or occupational safety reputation. This is not unexpected, as other companies also made themselves appear more favorable than their records later showed. However, this facility stood out in that it was the only one of the five where interviewees refused to answer questions. Other interviewees made their records sound better than they were or gave a vague answer. At this company, the Risk Manager reported that because the company is privately owned, they do not have to disclose any information they do not wish to.