Developing a Unified Manufacturing and Sourcing Strategy in a Multi-Business Unit Engineering Firm

by

Ramy Abu-Khalil

Bachelor of Science in Mechanical Engineering, Massachusetts Institute of Technology (2000)

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Signature of Author

Certified by
Donald B. Rosenfeld, Thesis Supervisor
Senior Lecturer, Sloan School of Management

Certified by
Jonathan Byrnes, Thesis Supervisor
Senior Lecturer, Center for Transportation and Logistics

Certified by
Sanjay Sarma, Thesis Reader
Associate Professor, Department of Mechanical Engineering

Accepted by
David Capodilupo, Executive Director

Accepted by
Lallit Anand, Chairman
Department of Mechanical Engineering
ABSTRACT

Competitive pressures in manufacturing industries have led to an increased utilization of outsourcing as a strategic alternative to vertical integration. This thesis develops a methodology to aid multi-business unit firms in formulating outsourcing strategies on the corporate or business group level. It offers frameworks for identifying non-core manufacturing capabilities and make versus buy decision making. In addition, it identifies critical organizational and communication linkages between levels of management and functional groups that are necessary precursors to developing a successful outsourcing strategy. Finally, it presents an analysis of the growing importance of the strategic sourcing function within the engineering firm, the informational inputs needed for the sourcing organization to adequately support activities across all business units, and investigates issues of measurement and performance within a cross-business unit support function. The research leading to the development of the described outsourcing methodology was conducted jointly between the MIT Leaders for Manufacturing Program and Honeywell International within the Honeywell Automation and Control Solutions Business Group.

Thesis Supervisor: Donald B. Rosenfield
Senior Lecturer, Sloan School of Management

Thesis Supervisor: Jonathan Byrnes
Senior Lecturer, Center for Transportation and Logistics

Thesis Reader: Sanjay Sarma
Associate Professor, Department of Mechanical Engineering
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NOTE ON PROPRIETARY INFORMATION

In order to protect proprietary Honeywell information, the data presented throughout this thesis has been modified, scaled, or minimized and does not represent actual values used by Honeywell.
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CHAPTER 1: INTRODUCTION

"As the economy changes, as competition becomes more global, it's no longer company vs. company but supply chain vs. supply chain."

- Harold Sirkin, VP Boston Consulting Group

1.1 Supply Chain and Competitive Advantage

In today's increasingly competitive world firms are required to provide higher quality and variety of products, at lower prices, in desired quantities and at desired times and locations to more demanding customers, all while maintaining profitability and driving corporate growth. This requires an ear tuned to customer needs and a close eye on firm performance and asset management. Pressure from Wall Street has increased managerial recognition that firms cannot be effective trying to be all things to all customers, which has led to the concept of core competencies. As a firm concentrates on its core competencies, those activities which contribute to its competitive advantage, it recognizes that other firms are better able to manage other aspects of the company's operations. These could be entire business processes such as marketing or logistics or subsets of processes such as specific manufacturing activity.

A firm must decide where within a value-chain it will best be able to create, capture, and deliver value to its customers and should develop a corresponding network of business partners and suppliers. In the setting of a product-based industry or manufacturing firm, this is called the supply chain. Fine (1998), in his book Clockspeed, argues that effective supply chain design is the ultimate core capability as competitive advantage is only temporary at best. Companies will not be able to gain and keep competitive advantage by adopting a static role in the value-chain, but rather, will be required to continually disintegrate and reintegrate or risk being overtaken by rapidly evolving competition. Therefore, supply chain design and management are critical to a firm's ongoing success.

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The concept of supply chain implies a relationship of firms that bring value to customers from raw materials to finished goods and delivery. In theory, supply chain integration allows a firm to focus on doing exceptionally well a few things for which it has unique skills and advantages. Non-core activities and processes are then shifted to other organizations that possess superior capabilities in those areas. Any firm that responds to a dynamic market and competitive environment by disintegrating or shifting non-core activities outside of the firm boundaries will undergo various outsourcing efforts correspondingly increasing the complexity of the supply chain it manages.

![Figure 1-1: Business Drivers for Manufacturing Outsourcing](image)

Outsourcing has become a common strategic tool for managers, and according to The Outsourcing Institute and Dun and Bradstreet the current total value of the manufacturing outsourcing market is $400 billion and expected to grow at greater rates. Freemarkets' research suggests that 77% of European and North American companies plan to conduct significant outsourcing and relocation activities in 2005. Finally, a recent Fortune 500 survey of annual reports indicates significant operational and relocation charges averaging $111 million. Figure 1-1 captures several of the key business drivers for manufacturing outsourcing including global competition, the need to de-capitalized, and the need to focus on core competencies.

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1.2 Thesis Scope and Motivation

Although much literature exists on the concepts of core competencies, vertical integration, make versus buy decisions, and supplier management, relatively little has been written regarding the actual execution of any of these activities within the corporate environment. This thesis will explore these topics and how decisions surrounding them are made, supported, and executed within a firm, specifically from the perspective of manufacturing outsourcing, an activity which encompasses all of the concepts mentioned above. The thesis delineate a process for initiating outsourcing activity, as well as the cultural and organizational enablers that are necessary to support such an initiative. Advice on how to achieve desired financial and strategic returns from outsourcing activity is not within the scope of this thesis, but rather rests within the appropriate use of tools developed or referenced herein.

1.3 Thesis Overview

Chapter 2 will provide background on Honeywell ACS, the corporate setting for this research, the problem statement driving this research, and the methodologies used to examine ACS operations and collect relevant information.

Chapter 3 provides an analysis specific to previous Honeywell ACS outsourcing strategies drawing generic conclusions as to the necessary precursors for a successful outsourcing effort.

Chapter 4 introduces a roadmap for developing a cross-business unit outsourcing strategy. This framework serves as a backbone for the remaining chapters, each examining a step on the strategy development roadmap.

Chapter 5 discusses the theory of core competencies and vertical integration followed by a methodology used to identify core and non-core content in ACS manufacturing. The treatment of core and non-core classifications and vertical integration should stem directly from the firm’s business strategy.

Chapter 6 proposes a make versus buy framework to guide implementation of vertical integration strategies, and examines how this was used in ACS.
Chapter 7 diverges from the manufacturing and sourcing strategy roadmap proposed in chapter 4 to examine in greater detail the strategic sourcing function and its impact on corporate strategy (vertical integration), business strategy (make versus buy decision), and functional strategies (outsourcing implementation).

Chapter 8 explores prioritization of corporate, business unit, and functional group goals, and how incentives are established to meet those goals within the context of ACS. This is done from an outsourcing perspective, examining how various incentives and goals can support or inhibit outsourcing strategies implementation.

Chapter 9 draws both general conclusions from the Honeywell-specific research, and makes recommendations to Honeywell and other firms that may be involved in manufacturing outsourcing activities.

The remainder of the introduction section describes a few of the motivators and dangers of outsourcing that should be considered throughout the entire discussion.

1.4 Outsourcing – Potential Benefits

Increased competitive pressures have led to a dramatic increase in the use of outsourcing as a strategic lever over the past decade. The reasons a firm may elect to outsource are numerous, and a few are listed and described below:

Improve company focus: Outsourcing lets a company focus on its core activities, or those where it can add the greatest value to the customer, by having non-core functions assumed by an outside expert. Through outsourcing, a firm realizes its vertical disintegration strategy and aligns the activities it does choose to perform with its overall business goals to create strategic fit. Non-core activities that do not receive appropriate attention become less efficient and less productive. Outsourcing them reduces this potential liability and allows management to apply greater attention to high-yield activities.

Make capital funds available: Non-core activities require capital investment to maintain even minimal levels of performance. By outsourcing non-core activities capital is freed for use on core activities, and expenses incurred only on a need basis in the form of purchases from a supplier. Outsourcing can essentially turn fixed costs into variable costs for the firm.

Cash Infusion and ROIC: During an outsourcing initiative assets of significant value such as equipment and facilities may be sold to the future supplier, who then in turn may use the assets to provide products or services back to the client. At the same time that asset sales generate cash the firm’s total assets and invested capital decrease while returns remain constant improving both return on assets as well as return on invested capital.

Reduce operating costs: By assuming a buying firm’s non-core activities as its own core competencies and investing management time and funds accordingly, outside providers may be able to offer firms lower prices for products or services based on economies of scale gained through having multiple buyers or a greater expertise by assuming a firm’s non-core activities as its own core activities, investing management time and funds accordingly. Suppliers, due to the nature of their business, may also pursue higher volumes but lower margins than the buying firm. Finally, suppliers may enjoy a lower labor cost advantage compared to buyers in developed regions. Lower wages directly lower a firm’s operating costs increasing one aspect of competitive advantage.

Reduce risk: Dynamically changing markets, competition, government regulations, technologies, and financial condition all contribute to the risk associated with any investment a firm makes. Suppliers make investments on behalf of many customers mitigating the risk burden that any one company would carry alone.

Resources unavailable internally: Firms may outsource because the necessary resources to undertake an activity may not exist within the firm’s boundaries. These resources may be knowledge or capacity-based, the former requiring time and human capital and the latter
requiring financial investment. Firms may also pursue quality improvements or access to
technologies offered by world-class suppliers.

1.5 Outsourcing – Potential Pitfalls

While there are tremendous benefits to be gained through a successful outsourcing effort,
significant amounts of academic literature and current business press have identified dangerous
pitfalls that may result:

Proprietary information loss: a firm risks losing its market dominance when a supplier
acquires proprietary technology and diffuses it to competitors. Proprietary technology may exist
within the manufacturing process or component integration.

Hold-up: If a firm relies too heavily on its suppliers its ability to negotiate favorable price
purchase agreements is weakened. This may result from high switching costs or vertical market
failure, where in both cases a supplier knows a buyer is locked in.

Incompatibility: A firm may find it difficult or more expensive to integrate a component when
assembling the final product. This can be one instance where there may be hidden factory cost
within the firm; specifically there may have been undocumented knowledge about the part or
process that did not translate well to the supplier. In other cases, the architecture of the product to
be outsourced may be integral, or not easily decomposed, adding another degree of difficulty to
integration.

Loss of control: By purchasing a component from outside of the firm’s boundaries it may inhibit
product changes or increase costs dramatically to do so.


Takeishi, A., “Knowledge Partitioning in the Inter-Firm Division of Labor: The Case of Automotive Product
Development,” Institute of Innovation Research Hitotsubashi University, 2001
These along with many more pitfalls may lead to diminished or negative returns from an outsourcing initiative. It is therefore imperative to fully consider strategic implications of an outsourcing decision as well as the total-cost, not just the service or product cost.
CHAPTER 2: BACKGROUND

This thesis is the result of a joint effort between Honeywell Automation and Control Solutions (ACS) and the MIT Leaders for Manufacturing Program (LFM). Data collection for this study was obtained through the Honeywell Global Transitions Team, a project management group within the ACS Integrated Supply Chain (ISC) organization responsible for manufacturing footprint rationalization and outsourcing efforts. The objective of the joint effort was to present ACS with a methodology to be used during its strategic planning by which it could identify outsourcing projects that had a high probability of yielding expected financial returns and meeting strategic objectives. In addition, this work reconciled and balanced efforts between various functions within the organization to better streamline and support outsourcing decision making and project execution. The research documented in this thesis focuses mainly on outsourcing of manufacturing activities but can be generalized to other business processes as well.

2.1 Research Setting

2.1.1 Honeywell International

Honeywell International, a Fortune 100 and Dow Jones Industrial Company, is a diversified engineering and manufacturing firm with over $23 Billion in revenues in 2003 (94% of which is business-to-business). It is composed of four strategic business groups (SBG): Aerospace, Automation and Control Solutions, Specialty Materials, and Transportation Systems totaling over 100,000 employees in nearly 100 countries.

Worldwide, Honeywell’s manufacturing footprint totals just over 200 factories. Figure 2-1 shows Honeywell International’s revenues by SBG as well as sample products.

Figure 2-1: Honeywell International 2003 Revenues
2.1.2 Honeywell Automation and Control Solutions

The ACS strategic business group, with a core expertise in innovating sensing and control technologies and systems integration, provides solutions for homes, commercial buildings, manufacturing plants, infrastructure, vehicles and devices to improve comfort, safety, security, productivity, control, and efficiency. ACS is composed of six strategic business units (SBU). Asia Pacific markets and manufacturing are managed as a seventh SBU.

Fire Solutions: The Fire Solutions group is a leading manufacturer of commercial fire alarm systems and advanced smoke detection products. Leading brands include NOTIFIER, Fire Control Instruments, Fire-Lite Alarms, Silent Knight, System Sensor, and Gamewell.

Security: The Security business unit is a leading manufacturer of alarm, access control and video surveillance products and systems that are used to protect lives and property in residential, commercial and industrial installations world-wide.

Environmental Combustion and Control: ECC products control both environmental factors such as temperature, humidity, and air quality in homes and commercial buildings as well as original equipment manufacturers’ (OEM) HVAC equipment.
Sensing and Control: S&C supplies sensors, switches and other devices for a variety of OEM applications in automotive, aviation, medical, information technology, consumer appliance, and industrial businesses.

Honeywell Process Solutions: HPS provides a full range of automation and control solutions and services to maximize production while promoting operations flexibility. Major industries served include refining/petrochemical, power generation, pulp and paper, and pharmaceuticals.

Honeywell Building Solutions: HBS, a service organization, integrates critical building systems provided by the other SBUs – as well as non-Honeywell suppliers – to improve productivity, cost effectiveness, safety and security. Customers include government, education, airports, and commercial segments.

2.1.3 Honeywell ACS Organizational Structure and Integrated Supply Chain

Honeywell has adopted a hierarchical organizational design to manage its numerous businesses starting with a corporate level which is divided into the strategic business group level, and further subdivided into the strategic business unit level. Each business unit has its own president and directors for each line of business, as well as functional leadership (HR, Finance, Operations, etc.) that work across the lines of business. This forms a business – function, matrix – management organization. The matrix organization also extends between any two levels of management. VPs of Operations from each business unit report both to their business unit president as well as the business group VP of Integrated Supply Chain (ISC). Directors of strategic sourcing report to the business unit VPs of Operations as well as the SBG VP of Strategic Sourcing who in turn reports to the SBG VP of ISC.

This matrix-management structure serves to link all of the business units and their respective functions at the business group level of the management hierarchy for the overall purpose of creating synergies and leverage. Business groups are then linked at the corporate level, however, the research contained in this thesis focuses across business units at the business group level to balance strategic as well as tactical activities.

The need to create common processes, share technology, leverage purchasing power, and create a portfolio of products that can generate greater value for the customer – as in the case of HBS –
all necessitate the need for an Integrated Supply Chain organization at the business group level. Figure 2-2 illustrates that integration in a diversified or multi-business unit firm must take place not only from supply through to demand, but across the business units as well. The black arrows highlight general operations that each business unit may perform independently while the red arrows represent activities that are common across business units and that can provide organizational leverage.

Figure 2-2: Integrated Supply Chain

ACS has a manufacturing footprint of over 60 factories located in the US, Mexico, Eastern Europe, and Asia Pacific. As a service organization HBS does not conduct or manage any manufacturing activity.

2.1.4 ACS Operations Strategy

According to Hayes, in his book *Pursuing the Competitive Edge*, there exist three levels of strategy that correspond well with the organizational hierarchy described above. At the highest level corporate strategy encompasses decisions regarding the industries and markets in which the firm participates, how it is structured to meet the demands of those markets, and how it allocates resources to various activities and groups. On the SBG and SBU level business strategies must be formulated to specify the scope of that business and its relationship to the corporation as a whole as well as how it proposes to position itself within a particular industry to achieve and maintain competitive advantage (cost, innovation, customer service, etc.). Functional strategies,

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such as marketing and operations strategies, are determined by the business strategy and must work together to support the type of competitive advantage being pursued.

Hayes continues to explain that company values are the foundation for strategy, that these values must be widely shared, that they should be expected to endure, and that they will encourage certain modes of behavior. Honeywell has set a clear agenda citing growth, productivity, cash, people, and enablers such as six sigma and digitizing processes as its primary initiatives. These initiatives resonate well with the potential benefits derived from outsourcing as a component of operations strategy described in the introduction, and as such, outsourcing of non-core manufacturing is a primary activity within the ACS ISC strategic plan.

The current methodology for developing the ACS operations strategy is a process called Strategic Plan (STRAP) and is performed on an annual basis. The STRAP encompasses a five year planning horizon. Activities from the first year of the STRAP comprise the content of the Annual Operating Plan (AOP). The STRAP and AOP include activities from environmental health and safety, strategic sourcing, manufacturing productivity, quality management, footprint rationalization, and logistics.

2.2 Problem Statement and Deliverables

In 2003 the Global Transitions Team conducted a feasibility study across the 5 ACS business units with manufacturing content. 18 significant outsourcing opportunities were identified 11 of which, when modeled, yielded worthwhile financial returns. Of the 18 projects 11 were also found to have adequate supply base to which current manufacturing activity could be outsourced. Nine projects were deemed feasible according to both financial and supply base criteria. However, none of the projects identified as feasible made it into the AOP. Figure 2-3 illustrates the screening funnel in graphical form. Issues such as excessive transportation and inventory (although within cost model constraints) as well as lack of alignment with business unit strategies prevented the transitions team from moving forward with any of the projects. It must be noted that the results from the 2003 effort may indeed be legitimate, and that a feasible project is not necessarily synonymous with a strategically sensible project.

Figure 2-3: 2003 Outsourcing Project Feasibility Screening
The joint research effort was chartered to uncover the reasons why the 2003 feasibility effort yielded only marginal results and to propose a methodology by which future outsourcing proposals could prove successful if both feasible and sensible. Inherent in the study is an examination of critical business linkages that need to be formulated or strengthened, incorporation of business unit strategies and current states into any proposed methodology, issues of organizational awareness, and the relative importance of outsourcing as compared to other activities that may compete for similar resources.

Deliverables from the study included

- Gap analysis of current process
- Itemization of enablers and barriers to future efforts
- Methodology for determining outsourcing content
- Corresponding tools and organizational initiatives to support the methodology
- Recommendations for AOP 2005 content or future STRAP

Obvious challenges included the decentralized management structure, geographic dispersion, and the variety of business strategies pursued by each SBU. Hence, the methodology focused on identifying non-core activities in an effort to find commonality across business units that may possess very different manufacturing core competencies. Detailed discussion surrounding core competencies and levels of integration is covered in Chapter 5.
2.3 Approach and Methodology

A six step approach was used to develop the methodologies and strategic recommendations for outsourcing initiatives.

1. Exhaustive literature review identifying critical concepts, key variables, and industry trends.
2. Organization-wide interviews to understand outsourcing impact on various functions within ISC organization. A full list of interviews conducted can be found in Appendix A.
3. Industry benchmarking to determine best practice dos and don’ts.
5. Synthesize information and generate recommendations while pursuing an iterative dialogue with ISC organization.

Pilot recommendations where possible

These 6 steps were pursued with the following goals and resolutions in mind:

- Provide decision making support frameworks to aid in non-core activity identification and the make versus buy decision.
- Recommend organizational or measurement system changes to clearly identify decision makers, improve resource allocation, and align manufacturing and sourcing activities.
- Understand the cultural implications of shifting from a vertically to horizontally integrated supply chain and to recognize the shift from purchasing to strategic sourcing.

2.4 Chapter Summary

ACS hopes to pursue an aggressive outsourcing strategy to achieve operational flexibility, reduce invested capital, and reduce operating costs. Composed of seven business units, five of which have significant manufacturing operations, reconciling the different operations strategies derivative of different business strategies poses significant challenges. Recognizing that each
business unit may have unique core capabilities in manufacturing, the study focuses on developing frameworks for clearly identifying non-core content, activities suitable for outsourcing, and finding commonality amongst business units to generate synergies and leverage. In this way the ACS ISC organization can integrate its supply chain not just from supply to demand in one business unit, but also across multiple business units.
CHAPTER 3: ANTECEDENTS OF A SUCCESSFUL OUTSOURCING INITIATIVE

The initial step in developing a new methodology for outsourcing project selection for ACS was first to understand the difficulties experienced during the 2003 outsourcing effort. Interviews with Transitions Team members responsible for conducting the feasibility studies, leadership that "vetoed" specific projects, and functional groups identified as barriers or enablers to the effort yielded four high level reasons for the marginal results.

Most often cited was a lack of capable suppliers to assume the manufacturing content ACS hoped to outsource. Similar to this was a lack of competitive quotes. Capable suppliers that did provide quotes often yielded cost neutral or cost negative results from the ACS sourcing cost model. Finally, strategic concerns were voiced both on the SBU level and on the ISC or SBG level.

Once the high-level reasons had been identified, more thorough examination yielded a set of lower-level reasons for each. Possible root causes were then explored for each of the lower-level reasons. Finally, the root causes were grouped into four major issue categories: Organizational Structure, Process, Markets, and Policy (sourcing and manufacturing). The gap analysis results are summarized in Appendix B.

3.1 Lack of Capable Supplier

Although a lack of capable suppliers was the most often cited reason for the marginal results of the 2003 effort, it was by no means the finest sieve in the project selection process. Figure 2-3 illustrates that capable suppliers were indeed found for several of the projects identified. Nonetheless, the frequency of mention warranted further investigation.

A deeper examination into the claim that suppliers capable of taking on the ACS manufacturing content did not exist revealed several underlying possibilities as to why that emerged as the most-cited reason.
• Poor supplier searches may have been performed. Root causes may include insufficient search time due to a rushed annual process, a general lack of outreach, lack of search resources, or the search structure.

• The supply market may have been inefficient. In its 2003 effort ACS focused on finding suppliers in emerging regions (ER), or low-cost countries. ER suppliers may not be as developed, technologically advanced, or large as domestic suppliers or as capable as Honeywell in-house manufacturing. However, the targeted supply market could have been expanded or Honeywell could have adopted a supply base development approach. Finally, capable suppliers may not have found Honeywell as a worthwhile buyer depending on industry focus and dollar-volume of business.

• Outsourcing packages may have been unappealing to suppliers. In the case of ACS, where supplier search was focused in emerging regions, packages may have been too large or the volume and mix incompatible with supplier capabilities. Internal sourcing policy where ACS does not wish to compose over 30% of any given supplier’s business may also have inhibited successful partnering with smaller organizations willing to develop capabilities for Honeywell.

• Honeywell’s partnering approach regarding asset transfer, co-location, contract length and specifications, logistics, and investment may have precluded finding a successful supplier.

Finally, the actual products Honeywell hoped to outsource may have been based on outdated technologies that can no longer be found in the supply market. One example is Honeywell’s need for thermoset plastics, where there use has almost been completely overtaken by more common thermoplastics.

3.2 Low or Negative Yield Quotations

Several ACS factories have been around for decades, and in many cases productivity limits have been reached making internal manufacturing capabilities potentially competitive with low-cost country offerings. However, instances of poor quotations may more often be attributed to the following:
• Unappealing package formulation as described above. Certain components of a request for quote (RFQ) may make or break a potential contract. Current total cost models may need to be expanded to provide sensitivity analysis during the reviews of RFQs.

• Logistics costs as included in total cost modeling may push a potentially high cost savings agreement into the negative returns zone.

• ACS set minimum ROI and IRR levels for project approval. The financial bars may have been set too high; lower financial returns could be offset by other benefits to outsourcing such as manufacturing flexibility.

• High asset specificity investments in Honeywell’s operations may outperform more flexible equipment investment made by general suppliers.

As in the case of lack of suppliers, quotations were by no means the finest sieve in screening potential outsourcing projects. Of greater relevance, but far less tangible, were the concerns expressed by SBUs and on the ISC level.

3.3 ISC Concerns

As the linking organization between business units, ISC level concerns focused primarily on process related issues within the 2003 project selection effort.

• Certain projects identified fell within the ISC manufacturing footprint rationalization plan defined by STRAP activities in previous years. The 2003 effort therefore did not account for already planned obsolescence of activity. During rationalization, content may be moved to a new site or shifted to the supply base. Projects identified by the 2003 effort would then be shifted to the supply base as part of the larger consolidation effort.

• Outsourcing independent of a rationalization effort may not resolve issues of burden remaining and later amortized on processes sharing the outsourced content’s rooftop. In general, accounting accuracy can be a key aspect of outsourcing evaluation. Although management might plan to shift from internal manufacturing to the supply base, the specific accounting methods used will determine the perceived financial impact of an outsourcing effort and in some cases could overshadow positive outcomes.
• Appropriate tracking and maintenance of tooling and tooling specifications, especially for very old products, is a major issue across all of the business units. Dated tooling may not be transferable to equipment used by suppliers, and cost of replacement may make an attractive outsourcing project yield negative returns. In many cases documentation to rebuild tooling was not available or in a format that could be easily transferred to suppliers.

• Hidden factory, those aspects of a process that are not clearly documented or that reside only within the knowledge of employees, is a major obstacle to outsourcing, and is prevalent in older factories that are more vertically integrated and have greater non-core content. Undocumented manufacturing practices make transference of content to a supplier extraordinarily difficult or nearly impossible.

3.4 SBU Concerns

Several business-specific issues were raised at the SBU level. In some cases issues are unique to SBUs, suggesting that any process used to determine outsourcing content from an ACS-wide perspective must provide opportunities for SBU-specific commentary. Ultimately any projects affect SBU-level performance and may not receive appropriate support or even approval if not coordinated jointly.

• A simple lack of faith in the appropriateness or potential success of outsourcing initiatives was expressed by representatives of several SBUs. Specifically, SBU manufacturing is currently responsible for meeting product availability and performance metrics. Outsourcing leads to a direct transference of responsibility and accountability to the supplier as well as the strategic sourcing organization.

• SBU manufacturing organizations manage a plethora of activity such as new product introductions, quality management initiatives, lean implementations, and interfacing with other functions. Outsourcing may not fit within SBU operations priorities as it may not be relevant to business strategy which would ultimately lead to implementation issues. For example, a quickly growing SBU may be more concerned with getting new products to market as quickly as possible and less concerned with the goals of other functions or levels of management (i.e. cost cutting, improving ROIC, increasing manufacturing
flexibility etc.). It would therefore be detrimental to force an outsourcing initiative upon an SBU in this situation. This highlights both reasons of resources as well as priority.

- In one case, an SBU did not support an initiative stating that the component or sub-assembly had direct impact on a large percentage of revenues generated. Although it may be non-core it might not be worth the financial risk. However, risk could be mitigated through outsourcing approaches such as building inventory or co-production until source of supply stabilizes.

- In another unique case, an outsourcing project identified was slated for obsolescence through a new product introduction.

3.5 Root Cause Groupings and Summary

Once the high and low level reasons had been determined, root causes were identified. The root causes were then classified into four groupings. These groupings may be generalized to any manufacturing firm, but the specific root causes composing the groupings will be unique to Honeywell. Examples to facilitate learning from this study are provided below.

3.5.1 Market Issues

Prior to or in conjunction with the feasibility studies, supply markets should be studied to determine efficient and competitive sources of supply. ACS focused on emerging regions, but the size of outsourcing projects may have made finding capable suppliers in developing countries a difficult endeavor. In addition, ACS needed to understand its process technologies in order to target potential markets. Supplier search takes time and resources, and should be balanced against internal efforts to develop a supplier or entire supply base.

3.5.2 Process

As illustrated by the 2003 process and the gap analysis as a whole, outsourcing involves many stakeholders including manufacturing, strategic sourcing, the ISC organization, and customers. On a finer level it will affect plants and individual personnel. It is therefore imperative that any outsourcing feasibility analysis include input from all relevant stakeholders, especially since business environments can change very rapidly. Outsourcing efforts run on the SBG level must
incorporate SBU level concerns, product roadmaps, and obsolescence strategies. Strategic Sourcing can also improve the process through RFQ construction and sensitivity analysis as well as supplier search and qualification. Finally, on the SBG level, obsolescence planning from manufacturing footprint rationalization must be incorporated.

3.5.3 Policies and Organization

This can be the most complex of root causes as different functions and levels of the management hierarchy may all adhere to policies that support or inhibit the outsourcing of manufacturing content. First, a link between manufacturing and sourcing must be clear and trusting. Manufacturing will feel repercussions of supply interruption and must entrust the sourcing organization and selected suppliers to perform. Linked closely to the ‘market’ root cause grouping is the strategic sourcing approach. Depending on the content to be outsourced, sourcing must choose whether to tap into global or regional markets. This should be based upon risk models adopted across the entire ACS organization, and keeping in mind the criteria for doing business with emerging regions will be very different from those for doing business in developed countries. Lower costs offered by emerging regions will come with an inversely proportional amount of risk. Of greatest importance, and requiring organization wide reconciliation prior to any effort are the reasons to outsource. SBU Operations, Strategic Sourcing, and SBG level management may all have different goals in approaching an outsourcing project, and it must be clear which metrics will take precedence. The SBG level may care more about invested capital reductions, strategic sourcing may care about increasing spend in emerging regions, and operations may care about maintaining quality levels. In any case, project priorities must be clearly identified and represented and full support should be provided from all parts of the organization once a project is pursued.

3.6 Implications of the 2003 Outsourcing Effort

Individuals as well as organizations can learn from their successes as well as their failures. In the case of ACS, several of the reasons cited during the gap analysis interviews were idiosyncratic to the 2003 outsourcing process. However, the results from the 2003 effort have left an imprint on the minds of management, feasibility analysts, and support functions. This has generated a cultural barrier to outsourcing within certain parts of the organization. Outsourcing, in and of
itself is already a controversial topic, and as such, issues in implementation or on the strategic level can only exacerbate negative perception. It is therefore imperative that firms assume an extremely diligent approach to outsourcing, and communicate its relevance to business groups, business units, and functional strategies throughout the appropriate parts of the organization.
CHAPTER 4: STRATEGIC MANUFACTURING AND SOURCING ROADMAP

At the heart of the outsourcing project identification methodology developed for ACS is the strategic manufacturing and sourcing roadmap. It is composed of eight data gathering or decision making steps each of which has a set of tools developed or referenced to aid in its execution. Not all of the steps may be applicable in the study of particular manufacturing content. Figure 4-1 illustrates the roadmap. The remainder of this chapter will serve as top level guidance for the use of this framework while subsequent chapters will explore each step of the roadmap in more detail.

The steps can be summarized as follows:

1. Conduct a screening of current operations to understand total content currently being manufactured.

2. Classify the content identified in step 1 as core or non-core to the business. This step must take into account the business strategy at the corporate, business group, and
business unit levels. The selection of core competencies should translate into the firm’s vertical integration strategy and vice versa.

3. If content is considered core, a capability analysis should be performed to determine internal class of capabilities. The goal is to be world-class in activities considered core.

4. If content is considered non-core or core with very low internal capabilities a Sustaining Analysis should be performed. Sustaining analyses determine whether content should be kept in-house or outsourced. It takes into account the strategic relevance of the content (SBU level), the current state of affected business, total cost, supply base structure, product architecture, economic drivers and other considerations. Sustaining analyses should reflect decisions made earlier in developing the vertical integration strategy.

5. If non-core content will not be sustained in house outsourcing project planning should commence. On occasion, competencies defined as core may also be outsourced. This surprising result is discussed later in this chapter. Outsourcing project planning and management represents the actual execution of the initiative and involves steps such as team formation, strategy development, supplier selection, term negotiation, resource transitioning, and supplier relations management. At the very least these activities will involve manufacturing, sourcing, engineering, finance, possibly marketing, and potentially other functions.

6. An alternative to outsourcing projects is obsolescence planning if products or plant sites are slated for future elimination. A sustaining analysis might illustrate that outsourcing is not the best solution for non-core content, especially since outsourcing projects require resources and potential capital investment. In such cases obsolescence planning should be pursued. This option may exist for specific product lines that are soon expiring or entire facilities that may house targeted non-core content.

7. If core activities are found marginally capable from the capability analysis or are too critical to competitive advantage, then investment and improvement planning must ensue to bring capability to world-class levels.
Finally, in the case of a diversified firm with clearly defined functional groups, a prioritization process must take place to ensure appropriate allocation of funds, resources, and management support.

As this research is focused on outsourcing, it is more concerned with non-core content. Steps 1, 2, 4 and 8 are highlighted in Figure 4-1 and are explored in greater detail in later chapters. Step 5 deals with actual project planning and execution based on modeling performed in step 4 and deals more in the realm of project management, falling outside of the scope of this work. Step 6 is touched upon in several parts of the discussion. Finally, activities to improve capability, be it quality, flexibility, or cost reduction fall within the manufacturing function, and there exists tremendous amounts of literature on TQM, Lean Manufacturing, Six Sigma, and other methodologies to improve manufacturing capabilities (Step 3 and 7).

4.1 Factory or Product Line Screening

The first step in determining an outsourcing strategy is gaining a firm understanding of what is being manufactured and purchased in current operations. This may seem like information that should be at hand readily, but in a complex supply chain network with over 60 manufacturing sites, hundreds of suppliers, and thousands of SKUs it can prove quite complex. Improvements in IT can aid in this undertaking, but as was the case with ACS and in many other manufacturing firms, efforts to reconcile the fragmented operations into a common system could take months or even years.

The screening of in-house manufactured products can be approached from a product or manufacturing process perspective. In the former each product can be decomposed to its most basic level bill of materials, with common parts across all products aggregated into part families or commodity groups. This approach can be difficult with an extensive product offering and geographically dispersed manufacturing network.

Alternatively a process census can be performed where each manufacturing site compiles a list of processes it performs as well as the associated cost factors. This was the method used in the ACS study. The lists were aggregated to get a sense of total similar content across all business units, but each site and process represented a singles outsourcing opportunity. Content identified
ranged from fabrication and assembly to calibration, testing, and packaging. In parallel, data regarding the direct spend of each business unit was gathered and aggregated similarly. The factory screening will be discussed in greater detail in Chapter 5.

4.2 Core and Non-core Classification

Guiding definitions of core and non-core content were developed to support the classification process. Of greater value were detailed interviews with the manufacturing leaders of each business unit. Business and operations strategy discussions led to surprisingly clear determinations of core and non-core content for each business unit. Core activities are the basis for a SBU's competitive advantage and must fit or be developed to fit with the firm's pursued business strategy. Although they may not be explicitly labeled, their contribution should be clearly understood. All activities not defined as core are considered non-core. General results showed that fabrication of specific components, a large percentage of factory activity, is considered non-core. This aligns well with the ACS mission of sensing technology innovation and systems integration. Frameworks to assist in the analysis of core capabilities are developed in Chapter 5: along with the product screening process.

4.3 Sustaining Analysis

Once the core and non-core classifications have been applied to existing manufacturing content, non-core content goes through a sustaining analysis. Ideally all non-core content could be shifted to the supply base; however, reasons such as cost, strategic implications, intellectual property, and lack of supply base may influence a firm to keep such content within the firm boundaries. At best the sustaining analysis will show immediate and positive potential returns for an outsourcing project. In the worst case scenario non-core content may have to be sustained indefinitely. However, it is more likely that an appropriately performed sustaining analysis will suggest a time horizon and a set of activities that the firm may elect to perform to be able to shift that non-core content to the supply base. Examples include waiting for a regional supply base to mature or proactively developing a supplier, minimizing investment in a non-core activity until it becomes cost-effective to shift it to a supply base, or building an organization capable of managing content in a supply chain that was previously managed by the internal manufacturing function.
A key take-away from the sustaining analysis is that a firm may be forced to continue performing non-core content. This does not change the fact that the firm has already decided in the previous step that such content is not relevant to creating its form of competitive advantage. Complete alignment between vertical integration strategy and outsourcing implementation will inevitably face barriers, some of which will be insurmountable in the short term. Therefore the firm should periodically revisit the sustaining analysis to determine if circumstances have become favorable for outsourcing. It is also critical to note that all firms will maintain a minimum amount of non-core content that is necessary for basic operation of the firm. It is therefore important to reduce the resource drain or negative impact that essential non-core content may have on the firm.

Sustaining analyses performed on under-developed core competencies may also suggest outsourcing if the performance gap between the firm and the supply base is too great. In such cases a firm may elect to temporarily outsource such content to gain learning opportunities and access to capabilities of their supplier. In the meantime the firm has to develop a plan to insource the work so as to avoid dependency on their supplier for both knowledge and capacity. Outsourcing of under-developed core competencies is often referred to as “spilt milk.”

Finally, on rare occasions, the sustaining analysis may act as net, catching core competencies that a firm may have inappropriately classified as non-core. Thorough strategic and cost analyses may prove to the firm that it has developed significant capabilities that could be transferred to new markets or better exploited within current markets. This is represented in the diagram as a dotted line marked ‘feedback’ linking sustaining analysis back to the core / non-core classification.

4.4 Outsourcing Project Prioritization

SBU level manufacturing, Strategic Sourcing, and the Integrated Supply Chain organizations each perform activities that ideally would be in alignment; however, each of these functions was established to achieve various goals that contribute to firm-wide performance. Manufacturing management seeks to meet quality, productivity, and order time to request targets for its particular SBU. Strategic Sourcing management works towards reducing year over year costs (deflation), directly impacting the bottom line. The integrated supply chain management seeks to develop common processes, optimize the asset base, and implement enabling technologies to
improve performance across all function and business units. Each uses a various array of projects to meet its goals. For example, strategic sourcing can use its supply chain integrators or commodity managers to renegotiate existing contracts to gain lower prices, or resource work from high cost to lower cost suppliers. Manufacturing can utilize management or engineering assets to support productivity improvements or new product introductions. Therefore, in developing an AOP or STRAP with outsourcing content that utilizes resources from all of the organizations, all project types must be considered. This concept, developed in Chapter 8, looks at the various organizations and proposes a method for “stacking” projects for the AOP.

4.5 Section Summary

This section proposed a roadmap for joint manufacturing and sourcing strategy development. It described an eight-step process firms can use to identify core competencies and shape operating plans accordingly. Of the eight steps, four are critical for identifying feasible outsourcing opportunities. These four steps will be discussed in greater detail in the subsequent chapters.
CHAPTER 5: FIRM CAPABILITIES AND LEVELS OF INTEGRATION

Core competencies, vertical integration, and the make versus buy decision have become synonymous for dictating the activities a firm should undertake to gain its desired competitive advantage. In the manufacturing context these concepts determine how a firm’s operations strategy is realized and how the business strategy is supported in turn. Although these concepts all support the development of an operations strategy they should be understood discretely. The transition from understanding a firm’s core competencies to determining an appropriate and strategic level of vertical integration to performing and executing a rigorous make versus buy analysis should be purposeful and distinct. This chapter first discusses these concepts and then applies them through steps 1 and 2 of the manufacturing and sourcing strategy roadmap. The make versus buy decision (step 4) is treated separately in Chapter 6:

5.1 Core Competencies and Strategic Advantage

Competency Theory has been a hot topic in strategic management literature for several decades. It argues that short-run competitiveness is derived from price and performance attributes of current products whereas long-term advantage is found in management’s ability to “consolidate corporate-wide technologies and production skills into competencies that empower an individual business to adapt quickly to changing opportunities.”

The 1980s introduced the resource-based view of the firm (RBV) where a firm was understood to be a bundle of assets and capabilities. In this model firms were heterogeneous to one another due to possessing unique intangible assets and capabilities known as strategic resources, and it was the skilled exploitation of those strategic resources that created competitive advantage.

In the early 1990s the competence-based perspective emerged, arguing that core competencies, not discrete assets or capabilities, contributed to sustained competitive advantage. Core


competencies, the result of a collective learning process, are skills or knowledge sets that a firm builds over time. Core competencies are generally rooted in the ability to integrate and coordinate capabilities from several functions in an organization.

The later part of the same decade expanded on the competence-based perspective by introducing the dynamic capabilities approach which claims that the competitive advantage a firm derives comes through leveraging the managerial or organizational processes of a firm. Long-term competitiveness depends upon dynamic capabilities or “the capacity to renew competencies so as to achieve congruence with the changing business environment.” This resonates with Fine’s assertion (1998) that competitive advantage is at best temporary and that flexibility derived from the ultimate core competency of supply chain design is the only sustainable competence.

Common to all of the strategic management approaches are the attributes of resources, capabilities, and competencies. They should be valuable as they generate the firm’s basis for competition. They should be rare, otherwise firms would not be providing a significant value-add and hence not able to extract significant economic rents. They should be inimitable lest competitors recreate them and diminish the firm’s advantage. Finally, they should be non-substitutable. A more thorough list of core competency attributes can be found in Appendix C.

To clarify the differences in terminology the following hierarchy of competencies has been developed as illustrated in Figure 5-1.

Figure 5-1: Hierarchy of Competencies


At the base of the hierarchy are resources. These can include assets such as manufacturing equipment and staff. Capabilities or the firm’s ability to exploit its resources build the next level of the hierarchy. This would include the ability to produce saleable products using the manufacturing equipment and staff. Competencies, the third level in the hierarchy, integrate and coordinate a set of capabilities. These competencies can reside within a single function such as manufacturing or can be cross-functional as well. One example from the ECC business unit of ACS is the manufacture of residential gas valves. The manufacture of gas valves incorporates four manufacturing processes each internally determined to be non-core. However, when uniquely combined, the four capabilities provide the business unit with a competitive product. Attempts to outsource the manufacture of these valves have shown that the competency is not available on the market and may indeed be a source of competitive advantage. In addition, safety, the critical to customer requirement in these products compels the business unit to pay vigilant attention to their manufacture. This example illustrates the cross-functional aspect where manufacturing and marketing work together to position an end-product relative to the customer.

Finally, core competencies form the pinnacle of the hierarchy crossing SBU boundaries and resulting from different SBU competencies. The Honeywell Building Solutions business unit described in the background provides high-value added integration services using products created through the capabilities of each SBU. From a corporate perspective, integrated supply chain as a tool to gain competitive advantage is another example of a core competency.
Competency theory can be applied throughout the firm. In the manufacturing setting resources will include tangible assets such as manufacturing equipment and other plant, property and equipment. It becomes apparent from the hierarchy that any single manufacturing process can be considered a capability within the firm. A process-based approach to formulating an outsourcing strategy may then affect the basis of broader manufacturing competencies. A common example is Sony’s competence in miniaturization. However, it may be worthwhile to understand specifically which manufacturing activities contribute to competencies that ultimately yield competitive advantage. Manufacturing activities include fabrication, assembly, test, calibration, inspection and packaging. Instances where these activities are not part of a greater competence or are not contributors to competitive advantage become candidates for outsourcing. Examples specific to ACS will be discussed later in this chapter.

Clear identification and understanding of core manufacturing assets, capabilities, and competencies is the foundation of developing an operations strategy. In turn, the primary function of an operations strategy is to guide the business in putting together the set of operating capabilities that will enable it to pursue its chosen competitive strategy over the long term. Clear identification allows a firm to choose its boundaries or degree of vertical integration.

5.2 Vertical Integration

A firm’s level of vertical integration describes how much of the value chain falls within its legal boundaries or the degree to which a firm owns its upstream suppliers and downstream customers. Figure 5-2 shows a simplified value chain of the manufacturing industry. Example A shows a firm with a low level of vertical integration, focusing only on assembly. Examples B and C illustrate higher levels of vertical integration with the former integrating upstream or backwards and the latter integrating downstream or forwards. The theory of vertical integration is valuable when performing a Porter’s Five Forces strategic analysis of a firm’s position within an industry structure, particularly with respect to issues such as market power, bargaining power, hold-up, double marginalization, and the ability to extract maximum profits from within the value chain.

Figure 5-2: Examples of Vertical Integration
There are several reasons a firm may elect to vertically integrate as illustrated in Table 5-1.

<table>
<thead>
<tr>
<th>Reasons to Vertically Integrate</th>
<th>Reasons to Vertically Disintegrate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce coordination with the supply base and gain greater control of operations</td>
<td>Increased Risk Exposure - Demand fluctuation</td>
</tr>
<tr>
<td>Capture upstream or downstream profit margins</td>
<td>Higher invested capital</td>
</tr>
<tr>
<td>Increase competitive barriers to entry</td>
<td>Diffused management focus</td>
</tr>
<tr>
<td>Gain access to downstream distribution channels or upstream limited sources of supply</td>
<td>Access hard to get resources or technologies</td>
</tr>
<tr>
<td>Drive investment in highly specialized assets for which general suppliers or customers may be unwilling to invest</td>
<td>Decreased firm flexibility</td>
</tr>
<tr>
<td>Expand portfolio of core competencies</td>
<td></td>
</tr>
</tbody>
</table>

The last reason listed in favor of vertical integration emphasizes the importance of first understanding the firm’s core competencies or bases of competitive advantage and its corresponding business strategy. In dynamically changing business environments or industry
structures firms must recognize when core competencies become core rigidities and shed them while developing new competencies in parallel. Vertical integration decisions made in the past may be legacy, and a firm must update its beliefs about its competitive landscape to determine whether past strategies are or will remain competitive. Within the manufacturing sector, pressures described in the introduction such as global competition and increasingly more demanding customers along with the emergence of a more prevalent and specialized supply base have driven increases in disintegration through outsourcing to lower cost or more highly capable suppliers. Several additional reasons in favor of or against vertical integration proposed by other scholars are incorporated in this work during the review of sustaining analyses or make versus buy decisions.

Knowledge-based activities generate most of the value in services and manufacturing. These include activities such as research and development, systems integration, and marketing, all of which require proximity to the customer. Thus the tendency for engineering firms has been to disintegrate from the back towards the front of the value chain relinquishing first fabrication then assembly and so on.

Vertical integration involves ownership of assets. At one operating extreme a firm can be entirely vertically integrated. Outsourcing involves some type of contractual relationship with a supplier, partner, or customer that owns an asset and uses it on behalf of the firm. At the other operating extreme a firm can maintain arms-length relations with its counterpart utilizing short-term contracts or spot transactions. This continuum of governance structures is illustrated in Figure 5-3.

Figure 5-3: Continuum of Governance Structures

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More examples along a continuum of governance can be found in Appendix D.

In a 100% vertically integrated firm, all production is managed in-house by the manufacturing function. Anything short of full integration requires a different set of management skills geared towards interfacing with the supply base. Thus, as a firm disintegrates its manufacturing activities it must develop competencies in managing its supply base or in other words, as a manufacturing firm moves towards a less integrated strategy it must develop decision-making frameworks, go through organizational restructuring, and develop new processes for managing supplier performance. Purchasing departments may be sufficient to manage arms-length contracts; however, the concept of strategic sourcing has emerged as a critical lever in developing a supply chain strategy and creating value through relationships types from across the entire continuum. Chapter 7: is dedicated to understanding the importance of the strategic sourcing function in realizing vertical integration strategies, its relationship with manufacturing, and its role in managing the supply chain.

5.3 Section Summary

The preceding sections introduced the concepts of core competencies and vertical integration. Companies must develop business strategies that utilize their core competencies while at the same time deepening or developing competencies that will provide strategic advantage in dynamically changing business environments. As industry structures change a firm may opt to adjust its level of vertical integration. A firm may become more vertically integrated to combat supplier or customer bargaining power or develop new markets or it may vertically disintegrate in order to focus on areas of the value chain where it can create, capture, and deliver greater value. As a firm disintegrates it shifts its non-core content to suppliers that are more capable of providing and extracting value from those activities. This process of disintegration is described as outsourcing. Thus a firm jointly decides what strategy to pursue and what competencies to
develop or maintain, then it selects a corresponding integration strategy. If the firm chooses to disintegrate it must develop its outsourcing strategy.

The following sections describe the process of identifying core competencies and strategic levels of integration within Honeywell ACS manufacturing.

### 5.4 Manufacturing at ACS

Integrated Supply Chain management at ACS recognizes the competitive trends described earlier and believes that some level of disintegration is required to remain competitive. Honeywell ACS manufacturing has traditionally been vertically integrated with the entire range of manufacturing activities performed in-house. To develop an outsourcing / disintegration strategy an understanding of activities performed across its wide manufacturing footprint was necessary to then determine which activities were core to the operations and business strategies.

### 5.5 Identifying Manufacturing Content in ACS

To identify manufacturing content across its 60+ factories a process census was performed at each manufacturing location. Data such as process, direct headcount, indirect headcount, and conversion cost were collected. Conversion cost represents the process cost not including cost of materials \( \text{CC} = \text{LBM} - \text{M} \). Additional information that could be gathered during a process census could include asset market and book value. Table 5-2 represents type of data collected. Cost and headcount data has been removed, however, as a point of reference and to justify the relevance of developing a unified manufacturing and sourcing strategy within ACS, non-core manufacturing content total conversion cost is in the hundreds of millions (USD), with corresponding direct headcount in the thousands (persons).

<table>
<thead>
<tr>
<th>SBU</th>
<th>Location</th>
<th>Plant Site</th>
<th>Process</th>
<th>Conversion Cost</th>
<th>Direct Headcount</th>
<th>Indirect Headcount</th>
</tr>
</thead>
<tbody>
<tr>
<td>S&amp;C</td>
<td>North America</td>
<td>Site A</td>
<td>Plastic Molding</td>
<td>XX</td>
<td>YY</td>
<td>ZZ</td>
</tr>
<tr>
<td>S&amp;C</td>
<td>North America</td>
<td>Site B</td>
<td>Plastic Molding</td>
<td>XX</td>
<td>YY</td>
<td>ZZ</td>
</tr>
<tr>
<td>ECC</td>
<td>North America</td>
<td>Site A</td>
<td>Stamping</td>
<td>XX</td>
<td>YY</td>
<td>ZZ</td>
</tr>
<tr>
<td>ECC</td>
<td>North America</td>
<td>Site C</td>
<td>Stamping</td>
<td>XX</td>
<td>YY</td>
<td>ZZ</td>
</tr>
</tbody>
</table>

A list representative of the types of activity found across ACS sites is shown in Table 5-3.
Census data from all SBUs and manufacturing sites was then aggregated to form SBU and ACS-wide manufacturing snapshots. Figure 5-4 shows the relative conversion cost (Labor + Burden) of various manufacturing activity across all of ACS. Actual cost data is hidden.

<table>
<thead>
<tr>
<th>Manufacturing Activity</th>
<th>Application, Component, Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assembly</td>
<td>Cable</td>
</tr>
<tr>
<td>Assembly</td>
<td>Circuit Card</td>
</tr>
<tr>
<td>Assembly</td>
<td>Electro-Mechanical</td>
</tr>
<tr>
<td>Assembly</td>
<td>Electronic</td>
</tr>
<tr>
<td>Assembly</td>
<td>General</td>
</tr>
<tr>
<td>Assembly</td>
<td>Mechanical</td>
</tr>
<tr>
<td>Assembly</td>
<td>Sensor</td>
</tr>
<tr>
<td>Assembly</td>
<td>Thick Film Hybrid</td>
</tr>
<tr>
<td>Assembly</td>
<td>Valve</td>
</tr>
<tr>
<td>Calibration</td>
<td>Electro-Mechanical</td>
</tr>
<tr>
<td>Calibration</td>
<td>Electronic</td>
</tr>
<tr>
<td>Sub-Assembly</td>
<td>Optical</td>
</tr>
<tr>
<td>Test</td>
<td>Electro-Mechanical</td>
</tr>
<tr>
<td>Test</td>
<td>Electronic</td>
</tr>
<tr>
<td>Test</td>
<td>Sensor</td>
</tr>
<tr>
<td>Test</td>
<td>Thick Film Hybrid</td>
</tr>
<tr>
<td>Test</td>
<td>Valve</td>
</tr>
<tr>
<td>Inspection</td>
<td>Visual</td>
</tr>
<tr>
<td>Other</td>
<td>Coil Winding</td>
</tr>
<tr>
<td>Other</td>
<td>Leadwire Prep</td>
</tr>
<tr>
<td>Other</td>
<td>Mercury Switch Wrapping/Solder</td>
</tr>
<tr>
<td>Other</td>
<td>Painting</td>
</tr>
<tr>
<td>Other</td>
<td>Plating</td>
</tr>
<tr>
<td>Other</td>
<td>Powder Coating</td>
</tr>
<tr>
<td>Other</td>
<td>Welding</td>
</tr>
<tr>
<td>Fabrication</td>
<td>Die Casting</td>
</tr>
<tr>
<td>Fabrication</td>
<td>Filled Element</td>
</tr>
<tr>
<td>Fabrication</td>
<td>Foundry (Brass)</td>
</tr>
<tr>
<td>Fabrication</td>
<td>Foundry (Red Bronze)</td>
</tr>
<tr>
<td>Fabrication</td>
<td>Glass Forming</td>
</tr>
<tr>
<td>Fabrication</td>
<td>Machining</td>
</tr>
<tr>
<td>Fabrication</td>
<td>Plastic Molding</td>
</tr>
<tr>
<td>Fabrication</td>
<td>Screw Machining</td>
</tr>
<tr>
<td>Fabrication</td>
<td>Sensor</td>
</tr>
<tr>
<td>Fabrication</td>
<td>Sheet Metal Forming</td>
</tr>
<tr>
<td>Fabrication</td>
<td>Stamping</td>
</tr>
<tr>
<td>Fabrication</td>
<td>Tooling</td>
</tr>
</tbody>
</table>

Figure 5-4: Relative Conversion Costs of ACS Manufacturing Activities
5.6 Classifying Non-core Content in ACS

Once site-level manufacturing content was identified a classification process was applied to determine specifically the non-core content for the purpose of identifying feasible outsourcing opportunities. A three-pronged approach was used to classify content:

1. General definitions of core and non-core content were developed to serve as ACS-wide guidelines.

2. Core Content Screens were applied to manufacturing activities identified by the process census. Based on the general definitions and core screens preliminary classifications were then applied.

3. Interviews were conducted with manufacturing leaders from each business unit to validate the preliminary classifications and to identify SBU or process/product specific exceptions.
5.6.1 General Definitions

Several years prior to this exercise ACS had developed a set of definitions it used to classify core and non-core content in manufacturing. Benchmarking with other companies, across other Honeywell business groups, and cross-referencing with literature yielded the 2004 definitions in Figure 5-5.

Figure 5-5: Honeywell ACS General Definitions of Core Competencies and Non-core Activities

<table>
<thead>
<tr>
<th>Core Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Provides a competitive advantage, drives product differentiation, are proprietary</td>
</tr>
<tr>
<td>• Invest in competency to continue to grow the business and keep competition in check</td>
</tr>
<tr>
<td>• Focus resources for maximum advantage</td>
</tr>
<tr>
<td>• Must drive for best-in class performance</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Non-core (Peripheral) Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Not strategic or proprietary</td>
</tr>
<tr>
<td>• Generally commodity-like (cost sensitive)</td>
</tr>
<tr>
<td>• Benchmarking not required</td>
</tr>
<tr>
<td>• Eliminate Investment</td>
</tr>
</tbody>
</table>

These definitions reflect very closely the concepts from the discussion of competency theory; however, they do add a clearer picture of what is non-core within the firm. It is valuable to note that it may in fact be easier for a firm to identify non-core content than it is to label its core competencies. These definitions serve as business group level guidelines to aid in strategic discussions, but alone are not rigorous enough to perform specific classifications.

5.6.2 Core Content Screens

To provide a finer screen in identifying core competencies two sets of questions and a hierarchy of strategic relevance were developed and applied to every activity identified by the process census. The first set of questions aids a firm in identifying the strategic value of an activity as well as its depth or position within the competency hierarchy. The second set of questions aids in
the actual classification decision. The hierarchy of strategic relevance aids management in locating a product component or process within the overall context of the firm.

Strategic value and connection to integration strategy:

1. Are these activities capabilities (functionally based), competencies (SBU based), or core competencies (cross-SBU)? This question helps management understand the value add of each activity.

2. What is the company’s strength in this activity relative to its competitors, and do competitors even participate in this activity? This is a generic benchmarking question and relates to industry trends.

3. What are the key changes taking place in the industry? This question gets managers to consider the activity relative to industry structure and to instigate a discussion on whether the firm’s boundaries match that industry structure.

4. Is there a link between competitive advantage and this activity? This question explores the causal relationship between competencies, competitive advantage and added-value.

5. Are the activity and its corresponding competitive advantage durable? This question explores the temporal aspect of competitive advantage and the ability of the company to sustain the activity or the ability of competition to mimic it.

6. Which competencies or capabilities should be sustained and improved upon, which are irrelevant, how can they be better leveraged, and what new ones should be developed?

This set of questions is designed to generate dialogues surrounding broad activities such as fabrication, assembly, test, and calibration. The next set of questions can be applied to specific processes, products, or components to yield actual classifications.

Core or Non-Core Questions

1. Does this Process, Component or Product provide a competitive advantage?

2. Is the business strategy dependent on this Process, Component or Product?
3. Does this Process, Component or Product differentiate HW positively in the marketplace?

4. Is this Process, Component or Product unique, inimitable, or world class?

5. Is this Process, Component or Product a trade secret or contain strategically important proprietary knowledge?

6. Is HW ownership of this Process, Component or Product a major customer concern?

7. Does this Process, Component or Product affect the message of Sales and Marketing?

An answer of "yes" to any of the questions yielded an automatic Core classification to the process, product, or component to which the questions were being applied.

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**Figure 5-6: Core Screening Flow Chart**

This set of questions can also be represented by the flow chart in Figure 5-6 for quicker reference.

Finally, the concept of a hierarchy of strategic relevance can serve to directly link a component, product, or process to a business strategy or form of competitive advantage. Figure 5-7 represents a hierarchy used to gain buy-in within ACS regarding fabrication as a non-core activity.

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**Figure 5-7: Hierarchy of Strategic Relevance**

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This hierarchy represents a product perspective with the peak being the end product used by the customer. Decomposing final products yields sub-assemblies in the middle tier and then components at the base. The hierarchy represents generalizations from the perspective of an engineering firm pursuing a knowledge-based value-add to the customer. A triangle is used to show that a firm may have very few end products that ultimately drive its positioning within a market, but those end products may contain a tremendous number of discrete parts or components. The higher up the hierarchy outsourcing takes place, the more of the value chain it is giving to its suppliers, and a firm should be conscious of a supplier's ability to forward integrate.

After the first two phases of the process preliminary classifications were applied to the activities identified in the process census. The resulting classifications are captured in Table 5-4.

Table 5-4: ACS Manufacturing Content by Classification
Table 5-4 highlights the ambiguities that emerge when theory is applied to the real-world context. The preliminary classification process yielded three different classifications instead of the expected two: core or non-core. A grouping of “maybe core” illustrates the difficulty in determining what capabilities are indeed core. However, for the purpose of developing an outsourcing strategy, the content identified as non-core presented ACS with a tremendous number of project opportunities and affected approximately $200 million in conversion cost and an approximate headcount of 1000.

Non-core activities are largely composed of fabrication and other low-value added activities. This correlates well with the vertical disintegration trends exhibited by engineering firms where there is a migration to focus on more knowledge-based higher value-add activities.

### 5.6.3 Interviews with Manufacturing Leaders

The preliminary classification process was performed on the aggregate ACS manufacturing activity. To generate an SBG-wide consensus on the content classified as non-core a validation process was developed whereby the manufacturing content of each SBU/site was discussed with that SBU’s manufacturing leader. The total process census was short-listed to include only the non-core content, and each combination of SBU, site, and process was identified as a potential
outsourcing project. Each project was reviewed with the manufacturing leader to identify any conflicts with or linkages between the content, the operations strategy, and the business strategy.

The interviews generated a standard set of outcomes.

1. Consensus across all SBUs was achieved with respect to the general manufacturing processes captured in the manufacturing census.

2. Sub-processes were identified and run through the classification process. In many cases the sub-process was determined to be core and the corresponding project or portion of a project was removed from the short-listed census. Examples of sub or specialty processes include laser welding as a subset of welding, plastic molding over delicate sensors, or the machining of proprietary designs. These specialized manufacturing processes provided product differentiation or were dependent on proprietary technologies.

3. In other instances a particular process was embedded in a manufacturing flow, and outsourcing of that specific process would interrupt manufacturing or drive significant increases in work-in-process inventory. Projects that interrupted manufacturing flow were also eliminated from the project list.

4. Instances where a component or product exhibited an integral architecture were noted in the project list. The over-molding of plastic over delicate sensors is an example of integral product architectures common within ACS.

A simple summary table validating the classifications can be found in Appendix E.

5.7 Insights from the Identification and Classification Process

The census and classification process identified several interesting points about the current and future ACS operations strategy. Manufacturing was largely separated by SBU with few locations in the ACS footprint performing manufacturing for multiple SBUs. Therefore according to the hierarchy of competencies, the capabilities developed by each SBU never converge to develop a firm-wide competency. Manufacturing processes may be common to all SBUs, but the learning from each site SBU is not shared across the entire business group. This separation of learning also exists within SBU with geographically separated sites. In this way, although ACS may have dedicated sum-total tremendous resources to a given process, the company is not benefiting
entirely from its investment and is losing the opportunity to leverage capabilities from all corners of the firm into a competency. As ACS consolidates its footprint and brings SBUs together under shared rooftops it will better be able to leverage its assets and capabilities across the firm.

The greatest opportunities to address non-core content fell within 15 of the 60+ plants, illustrating that the non-core footprint is far smaller than the entire ACS-wide manufacturing footprint. In addition, greater than 50% (measured by conversion cost and headcount) of the non-core content falls within three manufacturing processes: machining, plastic molding, and metal stampings as illustrated by the staggering differences in the Pareto chart from Figure 5-4. From the sourcing perspective these are considered commodities and are already being sourced by ACS in high volumes.

The process also highlighted geographic differences in the maturity of the ACS vertical integration strategy. Sites in Asia and within the Security business unit had very little non-core content when compared to other SBUs. This could be due to the locations being relatively new or the business units pursuing vertical disintegration strategies independent of the ISC initiative.

5.8 Section Summary – Linking Business Strategy, Core Competencies, and Vertical Integration in ACS

ACS is pursuing a product and service based business strategy by focusing on the innovation of sensor technologies and the integration of complex systems in homes, commercial buildings, manufacturing plants, infrastructure, vehicles and devices. As such, high value-add manufacturing activities such as assembly, calibration, and testing emerge as core across all SBUs, while lower value-added / margin activities such as fabrication are less relevant to meeting the goals of the overall business. Traditionally a vertically integrated manufacturing firm, ACS is working to develop an outsourcing strategy to shift non-core content to the supply base. This analysis illustrates that component fabrication, specifically plastic moldings, machined parts, and stamped metal parts, may be an excellent starting point for ACS in pursuing its vertical disintegration / outsourcing strategy.
5.9 Sourcing Non-core Content

Although ACS has been described as a highly vertically integrated manufacturing firm it still purchases a significant amount from its supply chain. Estimated direct material spend for ACS in 2004 was approximately $1.8 Billion with a large percentage of that dedicated to commodities that are also being manufactured in house. Approximately 50% of total machining and stamping consumption is purchased while the other 50% is manufactured in-house.

To facilitate successful outsourcing implementation, ACS must develop its strategic sourcing organization. Shifting millions of dollars of content from in-house production to the supply base will facilitate tremendous reductions in the resources and management needed in manufacturing, but at the same time, a proportional increase in supplier and spend management will be required. Therefore vertical integration decisions in manufacturing must be made jointly between manufacturing and strategic sourcing with the support of business group management. The pace at which a manufacturing organization vertically disintegrates must be matched by a corresponding increase in the capabilities of the strategic sourcing function.

The next chapter discusses step 4 of the manufacturing and sourcing strategy roadmap, the sustaining analysis, or more commonly known as the make versus buy decision, while subsequent chapters address the alignment of manufacturing and sourcing in developing an outsourcing strategy and the increasingly important role of strategic sourcing in supply chain competitiveness.
CHAPTER 6: IMPLEMENTING VERTICAL INTEGRATION STRATEGIES

The previous chapter explored the process of identifying and classifying non-core activities in a firm, and how vertical integration strategies could be developed around that information. In the case of Honeywell ACS, the following steps were followed:

1. Manufacturing industry trends clearly defined
2. ACS Business strategy articulated
3. Current manufacturing content identified, grouped, and compared against industry trends and business strategy
4. Component fabrication determined to be non-core to the overall business
5. Vertical disintegration opportunities validated by business unit to short-list potential outsourcing projects
6. Compare manufacturing content to current sourcing activity

Thus a vertical disintegration strategy has been proposed – to outsource low value-add content in manufacturing such as fabrication of commodity type components. The strategy is composed of clearly-identified outsourcing opportunities. Before any component of the strategy can be executed, a thorough analysis must be performed to determine whether or not it could generate the firm’s desired goals. Differences in goals between the business group, business unit, and functions is discussed in later chapters.

The thorough analysis conducted to predict the returns of a potential outsourcing project is commonly known as a make versus buy decision. This is represented as step 5 in the manufacturing and sourcing strategy roadmap, and is labeled as a “Sustaining Analysis.” This new terminology is introduced to provide continuity to the core / non-core classification system. A third definition is introduced into the general classification definitions presented in the previous chapter and can be seen in Figure 6-1.

Figure 6-1: General Definitions of Operating Activities
Core Competencies

- Provides a competitive advantage, drives product differentiation, are proprietary
- Invest in competency to continue to grow the business and keep competition in check
- Focus resources for maximum advantage
- Must drive for best-in-class performance

Non-core (Peripheral) Activities

- Not strategic or proprietary
- Generally commodity-like (cost sensitive)
- Benchmarking not required
- Eliminate Investment

Sustaining Activities

- Noted as non-core but for which the cost/benefits of outsourcing are not favorable
- Must be repeatable and stable, but do not require on-going major investments
- Businesses will trade-off vertical integration vs. outsourcing (based on detailed cost analysis /discussion)
- Best-in-Class performance not required

Content identified as sustaining through the analysis is noted as non-core but for which the cost or benefits of outsourcing are not favorable. In rare instances where the firm is not capable of adequately performing core activities those activities may be sustained outside of the firm boundaries until the firm can improve its capabilities. Non-core content identified as sustaining should have clearly defined timelines and actions to prepare the activity for outsourcing. In the worst case, a non-core activity that is critical for standard business operations must be sustained indefinitely. If such activities are identified they should be eliminated from further discussion. Sustaining activities should be reviewed periodically to understand their position relative to changing markets and industry structures.

Much like competency theory, the make versus buy decision has been a hot topic in management literature, and several decision support frameworks have been developed to assist management. Several of these frameworks are introduced in the first half of this chapter. The second half will discuss a decision making roadmap and a few of the corresponding tools developed through this research specifically for ACS.
6.1 Make Versus Buy Thought Frameworks

Several approaches to addressing the make versus buy decision have been developed. Factors such as total cost modeling, technology selection, product architecture, knowledge and capacity based capabilities, supply base capabilities, and strategic relevance have individually been promoted as the bases of outsourcing decision making, but any manufacturing outsourcing decision must take into account the multiple dimensions presented by these factors. This section will discuss frameworks that have emerged as most relevant to the make versus buy decision in manufacturing firms. The largest non-core opportunities identified, machining, plastic molding, and metal stamping will be used as case studies within each of the frameworks.

6.1.1 Process Technology

Welch and Nayak highlight manufacturing process technology as a key determinant in the success of an outsourcing decision. They postulate that process technologies have significant impact in providing a firm its competitive advantage, that the maturity of process technologies should be considered in making vertical (dis)integration decisions, and that an understanding of competitors’ process technologies is fundamental.

With respect to process technology and competitive advantage, management must have a clear understanding of which technologies are necessary to attain or maintain competitive advantage. This was captured within the validation phase of the competency screening. General processes such as plastic molding and welding were considered non-core, albeit each of these has variants. For instance, types of plastic molding processes include single and multi-shot injection molding, compression molding, transfer molding, and blow molding. Plastic molding may also vary by types of plastic materials used such as thermoset or thermoplastics. Within ACS, insert molding technologies are considered a source of competitive advantage. The integral packaging of sensors within plastics affects both size and performance of ACS core products and is critical to competitive advantage.

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16 Welch, J. and Nayak, P.R., "Strategic Sourcing: A Progressive Approach to the Make-or-buy Decision," Academy of Management Executive, vol. 6, 1992
The maturity of a process technology should be examined not just within an industry, but across all industries. This aids managers in determining what amount of resources should be invested in technology development versus reapplication, and also gives some type of gauge to assess how a process technology migrates from industry to industry.

Finally, internal process technologies should be directly benchmarked against that of competitors whenever possible. This could be done through product reverse engineering, and should include some cost comparisons. Any proprietary knowledge contained within a process technology should be protected and may invalidate a process’ potential for outsourcing.

Nayak and Welch combine their key determinants of process technology outsourcing into the matrix shown in Figure 6-2.

![Figure 6-2: Process Technology Strategic Sourcing Model](image)

The model developers recommend purchasing all content based on technologies that are considered non-core to the firm. In applying this to ACS this would include the general component fabrication processes. For process technologies considered critical to the firm and are still undergoing some type of evolution or advancement the model developers suggest that a firm keeps it in house. Taking the sensor over-mold process as an example, should the advantages it provides ever become commoditized, ACS should consider finding a supplier once the supply base has reached a level of parity. Situations such as this occur when the value-add to the customer has peaked and include product aspects such as size and sensitivity. At that point the product becomes cost-competitive and ACS should pursue the low-cost option whether it is in-house or external, hence the marginal buy category. In cases where entirely new technologies are needed to develop new products and customers, a firm should seek to develop those capabilities.
internally. If a mature technology exists but has not yet been applied to a certain industry, a firm should consider developing a supplier capable of transferring that technology from the origination industry to the target industry.

6.1.2 Capacity, Knowledge, and Product Architecture

Whitney and Fine describe outsourcing in terms of dependency classes. They present two kinds of dependency: dependency based on knowledge and dependency based on capacity.\(^{17}\)

- Knowledge Dependency: A firm lacks the skill to manufacture a necessary item and requires a supplier to provide it.

- Capacity Dependency: A firm possesses the skills to manufacture a necessary item but elects to source it. Reasons could include time, cost, floor space, or management attention.

They identify a continuum of skills such that as a firm moves from dependence for knowledge to dependence for capacity it also moves from a greater degree of dependence to a lesser degree of dependence. Simply put dependency on a supplier for knowledge places a firm in a low bargaining power position. Dependency on capacity is not ideal but allows a firm the option to vertically integrate if it needs to assume control of a sourced activity.

When applied to ACS this presents a very interesting situation. From the SBG perspective, outsourcing presents an opportunity to convert fixed costs to variable costs and improve return on invested capital. That being the case, asset reduction is a key driver in outsourcing and would create a dependency on capacity. A corresponding reduction in headcount would cost ACS its knowledge in manufacturing productivity, and depending on the relationship between manufacturing and engineering in new product development, it may also cost ACS knowledge in design. In the case of plastic molding and metal stamping, a tremendous portion of total engineering knowledge is captured in the form of tooling. In an ideal situation ACS could retain tooling design and manufacture and outsource only component production. This would eliminate

supplier switching costs and retain design and manufacturing knowledge in-house; however, this may not be a feasible strategy. Tooling is a very high-cost and labor intensive activity making it a good outsourcing candidate in a cost-sensitive environment.

Whitney and Fine also introduce the concept of product architecture. Modular product architecture is one that can be decomposed into discrete parts and is more suitable for outsourcing. Dependency and Product Architecture concepts are combined in the matrix shown in Figure 6-3.

![Figure 6-3: Matrix of Dependency and Outsourcing](image)

Machining, plastic molding, and metal stamping compose the majority of ACS non-core activity. These components are generally modular within an assembly, can be reverse engineered easily, hold little proprietary information, and can be easily outsourced. If their positions within an assembly can indicate levels of greater functionality, more care should be taken.

ACS has tremendous outsourcing opportunities with easily decomposed commodities as described above, but other firms that have more evolved outsourcing initiatives may be faced with the need to outsource integral components. In such cases it may be worthwhile to increase the scope of the outsourced component/subassembly until it reaches a decomposable level. A firm seeking to outsource integral content may be forced to outsource more than it desires in

order to create a modular subset of work to outsource. Outsourcing the modular subassembly may prove more successful than creating complex operating ties to link activities surrounding the integral content.

Fine takes the concept of product architecture a step further and relates it to industry architecture. He argues that integral product architectures drive integral supply chain structures or vice versa. As industries or products mature they may become more modular in which case there is a general trend from the upper left to the bottom right in Figure 6-4.

Figure 6-4: Relationship between Product and Industry Architectures

Firm’s can pursue the northern or southern route. In the former, industry dynamics force a modular supply chain and to remain competitive firms may redesign products to have a more modular design. More likely, as products mature they may take on a more modular architecture enabling a modular industry structure to develop as firms specialize in particular areas where they hope to achieve value-add.

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The concept of the strategic hierarchy from section 5.6.2 can be combined with Fine’s industry / product architecture model to develop a greater understanding of a firm or product’s position within an industry structure as in Figure 6-5.

From the perspective of an engineering driven firm the combined framework shows that the strategic relevance of any given decomposable is reduced as it can be assumed by the supply chain and therefore the value add lies within the knowledge-based capability of bringing both the supply chain and product components together in innovative or low-cost manners.

6.1.3 Supply Base Capabilities

Several make versus buy theories are developed based on a market-structure perspective where supply and demand factors can affect a firm’s ability to control its inputs. The market structure approach takes into account factors such as the number of suppliers, transaction costs and
switching costs. Monczka offers the matrix seen in Figure 6-6 to explore the relationship between the number of capable suppliers and value to the buyer.

Figure 6-6: Functional Purchasing Policy / Classification Matrix for Commodities

<table>
<thead>
<tr>
<th>Few Capable Suppliers</th>
<th>Many Capable Suppliers</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Value to Buyer</td>
<td>Strategic Commodities</td>
</tr>
<tr>
<td></td>
<td>Leverage Commodities</td>
</tr>
<tr>
<td>Low Value to Buyer</td>
<td>Acquisition Commodities</td>
</tr>
<tr>
<td></td>
<td>Multiple Commodities</td>
</tr>
</tbody>
</table>

In the ‘acquisition’ quadrant, since the value of the product is low and the number of suppliers few, search costs may outweigh the value of the item. The focus on products in this quadrant should be on removing the effort and transactions required to obtain them. From an outsourcing perspective, cost models should be very detailed to ensure an ROI, and planning should take into account difficulties in securing source of supply.

In the ‘multiple’ quadrant, the value of the item is still low, but there are a greater number of suppliers. In this case the focus in outsourcing should be securing the lowest price possible. This quadrant indicates the easiest and most-cost-effective outsourcing opportunity.

In the realm of high value to the buyer, the ‘leverage’ quadrant indicates an opportunity for the purchasing firm to reduce its supply base, develop relationships, and extract significant cost-reductions. This type of outsourcing effort is best coordinated with a long-time partner and

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across the entire firm. Such opportunities should be clearly identified. Initial review of the three processes identified suggests that they may fall within this quadrant. Multiple SBUs utilize plastic molded, machined, and stamped components. Aggregating this demand and presenting it to specifically selected suppliers may give ACS an opportunity to reduce costs dramatically.

The ‘strategic’ quadrant represents the most complex outsourcing opportunities. Few suppliers exist, so the firm has little bargaining power, and the items are necessary. Items that must be sourced from this quadrant will require very unique relationships from the continuum of governance structures.

6.1.4 Outsourcing Frameworks Summarized

Beckman and Rosenfield succinctly captures the concepts in each of the frameworks in his four-part framework on vertical integration and outsourcing decision.22

- Strategic Factors link the outsourcing decision with the firm’s choice of core competencies, business strategies and vertical integration strategy. A firm will maintain capabilities that contribute to its competencies. Using the example of residential gas valves within the ECC business unit, the firm retains several processes considered independently to be non-core but together create a core manufacturing capability that grants the firm competitive advantage in the gas-valve market. Recently, the structure of the industry has changed, and capable suppliers have emerged, but ECC has still maintained control of gas-valve production to avoid customer concerns with respect to quality in these potentially risky products. This example highlights the fact that business strategies and vertical integration strategies may align, but there could exist issues of timing and implementation. These are captured within the make versus buy-framework.

- Market factors address supplier markets for the activities the firm chooses to outsource, as well as the structure and dynamics of the firm’s industry. Where few suppliers are available, a firm may choose or be forced to retain activities on-house, contrary to the desired vertical integration strategy. Ownership of an activity in the presence of an

undeveloped supply market protects the firm from hold-up, loss of bargaining power, and dependency on suppliers. In an industry where little outsourcing takes place, shifting content beyond the boundaries of the firm may jeopardize a firm’s competitiveness. Referring once again to the gas valves example, currently none of ECC’s competitors within the market space outsource their valve fabrication. ECC could stand to lose significant market share if it were the first to outsource gas valve production.

- Product and technology factors assess the outsourcing decision from a technology strategy and product architecture perspective. If a technology underlying a manufacturing process is new or if it is fundamental to the firm’s products, a firm may elect to develop capabilities in-house. However, if the technology is developed externally or it is used in a modular architecture the firm may elect to outsource. Revisiting the example of tooling, if the firm’s products depend heavily on tooling-intensive manufacturing processes it may be in the firm’s interests to retain a competency in tooling design. At the same time, the products generated from the tooling-intensive process are generally modular in architecture and easily outsourced.

- Economic factors compare the costs of in-house production against those of purchasing from a supply base. A firm may choose to own an activity if it can perform that activity at lower cost, the investment required is reasonable and the transaction costs associated with procuring the output of the activity from outside are high. A firm may outsource when such economies can not be achieved.

6.2 Sustaining Analysis (Make vs. Buy) in ACS

Based on the multiple dimensions described in the previous section a sustaining analysis flow chart or make versus buy decision framework was developed for ACS as seen in Figure 6-7.

Figure 6-7: ACS Make versus Buy Decision Framework
Each diamond represents a decision or information consolidation point. Following the flow chart from the start point, the first action is to determine whether the product, process, or component is considered core to the firm's competitive advantage utilizing the process described in the previous chapter in conjunction with any type of industry benchmarking data. If it is considered non-core, an intellectual property screen must be performed. The IP screen fell outside of the scope of this research, requiring educated resources from marketing, engineering, legal, and manufacturing. If a competency is considered core a capacity analysis should be performed. In cases where capacity is insufficient, the firm must make a capital investment decision or outsource and become dependent on suppliers for capacity. After the IP screen an assessment of the component, product, or processes effect on manufacturing flexibility and control should be performed. Specifically, instances of integral product architectures or processes embedded in the manufacturing flow should be evaluated in detail before continuing. If the product or manufacturing flow is integral the capacity test should once again be performed with a greater emphasis on creating capacity internally.

Once manufacturing flexibility and control has been determined, obsolescence screening should be performed. This will require information from the manufacturing footprint rationalization plan, SBU value stream mapping activities, and an understanding of next generation products and scheduled new product introductions (New Product or Technology Roadmaps).
After obsolescence strategies have been clearly identified the firm must identify a set of capable suppliers. Most make versus buy literature cites a capable supply base as a critical factor for successful outsourcing, however very little is written about how to actually identify that supply base. This activity is far more complex than most firms realize and has spawned an entire industry based on supplier relations management, where the greatest value-add SRM firms provide is in the supplier search and qualification stage. Supplier search and supply base structure analysis is discussed in section 7.4.

Finally, after all of the screens have been performed, a cost-model should be developed. Development of a total-cost model also fell outside of the scope of this research as there is already significant literature regarding cost modeling in the make versus buy decision, and Honeywell ACS was already using a well-developed modeling tool. The cost-model is performed at the end of the strategic screening activities for several reasons:

- The strategic screens promote dialogue amongst the various leaders of potentially affected functions.
- Extended dialogues aid in the formation of metrics to assess the return of an outsourcing project. Strategic concerns and performance measures will be voiced from every function and level of the management hierarchy involved.
- Cost modeling requires intensive information gathering and resource utilization across functions, such as strategic sourcing, manufacturing and finance as well as potentially multiple suppliers.

In the fortunate cases where a project has made it through the strategic screens and yields a positive ROI from the total cost model the firm should outsource. In cases where firm costs are lower than that of the supply base, longer term strategic ramifications should be considered. Markets and industry structures are dynamic; outsourcing decisions should be made with those trends in mind. If short-term cost impact is the firm's priority then it should continue to produce.

The discussion surrounding the decision making framework has alluded to two external factors that influence decision making: environmental factors and trends that drive outsourcing and the performance measures used to determine the viability or success of an outsourcing initiative. The
latter is also an output. Alignment of performance measures is critical to the proper functioning of the process described above and is explored in greater detail in a later chapter.

6.3 Chapter Summary

This chapter introduced conceptual frameworks used in the make versus buy decision as well as a unifying framework for performing sustaining analyses within Honeywell ACS. The sustaining analysis framework strove to link several of the thought frameworks into a series of cohesive discussions, information gathering activities, and decision points to aid in the development of a firm-wide outsourcing strategy composed of financially and strategically feasible outsourcing projects.

The sustaining analysis or make versus buy framework continues where vertical integration strategy ends. Vertical integration strategy maps out the ideal firm structure to meet a company’s business objectives. The sustaining analysis examines whether or not and how a firm can achieve its ideal level of vertical integration. It is critical to distinguish between the vertical integration strategy and the sustaining analysis in a corporate setting as the former reflects the desired value add of the firm and the latter explores how a firm can achieve that value add. The clear understanding of integration strategy and sustaining analysis provides perspective to a firm’s management in making outsourcing trade-offs. For instance, an engineering firm may elect to outsource fabrication despite a higher cost position so as to focus on its target competencies. A technology-driven firm may elect to integrate into technologies existing in other industries so as to become a market-leader or drive further advancements.

The gap analysis described in Chapter 3 identified several non-process factors that contributed to the marginal results generated from the ACS 2003 effort. As these factors were explored, it became apparent that outsourcing strategy development could not take place independent of the greater strategic sourcing functional strategy. The next chapter will divert from the manufacturing and sourcing strategy roadmap to take a deeper look into the growing importance of strategic sourcing in a disintegrating industry structure as in the case of ACS, while Chapter 8 will review step 8 of the roadmap to examine how the multi-business unit firm can organize the pursuit of multiple functional strategies.
CHAPTER 7: ORGANIZATION, INFORMATION, AND THE GROWING IMPORTANCE OF STRATEGIC SOURCING

As described in Chapter 4, it is nearly impossible for an organization to be 100% vertically integrated. This would entail the organization to extract its own raw materials, convert them into equipment, products, and infrastructure. Therefore, to varying degrees depending on industry, each firm must develop a competency in purchasing the goods and services which it utilizes in its operations. As an industry becomes more modular with firms specializing in specific value-added contributions to an end product all of the firms within that industry will have a more complex supply chain to manage.

The pressure to maintain or grow profits in an era of global dynamic competition has created an industry spanning focus on cost management. Firms must search for new ways to reduce costs and pass those savings on to customers while preserving profit margins and meeting shareholder needs. An internal perspective led to the evolution of cost reducing systems such as lean manufacturing, process re-engineering, and six-sigma. An external perspective points to reductions in the cost of materials and services. To manage the externally facing activities firm-wide, the tactical role of purchasing or managing the day-to-day material and information flows must evolve into a strategic activity linking several functions within the organization as well as the supply chain. The expanded role of purchasing can be seen in Figure 7-1.23

Figure 7-1: Purchasing as a Boundary-Spanning Function

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In an industry where the supply chain can act as a source of competitive advantage, the strategic sourcing organization is responsible for several activities including:

- Supplier identification – finding suppliers to meet existing or anticipated purchase needs
- Supplier evaluation and selection – determining if specific suppliers are capable of meeting needs
- Supplier management – ongoing management of the supply base
- Supplier development and improvement – taking actions to improve overall supply base or individual supplier performance
- Supplier integration – involving suppliers in the internal activities of the organization to create a seamless working relationship
- Monitor supply markets and trends and interpret the impact of these trends on company objectives
- Identify the critical materials and services required to support the ACS strategy and, SBU strategies, and functional strategies including the development of detailed purchasing plans for critical commodities
- Coordinate purchase volumes, develop procurement strategies, develop company-wide purchasing systems and processes
• Support new product introductions

All of these activities require close relationships with marketing, engineering, finance, manufacturing, logistics, quality, and the supply chain.

This chapter will explore Strategic Sourcing within ACS including its organizational structure, current state of evolution, capabilities and value-add, and the implications these have on outsourcing strategy development.

7.1.1 Types of Goods Sourced

The sourcing organization is responsible for procuring a variety of goods and services necessary for basic operation of the firm. These include:

• Raw materials: includes items such as petroleum, coal, lumber and metals characterized by an extremely limited degree of processing.
• Semi-finished products and components: includes all items purchased from suppliers required to support an organization’s final production. This may include sub-assemblies.
• Finished products: includes items from suppliers for internal use or resale.
• Maintenance, Repair, Operating (MRO): includes anything that does not directly go into an organization’s product, but are essential for running a business.
• Production support items: includes materials required to pack and ship final products.
• Services: includes services relating to all aspects of the business from facilities maintenance to transportation and logistics.
• Capital equipment: includes assets intended for use beyond a single year. These assets can be general or highly specialized.

The outsourcing discussion so far has revolved around those items used directly in the product including raw materials, semi-finished products, and finished products. These items constitute a firm’s direct material spend. The types of products purchased can be identified on the hierarchy of strategic relevance (for an engineering firm) with raw materials located near the base and finished goods at the top. It was noted earlier that the outsourcing of finished goods or final
assemblies could compromise a firm’s strategic advantage, and in the case of ACS, there is significant opportunity closer to the base of the hierarchy where there are fewer risks to outsourcing. Plastic molded, machined, and stamped parts fall within the category of semi-finished goods.

7.2 ACS Strategic Sourcing Organizational Structure

Within ACS, the Integrated Supply Chain has established a Strategic Sourcing organization as a function supporting all of the business units. Strategic Sourcing has adopted a decentralized structure, each SBU having a director of sourcing and commodity managers to manage targeted direct spend items. There are also manufacturing site purchasing personnel to address daily activity. The SBU directors of sourcing report to the VP of Strategic Sourcing who in turn reports to the VP of ACS Integrated Supply Chain. In addition to the SBU directors there is a director of emerging region sourcing who has managers and teams located in Asia Pacific, Mexico, and Eastern Europe. These teams work across the business units.

The division of the organization by SBU has created silos both internally and externally. Within the three identified commodities there is very little supplier overlap between each of the SBUs as depicted in Figure 7-2.

This is a direct consequence of the decentralized structure, and inhibits the organization from coordinating its purchasing volumes and maximizing its leverage to gain substantial volume discounts. Figure 7-2 highlights the current state of ACS, each SBU having its own supply base, as well as the desired state where SBUs share common processes, a common supply base, and

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the firm is tightly integrated with that supply base creating a true integrated supply chain for competitive advantage. Path A indicates the more practical method of achieving the ideal state, first by creating common processes and a common supply base within the SBU's then integrating that supply base to create an extended Honeywell organization.

The following sections further highlight organizational and informational deficiencies within the ACS Strategic Sourcing function that inhibit development and execution of outsourcing strategy as well as actions taken immediately and proposed in the long term to remedy those deficiencies and enable the organization.

7.3 Informational Gaps Inhibiting Outsourcing Strategy

As described in the gap analysis in Chapter 3, organizational, market, policy, and process factors contributed to the marginal results achieved by the 2003 outsourcing effort. The manufacturing and sourcing roadmap with its detailed outsourcing strategy development steps addresses the bulk of the process issues identified, however organizational and informational issues still exist that could impede positive results from the 2004 joint effort. A comprehensive internal and external look yielded the set of inputs and outputs necessary to make the outsourcing strategy actionable seen in Figure 7-3. It was soon realized that the outsourcing strategy could not be developed independently of the greater sourcing functional strategy.

Figure 7-3 identifies both information and processes that are necessary for the development of an outsourcing strategy. These information and process inputs should be provided by the strategic sourcing function and hence are discussed here.

Supply market assessment: This is a thorough characterization of the supply base and the capabilities it can bring to the firm. It can be performed by geographic region and by commodity and should give an indicator as to the number of players in a supply market, the capabilities of those players, and total market size.

Commodity Positions: These describe per SBU, per commodity the current spend per supplier, # of suppliers, and geographic location. It also collects internal information as to the status of the suppliers. Red suppliers should be dropped, Yellow Supplier should be closely monitored and improved, Green suppliers are slated for growth.
Global Commodity Team Process: At the time of this research, ACS had not implemented cross-functional teams to develop firm-wide plans for high-leverage commodities. A Global Commodity Team Process was developed to aid in commodity strategy development.

Figure 7-3: Inputs to the Development of a Comprehensive Sourcing Strategy (ACS)

ACS Global Commodity Strategies: At the time of this research ACS had developed commodity strategies to address only electronics purchasing. Other high-spend direct materials such as plastic molding, machined and stamped parts, die castings etc. had not been addressed in a firm-wide manner. A commodity strategy should take into account the supply base information described above as well as the opportunities or projects that compose related functional strategies.

Baseline Commodity Volume Data: This was performed in the first step of the manufacturing and sourcing strategy roadmap where all of the internal “make” data was collected including headcount and conversion cost. Spend data was also collected to generate a comprehensive or total-consumption snapshot for the 3 target commodities.
ACS Definitions and non-core validation process were discussed in previous chapters. The non-core project screening provided a short list of potential outsourcing projects and composes the outsourcing strategy. In an ideal situation this project list could be executed as-is, however it relies heavily on resources from multiple organizations and must be included at the very least in the greater Strategic Sourcing functional strategy.

Supply Base Technical Capabilities Survey: This was a generalized tool developed to substitute for the supply base assessment which had a long-lead time for completion. It gathered general information by region with regards to supplier capabilities in terms of volume, part complexity, part precision, part size, and product mix. Capabilities were classified as Red, Green, Yellow, meaning not-capable, capable, and marginally capable respectively.

Global Sourcing Strategy Development Process: This describes the manner in which the various types of sourcing projects are prioritized and sourcing resources are allocated. This is labeled as step 8 in the manufacturing and sourcing strategy roadmap and is the topic of discussion of the next chapter.

The five boxes on the far right of Figure 7-3 represent actual project content. Six sourcing project categories are identified with outsourcing representing only one category. These project decks (list of category projects) are the inputs that the Global Sourcing Strategy Development Process optimizes. The information and processes, along with budgets and resources, act as constraints.

The major informational gap inhibiting successful deployment of the outsourcing strategy was the lack of clearly defined global commodity strategies. It was not understood whether the current or potential supply base could sustain the dollar volume ACS wished to outsource, and if supply base development was needed what actions would be necessary to facilitate this. Finally, the rigorous outsourcing strategy highlighted that the decentralized sourcing organization might not be immediately capable of formulating such commodity strategies or managing the proposed increase in spend.
7.4 The Search for Capable Suppliers – Supply Market Assessment

ACS has the goal to increase its spend in emerging regions or low cost countries in the coming years. This is driven by several factors:

- Capitalize on suppliers’ cost structures in low-cost labor markets
- Have a business presence in future target markets
- Pre-empt manufacturing rationalization activities which may involve targeted emerging regions

ACS has focused its strategic sourcing as well as manufacturing footprint formation towards Mexico, Eastern Europe, and Asia Pacific. Results from the gap analysis showed that the previous outsourcing effort had also focused largely on the emerging regions, combining the goal of increasing emerging regions spend with those of cost reduction, asset base reduction, manufacturing flexibility, and improved management focus. The capability of the regional supply bases was called into question; however such information is imperative in developing a global commodity management strategy which can then support large scale manufacturing efforts. To this end, a comprehensive supply base assessment was performed in Eastern Europe, Asia Pacific, and Mexico with respect to the proposed leverage commodities of plastic moldings, machined parts and stamped parts.

Working jointly with the Emerging Regions Sourcing Teams, a limited set of criteria was developed to identify as many suppliers as possible in the respective regions. Data collected from the extensive search included:

- Basics such as the company name, location, and commodity it manufactured
- Does the supplier have an established quality system?
- Does the supplier have direct/indirect export capabilities?
- Is the supplier technically competent including Equipment (CNC etc.), Software (Compatible CAD/CAM), and Product (Able to meet industry standard tolerances)? This could generally be understood from the products it supplies or sample product pictures
- Do they serve at least one world-class customer? A world-class customer represents any large scale manufacturing or engineering firm that may pursue sourcing goals similar to Honeywell.

- What are the major industries the supplier serves?

- Annual Revenues

Additional information that is more difficult to obtain included:

- Is the supplier certified to a standard quality system (TS, QS, AS, ISO)

- What classifications of the commodity does it produce? Classification systems based on product or process attributes were developed to facilitate this more detailed technical dialogue. Examples for stamping and machining are shown in Figure 7-4 and Figure 7-5 respectively. The classifications are necessary to generate a meaningful dialogue with suppliers and to gain a detailed understanding of their capabilities.

Figure 7-4: Metal Stamping Classification System

<table>
<thead>
<tr>
<th></th>
<th>1 Cold rolled steel</th>
<th>2 Hot rolled steel</th>
<th>3 Electro galvanized steel</th>
<th>4 Stainless steel</th>
<th>5 Aluminum</th>
<th>6 Copper</th>
<th>7 Beryllium Copper</th>
<th>8 Brass</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Progressive die</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>17</td>
<td>18</td>
</tr>
<tr>
<td>2. Fine blank</td>
<td>21</td>
<td>22</td>
<td>23</td>
<td>24</td>
<td>25</td>
<td>26</td>
<td>27</td>
<td>28</td>
</tr>
<tr>
<td>3. Draw / Transfer</td>
<td>31</td>
<td>32</td>
<td>33</td>
<td>34</td>
<td>35</td>
<td>36</td>
<td>37</td>
<td>38</td>
</tr>
<tr>
<td>4. Brake form / Sheet metal</td>
<td>41</td>
<td>42</td>
<td>43</td>
<td>44</td>
<td>45</td>
<td>46</td>
<td>47</td>
<td>48</td>
</tr>
<tr>
<td>5. Lead frames</td>
<td>51</td>
<td>52</td>
<td>53</td>
<td>54</td>
<td>55</td>
<td>56</td>
<td>57</td>
<td>58</td>
</tr>
<tr>
<td>6. Foursides / wire forming</td>
<td>61</td>
<td>62</td>
<td>63</td>
<td>64</td>
<td>65</td>
<td>66</td>
<td>67</td>
<td>68</td>
</tr>
<tr>
<td>7. Miscellaneous</td>
<td>71</td>
<td>72</td>
<td>73</td>
<td>74</td>
<td>75</td>
<td>76</td>
<td>77</td>
<td>78</td>
</tr>
</tbody>
</table>

The metal stamping system uses two digits, the first to represent a specific stamping process, and the second to represent the type of metal stamped.

Figure 7-5: Machining Classification System
The machining classification uses more standard part descriptors such as volume, complexity, size and size as well as process segmentation.

Once collected this data could serve as a resource to future global commodity teams as a basis for understanding regional markets and sources of supply. This supply base assessment acts only as a market evaluation and only supports Honeywell’s existing supplier selection practices. The aggregate market evaluation results for each of the target commodities in Asia Pacific and Mexico can be found in Appendix F as well as an example of the data collected.

Multiple channels were used to identify suppliers including the World Wide Web, industry data bases, provincial or state government organizations, and commodity manager experience.

As the supply market assessment is an activity that requires tremendous time and resources, a faster capability assessment format was developed to aid in overall strategy development. An example of the supply base technical capabilities assessment can be found in Appendix F. A concept illustration is presented in

Figure 7-6: Technical Capabilities Assessment
Using simple product defining criteria as opposed to commodity specific classifications as in the case of stamping, experienced commodity managers were polled as to the capabilities of the supply base in various regions. A red, yellow, green system was developed to highlight those regions that lack capabilities, have marginal capabilities, or are fully capable of manufacturing a specific index of parts. 48 indices were defined using 4 criteria (volume, complexity, mix, precision) at levels of high and low, and a fifth criteria at 3 levels (Size: small, medium, large).

The supply market and capabilities assessment immediately identified that the supply bases of Asia Pacific, Eastern Europe, and Mexico that Honeywell ACS had identified were not capable. This indicated that specific activities such as supplier development were needed to grow a dependable source of supply.

7.5 Commodity Positions, Supply Base Proliferation and NPI

Current commodity positions were identified in support of the strategic sourcing organization, but only limited data and the conclusions drawn from the study will be included in this report. A commodity position is composed of the number of suppliers, current spend, and distribution of that spend over the suppliers as well as the summarized performance evaluations of each supplier. The positions of each SBU were identified by commodity to identify the existing
supply base's capability to absorb content from outsourcing initiatives. In addition the current initiatives and issues faced on the SBU level with respect to each commodity were identified.

The commodity position study showed that each SBU had a unique supply base despite similarities in consumption of commodities. In several cases single SBUs had upwards of 100 suppliers for a single commodity. Across ACS there may have been several hundred suppliers providing similar products. With the ACS spend fragmented across so many suppliers the opportunity to gain volume leverage is lost. In addition, the ability of commodity managers to form strategic relationships is limited by the need to monitor the expansive supply chain. This has profound impact on outsourcing projects which could involve millions of dollars worth of content. In many cases suitable ROI can not be achieved without some degree of partnership and asset transference, but those partnership and relationship management capabilities are stressed by a large supply base.

This supply base proliferation is captured in Figure 7-7 which shows what is termed as an immature commodity management profile.

![Figure 7-7: Immature Commodity Management Profile](image)

Both graphs show the majority of spend concentrated within a few suppliers, and then a long tail of suppliers with very low dollar-volumes. Analyzing this distribution by supplier rank shows that those suppliers with higher spend are usually Green or growth suppliers, while those at the end of the tail are considered low-performing or Red suppliers. With such an obvious proliferation in suppliers it begs the question, "What is ACS doing to rationalize the supply base?" Interviews with SBU commodity managers indicated that 20% of time was spent managing the tail while 80% was spent managing the Green suppliers as shown in the right side of Figure 7-7. This was common across all SBUs and commodities that exhibited the immature
profile. The driving force behind this phenomenon is an issue of functional goals and incentives. Commodity managers are tasked with bringing ACS year over year cost reductions. A marginal decrease in cost from a high-spend supplier yields much better return than the rationalization of the supply base. This proliferation in turn inhibits a commodity manager’s ability to develop further strategic relations and generate greater value-add or cost savings over the long run.

Figure 7-8: Mature Commodity Management Profile

Figure 7-8 depicts what is described as a mature commodity profile. There are far fewer suppliers, each with much greater spend. SBUs with commodities exhibiting such a profile tended to have a greater number of strategic value-added partners. There are difficulties in managing such a profile. As suppliers work with a company they may be able to deliver year over year savings for a finite number of years by improving productivity and developing unique knowledge or working capabilities. Over time the ability to extract productivity improvements decreases. ACS commodity managers working with such suppliers were driving initiatives to relocate suppliers to emerging regions to capitalize on low-cost labor opportunities or to develop equity based ventures with less capable low cost region suppliers to continue generating year over year savings.

Two main determinants of this supply base proliferation were identified. First there historically had been a poor linkage between strategic sourcing and new product introductions. Product development engineers would often identify suppliers independently and then transfer contracts
over to the sourcing organization. Therefore NPI support was identified as a major gap within the sourcing organization. This has indirect implications on outsourcing as it creates opportunities for non-core content to enter the manufacturing system in cases where engineering opts to use manufacturing as a supplier. A checks and balances involving engineering, manufacturing, and sourcing did not exist within the NPI process at the time of this research.

Another issue is niche buying where undesirable content is given to specialist manufacturers. Strategic partnerships could eliminate this as high-spend partners would be obliged to absorb "cats and dogs" as well as higher volume, lower-mix, higher-margin content.

Ultimately the commodity position assessment illustrated that the ACS supply base was indeed divided by SBU which immediately poses several challenges to the business group approach to outsourcing. If a manager from SBU A holds the relationship with a supplier capable of absorbing outsourcing content from SBU B, will that manager become responsible for that content or will the supplier have multiple points of contact? This inherent conflict between the decentralized sourcing organizational structure and the centralized strategy development approach identified the need for a unifying process or group. To this end, the implementation of global commodity teams was suggested to aggregate disparate SBU and market data such as that provided in the supply market assessment. These teams would then be responsible for developing firm-wide commodity strategies that could then facilitate outsourcing strategy development as well as other sourcing project category strategy development.

7.6 Commodity Team Process and Commodity Strategies

Figure 7-3 identified several types of information that are necessary to develop both an outsourcing strategy and a greater strategic sourcing functional strategy. As depicted, much of this information was collected independently during the process census and sustaining analysis (MvB), however this type of information is often referenced by several functions and SBUs to develop other functional strategies. Therefore it would benefit the organization to capture, store, and maintain that data centrally. Ultimately this information should be used to develop Global Commodity Strategies, a cross-functional approach to making the manufacturing and sourcing decisions for a specific part family. The use of cross-functional global commodity teams (GCT) was recommended as a vehicle to manage manufacturing, purchasing, and market data and to
develop strategies accordingly. A table describing the team structure, roles and responsibilities, information inputs, and outputs can be found in Appendix G.

The outputs of the global commodity team process should cohesively define a commodity strategy, and should serve both the functional/SBU strategies as well as the business group objectives. Activities generated or decisions made by the GCT should include:

- Supply Base Optimization activities: Plans to rationalize the supply base as well as develop its capabilities. Supply base development may be necessary to support a geographic purchasing strategy.

- Geographic Purchasing Strategy: Determination of where a given commodity should be purchased, i.e. locally, domestically, regionally, globally. In the case of electronics, Honeywell has targeted the Asia Pacific emerging region as a strategic source of supply. The transportation business group uses a local supply strategy for mechanical components such as castings and machined parts, developing its supply base as necessary.

- Supplier Relationship Management: Strategic Assessment of which commodities should be purchased at arms length or through partnership.

- Supply Chain Needs Analysis: Thorough understanding of the relationship between a business unit strategy and the corresponding SBU operations strategy to determine what type of sourcing activities in support of that specific SBU are needed.

- Project Decks: List of each project type to be executed in support of the AOP and STRAP.

Ultimately, the global commodity strategy should take into account the needs of all other functions and functional strategies.

The ACS Strategic Sourcing organization had not yet evolved to the point where it could support the development of cross-functional strategies. To aid the organization, models of supplier management, just one of its multiple responsibilities, were developed to assist it in defining its
own trajectory for maturity. These models are included in Appendix H, but will not be discussed here.

7.7 Chapter Summary

This chapter discussed Strategic Sourcing, its role in the firm, and how the maturity-level of the strategic sourcing organization can impact other functions. This was introduced in the context of outsourcing, where several informational inputs are needed from strategic sourcing to facilitate strategy development. The design of a strategic sourcing organization and its placement within the firm are critical to the successful development of an integrated supply chain.

Specific to Honeywell, this discussion identified several gaps that its strategic sourcing organization can work to fill to support the development of outsourcing strategies as well as its own greater functional strategy. In particular, the need for well-developed global commodity strategies was identified. Global commodity strategies encompass various inputs such as materials trends, supply base capabilities, internal production volumes, current purchasing volumes, and the projected needs of other functions and all business units. The development of global commodity strategies requires centralized management to collect, analyze, maintain, and distribute relevant information. Global commodity teams are one vehicle by which global commodity strategies can be developed and updated. The use of such cross-functional teams is a good fit for ACS as it does not require re-organization of the functional group.

The next chapter will discuss various the various types of projects supported by the sourcing organization. Projects are the building blocks of an executable strategy, and with a wide variety of projects each satisfying a different set of goals, the entire ISC organization must be involved in project prioritization to best utilize limited resources and still meet corporate, SBU, and functional objectives.
CHAPTER 8: PROJECT PRIORITIZATION AND INCENTIVE DESIGN

Chapter 7 discussed the various inputs used in the development of a comprehensive strategic sourcing strategy focusing on information requirements. This chapter will more thoroughly examine projects as the building blocks of strategy or the means by which strategic goals are achieved. Outsourcing is just one project type, and outsourcing strategy development must be performed within the greater contexts of manufacturing and strategic sourcing functional strategies. In the next section the various types of sourcing projects will be identified, described and linked to the metrics the firm uses to evaluate performance. Once identified, a method for prioritizing these projects will be proposed and resulting conflicts of measurement and incentives will be analyzed.

8.1 Project Types

Chapter 7 alluded to various types of strategic sourcing projects within ACS including:

- **Negotiations**: Lowers costs on goods purchased from a given supplier. Impacts strategic sourcing deflation targets.

- **Resourcing**: Content from a high-cost supplier shifted to a low-cost supplier, often in the emerging regions. Impacts emerging region spend and deflation targets for strategic sourcing.

- **New product introductions**: Sourcing of components used in new products from the supply base. Sourcing supports the engineering and manufacturing organizations to ensure that non-core content from new products does not enter the ACS manufacturing system. Impacts engineering product cost targets.

- **Outsourcing in transition**: Shifting manufacturing content to the supply base concurrently with a factory move or consolidation. Impacts SBG operating costs and strategic motives. May lower total costs, but negatively impacts manufacturing burden allocation. This may increase emerging region spend for strategic sourcing.
- **Outsourcing stand alone:** Shifting a subset of the total manufacturing performed at a site to the supply base. Impacts SBG operating costs and strategic motives. This may increase emerging region spend for strategic sourcing.

- **Insourcing:** Shifting manufacturing activities from the supply-base in house. Impacts manufacturing productivity. This might be motivated to improve productivity when labor is viewed as a fixed cost as in a labor union environment.

- **Supplier development:** activities to improve supply base or individual supplier performance. Such projects may serve the supply chain needs of the business units or help strategic sourcing meet deflation targets.

### 8.2 Project Decks

A project deck is a listing of potential projects within a given SBU, commodity, function, or project type as described above.

With this variety in project types it becomes apparent that some method of prioritization is needed, however differences in the strategic objectives and performance metrics between functions and SBUs, added to a limited understanding of project opportunities makes the prioritization of sourcing projects a difficult task.

Outsourcing projects have been clearly defined via the manufacturing and sourcing strategy roadmaps. Transition and consolidations are amongst the largest-scale initiatives within the Integrated Supply Chain organization and are scheduled on the 5-year STRAP timeline well in advance of execution. Therefore, stand-alone outsourcing and outsourcing-in-transition project decks can easily be formulated.

Much like outsourcing projects, new product introductions are on clearly defined schedules as determined by the firm’s product roadmaps. A comprehensive look across all new product introductions should generate an NPI project deck.

Negotiations projects are determined on a year-by-year basis and are dependent on previous negotiation history to ensure the same supplier is not approached to grant major cost-reduction concessions in consecutive years. Resourcing projects are handled in much the same way;
however, the pool of projects can be more clearly defined once a supply base rationalization plan has been established (Figure 8-1).

Figure 8-1: Developing a Resourcing Project Deck

All content sourced outside of the target supply base becomes a candidate for resourcing.

Insourcing projects are rare but do occur. They may be driven by tremendous productivity improvements in regulated labor environments, in an effort to reduce supplier bargaining power, or to re-establish core-content that may have inappropriately been outsourced. In the latter case resourcing activities may be attempted first. In either case the firm should be able to predict the need for insourcing well in advance and can develop a project deck accordingly.

Figure 7-3 illustrated the need to have clearly defined project decks before formulating an overall Strategic Sourcing functional strategy. Lack of clearly defined decks inhibits a fair allocation of resources as well as the project prioritization process. The next section discusses project prioritization in conditions of incomplete information.

8.3 Project Prioritization

Once decks for each project type have been developed, projects must be prioritized using the following factors as constraints:

- Temporal Flexibility

- Functional, SBU, and SBG annual operating goals

- Functional, SBU, and SBG strategic priority

- Resources (people, financial)
Figure 8-2 illustrates conceptually how different project types may be on fixed schedules, while other project types can be performed on a flexible time schedule.

In addition, certain project types have fixed content. For instance, during a consolidation it may be absolutely necessary to outsource certain manufacturing activity, whereas in resourcing projects, the sheer availability of project options allows the firm to select which content it wishes to shift from one supplier to another. The matrix indicates that NPI and outsourcing in transition projects are fixed both in time and content, whereas negotiation and resourcing projects offer the most flexibility. Stand-alone outsourcing can be performed at the firm's discretion, but the content is limited. The relative size of each circle represents the potential dollar-value at-stake and is generally representative of project types.

As an example, using only the time and content flexibility approach yields a sequentially stacked deck as seen on the right hand side of Figure 8-2. Since outsourcing in transition and NPI sourcing are known in advance they are allocated resources first consuming the bulk of strategic sourcing's resources. At the same time NPI, insourcing and outsourcing may not satisfy the deflation goals that the ISC organization has set, and higher financial impact projects may have to take precedence as seen in Figure 8-3.
Figure 8-3 also illustrates how different projects generate financial impact in different ways, i.e. through deflation or productivity improvements.

The business units are the organizations that generate revenues, and often times they take precedence over support function as well as SBG level goals. Depending on the SBUs competitive strategy, certain projects may take precedence as in Figure 8-4.

Figure 8-4: SBU Strategy and Project Precedence
Although total savings from a single NPI project may be significantly lower than that from a resourcing project, NPI may have a much greater effect on future revenue streams. If using the supply base can speed time to market or provides a capability that does not exist in house NPI support may take precedence over all other projects.

Attempting to develop a prioritization scheme is a very complex matter when firm performance, strategy, and timelines must be balanced or traded-off. In the case of ACS, the lack of defined insourcing, resourcing, negotiation, and NPI project decks makes it difficult to propose a prioritization methodology other than the one based on temporal and content flexibility. In addition, the corporate, SBU, and functional objectives must be clearly articulated and prioritized before project selection. This highlights why a vertical integration strategy must be well-defined before developing an outsourcing strategy. A lack of understanding of the relative contributions to firm performance from the different levels and types of strategy directly results in measurement and alignment issues.

8.4 Measurement and Alignment

Examining the various project types and the impact they may have on the organization, it becomes evident that there is very little overlap between project type and function served. All the projects do have the goal of reducing costs either directly or indirectly through improved supplier quality and increased internal productivity; however, from a performance measurement perspective, the project types are aligned by function as seen in Figure 8-5.

Figure 8-5: Project Types, Occurrences, and Functions Served
The alignment of project types with particular functions such as engineering, manufacturing or strategic sourcing becomes a major issue when the resources used to execute these project types are shared as seen in Table 8-1.

Table 8-1: Project Types, Resource Providers, and Resources Utilized
As a support function strategic sourcing has been established to facilitate supply base-facing projects across all other functions within the organization. At the same time strategic sourcing has its own goal – to reduce direct-spend. Negotiations and resourcing projects provide immediate deflation impact while other strategic activities such as supply base reduction (discussed in chapter 7) and shifting from sole to multiple sources of supply yield weaker cost-saving results. The short term approach leads strategic sourcing to miss potentially high-yielding but longer term cost-savings opportunities.

This incentive – alignment issue extends beyond the boundaries of the strategic sourcing organization. Project types such as outsourcing or new product introductions do not aid the sourcing organization in meeting its annual deflation targets yet utilize strategic sourcing resources. Without aid from strategic sourcing, the other functions then focus on internal efforts. Manufacturing may be able to meet its goals through initiatives such as lean manufacturing implementation, and engineering can find supply sources outside the boundaries of strategic sourcing (causing a proliferation in the supply base). Outsourcing projects are held-up entirely. Thus the current set of organizational metrics limits the scope of strategic sourcing to tactical purchasing. An intense focus on the deflation metric has passively allowed supply base proliferation, a lack of support for outsourcing initiatives, and the lack of development of a supplier development competency.

Metrics beyond deflation are necessary to incentivize strategic sourcing to adequately support other project types as well as other strategic actions internal to the function. A few suggestions are described:

- Determine the cost of supplier management, and attribute actual cost savings figures to supply base rationalization activity.

- Measure NPI cost-savings against a predetermined target or average of unused quotes.

- Measure outsourcing cost-savings against in house manufacturing price

Ultimately, any changes in metrics must also be reflected in personal performance evaluations to ensure that employee activities are aligned with the goals of the firm.
8.5 Chapter Summary

This chapter identified the various types of projects that utilize the strategic sourcing function. Outsourcing is only one of these project types and must be considered within the greater context of the strategic sourcing strategy. Different types of projects yield different types of results affecting firm performance. The link between project type and results may lead the different functions, SBU's, and SBG to focus on specific project types. If the strategic sourcing organization is evaluated on how it supports the rest of the organization and how it delivers year over year cost-savings issues between performance measurement and employee activities will emerge. Alignment can be achieved by a clearly articulated prioritization of business goals including the various SBG, SBU, and functional levels of strategy. Once the organizational goals have been aligned, projects can be selected and prioritized to meet those goals.
CHAPTER 9: CONCLUSIONS AND RECOMMENDATIONS

Although the methodology proposed herein to generate a unified manufacturing and sourcing strategy was developed within the confines of a single firm, Honeywell ACS, several general conclusions can be drawn to aid other companies in developing outsourcing strategies. The research proposed a roadmap to first identify core competencies based on the firm's business or competitive strategy. These competencies define the firm's target level of vertical integration. Then, all of the activities which the firm currently performs are benchmarked against the vertical integration targets. Activities considered non-core are slated for outsourcing, but first must undergo a sustaining analysis. The sustaining analysis examines strategic factors within the affected business unit, economic factors to ensure outsourcing is financially sound, market factors including the supply base structure and supplier bargaining power, and product/technology factors.

Once outsourcing content has been identified it must be prioritized within manufacturing and sourcing functional strategies to determine fit and contribution to firm goals. Increasing utilization of outsourcing shifts firm activity from manufacturing to strategic sourcing. As such, the strategic sourcing organization must be positioned within the firm not just to deliver bottom-line savings but to support the increasing needs of other functional groups.

9.1 General Conclusions

9.1.1 Precursors to Successful Outsourcing

This research identified several precursors or antecedents to successful outsourcing. A gap analysis performed within Honeywell ACS yielded four generic categories of factors that contribute to the successful adoption and implementation of outsourcing: organizational structure, policy, process, and market. Organizational structure and incentives define the actions of the various functional groups and levels of management. Performance measurement should be aligned with strategic goals, and the various levels of strategy need to be developed in an integrative manner. Business strategy should determine the vertical integration strategy which in turn should influence the functional manufacturing and strategic sourcing strategies with outsourcing strategy as a subset of total strategic planning activity.
In cases where organizational structure can not provide the necessary channels for communication robust business processes need to be implemented. The manufacturing and sourcing strategy development roadmap is one such process requiring several cross-functional dialogues to ensure that all perspectives within the organization are heard and are appropriately incorporated according to their strategic fit. In addition, the use of cross-functional teams can aid a firm in achieving its desired leverage or synergies.

Policy factors were explored only briefly. Policies exist, official or unofficial, within all functional groups and levels of management. These policies may be legacy beliefs or activities that can inhibit firm progress towards newly developed targets in dynamically changing business environments. All policies should be revisited as the firm and its position within an industry mature. As an example, purchasing organizations may need to develop fresher approaches to supplier and spend management as the strategic lever of outsourcing is used more frequently.

Most often cited within Honeywell ACS as the primary inhibitor to outsourcing was a lack of capable suppliers. The regional supply market and capabilities assessments performed as part of this research support those assertions, although in the case of the ACS 2003 Outsourcing Effort capable suppliers were identified for several proposed projects. As firms adopt a more aggressive outsourcing approach, their need for capable supply bases in targeted customer or manufacturing regions will grow. Supplier search and qualification is a time and resource intensive activity, and firms must have plans in place to sustain production until local supply bases mature, develop those supply bases independently, or adopt a global sourcing and logistics approach. The trade-offs between developing a supply base and global sourcing has not been well-documented to date, and such supporting cost-models in support of this research were not easily identified. This is an excellent opportunity for future operations strategy research.

9.1.2 Outsourcing, Cost Models, and Accounting

Discussed only briefly in this work are the methods of accounting used in the cost-benefit analyses used to evaluate outsourcing projects. Within Honeywell, cost models for independent outsourcing projects often yielded neutral or negative net present values and excessive internal rates of return. Conversely, outsourcing in conjunction with manufacturing footprint
rationalization yields significantly better financial results.\textsuperscript{24} This discrepancy in financial results from the different outsourcing circumstances is of course due to the amortized burden allocation of independent outsourcing projects which effectively increases the cost of producing the remaining products within a given site.

Regardless of the methods of burden allocation and accounting used, cost models alone are not sufficient to justify or invalidate a specific outsourcing opportunity. Costs must be weighed against the strategic impact on the functional group, business unit, and business group, and ranked within the overall firm priorities.

\textbf{9.1.3 Outsourcing, Firm Priorities and Integrative Strategy Development}

Much attention has been paid to firm priorities in this work. Within a multi-business unit, strategic alignment across levels of management and functions requires clearly articulated goals that fit well with the firm’s competitive strategy. ACS Marketing literature positions the firm as a leader in sensing innovation and systems integration, yet cost reduction and standard manufacturing metrics are the focus of the integrated supply chain above issues such as new product introductions. As an engineering firm, costs must be balanced against priorities such as time-to-market and technology development.

Once the competitive strategy is clearly articulated the vertical integration strategy can be developed accordingly. This vertical integration strategy should be internalized by all levels of management and support functions. In the case of a vertically disintegrating firm this should translate into the support of outsourcing strategy development and implementation.

Outsourcing is just one activity within the greater functional strategies of manufacturing and strategic sourcing, and its relative priority is determined by the level of integration pursued. For the functions to develop a balanced portfolio of activities all potential opportunities within each type of project must be identified. The methodology discussed here aids a firm in clearly identifying outsourcing content, but other project types such as resourcing, negotiations, and new product introduction sourcing should be similarly examined. Once all of the opportunities that

\textsuperscript{24} Henkle, A., “Global Supply Chain Design and Optimization Methodology,” MIT LFM Thesis, 2004
could feasibly be included in a STRAP or AOP have been identified they can be prioritized using simple algorithms or techniques such as linear programming. Various organizational metrics or goals can be weighted and used as constraints, then the relative performance of each project can be matched to those constraints to develop a portfolio that meets multiple firm objectives such as manufacturing cost reduction, ROIC improvement, deflation, increased flexibility, etc. It should be noted that misaligned incentives could jeopardize the progress of projects extremely valuable to the firm.

The need for full project information illustrates the need for integrative strategy development. All functional, business unit, and business group strategies must be developed together in order to meet the goals of a specific group in addition to the firm as a whole.

9.1.4 “Spilt Milk”

Spilt milk describes the rare occasion when a firm may elect to outsource an activity it considers a core competence. Although the concept of spilt milk defies expectation, it can occur if a firm’s capabilities in a given activity are deficient or lagging those of potential suppliers, if it lacks the capacity to perform 100% of the activity in-house, or if it lacks the knowledge to perform the task such as in new or rare technologies. In any of these cases, the firm should assess its position within the value chain and act accordingly, whether this is rapidly developing the capability in-house, or exiting the activity entirely.

9.1.5 Focusing on the Core

This work has largely revolved around outsourcing, for which clearly defining non-core activities is essential. However, this focus on non-core content may well serve outsourcing strategy development, but it is a misguided perspective of the firm. As this research noted, defining core capabilities and competencies is a difficult task, but critical if management is to provide well-defined leadership to the firm. Contrary to what is presented herein, management should be focusing on the core.
9.1.6 Strategic Sourcing and Supplier Management in a Multi-Business Unit Firm

Fine argues that supply chain design is the ultimate core competence. This involves the development of integration strategies in addition to standard competitive strategy analysis. When it comes time to implement, however, the majority of supply chain design implementation will fall upon the strategic sourcing organization. Prahalad and Hamel, in their seminal work on core competencies discuss the tendency of business units to underinvest in core competencies stating, “When the organization is conceived of as a multiplicity of SBUs, no single business may feel responsible...nor be able to justify the investment required to build world leadership in some core competence.” As a firm shifts content from manufacturing management’s control to the supply base it will need to develop the capabilities of its strategic sourcing organization and recognize the cross-SBU function as critical to the firm’s competitive advantage.

9.1.7 Fabrication

Running content through the manufacturing and sourcing strategy development roadmap yielded general conclusions regarding manufacturing content within ACS, specifically that fabrication of modular components, as in the cases of plastic molded parts, machined metal parts, and stamped metal parts are non-core activities. Most of the outsourcing difficulty experienced by ACS stemmed from its own cost-competitive capabilities as well as lack of suppliers capable of absorbing the large amounts of manufacturing content. The general conclusion that fabrication is non-core aligns well with the vision of ACS as an innovation driven systems integration firm.

9.1.8 Management and the Outsourcing Decision

The methodology described within this work has been described as the manufacturing and sourcing strategy development roadmap. This begs the question, “Who is ultimately responsible for the make versus buy decision?” Figure 9-1 shows data from a study conducted by McKinsey and company of several machinery and component manufacturers in the US and Europe.

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The graph indicates that the most successful companies approach strategic make versus buy decision from the top levels of management. Other successful firms place responsibility of the make versus buy decision within Materials Management or what otherwise may be known as purchasing. Interpretation of the data requires an understanding of the context in which the term "make versus buy" is used. The introductory chapters noted that vertical integration, competency theory, and outsourcing are synonymous; however, this research has attempted to prescribe a methodology where the "make versus buy" decision is broken down into smaller discrete decisions that can be owned by various functions or levels of management. The vertical integration decision determines the boundaries of the firm and is determined by top management. This requires a clear understanding of the current and future competencies required to remain competitive in a dynamically changing industry environment. Potential outsourcing opportunities should be identified jointly by manufacturing, strategic sourcing, and a third party such as the ACS transitions team unless performance measurement and incentives can be created in a way that a particular function can willingly assume a leadership role during the feasibility studies. Once content is identified, cross-functional teams are needed to perform sustaining analyses, but
as the future owners of this content and greatest providers of decision making information will be the strategic sourcing organization it makes sense that team leadership come from that group. Once an outsourcing project is determined to be feasible, outsourcing strategies including criteria such as supply base development, global sourcing, number of suppliers and types of partnerships should be determined, also by the strategic sourcing organization. Finally, outsourcing implementation will once again require a cross-functional team as well as the support of all levels of management.
APPENDIX A – INTERVIEW LIST

Industry Benchmarking Interviews

<table>
<thead>
<tr>
<th>Name</th>
<th>Company</th>
<th>Business Group</th>
<th>Division / Department</th>
<th>Title</th>
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<tr>
<td>Matthew Capeci</td>
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<td>Performance Polymers and Chemicals</td>
<td>Leader - Global Supply Chain</td>
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<td>Joetta Alcalde</td>
<td>Honeywell</td>
<td>Transportation Systems</td>
<td>Garret Turbocharging Systems</td>
<td>NPI Manager</td>
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<tr>
<td>Wes Margeson</td>
<td>Honeywell</td>
<td>Aerospace</td>
<td>Commercial Avionics</td>
<td>Supply Transition Program Manager</td>
</tr>
<tr>
<td>Miriam Park</td>
<td>Honeywell</td>
<td>Aerospace</td>
<td>BRGA - ISC</td>
<td>ISC Leader</td>
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<tr>
<td>Prentis Wilson</td>
<td>Honeywell</td>
<td>Aerospace</td>
<td>Commercial Avionics</td>
<td>Director of Global Sourcing</td>
</tr>
<tr>
<td>Fred Enriquez</td>
<td>Honeywell</td>
<td>Aerospace</td>
<td>ESS</td>
<td>ER Sourcing Leader MX</td>
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<tr>
<td>Michael Dunleavy</td>
<td>Honeywell</td>
<td>Transportation Systems</td>
<td>Honeywell Turbo Technologies</td>
<td>Director Worldwide Supply Base</td>
</tr>
<tr>
<td>David Amado</td>
<td>UTC</td>
<td>Corporate</td>
<td>Global Sourcing Latin America</td>
<td></td>
</tr>
<tr>
<td>Andresj Geryszewski</td>
<td>Ford</td>
<td></td>
<td>Ford Global Sourcing Development - Europe</td>
<td>Country Manager - Poland</td>
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<tr>
<td>Stewart Ongchin</td>
<td>Boeing</td>
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<td>Wings</td>
<td>LFM Intern</td>
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<td>Jason Kary</td>
<td>GE</td>
<td></td>
<td>Energy</td>
<td>VMI and Sourcing Commodity Lead</td>
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<td>David Morgenstern</td>
<td>Freemanmarkets / Ariba</td>
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<td>Low Cost Country Sourcing Specialist</td>
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<td>James Clark</td>
<td>VitalSources</td>
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<td></td>
<td>Marketing Rep - China Sourcing</td>
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<tr>
<td>Ernesto Reyes</td>
<td>Caterpillar</td>
<td></td>
<td></td>
<td>Independent Consultant</td>
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<td>Patricio Mejia</td>
<td>Johnson Controls</td>
<td>Controls</td>
<td></td>
<td>Independent Consultant</td>
</tr>
<tr>
<td>Aaron Raphel</td>
<td>HP</td>
<td></td>
<td>PCs</td>
<td>LFM Intern</td>
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ACS Commodity Manager Interviews

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<th>Machining</th>
<th>Plastics</th>
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<tr>
<td>ECC/S&amp;C NA</td>
<td>Tim Current</td>
<td>Vivek Kapoor</td>
<td>Bill Orr</td>
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<td>Egbert Hidding</td>
<td></td>
<td>Joerg Sebik</td>
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<td>HPS</td>
<td></td>
<td>Joe Akers</td>
<td>Marie Kerlin</td>
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<td>Security NA</td>
<td>Victor Eisenberg</td>
<td></td>
<td>Pat Martone</td>
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<td>Fire NA</td>
<td>Tom Wilson</td>
<td></td>
<td>Cory Miller</td>
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<td>Security Europe</td>
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<td>Giorgio Licen</td>
<td>Kevin Garry</td>
</tr>
<tr>
<td>Fire Europe</td>
<td></td>
<td></td>
<td>Giorgio Licen</td>
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<tr>
<td>Security Asia</td>
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<td></td>
<td>Echo Law</td>
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<td>Mexico</td>
<td>Jose Valdes</td>
<td>Santos Ortiz</td>
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<td>Asia</td>
<td>TC Lee</td>
<td>Yolanda Yu</td>
<td></td>
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<tr>
<td>Eastern Europe</td>
<td>Alex Balla</td>
<td></td>
<td>Gergely Baranyi</td>
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</tbody>
</table>

ACS SBU Operations Leaders Interviews

S&C – Steve Spiller

HPS – Jon Lyons

ECC North America – Ron Meester

ECC Europe – Peter Dobbs

Fire – Jeff Boehler

Asia Pacific – JC Chang

Security – Bruce Gleghorn
S&C – David Strain
S&C – David Schmidt
S&C – Russ Tilsner
S&C – Neil Yeargin

ACS Emerging Regions Sourcing Directors
Mexico – Hugo Villarreal
Asia Pacific – Soh Hin Tan
Eastern Europe – Suressh Keshav

ACS SBU Sourcing Directors
S&C – Ann Ackerson
HPS – Robert Kajca
Fire - Bill Ballweber

Finance
Transitions Team – Michael Harrington
Strategic Sourcing – Chris Johnson

SBG Executive Staff
Joe DeSearla – VP Integrated Supply Chain
Mike Slomke – VP Strategic Sourcing

Transitions Team
Frank Nonnenmann – Director
Luis Yanex – Outsourcing Specialist
Manuel Solis – Outsourcing Specialist
Vik Nargunam – Materials Management Specialist

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<table>
<thead>
<tr>
<th>High Level</th>
<th>Low Level</th>
<th>Root Cause</th>
<th>Bucket</th>
<th>Notes</th>
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<tbody>
<tr>
<td>No Capable Suppliers were identified</td>
<td>A) Poor Search Performed</td>
<td>ER Team Structure, ER Team Resources Time, Lack of Outreach</td>
<td>Org, Org, Src. Policy, Process</td>
<td>Focus was on ER only (MX for US and E, Eu for Eu)</td>
</tr>
<tr>
<td></td>
<td>B) Inefficient Market</td>
<td>No Capable Suppliers in Region, Target Market was Limited</td>
<td>Market, Src. Policy</td>
<td>HW demanded supplier that had experience similar to package</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Capable Suppliers are not industry players</td>
<td></td>
<td>O/S Goals + ER Goals + Savings Goals all mixed</td>
</tr>
<tr>
<td></td>
<td>C) Unappealing Package</td>
<td>Packages too large; volumes/mix, Incomplete RFQ Data</td>
<td>Src. Policy, Process</td>
<td>offered only parts packages instead of strategic partnerships</td>
</tr>
<tr>
<td></td>
<td>D) Resourcing approach used</td>
<td>No Long Term growth partnerships offered</td>
<td>Src. Policy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E) Narrow supplier consideration</td>
<td>Only Suppliers with capabilities similar to package approached</td>
<td>Src. Policy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>F) Outdated Technology</td>
<td>No redesign or obsolescence of old products</td>
<td>Market, Src. Policy</td>
<td></td>
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<tr>
<td>High Level</td>
<td>Low Level</td>
<td>Root Cause</td>
<td>Bucket</td>
<td>Notes</td>
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<tr>
<td>------------</td>
<td>-----------</td>
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<td>-------</td>
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<tr>
<td>2 Quotes were not competitive - cost neutral or negative</td>
<td>A) Unappealing Package</td>
<td>Packages too large, volumes/mix</td>
<td>Process</td>
<td>do we keep investing to stay competitive</td>
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<tr>
<td></td>
<td>B) Strong in-house capability</td>
<td>HW mfg. is market competitive</td>
<td>Ops. Policy</td>
<td>What is Sourcing Supply Chain Design?</td>
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<td></td>
<td>C) Logistics</td>
<td>No regional competitive / efficient market</td>
<td>Market / Policy</td>
<td>O/S Goals + ER Goals + Savings Goals all mixed</td>
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<td></td>
<td>D) Bar too high</td>
<td>ROI cut-off too high - Why O/S?</td>
<td>Src. Policy</td>
<td>do we keep investing to stay competitive</td>
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<td></td>
<td>E) In-house highly specialized equipment vs. Suppliers with Flexible equipment</td>
<td>HW mfg. is market competitive</td>
<td>Ops. Policy</td>
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<td>3 SBU Concerns</td>
<td>A) No Faith</td>
<td>Supply Accountability metrics</td>
<td>Ops. Policy</td>
<td>No Process Existed to incorporate SBU</td>
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<td></td>
<td>B) Priority</td>
<td>Too many resources tied up in other activities</td>
<td>Ops. Policy</td>
<td>Concerns / Business Strategies into the project selection process</td>
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<tr>
<td></td>
<td>C) Labor Issues</td>
<td>Union</td>
<td>Ops. Policy</td>
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<tr>
<td></td>
<td>D) Limited Resources to support initiative</td>
<td></td>
<td>Org.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E) Products involved constitute affected potentially large revenues</td>
<td></td>
<td>Ops. Policy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>F) Burden and Overhead Remain</td>
<td>Package too small</td>
<td>Process</td>
<td></td>
</tr>
<tr>
<td></td>
<td>G) NPI affected outsourcing evaluation</td>
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<td>Process</td>
<td></td>
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<td>4 ISC Concerns</td>
<td>A) Project within ISC Footprint plans</td>
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<td>Process</td>
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<tr>
<td></td>
<td>B) Poor project scope definition</td>
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<td>Process</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C) Burden remains</td>
<td></td>
<td>Policy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D) Tooling Tracking / Knowledge</td>
<td></td>
<td>Process</td>
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</tr>
</tbody>
</table>
APPENDIX C – ATTRIBUTES OF CORE COMPETENCIES

Criteria that core competencies must meet: 26

- Essential to long and short-run viability of the firm
- Difficult to imitate and not easily identifiable by competitors
- Unique to the firm
- Combination of skills, resources, and processes
- Sustainable over time
- Necessary to develop the firm’s core products and end offerings
- Necessary to realize the firm’s strategic vision
- Foundational to the firm’s strategic decision, specifically with respect to diversification, downsizing, rationalizing, and strategic partnerships
- Commercially valuable

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APPENDIX D – CONTINUUM OF OUTSOURCING RELATIONSHIP GOVERNANCE STRUCTURES

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27 Blumberg, L. and Miller, J., “How to engage in a strategic outsourcing relationship” Biopharm, Aug 2002
### APPENDIX E – CORE & NON-CORE CLASSIFICATION
**SUMMARY TABLE AND COMMENTS**

<table>
<thead>
<tr>
<th>Process</th>
<th>ECC NA</th>
<th>ECC Europe</th>
<th>HPS Commerical</th>
<th>HPS Industrial</th>
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<th>S&amp;C</th>
<th>FIRE</th>
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<td>Machining - turning/NC/rotary transfer</td>
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<td>100% Visual Inspection</td>
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<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>2) Insert mold</td>
<td>Overmold</td>
<td>Overmold</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Welding</td>
<td>NC</td>
<td>C</td>
<td>C</td>
<td>NC</td>
<td>NC</td>
<td>C</td>
<td>C</td>
<td>NC</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Powder Coating</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Coil winding/potting</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

Blue = Core process by virtue of product/technology or business

Green = Perceived Cycle Time and Cost advantage; special equipment

Yellow = Embedded Process Map, Obsolescence Strategy, Insourse Candidate (ECC Only)
APPENDIX F – SUPPLY MARKET ASSESSMENT RESULTS

All suppliers meet the following:

- Established/Certified QS
- Bilingual Mfg. + Sales
- (In)Direct Export Capability
- Technically Capable (IT, Equip.)
- Tier 1 Customer Base

Asia Pacific:

Stamping - Supplier Distribution
122 Suppliers > 3B USD
Plastic Molding - Supplier Distribution
92 Suppliers > 1.5B USD

Machining - Supplier Distribution
114 Suppliers > 1.1B USD
Mexico:

Stamping - Supplier Distribution
64 Suppliers > 1.8B USD

Plastic Molding - Supplier Distribution
75 Suppliers > 1.1B
Machining - Supplier Distribution

48 suppliers > 190M USD
<table>
<thead>
<tr>
<th>Supplier Name</th>
<th>City</th>
<th>Country</th>
<th>Industries Served</th>
<th>Preferred Standards</th>
<th>Required Criteria</th>
<th>Additional Information</th>
<th>Revenue (USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Micro Precision</td>
<td>Shenzhen</td>
<td>China</td>
<td>Machining</td>
<td>ISO</td>
<td>Yes</td>
<td></td>
<td>$6,000</td>
</tr>
<tr>
<td>2. Micro Metal Manufacturing Ltd</td>
<td>Dongguan</td>
<td>China</td>
<td>Machining</td>
<td>ISO</td>
<td>Yes</td>
<td></td>
<td>$5,000</td>
</tr>
<tr>
<td>3. Micro Pression Hardware Co Ltd</td>
<td>Shenzhen</td>
<td>China</td>
<td>Machining</td>
<td>ISO</td>
<td>Yes</td>
<td></td>
<td>$2,000</td>
</tr>
<tr>
<td>4. Micro Compression</td>
<td>Dongguan</td>
<td>China</td>
<td>Machining</td>
<td>ISO</td>
<td>Yes</td>
<td></td>
<td>$3,000</td>
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<tr>
<td>5. Micro Precision</td>
<td>Shenzhen</td>
<td>China</td>
<td>Machining</td>
<td>ISO</td>
<td>Yes</td>
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<tr>
<td>6. Micro Metal Manufacturing Ltd</td>
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<td>China</td>
<td>Machining</td>
<td>ISO</td>
<td>Yes</td>
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<td>$5,000</td>
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<tr>
<td>7. Micro Pression Hardware Co Ltd</td>
<td>Shenzhen</td>
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<td>ISO</td>
<td>Yes</td>
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<tr>
<td>8. Micro Compression</td>
<td>Dongguan</td>
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<td>Machining</td>
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<td>Yes</td>
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<td>$4,000</td>
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<tr>
<td>9. Micro Precision</td>
<td>Shenzhen</td>
<td>China</td>
<td>Machining</td>
<td>ISO</td>
<td>Yes</td>
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</tr>
<tr>
<td>10. Micro Metal Manufacturing Ltd</td>
<td>Dongguan</td>
<td>China</td>
<td>Machining</td>
<td>ISO</td>
<td>Yes</td>
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<td>$6,000</td>
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<tr>
<td>11. Micro Pression Hardware Co Ltd</td>
<td>Shenzhen</td>
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<td>Machining</td>
<td>ISO</td>
<td>Yes</td>
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</tr>
<tr>
<td>12. Micro Compression</td>
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<td>Machining</td>
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<td></td>
<td>$4,000</td>
</tr>
<tr>
<td>13. Micro Precision</td>
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<td>$5,000</td>
</tr>
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<td>14. Micro Metal Manufacturing Ltd</td>
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<td>China</td>
<td>Machining</td>
<td>ISO</td>
<td>Yes</td>
<td></td>
<td>$6,000</td>
</tr>
</tbody>
</table>
### Overall Supply Base Technical Capability - STAMPING

#### Instructions
- Please indicate in column G whether the emerging region supply market is efficient at producing parts characterized by the descriptors.
- An efficient market is defined by knowledge of at least 5 suppliers providing that type of product.
- Please indicate in column F whether you believe the supply market in your emerging region is competitive by price with other regions.

#### Example:
- US Suppliers may be green for most technical indices, but may be competitive only on high volumes where labor content is low.

#### Summary Comments
- World Market for stamped parts seems strong due to a solid AP market. Mexico appears uncompetitive, and EE is strong with the exception of high complexity - Precision parts, or content that requires significant engineering capability.

#### Table: Technical Capabilities Assessment Example - Stamping, All Regions

<table>
<thead>
<tr>
<th>Index</th>
<th>Size</th>
<th>Complexity</th>
<th>Precision</th>
<th>Volume</th>
<th>Mexico</th>
<th>Pacific</th>
<th>Eastern</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>1</td>
<td>Small</td>
<td>High</td>
<td>High</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>2</td>
<td>Small</td>
<td>High</td>
<td>High</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Efficient (Red, Green, Yellow)
- Competitive (Red, Green, Yellow)
<table>
<thead>
<tr>
<th>GCT Member</th>
<th>Member Function</th>
<th>Inputs</th>
<th>Team Processes</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>ER Commodity Manager</td>
<td>Provide options to better utilize emerging regions</td>
<td>Supply Base Assessments, ER Potential Supply Base, Country Analysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commodity Manager</td>
<td>Highest Spend SBU Commodity Manager leads team / Project Manager Provides SBU specific information / needs</td>
<td>Commodity Volume Data / Positions - Spend by SBU, Commodity, Region, Supplier Performance Metrics - Defect, ER Seeond, Rationalization Current Suppliers &amp; Capability Supplier Development Needs Reourcing + Negotiation History</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supplier Quality Engineers</td>
<td>Support Supplier ID &amp; Support Supplier</td>
<td>Supplier Assessments Supplier Development needs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supplier Development Engineers</td>
<td>Provides manufacturing data</td>
<td>STRAP Transitions/Consolidations Commodity Volume Data - Production (by classification/cluster) Reourcing Plans</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operations Liaison (ACSL)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engineering Liaison</td>
<td>Provides input on new products and technologies</td>
<td>New Product Roadmap</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Team Champion</td>
<td>Strategic Sourcing Director of highest spend SBU</td>
<td>SBG-level strategic alignment Team Accountability</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Outputs**

- Target Supply Base
- Supplier Rationalization Plan
- Supplier Relationship Management
- Supply Base Development Plan
- Sourcing Strategy - Local, Regional, Global
- Multi-Project Deck - Negotiations - Resourceing - NPI - Outsourcing - Supplier Development - Resource Allocation
- Feedback into Project Decks
APPENDIX H – MODELS OF SUPPLIER MANAGEMENT

4-Part Framework
1. Supply Base Management
2. Supplier Development
3. Supplier Integration
4. Supplier Business Integration

Why do Supplier Management?
Lower levels of vertical integration imply increased dependence on suppliers for timely delivery of quality products and services at competitive prices. Ability to compete is impeded by deficiencies in supplier's performance and/or capabilities.

The following pyramid illustrates the growing level of competencies within a firm as its strategic sourcing organization matures.

1.) Supply Base Management

Supply Base Development: A firm's effort to develop a new supply source

- Applicable in targeting a supply base locally/globally
• Involves:
  – Establishing Local/Global Sourcing Strategy (commodity)
  – Locating source of supply
  – Qualifying source of supply
  – Creating a competitive source of supply (single vs. multiple sourcing)
  – May incur Supplier Development Activity

Supply Base Maintenance: A firm’s efforts to maintain performance of existing source of supply as well as supply base manageability

• Involves
  – Establishing Local/Global Sourcing Strategy (commodity)
  – Supply Base Rationalization
  – Establishing supply base/chain performance management systems
    • Regional comparisons, supplier management criteria review

2.) Supplier Development

Supplier Development: A bilateral effort by both the buying and supplying organizations to jointly improve the supplier’s performance and/or capabilities in one or more of the following areas:

  – Cost
  – Quality
  – Delivery
  – Time to Market
  – Technology
  – Environmental Responsibility
  – Managerial Capability
  – Financial Viability

Supplier development should take place early in the supplier management cycle, but is a capability that exists within mature strategic sourcing organizations.

Supplier development is the most basic investment in a supplier, and sets the basis for developing an integrated supply chain that can provide competitive advantage.

The following graph illustrates the supplier maturity curve
Supplier development can be classified as reactive or proactive. In reactive supplier development the buying firm invests to aid the supplier in meeting minimum requirements, and usually focuses on quality. Proactive supplier development involves activities to aid a supplier in delivering ongoing value such as cost-savings.

### Types of Supplier Development

<table>
<thead>
<tr>
<th>Reactive</th>
<th>Proactive</th>
</tr>
</thead>
<tbody>
<tr>
<td>• In response to supply chain deficiency</td>
<td>• Preempts supply chain deficiency</td>
</tr>
<tr>
<td>• Deficiency may impact buying firm</td>
<td>• ROI unknown/unseen &amp; based on perceived gain</td>
</tr>
<tr>
<td>• Impact is quantifiable and derived</td>
<td>• Focus on high performers</td>
</tr>
<tr>
<td>from issue resolution</td>
<td>• Strategic/long-term portfolio perspective</td>
</tr>
<tr>
<td>• Focus on low performers</td>
<td></td>
</tr>
<tr>
<td>• Tactical/immediate</td>
<td></td>
</tr>
</tbody>
</table>

### 3.) Supplier Integration
Supplier Integration: Activities involving both buying and supplying firms to facilitate streamlined business operations

- Quality Systems
- IT – ERP
- Materials Management
  - Consignment
  - VMI
  - Coordinated logistics
- Joint Production Planning (Demand Forecasting + Inventory)
- Shared Business Processes and Best Practice

Although systems are shared, the firm/value chain boundaries remain discrete.

4.) Supplier Business Integration

Supplier Business Integration: Actions/activities with long-term financial impact to both the buying and supplying firm, directed towards creating competitive supply chain advantage

- Co-location
- Integrated Production
- Integrated Product Development
- Multi-tiered purchasing
- IP / Technology Share
- Financial investment / equity positions

Firm / Value Chain Boundaries are blurred.
Supplier Development Model

Increasing Integration

Stage 1: Integrative Development

1. Identify, Assess, and Rationalize the Supply Base
2. Search for Competitive Suppliers
3. Establish Performance Metrics & Assess Suppliers
4. Supply Base Rationalization
5. On-site risk Assessment by Cross-functional Team
6. Problem Solving to Eliminate Supplier Deficiencies (Reactive)
7. Establish open Relationship Through feedback And Information Sharing
8. Systematic Supplier Development
9. Maintain Momentum
10. Supplier Integration In New Product/Process development
11. Establish Performance Improvement In 2nd for suppliers
12. Establish Integrated Supply Network

GOAL: Self-Reliant Supply Base Continuous Improvement
GOAL: Suppliers meet Current production Requirements
GOAL: Pool of Potentially Capable suppliers

Stage 2: Proactive Development

Stage 3: Integrative Development

Honeywell Confidential and Proprietary
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