NOTTINGHAM UNIVERSITY BUSINESS SCHOOL

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WORLD CLASS OPERATION EXPLORATION – HONEYWELL H.O.S AND V.P.D

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Important Notice:

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EXECUTIVE SUMMARY

Six Sigma was introduced to business world by Motorola in 1986; this creative Six Sigma management system incorporates a school of contemporary quality and operation management initiatives. This system defines measures, analyzes, improves and controls variables in manufacturing and business operation process, in order to obtain predictable output with quantification of input variables and to achieve customer satisfaction. The Six Sigma system depends on the commitment from each employee, especially from top management, but is mainly driven by Six Sigma experts – employee certified with Green Belt or Black Belt title. The adaptation to Six Sigma system has created billions of cost reduction and increment of sales per annum to pioneer enterprises such as Motorola, GE and Allied Signal.

Six Sigma emphasizes intensive data collection, causal analysis, parameters quantification, statistics and adoption of a series of scientific tools, which are recognized and upheld in Western economic, academic and business world. Sizable US and UK companies applauds the Six Sigma as a successful business management model backed with a number of qualified tools in logic, mathematic, statistic and systematic science application. To some extent, the Six Sigma becomes quintessence of Western business management philosophy.

In the same period, one MIT MBA thesis coined another governing management model – Lean manufacturing. This model is based on Toyota Total Production System (TPS), featuring the harmony of people and their workplace, smooth flow of manufacturing and business operation, waste elimination in daily activities, empowerment of front line worker to produce product or service faster, better and safer. Lean manufacturing experts advocate methodologies and philosophies popular in the Eastern Asia, such as the Five S (sorting, straighten, shining, standardizing, sustaining), Value Stream Mapping, Kanban Pull, Poka-yoke, etc. Lean manufacturing simplifies everything and manufactures, advocators support that daily activities of every employee will determine the sustaining success of business, and contends that the foundation of Lean manufacturing is ingrained in each employee's attitudes and is rooted in organization culture. The Lean manufacturing system or TPS has created an extraordinary competitive advantage for Toyota.

There are a large number of companies have adopted either Six Sigma or Lean manufacturing in strategic operation management which impactx companies in strategy, resource and operation management in different approaches. We will concentrate on the topic whether the organic integration of both management models in one single enterprise can create impeccable competitive advantage, the realization procedure, the confliction or constraints of these two systems imposed

upon the organization and business development. Therefore, we will research characteristics of Lean and Six Sigma in Honeywell International operation management. The company adopted Six Sigma quality system and introduced Lean model in 1990s. In the last decade the company developed its own Honeywell Operation System (H.O.S) and Velocity Product Development (V.P.D) and claimed these are based on essence from both Six Sigma and Lean.

Honeywell H.O.S is a comprehensive, integrated business approach to drive sustainable performance in safety, quality, delivery, cost, and inventory. It is believed that H.O.S incorporates a broad application of Lean manufacturing and Six Sigma tools against Standardized work, Rapid problem solving, Continuous improvement, Knowledge sharing.

Honeywell promotes V.P.D as the activity of creating new product introduction systems which are highly responsive and flexible to customer demand by eliminating all forms of waste to drive profitable growth and improving new product introduction success rate and cycle time. V.P.D comprises key Six Sigma and Lean methodologies and applications such as Knowledge management, TRIZ, DFSS and 3 View System Engineering.

1.0 Introduction

In the 2008 World economy downturn, Wall Street veteran Leman Brother bust amid of a number of desperate finance and property companies bailout. The credit markets ceased functioning, consumers batten down the hatches and the global economy slows. Uncertainty besieges not only the downturn's depth and duration, but also the future of a global economy.

Simple survival becomes the primary strategy to most managers when confronting a downturn crisis. Some managers, however, realize that a period of uncertainty, with financial and competitive landscapes changing almost overnight, can be the ideal time to achieve important strategic gains. Companies can restructure their supply chains quickly if capital market breakdowns make global sourcing too risky. If the global economy could obsolete a type of business, it's critical to finish all the preparatory work needed to sell it before every company with that kind of unit reaches the same conclusion (2008 Bryan et al.). Douglas Daft, Coca-Cola's chief executive, as head of the company's Asian operations in 1997, he watched a financial storm swept across much of Asia and selected acquisition as key strategy by then. Daft grew Coco-cola business in Asia significantly after the 1997 Asia finance crisis was over (2002 Barton et al.)

Acquisition may not in the option list to other companies, instead they could develop several coherent, multi-pronged strategic action plans, including strategies on how to use less resources to produce product or service exceeding customer expectation, how to inject more 'Green' concept into product or service, how to build up supplier chain efficiency, or how to reengineer operation to be driven with Lean, Benchmark, Velocity or Six Sigma methodologies.

To execute these strategies, companies will go through changes. Changes in a company are critical to help the organization materialize intangible superior strategy to solid finance return and meet stakeholders demands. Former GE CEO Jack Welch often quoted "Control your own destiny or someone else will." It is the failure to change at the appropriate chance that foil even the greatest strategy, furthermore falters the fundamentals of the organization as customer demand, market, technology, politics, society and industry evolve eternally. To change effectively, it requires an ability to foresee the external dynamics of the environments in which the company operates and to alter a company's product, production, marketing, corporate governance, structure, and culture,

Large organizations display considerable inertia while deal with changes. Senior managers possess non-updated, inaccurate information due to unnecessary hierarchy and other factors, their behavior are neither purposive nor strategic, but simply routine. Even some changes of strategic direction are ultimately cosmetic, perhaps merely leading to new mission statements, just degrading into marketing and sales tools. Nevertheless some substantial strategic change has re-shaped the

company and revolt the landscape of the industry. Alfred Sloan invented creative marketing strategy - segmented car market and successfully positioned Buick, Chevron and other brands to designated consumer stratums. Kenneth Lay converted Enron from a regional Gas exploiting company to an ever global giant of energy firm with integrated and high-value added supplier chain.

The last few decades have seen a number of economic and management models addressing strategic operation problem. In 1980s Total Quality Management was mooted as the way forwards, TQM is a management approach for an quality centered organization, depending on the participation of all its members and aiming at long-term success through customer satisfaction. This TQM concept was later absorbed into Six Sigma, Lean and a series of management methodologies.

The 1990s saw the advent of Business Re-engineering and Lean Manufacturing, the former underpins that organization should stop doing what was akin to 'rearranging the chairs on the decks of the Titanic", instead Firms should be transferred to a series of process. The latter emphasizes consistent improvement in day-in and day-out activities initiated by every employee. Entering the new millennium, Globalization, e-Business and Green technology profoundly shaped new strategic operation theory and execution. In 2004 In Search of Excellence, Tom Peter and Bob Waterman pointed out three prevailing misunderstandings on operation and strategy management. Firstly, people and organization are not "rational" in the way that strategy, business, and organization are typically assumed. It is dangerous to force a simplistic and misguided rational model on the business management. "Garbage Can Model" invented by March, Cohen and Olsen might provide alternative explanation on how company, strategy and problems are assimilated. Secondly, most of the management systems that treat people as "factors of production," equalling to machine, material and other ingredients to run business, are de-motivating. It is against the Lean and Six Sigma philosophy. Thirdly, the challenge to Strategic operation is not material, machine and asset management, but these "soft stuff", including shared values, skills, staff, style, system, which are summarized in McKINSEY 7s Framework (2004, Peter et al.).

In current economic background, this management project will focus on corporate strategic operation management, and examine the business impact from Lean, Six Sigma and other operation management initiatives. We will study that Honeywell International instills elements of both Lean and Six Sigma methodologies into its strategic operation management initiatives – H.O.S and V.P.D. The company was one of these pioneers adopting Six Sigma in 1980, and applied Lean manufacturing in production in 1990s. Most remarkably, Honeywell combines Six Sigma, Lean Manufacturing and other sophistic scientific and business management models into Velocity Product Development (V.P.D) and Honeywell Operating System (H.O.S). V.P.D is a series of activities of creating new product introduction systems which are highly responsive and flexible to customer

demand by elimination of all forms of waste to drive profitable growth. H.O.S is a systematic way to manage the Integrated Supply Chain and drive excellence in safety, quality, delivery, cost and inventory.

In Chapter 2, we review relevant academic publication and papers on Organization, Strategy, Decision making, change management, business operation, such as Six Sigma, Business Reengineering Process, Productivity, Lean, Culture factors and other academic management models.

In chapter 3, we will inspect changes of three organizational levels in perspective of company, division and department. In company level, we will review basic principles underneath these two Honeywell business initiatives, examine their structure and elements. In division level, we will observe the process of HOS implementation and scrutinize two case studies – a mature US factory and a Green Field Singapore/Indonesia factory. In department level, to assess the impact of H.O.S and V.P.D to factory floor activities and operation performance, we will zoom into the test engineering department in Singapore/Indonesia division.

In chapter 4 Discussion, we will compare H.O.S and V.P.D. with other relevant academic business models and investigate the impact to the company, division and department. In company level, we evaluate the corporate performance as a result of VPD and HOS, and explore whether the company can overcome the inertia. Under division level we research how the process should be implemented in reality, address the problems encountered and propose solution. In department level, we will look into key issues exposed in test engineering department, and try to find solutions based on H.O.S and V.P.D systems.

In chapter 5 Conclusion, we will revisit these academic viewpoints introduced, re-examine the content of the Honeywell strategic operation model – H.O.S and V.P., probe the effectiveness of the proposals and solutions in company, division and department levels, and the implication to the business world.

Most of Data and information are obtained from sources available to public – Academic publication, theoretical books, business magazine and Internet SharePoint. Some data, tables and diagrams are extracted from production report, intranet, training material or publication of this company after filtering out sensitive business information.

2.0 Literature review

2.1 Organization, Strategy and Decision Making

All organizations operate in competitive environments. Such an environment can be considered in two disparate 'current' and 'future' forms (Braganza, 2001). The 'current' form consists of products and services that already exist, competitors that are identified and whose relative strengths and weaknesses are understood, customer demands are known and supply chain are in place. In the 'future' form, an organization's competitive environment is as unknown as the future itself, companies strive to develop products and services that deliver superior value and delight existing and new customers whose demands become ever more sophisticated. Organizations attempt to revolutionize the very basis of competition that force traditional business relationships to be reinterpreted.

Organizations need strategies that address current problems and envisage future competitive environments. Business strategies that address the current environment are generally based on a consideration of meeting customer needs, securing a strong position in the industry, optimizing financial position, enhancing existing competencies, and developing employees. Business strategies that deal with the shaping of the future environment must set aside the current assumption about the industry, combining imagination and acumen to craft the future sources of competitive advantage in ways that best suit the organization.

The decision process forces organizations to reflect the fundamental of strategy – the pattern of decisions in a company that determines and review the objectives, purposes or goals, producing the primary policies and plans for achieving those goals (Andrews 1997). The process consists of two major components - Formulation and Implementation, the former is the rational process of identifying opportunities in the business environment and determining how the firm can best exploit these; the latter is the administrative process of making the plans operational. It will involve appropriate organizational structures, incentives, information system, co-ordination of subdivided activities, personal leadership etc. the rational Strategy is supported in the Mckinsey /Harvard methodology. Walton adopted rational strategy to convert Wal-Mart from a few unknown Dime shops to a World leading grocery retailer.

The traditional rational strategic decision model follow the logic sequence: Starting from problem analysis, selecting alternative courses of action through SWOT or other managerial tools, analyzing consequence in perspective of feasibility, risk & return, ending at the best option selection. However this type of strategy decision making model is arguable for its bounded rationality,

predictable behaviour, imperfect information, limited processing capacity, assumption of certainty and stability. Mintzberg argue that successful strategies rarely following initial planning, instead they tend to merge and evolve as the organization adjusts to its environment, these strategies follow closely an emergent process featuring consistent tactical alignment of corporate strategy. This type of strategy are built from bottom up, filtering to top executive through the front line practices, rather than the top-down process upheld in Rational strategy approach. The change is typically incremental not revolutionary. Strategy emergence depends on internal politics/relations, feedback and testing, strongly root in organization culture and people.

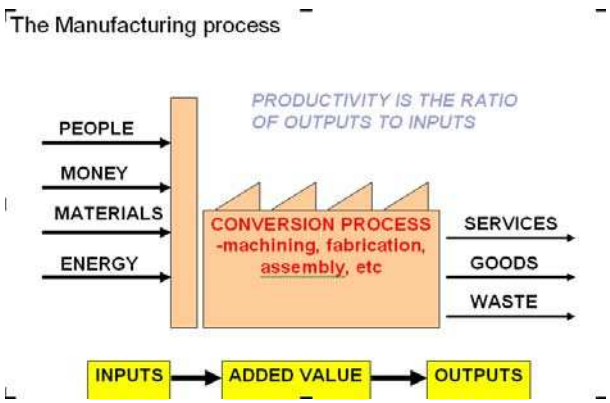
In today's business environment, Emergent strategy calls for a "just in time" approach to strategy setting, risk taking, and resource allocation by senior executives. Managers representing each function group of one company, for example, might have weekly or even daily "all hands" meetings to exchange information, unfold gridlock and make fast operational decisions. Unfreezing from rigid top down strategy process, the emergent strategy process emphasizes developing as many options as possible. As companies prepare for such opportunities, they should also create options to maintain good health under difficult circumstances. Strategic management has been increasingly characterized by emphasis on core competences. Firms are advised to divest unrelated business and return to core business. Moreover, competitive advantage is now increasing seen as a matter of efficiently deploying scare knowledge resources to product market. Much of this change in emphasis has occurred because of the emergence of a unified and rigorous approach to strategy, often called "the resource-based approach" (Foss, 1997).

Another strategy decision making model is Garbage can model (GCM) derived from organizational theory by Cohen, March and Olsen. GCM was developed in reference to ambiguous behaviors which contradict classical rational strategy model. GCM was influenced by the realization of aggregate uncertainty in decision environments, which trigger irrational behaviours response. GCM links organizational decision theory into organization anarchy characterized by problematic preferences, unclear technology and fluid participation. The GCM disconnects problems, solutions and decision makers or participants from each other. Problems are the result of performance gaps or the inability to predict the future. Significant solutions have to be prepared without knowledge of the problems they might have to solve. When organizations are expected to produce behavior that can be called a decision or initiative, choice opportunities arise in these occasions. Organizations tend to produce many "solutions" which are discarded due to a lack of appropriate problems. However problems may eventually arise for which a search of the garbage might yield fitting solutions.

2.2 World Class Operation and Manufacturing strategy

To survive or excel, organizations must execute in the present and adapt to the future. Since both executing and adapting require resources, manager face an unending competition for money, people and time to address the need to perform in the short term and the equally vital need to invest in the long run.

The demands of execution in short run create three deep barriers to adaptability to the future (Eric Beinhocker, 2006). The first barriers is People, people's mindset broadly become more rigid as they experience success and failure, their mentality tend to pick more rules over time, bigger and bigger shocks are needed to shake them up. The second barrier is Structure, an organization structure evolves in response to the problems they have to solve. Complex problems that must be divided into lots of chunks, size and complexity is essential to execute today, however its degrees of freedom to future adaptation drops. The third barrier is Resource, companies use asset, talent, knowledge, brands and reputations to exploit opportunities in current environment, however the same and only pool of resource won't be spared to large extent to explore for long term adaptation.



Exhibition 2.2.1 – Manufacturing process

Manufacturing or operations strategy is viewed as the effective use of manufacturing strengths as a competitive weapon for the achievement of business and corporate goals (Brown et al. 2000). Firstly, Operations strategy can be central to the implementation of an already devised business strategy. Operation role is important in providing 'strategic fit' in focusing efforts and resources so that operation strategy is consistent with business strategy. Secondly, operation strategy can be used in a more proactive approach. Operational capabilities would be viewed as part of the core capabilities / competencies which can be exploited and used to create new opportunities.

Any business consists of multiple processes, a business process means the co-ordination and integration of activities performed in different functions or department to create outputs that are of

value to one or more stakeholders. Coordination implies a set of activities constitute a process when linked explicitly to stakeholder expectations. Integration means intra-functional or inter-departmental operation forms only part of a process rather than be processes in their own right. Processes adding values to stakeholders refer to addressing external or internal stakeholder's expectations.

A world class company understands customer/client needs, empowers line workers to improve production and efficiency, leverages information technology, rationalizes inventory level, strives for zero defects in all processes, postpones customization as late as possible. Toyota doesn't modify its automobile to local needs, it customizes both products and operations to the level of consumer sophistication in each country, thus increase operation complexity, through maximizing creativities since the company have to develop new technologies, new marketing, and new supply chain (Hirotaka et al., 2008).

To achieve world-class operation, a company needs to increase productivities and efficiency Productivity is the amount of output produced relative to the amount of resources in the form of people, time, capital, material that go into the production. Productivity improves when the quantity of output increases relative to the quantity of input. Comparably, efficiency is the value of output relative to the cost of inputs used, efficiency improves when the cost of inputs used is reduced relative the value of output.

People is one of the most important factors in productivity improvement, the value of employee won't depreciate but will appreciate over the time. Productivity gains could be realized by redeploying people through headcount reduction, but not in the form of a layoff. Redeploy freed up resources to support needs elsewhere, which is the fundamental way to achieve productivity improvements for those people oriented organizations.

In the analysis people and productivity, there are a number of themes prevailing in excellent companies (Peters at el. 2004), firstly, the language in people-oriented institutions has a common flavour, such as certain ingrained philosophy "respect the individual", "make people winners," "let them stand out", "treat people as adults". All the language characteristics in the excellent companies are the phrases that upgrade the status of the individual employee, such as Associate (Wal-Mart), Crew Member (McDonald's), Cast member (Disney). It is not a Gimmick people management strategy flown down for the company, but something that employees also need to adapt with. A Toyota executive says that "every single person is the main actor on the stage". When Toyota promotes employees, it doesn't praise them; instead, executives deliver a message along these lines: "Congratulation on your promotion. Many others were within a hair's breadth of being selected. Keep that in mind as you do your job". This is to install humidity in employees by reminding them that their success is due in part to the efforts of equally accomplished colleagues. (Hirotaka, 2008)

Secondly, these people oriented organization is absent of a rigidly followed chain of command, informality is the norm for information exchange, people are not confined in fixed work place, top management is in regular contact with employees at the lowest levels , everyone is typically on a first-name basis. Another trait is less obvious organization structuring and layering. Excessive layering may be the biggest problem of the slow-moving, rigid bureaucracy and military style commands.

Thirdly, information availability is important as the basis for peer comparison which is the basic control mechanism in the excellent companies. Information is simply made available and people respond to it. The prime ingredient in the information-sharing is the non-evaluative nature of the process through an extensive psychological research, “superiors” are not telling “subordinates” what to do, On the other hand, the information is evaluative in that it brings to bear a most potent force – namely, peer pressure. People respond better and more strongly if the information is not blatantly evaluative. Passing the information quietly seems to spur people on to greater effort.

Fourthly, small is productive. The point of smallness is that it induces manageability and, above all, commitment. A manager can understand something that is small and in which one central discipline prevails. Even in organizations that employ hundreds of thousands of people, if the divisions are small enough, or if there are other ways of simulating autonomy, the individuals still counts and stands out.

In 1994 Wickham Skinner offered the idea of establishing ‘plants within a plant’, later the idea was developed into new concept of the focused factory with following characteristics (1990 Harmon et la.):

1. Communication is superb.
2. Management control the factory on the factory floor.
3. A lean administrative staff is located in the main plant.
4. Leaders wear many hats when a business is too small to warranty the hiring of specialist.
5. Factory support service is often provided by operators and assemblers.
6. Office staff is minimal and intimately familiar with factory operation, production and inventory status.
7. Securitized finance and budgeting, new machine is never purchased until current equipment capacities are fully utilized.

Robert Wiggins and Tim Ruefli has stratified a sample of 6,772 companies over 23 years into superior, middle and underperformance, only 5 percent remained in the superior stratum for 10 years or more. To rise and stay in world class, an enterprise need to develop world class operation through a series of business activities such as globalising its integrated supplier chain, off-shoring labour

intensive manufacturing function, IT, HR, customer service and R&D subsidiaries in low cost regions, deploying ERP system over all branch offices worldwide, acquiring and merging with financially or technically healthy industrial players.

These business activities are fundamentals to upgrade to world class operation, but this perspective emphasizes more on size, location, technology, tangible assets. The competitive advantage derived from this type of world class operation may not sustain, could be easily imitated by cash-rich investors or incumbents. The 1980s saw the apotheosis of strategic thinking with the publication of Michael Porter's Competitive Strategy which Porter identified five competitive forces: Suppliers, customers, substitutes, new entrants and rivalry in 1980. Porter's Competitive Advantage in 1985 stated that three generic strategies could be applied to all industries: lowest cost production, differentiated production and focused production. Porter's strategies re-emphasised Skinner's trade–off solution, world-class operation strategies have no optimum, only continuous improvement in all things. However Brown et al. argued that cost, quality and other features are not a trade-off, they must be combined in unique ways to meet strategic goals. Toyota's consistent success is a direct result of its turning operational excellence into a strategic weapon.

2.3 LEAN manufacturing

The concept of Lean manufacturing can be traced back to Japan after the Second World War, when Japanese manufacturers were facing a decline in human and financial resources. The circumstance forced Japanese manufactures to develop a new, low cost manufacturing methodology.

In Lean manufacturing, it requires that instead of being pushed to the market, products are produced according to customer needs with shorter lead time. Lean manufacturing can be seen as a system that focuses on continuously improving processes and is driven by customers, both internally and externally. Typically, the lean manufacturing initiatives consist of a few of tenets:

Quick changeover: To improve the setup operations, a setup analysis is undertaken to record the entire setup operations, process, time and motion involved in each step, then to improve through various reduction techniques.

Kanban systems: The Japanese word Kanban, which translates as "signboard", has become synonymous with demand scheduling. Taiichi Onho developed Kanban to control production between processes and to implement Just in Time (JIT) manufacturing at Toyota manufacturing plants in Japan.

With Kanban scheduling, the operators use visual signals to determine how much they run and when they stop or change over. The Kanban rules also tell the operator what to do when they have problems and who to go to when these problems arise. A well-planned Kanban has visual indicators that allow managers and supervisors to see the schedule status of the line at a glance.

Production process must only produce product to replace the product consumed by its customer and only produce product based on signals sent by its customer. This process allows the efficient transfer of parts from one department to another and automatically put a purchase order for products using minimum inventory levels.

Benefits of Kanban scheduling were summarized by Gross et al. in 2003

- Reduce inventory
- Improve flow
- Places control at the operation level.
- Create visual scheduling and management of the process
- Improve responsiveness to changes in demand
- Minimizes risk of inventory obsolesense
- Increase ability to manage the supply chain.

Workplace organizations system: Lean manufacturing cannot succeed in a disorganized workplace. Poor working conditions lead to wastes that delay production and increase defects. Healthy working condition is essential for efficient production. Many companies use the 5S system, which improves and standardizes the workplace environment for safe and effective manufacturing practices.

Value stream mapping: Value stream mapping can be defined as mapping the production path of a product visually. It is a starting point to help the management recognize waste and identify its causes. This process focuses on the production flow beginning with acquiring raw materials to the final production of the product. VSM helps an organization understand the production flow.

Total Productive maintenance: TPM optimizes the effectiveness of manufacturing equipment. It is team based and involves everyone in each function in the organization. This is achieved through preventive, corrective maintenance. TPM eliminates all accidents, defects and breakdowns.

Cellular manufacturing: Both equipments and workstations are arranged in a sequence to support the flow of materials and components with minimal transport or delay. CM helps produce various products with minimum wastage.

Quality at source: Quality inspection and product rework at any point in the production. Quality at source is done through two systems, Zero Quality Control and Poka-Yoke.

One piece flow: Producing one part correctly all the time so that the company can achieve its goals without unplanned interruptions and lengthy queue times.

Takt time: It refers to linking production to the customer by equalling the production pace with the pace of the actual final sales.

Employee involvement: Lean manufacturing results in changed production methods. Awareness about the changed production systems must begin at the top of the company, cascaded to next level and to the lowest level – shop floor. Employee are fully trained and empowered to accept and implement the changes, quality and continuous improvement.

Kaizen: It is the process of incremental improvements and achieving the goal of eliminating all waste that adds cost without adding value.

2.4 Toyota Production System

Toyota developed various processes such as Just-In-Time, Kanban and Heijunka's Level out the workload, as well as philosophies such as "work like the tortoise, not the hare". "Must be consistent flow, not uneven flow", etc., which collectively came to be known as the 'Toyota Production System'. The TPS target was to minimize the consumption of resources that were not of any value to a product.

TPS, Toyota's Distinctive approach to manufacturing is the basis of the "Lean production". Whilst there are some acknowledged differences.

Toyota focus on profit with systematic cost reduction through TPS in order to realize benefit. Lean tends to de-emphasizes this profit metric and thus become engrossed with these concepts of "flow" or "pull".

Companies overemphasize standard work, VSM, visual management and other tools beyond practical intent when they implement Lean concept in operation. At Toyota, the tools are used to expose particular problems and set up work around to problems but not solution.

Team supervisors and managers are the main focus of training efforts in Toyota since they lead the daily work areas, and they directly affect quality, cost, productivity, safety, and morale of the team environment. TPS is a management technique rather than change agents. In other 'Lean' companies over rely on developing the specialist, overlook the supervisor 'Lean' skill development.

Liker contends that if a company does not understand the culture behind TPS, even though it has the tools and techniques of TPS in place, the real work of implementing Lean has yet begun. The real TPS is about applying the 14 principles of the Toyota Way so that workers can contribute to the improvement of the system of themselves. 'Lean' supervisors and managers encourages, supports and demands co-workers' involvement by working, communicating, resolving issues, and growing together. TPS is a culture more than a set of efficiency and improvement techniques. These 14 TPS principles are divided into 4 categories –Philosophy, Process, People/ Partners and Problem solving that correlate to the four high-level principles - genchi genbutsu (go and see yourself), kaizen, respect and teamwork.

1: Base management decisions on long term, even at the expense of short-term financial goals.

2: Create continuous process flow to bring problems to the surface.

3: Use 'pull' systems to avoid overproduction.

4: Level out the workload (heijunka) –work like a tortoise, not a hare.

5: Build a culture of stopping to fix problems, to get quality right the first time.

6: Standardized tasks are the foundation for continuous improvement and employee empowerment.

7: Use visual control so no problems are hidden.

8: Use only reliable, thoroughly tested technology that serves your people and processes.

9: Grow leaders who thoroughly understand the work, live the philosophy, and teach it to others.

10: Develop exceptional people and teams who follow the company's philosophy.

11: Respect network of partners and suppliers by challenging them and helping them improve.

12: Go and See for yourself to thoroughly understand the situation (genchi genbutsu)

13: Make decision slowly by consensus, thoroughly considering all options; implement decisions rapidly (nemawashi)

14: Become a learning organization through relentless reflection (hansei) and continuous improvement (Kaizen)

Besides upholding the 14 principles, Toyota identifies seven major types of non value added waste (muda).

1. Overproduction, which generates excess inventory, which, in turn, leads to overstaffing and increased storage and transportation costs;
2. Waiting for the next step, tool, parts, etc;

3. Unnecessary transport or conveyance of work in process (WIP);
4. Over processing or incorrect processing due to poor tool and product design;
5. Excess inventory in the form of excess raw material, WIP, or finished goods, causing longer lead times, obsolescence, damaged goods, transportation and storage costs, and delay;
6. Unnecessary movement, such as walking and/or looking for, or stacking parts or tools;
7. Defects that result in repairs, rework, scrap, replacement production, and inspection;

Companies worldwide have tried to transfer TPS on their shop floor and some achieve extraordinary improvement, however results were tentative. Many people ask how the process can be applied to their company and operations. Liker acknowledges the difficulty of understanding the TPS and how to implant its workflow in other technical and service organizations in the same way. He devised 5 steps procedures:

1. Identify who the customer is for the each process as well as the added value the customer wants.
2. Separate the repetitive processes from those that are one-of-a-kind and apply TPS to the repetitive processes.
3. Map the flow to determine value added and non value added.
4. Think creatively about applying the broad principles of the Toyota Way to these processes, using a future-state value stream map.
5. Start implementation and learn, using the PDCA cycle. Then expand implementation to the less repetitive processes.

In-depth learning is difficult for organizations to adapt, develop and sustain. The toughest and most basic challenge is how to create an aligned organization where individuals have the 'Toyota type' DNA and are continually learning together to add value to the customer. Toyota creates confliction to meet this challenge.

When people confront with opposing insights, they can view the problem from different perspective; therefore the solution becomes more practical. Toyota advocates opposite viewpoints within the company, and challenges employees to find solutions by transcending differences rather than resorting to a tradeoff (Hirotaka 2008). The culture of confliction fosters new business innovations that position Toyota ahead of competitors. These innovations are usually achieved through eagerness to test hypotheses and learn from mistakes and successes, employees are encouraged to experiment using strict routines, which is defined in refined Plan-Do-Check-Act (PDCA), the continuous-improvement process used throughout the business world, into the Toyota Business Practices (TBP) process. The eight steps TBP lays out a path for employees to challenge the status quo: clarify the problem; break down the problem; set a target; analyze the root cause; develop

countermeasures; see countermeasures through; monitor both results and processes; and standardize successful process.

2.5 Six Sigma

Six Sigma refers to a process having 6 standard deviations between the process centre and the nearest specification limit. Sigma itself is a term used to refer to standard deviation, which is a measure of variation. Six Sigma was originally developed to improve manufacturing process, subsequently spread to other business process as the goal of Six Sigma is to eliminate defects which will lead to dissatisfaction of customer.

Six Sigma emphasizes those continuous efforts to achieve stable and predictable process results are of vital importance to business success. In GE, the six Sigma process works in following sequence, first, a project is identified. Then, critical-to-quality (CTQs) characteristics are defined. And finally, the six sigma process begins. 1. Measure: Identify the key internal process that influces CTQs and measure the defects generated relative to identified CTQs. 2. Analyze: The objective of this phase is to start to understand why defects are generated. Brainstorming, statistical tools, and so forth are used to identify key variables that cause the defects. 3. Improve: Here the objective is to confirm the key variable and then quantify the effect of these variables on the CTQs, to identify the maximum acceptable ranges of the key variables, to make certain the measurement systems are capable of measuring the variation in the key variables, and modify the process to stay within the acceptable ranges. 4. Control: The objective of this final phase is to ensure that modified process now enables the key variables to stay within the maximum acceptable ranges using tools such as statistical process control (SPC) or simple checklists (Slater, 1999)

2.6 Business Process Reengineering

Michael Hammer invented this influential business management methodology Business Process Reengineering (BPR) in 1990 Harvard Business Review. He urges company fundamentally rethinks and redesigns business process, only invest in value-added activities to achieve dramatic performance improvement in cost, delivery and quality. The new business model seeks radical rather than steady small improvement.

Over years, he published Reengineering the Corporation with James Champy in 1993 which further clarifies the BPR concept. He contends that BRP can not be planned meticulously and be accomplished in small and cautious steps. It’s an all-or-nothing proposition with an uncertain result. At the heart of reengineering is the notion of discontinuous thinking – of recognizing and breaking away from the outdated rules and fundamental assumptions that underlie operations(Hammer 1993).

BPR is one approach for redesigning the way work is done to better support the organization's mission and reduce costs. Reengineering starts with a high-level assessment of the organization's mission, strategic goals, and customer needs. An organization may find that it is operating on questionable assumptions of the wants and needs of its customers. Only after the organization rethinks what it should be doing, then it moves to decide how best to do it.

Within the framework of this basic assessment of mission and goals, reengineering focuses on the organization's business policy, practice and procedures that govern how resources are used to create products and services. In a structure of steps across time and location, a business process can be decomposed into specific activities to be modeled, measured and improved or eliminated. Reengineering identifies, analyzes, and redesigns an organization's core business processes with the aim of achieving dramatic improvements in critical performance measures, such as cost, quality, service, and speed.

2.7 Knowledge management

Knowledge is the human capacity (potential & actual) to make effective decision in complex and uncertain situations. Knowledge is to understand the right decisions based on available information is. Knowledge is different from Datum or Information. Datum refers to facts, numbers or individual entities without context or purpose, while Information is data that has been organized into a meaningful context, concepts or methodologies to aid decision making.

Knowledge Management (KM) is the organizational ability to provide the right information at the right time to make the right business decision and drive financial results. Knowledge is one of the most important assets in a growing organization. Knowledge can take many different forms:

- Facts, beliefs, truths, procedures & laws
- Know what, Know how, Know why
- Judgments & expectations, insights
- Relationships, leverage points
- Intuition & feelings
- Meaning and sense making
- Knowing who knows what

There are two types of knowledge – tacit and explicit knowledge. Tacit Knowledge is the undocumented expertise within an organization which may be essential to its effective operation. It is what people carry in their minds, but difficult to access, articulate and share. Sharing what people

know with others makes Tacit Knowledge useful with a few proven approaches, such as talking to people trusted, articulating into Explicit Knowledge, participating in Communities of Practice, capturing and documenting Lessons Learned, Collaborating with others. Explicit Knowledge is knowledge that has been or can be articulated, codified, and stored in certain media. It is what is documented, can easily be shared and modified.

To enables continuous productivity increase, knowledge needs to be captured, filtered, transferred, shared and organized for future reuse, otherwise it will be re-created or re-discovered at considerable cost. A business entity needs to follow up a recommended Knowledge Management Framework, identify what worked and what didn't, organize knowledge in proper context to access, formalize knowledge capture and reuse process.

To capture knowledge, conduct Learn During event during a business activity to quickly catch desired or undesirable observations, conduct Learn After event right after a business activity or a major milestone. Learn During and Learn After documents should be part of the business process.

Knowledge distillation transforms Learn During and Learn After documents into reusable knowledge assets, Learn During and Learn After documents may lack important contextual, background and applicability information, which are necessary for effective future reuse of knowledge. Knowledge distillation process produces a knowledge asset belonging to the functional or product line of Knowledge archive. The knowledge asset is the main vehicle for knowledge reuse.

Knowledge transfer involves transferring Tacit & Explicit technical domain knowledge between two or more individuals. Knowledge transfer is the primary human interaction model to develop local and global technical expertise. Knowledge transfer process attempts to identify and document critical organizational knowledge, transfer both Tacit and Explicit Knowledge from experts to learners in order to increase the breath and depth of critical expertise.

Knowledge sharing involves exchanging Tacit and Explicit information through electronic repositories, collaboration sites such as wikis and SharePoint, contact list of experts, work or autonomous communities, targeted communication via phone, email, IM, tagging such as wikis and blogs. Only shared knowledge can create lasting business value.

Reusing knowledge: Only knowledge that is found and understood in the context of the current situation can be reused to generate business value. Knowledge that is buried so deep that function teams cannot find has no business value; Document found but could not understand or relate to the current situation has no business value. The Learn Before process leverages expertise of the peers and information contained in knowledge assets to help planning new Business Activities, only knowledge that is found and understood in the context of the current situation can be reused to generate business value. What does knowledge reuse can start? KM experts believe it depends on

20% technology, 80% process and cultural change, which are shaped by behavior of the leaders, organization value, informal structure of organization, mistakes handled, behavior rewarded and punished and information captured, distilled and shared.

2.8 Culture impact

Fons Trompenaars in 1993 discovered four primary organizational traits depending on organizations are decentralized or centralized, informal or formal.

The United States and the United Kingdom companies are relatively decentralized and formal. Goals and processes are naturally aligned. It is acceptable or encouraged to celebrate the achievement of individuals, and the result is a very receptive environment for new business initiatives, this category of culture promotes improving process performance based on competent individuals driving results.

In German speaking countries, where organizations are centralized. Raising the capabilities of a work team, department or business unit is the focus. the power of any new business initiatives is in improving everyone's effectiveness by creating a culture of process discipline.

In Latin Europe countries (similar with most developing countries in Asia, Africa and Latin America), running business is more driven by relationship and hierarchy, senior managers to lead change of new business model to internalize and personalize.

In Nordic countries, an organization is a vehicle for individual to realize his/her full potential in pursuing new business initiatives which will frees up the capacity of individuals to grow and learn.

Depending on the culture background, an MNC must be adaptive in implementing new business initiative across region. Generating genuine enthusiasm means putting it in the right organizational context and communicating accordingly.

New strategic or world class operation initiatives such as BRP, Lean or Six Sigma are universally applicable, though how one communicates and implements should differ depending on the national culture. Companies operating in different regions should be aware of these implementation approaches. Leadership team should develop an explicit strategy to introduce BRP, Lean or Six Sigma as vehicles for strategic organizational change. Years of experience have shown that the major implementation challenges are people-related. Therefore, it is important to bear in mind these points:

- Set up steering team and select who is involved and how to motivate them to change.
- Incorporate "soft skills training" (e.g., facilitation and change management).

- Train teams as well as individuals to build the capability of groups and their commitment to implement and sustain improvements.
- Be aware that teams from different countries will progress at different rates.

3.0 H.O.S and VPD

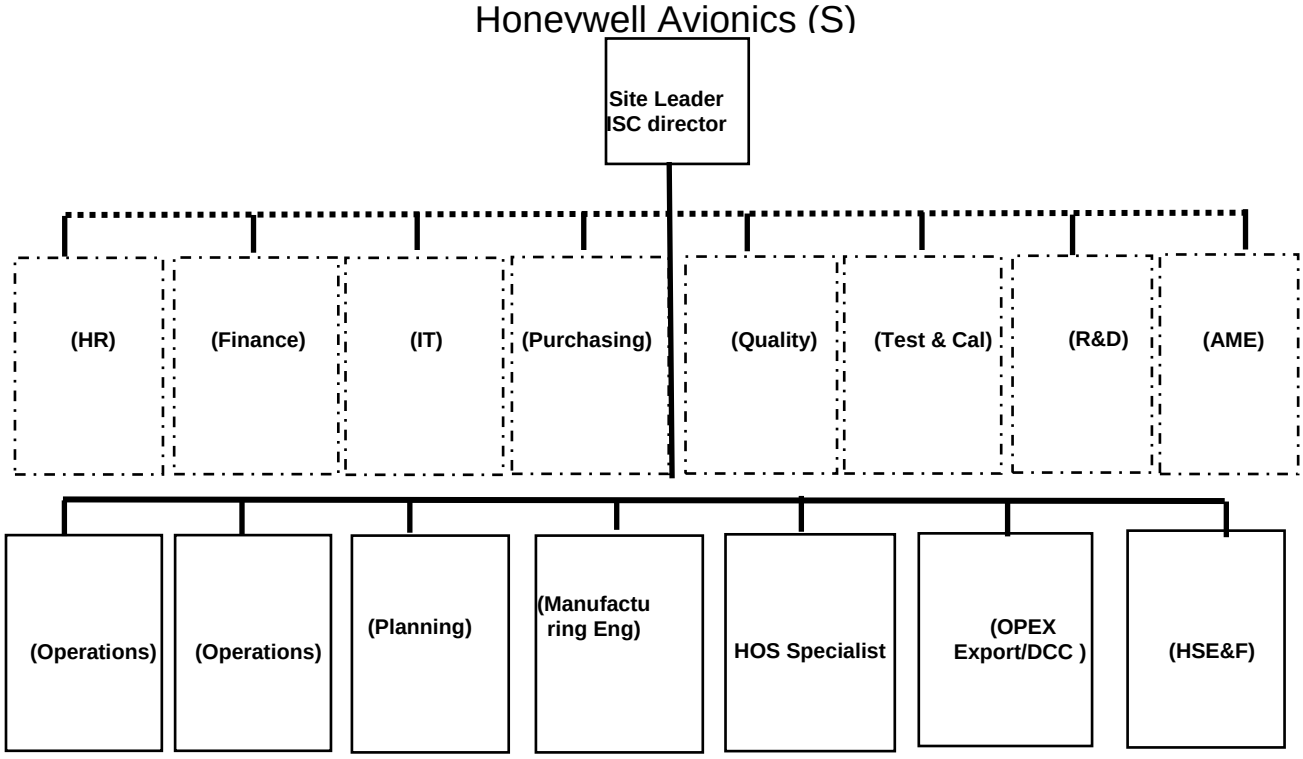
3.1 The company, division and department

Honeywell International is a diversified technology and manufacturing conglomerate which generates billions sales annually by 100,000 employees over 100 countries. In the previous century, Honeywell have undergone rounds of merge and acquisition, expanded business into aerospace products and services, control, sensing and security technologies for buildings, homes and industry, turbochargers, automotive products, specialty chemicals, electronic and advanced materials, and process technology for refining and petrochemicals.

Honeywell adopted the Six Sigma in his quality control in early 1990, production operation and supply chain management. However, despite being a pioneering member of Six Sigma in the industry, Honeywell has been losing its competitive advantage in the last decade. Competitors are embracing similar operating systems and getting better results. Executives of the company observe slowing improvement rates in safety, quality, delivery, inventory turns and overall supply chain management. There is no corporate wide systematic manufacturing or operation strategy, standardized management methodology, performance appraisal and knowledge sharing mechanism.

Honeywell Avionics Singapore (HAS) is one of Honeywell business divisions. HAS split operation in two regions, accommodating management, engineering, finance, procurement, production control departments in a Singapore facility (Exhibition 3.1.2), managing production, quality, logistics and production support functions in a Green Field Indonesian Batam factory. HAS produces a broad categories of Avionics products including flight recorder, communication and navigation radio, fight safety transponder and flight data management units, and sells Boeing, Airbus, Embraer, Raytheon, Bombardier and other customers.

HAS owns a committed and closely knitted leadership team which has grown rapidly in last two years. It establishes a unique competitive position by combining management expertise, engineering skill and logistics advantage in Singapore with low cost labour, facility and other resources in Indonesia. A complete supply chain network in the burgeoning south and east Asia region is taking shape. Integration with corporate system is on track with the introduction of SAP and new operation system such as H.O.S.

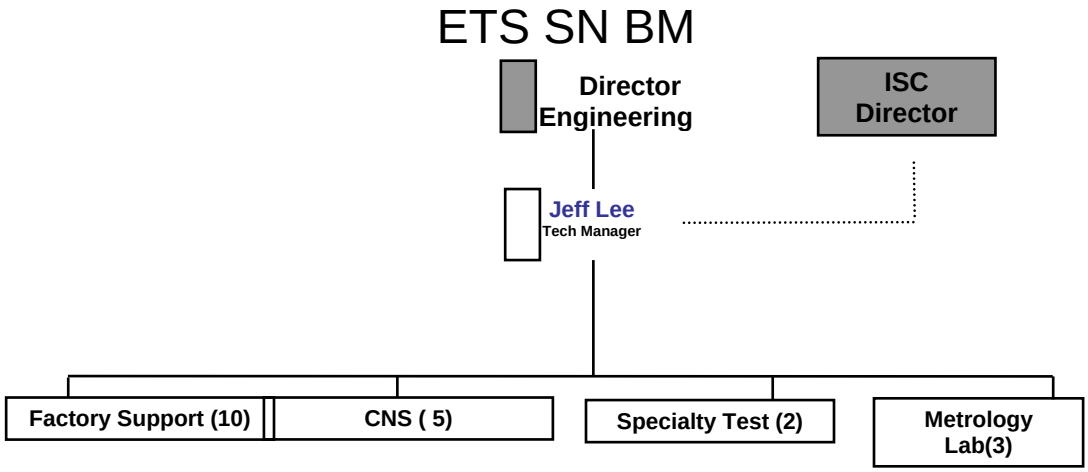


Exhibition 3.1.1 HAS Organization

In spite of the rosy side, the HAS management team lacks long term strategic planning and mentality. Production faces consistent material shortage and defect issues. Fluctuating demands disrupt production planning and inventory control. HAS depends on high cost Singapore engineers to conduct engineering projects and technical support without full deployment of Indonesian engineers due to skill gaps. The biggest challenge is the product portfolio, a large portion of products falls into 'sunset' category, parts or components are at the end of life and are difficult to control the quality, resulting endless production issue which overstretches HAS employee and pushes up employee turnover.

Jeff Lee is the Engineering Test Service (ETS) department manager. He and 20 ETS technical staff are responsible for 2,000 test equipments running in Indonesia Batam factory and Singapore design centre. ETS consists of 4 functional teams, Factory Equipment Support, CNS Test, Specialty Test and Metrology Test engineering (Exhibition 3.1.2). Factory support team resolves test equipment failures in real time, performs test equipments maintenance, fabricates hardware and facilitates new equipments introduction. The CNS team focuses on equipment upgrade and develop new devices. The Specialty Test team is responsible for environmental equipment maintenance and provide product qualification solution. Metrology Laboratory calibrates and repairs test equipments, and engage Original Equipment Manufacturer or a third party on instruments procurement and

maintenance. The customer of Factory Support and Metrology Lab teams is the Production, the customer of CNS and Specialty test is R&D which requires test equipments to support new product development, qualification and manufacturing.



Exhibition 3.1.2 HAS ETS Department Organization

Jeff's department was set up in less than three years, engineers and technician are young and willing to meet goals and achieve result. However the approved capital budget amount is outweighed with the actual obsolete equipment replacement demand. Majority of team members are enthusiastic but less competent in Avionics engineering. The ETS staffs burn out in enduring daily fire fightings triggered by customers. Language, communication and mentality barriers impede the HAS ETS team to collaborate with overseas teams in global projects. Detailed analysis is in exhibition 3.1.3.

Strength	Weakness
• Growing competency in General aviation, regional and production line test equipment re-engineering and maintenance, • Strong ETS international support. • Merging ETS process for development, maintenance and logistic management. • Job satisfaction measured by zero turnover. • Strong Teamwork, Job commitment and willingness to succeed. • 24/7 ETS hotline, flexible working hour.	• 90% ETS associates less than 2 year service • Significant technical gap compared to ETS international team. • Insufficient metrology in house calibration capacity. • Small spare equipment pool. • Limited across border tasks / projects management expertise • No Preventive maintenance expertise

Opportunities	Threats
• Green field • VPD and HOS enablers • Synergy from internal team collaboration	• Job substitute by ETS international team. • Talent to be hunted by competitors. • Obsolete test equipments impact on OTD • Uneven work load across functional teams. • Consistent in fire-fighting mode.

Exhibition 3.1.3 ETS SWOT

3.2 H.O.S

Leveraging its Six Sigma heritage, Honeywell has undertaken a major business transformation signalled with the implementation of H.O.S. starting from 2006. The company believes it is a breakthrough in operations - not just steady improvement, but a serious weapon to destroy competitors and shake up industries. The Honeywell Operating System (H.O.S) is a systematic way to manage the Integrated Supply Chain and drive results in five key areas, Safety, Quality, Delivery, Cost and Inventory. Organization is designed to enable and perpetuate through supportive structure, high performance management systems and specific leadership roles and responsibilities.

H.O.S makes use of Six Sigma plus tools and Lean methodologies to meet customer expectation through pursuing excellence in following process:

- 5S (cleanliness and order)
- Visual management
- Kaizen – continuous improvement
- Standardized work
- Process design for flow and quality
- Knowledge sharing
- Leaders own and drive the process
- Daily management system

H.O.S. is deployed through a 5 phased Standard Implementation Framework (SIF) that standardizes deployment method includes training and specifications, phase gate exit within date line.

Phase 1	Phase 2	Phase 3	Phase 4	Phase 5

Operational Readiness	Baseline and Planning	Learning Through Observation	Work Process Improvement	Knowledge Sharing
4-6 weeks	6-12 weeks	6-12 weeks	24-30 weeks	3-5 weeks

Exhibition 3.2.1 H.O.S SIF

SIF Phase 1 – Organizational Readiness: this step establishes the pre-implementation activities that a site needs to take prior to full scale HOS deployment. The organization establishes the deployment process, forms the Site Steering Team, engages labor partners, and provides site communications. Line leaders attend "Essentials for Supervision" and managers attend "Leadership Skills Workshop" training. The site improve Six Sigma (Lean) capability to engage in the foundational activities, clean and order all work areas – 5S, and establish visual management to enable rapid problem solving and basic flow.

Communication is critical to promote accountability and commitment from executive to operator level. Key strategies and topics to address tabulated in Exhibition 3.2.2 establish effectiveness through creating & sustaining H.O.S. awareness, persuading employees to take action, informing key audiences of changes, successes, best known methods and lessons learned, and demonstrating HOS Leadership.

S/N	Key Strategies	Topics to Address
1		Why HOS ? Why do we need HOS ? What do we want to achieve out of HOS?
	Engage Employees for a case for change	Why HOS now ?
2	Increasing employee knowledge & understanding on HOS	What is HOS ?
3	Clarify responsibilities, involvement, accountability, rewards	What does it mean to me ? What is required of me ? What's in it for me.
4	Communicate timelines / Progress	How are we doing ? How am I doing ? How or when do I get started ?
5	Share best practices / learnings / success	How can we improve ? What else are others doing that we are not ?
6	Develop 2 way communication opportunities	How can I provide feedback ? How can I ask questions ?
7	Involve all leaders in communication	Are leaders commitment to this ? Do my bosses understand the scope of HOS deployment ? What do they think ?
8	Resources available	Where can I get help ? From where ? From whom ? Any Training - classroom / OJT available ?

Exhibition 3.2.2 Communication strategy in SIF Phase 1

SIF Phase 2 – Baseline and Planning: This phase focuses on grasping the current state situation, outlines the desired future state condition, and develops plans to close the gap in a prioritized fashion. Some activities include assessing Site Maturity, Baseline Analysis, Organizational Baseline and Design, Hoshin Planning, building Leadership Commitment.

Maturity assessment: Honeywell defines the Standard Implementation Framework (SIF) to ensure consistency and quality of H.O.S adoption across sites. The Integrated Supply Chain (ISC) Site leadership owns and drives the implementation. Steering committee consists of site management

team trained by global H.O.S. coach. These managers plan and execute the H.O.S tools and process in each function group. The site hires H.O.S. experts who provide domain coaching and mentoring to enable everyone learn and implement simultaneously.

Honeywell selects SIF that measures the success of H.O.S at each site, assess the maturity before the site progresses to advanced phase. This assessment tool will also be utilized to share best practice, set expectation for the site, and demonstrate the improvement data through periodic reviews of this tool.

When the site is capable of the 2nd level of H.O.S., all production team leaders and supervisors can evaluate adjacent cell/area level activities, identify leading practice, and develop a strategy to continuously improve and cross train. HR leads the organizational design maturity level assessment in all areas, focuses on consistency and knowledge sharing, and organizes site assessment teams. H.O.S. Leader and Specialist lead the maturity evaluation in all areas, coach assessment teams to achieve the target. Managers participate assessment in own areas/cells, drive department scope continuous improvement. Plant director participates the steering committee and evaluate key area, drives site level continues improvement, and defines metric target. A scorecard in Exhibition 3.2.3 is based on the results from H.O.S sites exceeding Phase 2.

Performance \ Site	F port	S Bend	B Rouge	Atsa
Customer Defects (PPM) reduction	95%	66%	34%	70%
Customer Delivery increase - point	8	3	3	8
Inventory Turns improvement	9%	30%	15%	Meeting goals
Safety		30%	9%	Zero Incident rate
Labor Cost / Standard Hour reduction	10%	Conversion cost 6% decrease	Conversion cost meets goals	27%

Exhibition 3.2.3 H.O.S phase 1 and 2 Scorecard

SIF Phase 3 – Learning through Observation: the employees including site leader learn how to sharpen observation skills to identify waste, solve problems with urgency, and establish a visual management system. The site should start Leadership Coaching, employ Visual Management, implement Rapid Problem Solving approach, integrate HSE Management, and create Value Stream Mapping (VSM).

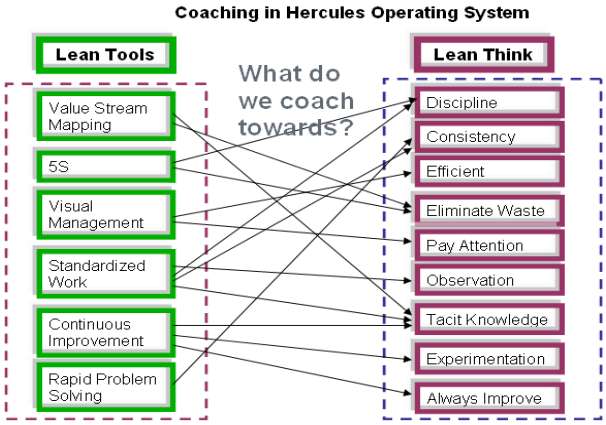
Coaching is an important management tool to motivate colleagues by building strong relationships, create an environment where they perform to their highest potential, enable colleagues understand what questions to ask to drive continuous improvement, develop a passion to drive for perfection and eliminate waste. Coaching can create a safety culture where the entire workforce and not just the HSE experts proactively control HSE risks. It can build and sustain true standardized

work, develop new capabilities, and eliminate the traditional paradigm that improvements are event based rather then process based.

Coaches do not develop people, they equip people to develop themselves, help others to understand a problem and develop an answer, help individuals be the best they can. Usually, Coaches focus on reinforce good behavior, redirect problem behavior and explore inexplicit behavior.

A simple Coaching Process includes understand coaching techniques and core concepts, identify opportunities, build relationships, establish coaching practice and learn from the process. The site needs to reinforce process and techniques to improve coaching effectiveness.

A coach should adhere to following principles of effective Coaching, being aware of self, setting the tone, using personal versus positional Influence, building commitment, providing client support, skills of effective coaching, asking effective coaching questions, active listening, providing constructive feedback, dealing with resistance, being a change agent. A coaching tools list in Exhibition 3.2.4.



Exhibition 3.2.4 Coaching in H.O.S

SIF Phase 4 – Work Process Improvement: Organizations hone the system of Process Design for Flow, finalize Material replenishment – Pull & Heijunka and Standardized Work, establish leadership roles and responsibilities, fully deploy Total Productive Maintenance (TPM).

Total Production Maintenance (TPM) will improve Safety, customer escaping prevention, one piece flow and inventories with predictable and reliable equipment supporting manufacturing and engineering product testing. TPM is a teamwork approach to solve issues related to equipment performance and continuously improve the return of capital investment by elimination of the six losses – equipment failures, set-up and configuration, idle/minor stops, reduced speed, defects in process and reduced yield.

TMP program can be categorized in 4 tiers. First, the leaders will organize the resources and prioritize activities based on the result of Value Stream Mapping (VSM), severity of failures and

business impact. The main metrics are Mean time between failure (MTBF) and Mean time to repair (MTTR).

Second, TPM work group will activate the autonomous maintenance or operator maintenance. A test operator interacts with equipments on daily basis, he/she is in a better position to determine the status of the equipment and provide solution within specification.

Third, it develops preventive or predictive maintenance where the work group monitors and predicts with fairly high accuracy the need for replacement of parts in equipments, records machine condition, and alerts a potential failure mode condition.

The 4th level is Equipment Kaizen in day to day basis by lifting constrains on set up, configuration, speed and accuracy.

SIF Phase 5 – Knowledge Sharing: The work teams learn techniques to move away from a purely event driven mentality to continuous incremental improvements mindset or Kaizen, extending into boarder supplier chain.

Knowledge Sharing consists of various activities and this sharing can be drawn from many types of experiences. The basic premise around Knowledge Sharing is to share and apply the learning to other areas, to make Knowledge Sharing organized, not individualized. 4 key components of Knowledge sharing are identified.

1. S.I.F and H.O.S specification Knowledge.
2. Best practice and Lesson learned.
3. H.O.S Maturity Assessment Tool for Knowledge Sharing.
4. External Benchmarking for Knowledge.

3.3 H.O.S in Phoenix IM&C

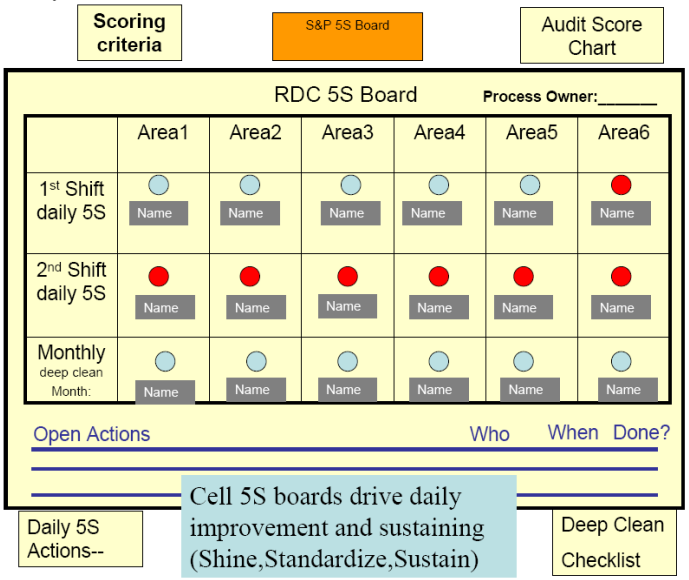
By end of 2008, HAS leadership team have completed phase I training. One common question raised is the effectiveness of H.O.S. on other sites, therefore Jeff and other managers was introduced Phoenix IM&C.

On November 1st, 2007 the Phoenix Honeywell business division Industrial Measurement and Control (IM&C) is in Phase 4 of the SIF. To reach this stage, IM&C have built up HOS training and driven improvements in material systems and operator productivity. They also put a great deal of focus on creating a management system capable of sustaining an organization that learns and improves every day.

The primary H.O.S. driver is Layered Leadership Standard Work (LLSW). Before the Management team implements LLSW, there is no consistent day to day actions, employees lose direction as the instructions from supervisor are spontaneous and in disorder, the operation is driven by single and isolated events, there is no basis on which to improve. The management team struggles to hold the initial gains after improving the process, communication is missing or confusion. New managers tend to shock the system, creating instability and affect the organizational commitment to customers. Relationships between leaders at all levels not clearly defined. There is no check and balance to ensure standard work is followed. Daily accountability is unclear. LLSW provides the opportunities to drive a standard process designed for efficiency, accountability and continuous improvement. LLSW is the glue that ensures new processes sustain and are continuously challenged. Critical processes are embedded in the appropriate leader's standard work and monitored at the appropriate frequency.

The second H.O.S. driver is to measure and assess 5S achievement in 4 levels for daily improvements and sustainable gains. **Level 1:** Needed and unneeded items are mixed through the workplace. Items are randomly placed or located through the workplace / area. Workplace areas are dirty, disorganized and key items NOT marked or identified. Workplace agreements are not posted, developed, or being followed. **Level 2:** Necessary and unnecessary items have been identified. Those items NOT needed have been removed from the workplace / area. Needed items are outlined. Designated locations have been established and marked for needed items Workplace areas and machines or equipments are cleaned on a regular basis. Cleaning is part of everyday work. **Level 3:** Processes are in place to maintain documented standards for Sort, Store, and Shine. Ownership of standards embedded into leader's standard work. Standards are followed daily and 5S is continuously sustained. **Level 4:** Achieved Level 3 for three consecutive months. First step was to develop and post factory standards, workplace agreements then train the workforce. Area Managers will create and maintain a shared drive for the 5S score cards. Plant leader is responsible for maintaining 5S factory standards with following procedures.

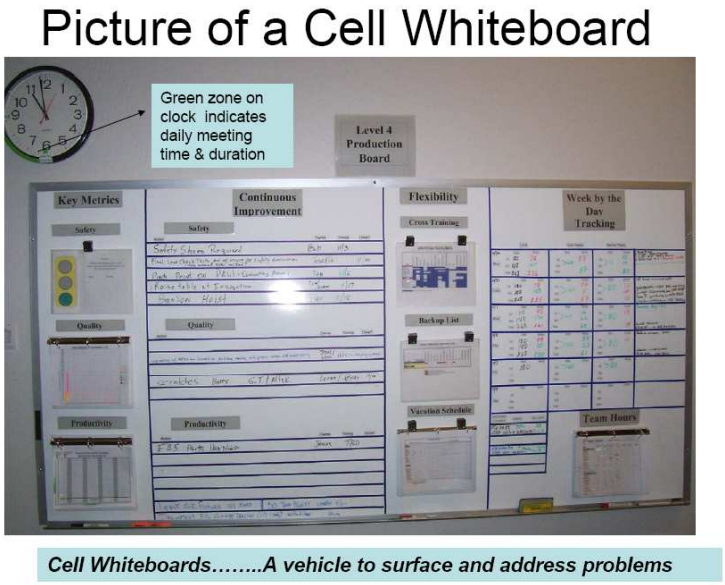
1. Complete the 5S scorecards quarterly, posting them on the factory boards before the end of the second fiscal week.
2. Ensure cell teams are following the standard work: cell 5S board.
3. Review 5S progress with teams on a quarterly basis after or during the audit



Exhibition 3.3.1 – Level 4 Cell 5S Board in IM&C

IM&C H.O.S implements 5S visual management - audit charts are updated quarterly by area manager (by end of second fiscal week), 5S actions are listed at the bottom of the board on separate sheets. Daily/Monthly actions are listed separately. The process owner, typically the area team leader or designee is identified on the board. This person is responsible for updating the actions.

The third H.O.S driver to IM&C is Rapid Response, visual controls are monitored throughout the day and issues are addressed by the team immediately. Major issues such as a line down condition are elevated using an ANDON process that is clearly visible and drives rapid response from support people that may or may not be in the immediate area.



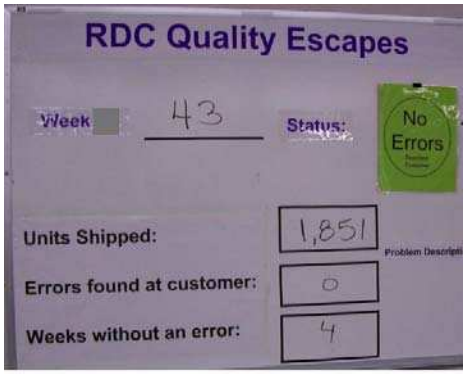
Exhibition 3.3.2 – Daily Cell meeting whiteboard in IM&C

Daily Accountability Meetings (Exhibition 3.3.2) is one popular H.O.S tool that IM&C implement, a standard whiteboard process was introduced in every cell to bring the team together and make problems visible. The key metrics tracked daily are: Safety, Output, Productivity and Quality. Improvements/opportunities are made visual with owners and due dates, team Flexibility (cross training) and attendance is visible, Parts issues are also visible with actions and owners.

To drive Safety and HSE system, safety related hazards are posted in the cell. A process is in place to maintain area binders that summarize the hazards in the area. Each specific operation also notes the hazard in the standard word document.

Quality Escapes - A visual process for bringing attention to customer quality escapes is in place. The intent is to make customer returns visible and to build a sense of accountability and pride in having 0 returns. Visual display is flipped from green to red if the area is responsible for a customer quality escape. Every week area managers attend a quality meeting that reviews customer returns. After the meeting the visual board is updated by the managers (Exhibition 3.3.3), if there are no returns, the board is updated to reflect another week without issues (visual stays green); if there are returns, the returned amount is recorded with a description of the error. The visual sign is flipped to red for 1 week and the "weeks without a problem" also drops to zero.

The PPM database is maintained on all returns per standard practice. After completion of the root cause analysis report, the Quality Engineer will have the final approval and file the form in the IM&C customer escapes root cause analysis binder. The issue will also be closed in the PPM database, the Quality Engineer tracks open actions via the PPM database. Managers responsible for the returns are assigned an action to complete a root cause analysis report. The accountability for updating this board is embedded in the leaders' standard work.



Exhibition 3.3.3 – Quality whiteboard in IM&C

Within the IM&C factory there are multiple visual management processes all tied together through Layered Leadership standard work, which consists of mainly in team Leader and manager layers. In team leader's layer, they will update the cell 5S board, update metrics on cell daily meeting whiteboard and drive action accordingly, calculate productivity daily using productivity calculator and plot on the graph on the whiteboard. In Manager's layer, managers will ensure 5S process is driven daily and perform quarterly audits, verify Team Leader standard work daily. They will review metrics daily via daily accountability process, ensure actions are being driven to completion. Managers will update the quality escapes board weekly and drive completion of problem solving form on all returns

The H.O.S fuels improvements in shop floor, office and the operation of IM&C, remarked by hundreds of successful incremental process improvements stories.

3.4 V.P.D

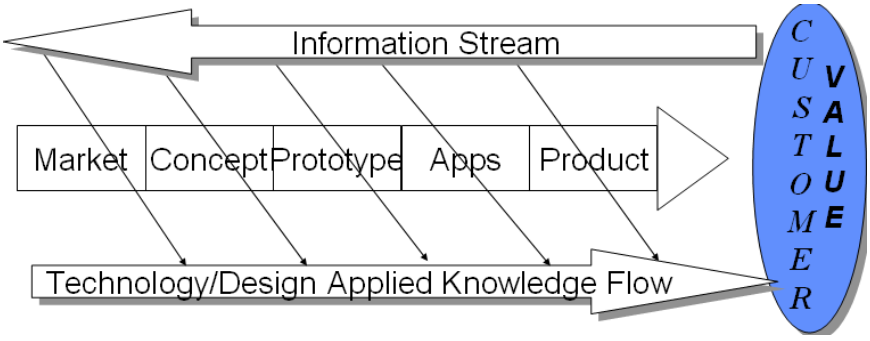
Leadership Standard Work, Visual management and a series of H.O.S. activities practised in Phoenix IM&C division operation, will help HAS and ETS re-orientate factory operation to be process-driven rather than event driven. However, H.O.S may not be the appropriate answer to ETS CNS and Specialty test teams that are devoted to equipment development and re-engineering. ETS needs to look into another Honeywell business initiative Velocity Product Development (V.P.D). V.P.D is a series of activities of creating new product introduction systems which are highly responsive and flexible to customer demand by elimination of all forms of waste to drive profitable growth by improving new product introduction success rate and cycle time.

V.P.D consists of Knowledge management, Design for Six Sigma, 3 View System Engineering, Honeywell Teamwork Management Process, TRIZ cognition / creativities methodology and Lean development. There is no stringent guideline or framework on the implementation sequence, most V.P.D elements are launched in parallel when engineering projects roll out. The fuzzy framework of V.P.D demonstrates the resilience in engineering and innovation activities, the core of V.P.D embodies these following traits.

First, it specifies value in the eyes of the customer. The fundamental of value is customers are willing to pay for the utilization or performance of product or service. Customers pay for the difference between outputs to original input in terms of new concept, stringent specification or realized function. All these benefits should be unleashed at the first time when customers start to utilize the product or service. Value added activity is an activity that changes the application, function, performance of technology knowledge or information to meet customer requirements. Non-

Value added activity is all other activities that take time or resources or does not satisfy customer requirements, such projects waiting while another project is being worked, project waiting to start, e-mailing circulation from one individual to another without prompt action, screening information before analysis, waiting for test information, transport parts / WIP in between production cells.

Second, V.P.D identifies value stream and eliminates waste. Value stream (Exhibition 3.4.1) collect, analyze the information from customers, industries and institutions and apply in the form of product or service to customers.



Exhibition 3.4.1 - Value Stream

In V.P.D., 8 area of waste are highlighted based on TPS in Exhibition 3.4.2.

Area of Waste:	**What they are:**
Defects	Missed Requirement, drawing errors
Overproduction	Design new subsystem every design
Transportation	Chasing approvals, data hand-offs
Waiting	No work order, customer approval
Inventory	Data in 5 places, projects waiting
Motion	Manual data or multiple data entry
Processing (Too Much)	Features not required, redesigns
Underutilized Creativity	Not using individuals capabilities, Not incorporating improvements

Exhibition 3.4.2 – 8 V.P.D wastes

On top of 7 wastes defines in TPS, Honeywell applies known techniques and systematic methodologies to eliminate or reduce them significantly in V.P.D. An excerpt from waste reduction tool matrix is listed in Exhibition 3.4.3.

Waste	Cause(s)	Project/ Pipeline Management	Hercules Team Mgmt Process	3 Views Systems Engineering	Decision Centric	Knowledge Mgmt Wikis	Economic Models	Risk Reduction Methods (Set-Based, Iterative,	Risk Reduction (Design Space)	DFSS Integration	Capacity Mgmt & Balancing	Reuse	Standard Work
High Product Cost	New Components Every Design							X	X	X			
	Poor Manuf Capability							X	X	X			
	Many Changes in Production												
	Unneeded features			X			X					X	
Project/People Waiting	Missing Information	X									X		
	Missing Resources	X									X		
	Working other Projects			X	X	X							
High NRE Cost	Redesigning Common Items							X					X
	New way of doing ever time							X					X
	Rework & Excess Iterations												
	Developing unneeded features			X	X		X		X	X		X	
Excess Planning	Poor Requirements												
	Too Many Projects												
	Unfocused Process	X	X	X			X				X		X
Rework & Excess Iterations	Poor Requirements				X			X	X				
	Changes from other groups				X			X	X				
	Poor/Missing Information												
	Validation Failures			X		X	X			X			

Exhibition 3.4.3 – Waste Reduction Tools

Third, V.P.D makes value flow at pull of the customer. This V.P.D principle requires Honeywell only release people, design tools, funding into the technology/design program when the market has demand determined by Voice of Customers, specifications, regulations. V.P.D aligns marketing, design and production along the value stream, applying knowledge and resource to what manufacturers have capacity to process. In the past, the tendency is to sells the best of Honeywell technology regardless it is valued or not by customers and to design a product beyond manufacturers' capability.

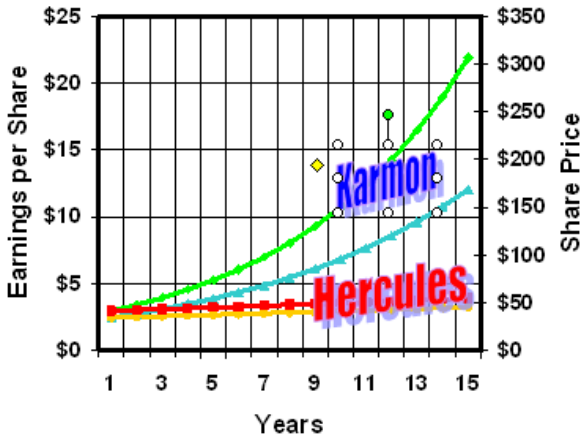
Fourth, V.P.D involves and empowers employees. Without employee involvement, V.P.D won't make it through. There are several properties of empowerment. 1. An organization learns how to manage employee's expectations, understand what they expectation, enable them to act on the initial step, keep the communication channel open to involve everyone, synchronize both management and employee to stand on the same board. 2. An organization builds commitment from all levels of staff, it may undergo roughly three phases (exhibition 3.4.4), the management should watch out both on-track and off-track activities.

Three Phases	**Things on-track**	**Things off-track**
Preparation, Awareness phase	Initial Contact with Targets of Change, Awareness of Need to change	Confusion
Acceptance phase	Understand personal consequence, positive perception agree to proceed	Negative perception, Decision not to attempt/support/ installation;
Commitment Phase	Installation, Adaptation, Institutionalization, Internalization	Change aborted after initial installation, change aborted after extensive installation

Exhibition 3.4.4 – Stages of building employees commitment

3. It balances tools and manages consequences. To move the employee and organization from status quo to a desired state, positive or negative consequence illustration will motivate an individual to move away from the status quo. The availability of a resource/ tool/process/skill will make employee able to perform in the desired state. Setting up steering team with all stakeholders gives this powerful credibility, whilst management could help organize engineering employee councils and change management panel. 4. It specifies roles of sponsor, customer, advocate, target, influent leader and change agent to help expedite the V.P.D adaptation. The sponsor sanctions the change, he has two key roles: 1) fund/resource the change and 2) apply positive and negative consequences to ensure appropriate behaviour of those required to change. The customers use final product/service, their input defines the scope of work. An advocate wants to achieve the change, but cannot fulfil the two key roles of the sponsor. Target is an individual or group who must change for the change to be successful. Change Agent helps the sponsor make the change happen. Influence leader has informal power and influence – He/She can help influence others if they are committed to the change.

In the Fifth trait, V.P.D should continue in pursuit of perfection. An astounding stock performance comparison with Honeywell and its competitor Karmon explains the importance of Continuous improvement in Exhibition 3.4.5. Karmon has implemented V.P.D like business / engineering process methodology years ago, its new product development time decreases from 4 years to 1.5 years, productivity improvement reports minimum 15% per year. While Honeywell owns the best products in every product line, but productivity gains is 5% per year.



Exhibition 3.4.5 – Stock performance VPD organization vs non-VPD organization

3.4.1 V.P.D Knowledge management

To start a successful knowledge management initiative, personalize knowledge management by choosing and implementing personal process and knowledge repository; Perform knowledge

management assessment in team and factory level; Identify what the most valuable knowledge is and where that knowledge is; Create process flow, skills, expertise, experience knowledge map; Develop knowledge capture, distillation, organization, categorization, sharing and reuse process; Develop electronic repositories and person-to-person knowledge sharing strategies around this process.

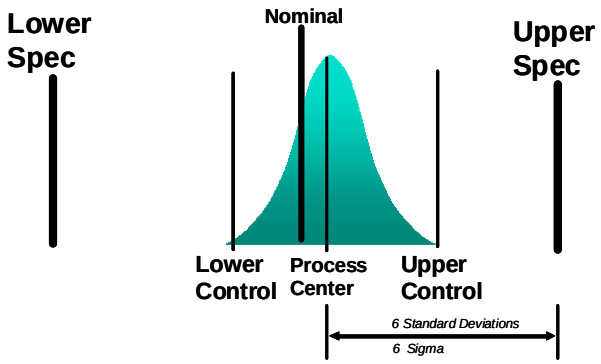
The mentoring process is one of important link from expert to learner in knowledge transfer, Honeywell V.P.D split mentoring in four phases:

1. Mentoring Selection and project plan, function teams perform Learn Before event to avoid known mistakes and reuse best practices, identify skill and technology gaps, identify experts and learners.
2. Mentoring project chartering, team members obtain agreement to work together with defined roles and responsibilities.
3. Ongoing mentoring, experts and learner conduct mentoring sessions and document transferred knowledge.
4. Mentoring closure/assessment, function teams perform Learn After event, assess effectiveness of the process, and suggest ideas for improvement.

A learning organization should avoid two common failures in knowledge management: Too much focus on technology, Not enough focus on leadership and employee behavioral changes, Arian Ward from Hughes Space & Communications claims “The idea is not to create an encyclopedia of everything that everybody knows, but to keep track of people who ‘know the recipe’, and nurture the technology and culture that will get them talking”.

3.4.2 Design for Six Sigma

Design for Six Sigma (DFSS) is a systematic methodology to reduce and manage variation in the product design process so all customer expectations can be met and so the product can be produced at 6σ quality levels.



Exhibition 3.4.6 – Six Sigma

The DFSS concept helps understand the implications of design decisions in a world where variation is everywhere. Design for Six Sigma provides a framework in which employees to think and design with tools to help learn more about the impact of variation on designs. Quality function deployment (QFD) is one of many DFSS elements, QFD transforms user demands into design quality and deploy methods for achieving the design quality into subsystems, component parts, and specific elements of the manufacturing process. QFD establishes development priorities for functional offering requirements with targets and measurement systems, it designs manufacturing to deliver product.

A number of other Six Sigma tools are applied in various business processes, such as applying Normal Distributions to analyze Yield, Root Sum Squared Analysis, Partial Differential Method, Monte Carlo Simulation Method, Gage R&R Control Charts, Measurement System Evaluation, Statistical Estimation in form of Confidence Intervals, Hypothesis Testing, Design Scorecard - Risk Management tool, DOE – Full Factorial Experiments, DOM, Linear Regression, Weibull Life Models, and Critical to Quality (CTQ) through graphical presentation of quantitative Variable Data by observing data Centre, Spread, Shape and Over Time,

3.4.3 V.P.D 3 view System engineering

3 view system engineering (3VSE) is a design centric methodology based upon industry standards and application of Lean principles, using graphical based design artifacts in order to minimize time/effort to obtain a collective team understanding of the user needs and system design to provide the context for requirements and to aide program planning and technical decision making.

The 3VSE consists of the operational view, the functional view and the architectural view. The operational view identifies operational, programmatic, business, regulatory requirements and measures of effectiveness & performance, it defines what customers want, what the need to accomplish, system boundaries, Constraints in term of operation, development, business, political environment. The functional view develops functional Model - function, control, data flow, and derives and allocates performance requirements to functions. The architectural view identifies components and subsystems, allocates functions and performance requirements to components and subsystems.

The 3VSE focuses on the production of a system design that meets user and system requirements. It captures and manages user vs. system requirements separately. It creates graphics first, text second when depicting artifacts of a system design.

3.4.4 TRIZ

Genrich Altshuller created the *Teoriya Resheniya Izobreatatelskikh Zadatch* (Theory of Solving Inventive Problems) in English called the Theory of Inventive Problem Solving (TIPS). TRIZ is a systematic discipline for delivering offerings with unique value for the market and the business. Discipline means techniques, approaches, tools and algorithms specific to a field of science or engineering. TRIZ emphasizes skills to solve problems and confidence to handle Problems, plus willingness to raise the bar and striving for elegant solutions.

Innovative product and service are based on several factors, identifying & characterizing markets, choosing features and requirements, creating, simplifying, fixing and implementing. However innovation may incur cost of low differentiation in choosing features and requirements, cost of value to customer in simplifying and cost of legacy problems in fixing.

Product and service usually consist of a number of properties, which are correlated with different conditions. Under certain conditions, one or several properties must occur. Each property must be segregated from the other. It must be property A when condition A happens or it must be property B when condition B happens, For example, it must be hot when at high altitude, or it must be cold when at low altitude. If these conditions can be separated in time, properties should be separated in time. If these conditions additively build up or decrease to evolve into opposite conditions, properties should be separated gradually. If each condition exists in separate entities, the properties should be separated in space. Properties of a product and service can be further separated in term of hierarchy, contradiction, appearance, perspective, response to field and substitution.

TRIZ promotes process centric methodology and contends products are also processes. It is a model centric system with equations, analyzing relationship of attributes to results. TRIZ is function centric and always show why objects are required and how they interact. Most importantly it is also attributes centric, correlating what attributes cause which consequence, generating higher levels of causal analysis to reveal many attributes that cause the problem, exposing how the problem progresses in time, contradictions in other context and alternative problems emerge.

3.4.4 V.P.D in ACBG

In 2006, there was growing pressure from competitors and customers of Automation and Control business group (ACBG) to deliver new zeolite catalysts. These catalysts are used by the petrochemical industry to produce diesel fuel, gasoline, and other chemical products. To meet the demand, the Catalyst, Adsorbents and Specialties business needed to commercialize as many as three new zeolites each year. Over the past decade it had taken, on average, more than three years to achieve one commercialization. ACBG needs a stronger product development process to stay at the top of the market, maximize revenue, and reduce costs to the business.

Before V.P.D was applied on new zeolite catalysts development, plants were trying to produce materials using ingredients and methods that could not be duplicated broadly. A new standardized Designs of Experiments incorporating these process improvements is used in every new product introduction at ACBG. The zeolite catalysts development in V.P.D context changed the way people worked within the business. As a result, three new zeolite materials have been brought to market quickly and successfully, raking in the initial revenue of $5 million. ACBG is now positioned to deliver at least three new zeolites per year for the next four to five years. The product development cycle for these materials was reduced from three years to about one.

Velocity Product Development is deployed throughout ACBG, reducing cycle times and helping the group to release more than 300 new products in 2007, up 46 percent from 2006. The gas detection division introduced a new carbon monoxide detector two months ahead of schedule, and the security division shortened time between product prototyping and market release by 23 percent, imposing a significant advantage in seasonal-selling programs. The group conducted more than 40 innovation workshops in 2007, filling the pipeline with new product ideas for years to come.

4.0 Discussion

4.1 Changes Challenge

Sustaining successful operational change is difficult to a MNC such as Honeywell. Business division are scattered in separated geographic sites throughout the world, varying drastically in number of employees, employee skill sets, process maturity, supply chain ecology, products or services, customer expectation, competition severity and social culture. These factors impose obstacles to design and execute operation innovation programs.

Trying to mitigate these big challenges, many companies resort to straightforward technical solutions rather than tackle the comprehensive organizational issues. Companies either make significant investments to hire experts or train internal staff to apply analytical Lean and Six Sigma tool kits on operational problems. Consequently, the tools and experts help diagnose operational performance almost immediately and a lots of short term operation improving achieved. When some companies overly reply on experts, rush to implement the tool kit without ensuring that their employees—including managers—are prepared to work and lead in new and different ways, In such cases, "burn out" and even distrust may set in, and efficiency gains vaporize as these experts move on to other projects. Overlooking these comprehensive organizational issues, however, drastically lowers any initiative's chance of success. Usually these initiative successes do not materialize the company's main objectives.

In one Honeywell aerospace factory, management wanted to decrease the inventory. One H.O.S expert, assigned to run this initiative, he worked out an inventory reduction process and began conducting kaizen projects. In the beginning, the new process drove down the inventory when the inventory topic was ranked top in operation meeting agenda, every department followed the process and make efforts to reach assigned target. But after management moved their attention to material problem, the inventory reduction process was not vigorously followed, the inventory climbed up again and issue lingered.

In another lesson learned from a Honeywell automation and control division. Initially H.O.S weren't adequately communicated by senior managers who defined it as another impetuous program. The H.O.S experts focused on what they could achieve—primarily easy wins, including technical changes to redesign assembly processes and to improve the effectiveness of certain machines. In retrospect, these changes, while broadly useful, did little to help meet growing demand for the product. Meanwhile, some of the company's salespeople, long frustrated with what they saw as the shortcomings of the operations group, began circumventing the production-scheduling system in

order to speed their own products through the queue. That undercut many of the efficiency gains the experts managed to create. The result, in fact, was chaos: line workers later showed executives a schedule indicating that one machine, chosen at random, was to perform 250 hours of work during an 8-hour shift. This revelation spurred the executives to refocus the program, investigate the organizational factors behind the difficulties, and ultimately identify much more far-reaching solutions—starting with an effort to get sales and operations to collaborate in setting production priorities and to work together on a daily basis.

4.2 Changes Desired

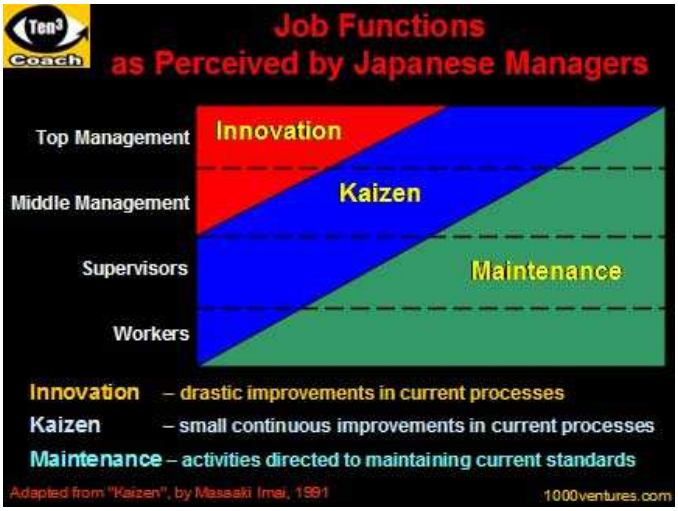
To sustain the organizational change, companies should consider structured planning and implementation, people management, continuous productivity improvement and performance assessment alignment.

Structured planning and implementation: When companies implement continuous improvement in a more coordinated approach, they can achieve sustainable results. The key is to start within a small number of business units and reach their business objectives, which in essence creating the blueprint to be replicated throughout the company. This approach focuses management's attention on the program and thereby helps ensure that its elements, such as technical changes and training, are sequenced properly to avoid confusing employees.

Of course, some elements of an operation innovation program must be instituted across divisions; a single production line, for example, shouldn't have its own performance-management system. By taking a more coordinated approach to implement, senior executives can concentrate on these across board initiatives, which could be a new IT system or compensation scheme, or even special career paths for employees who leave their line positions to assist in company-wide scaling activities over many months. With this fashion of initiatives serving as the mortar holding together the building blocks of the program, top companies minimize the chances that poor timing or unanticipated events will force employees to work in the firefighting mode in extended period.

A global IT services company took this type of approach when it first scaled up its pilot effort, choosing to focus on all operational activities associated with serving an important customer. To ramp up the program quickly, not to jeopardize the results by overextending the company's people, senior executives used this first expansion of the pilot as a training ground for the leaders of subsequent ones, the line managers and Lean-team members who would run the second and third waves were included in the first wave. This "pull forward" approach, supported by a project team at the corporate center to ensure consistency, helped the company extend the initiative to more than 100

global customer accounts in just 18 months. In addition to improving customer satisfaction significantly, the company substantially lowered its labor costs and raised labor productivity by more than 40 percent **(**Corbett et al. 2008).



Exhibition 4.2.1 – Maintenance, Kaizen and Innovation

People management: Employee can't change if managers don't, managers must act as role models for the behaviours and mindsets of employee working in their department. Managers need to change mindsets of providing immediate solution in daily operation issues, instead they should coach their staff using these opportunities. Managers should build clear performance appraisal system, make it transparent in department and communicate periodically to staff through candid dialogue. Manager should keep inspiring employees and recognizing the laudable result of frontline workers, who will be empowered and be proactive in meeting customer expectation in dynamic environment. Senior managers should keep aligning across boundary processes, maximizing the added value from each functional team in value chain. Senior managers should utilize visual management to demonstrate the importance of continuous improvement and making leadership standard work a habit. Leaders have to infuse meaningfulness of organizational mission or vision into day to day work when employees have difficulties to link daily operation to bigger picture of the organization, so the vision and mission is tangible to everyone.

Japanese managers function mainly in two area: maintenance, and improvement (Kotelnikov, 2008). The objective of the maintenance function is to maintain current technological, managerial, and operating standards. Under the maintenance function, the management must first establish policies, rules, directives and standard operating procedures (SOPs) and ensure that everybody follows SOP, which is achieved through a combination of discipline and human resource

development measures. The improvement function is aimed at improving current standards. Under the improvement function, management works continuously towards revising the current standards, once they have been mastered, and establishing higher ones. Improvement can be segregated in innovation and Kaizen. Innovation involves a drastic improvement in the existing process and requires large investments. Kaizen signifies small improvements as a result of coordinated continuous efforts by all employees.

Employee empowerment is pivotal in Kaizen. The suggestion system is an integral part of an established management system that aims at involving employees in Kaizen. The number of worker's suggestions is regarded as an important criterion in reviewing the performance of the worker's supervisor and the manager of the supervisor. The Japanese management encourages employees to generate a great number of suggestions and works hard to consider and implement these suggestions, often incorporating them into the overall Kaizen strategy. Management also gives due recognition to employee's efforts for improvement. For example, Quality control (QC) circle is a small group that voluntarily performs quality-control activities in the workplace. QC circles can be viewed as a group-oriented suggestion system for making improvements. Building on a network of QC circle, Total quality control (TQC) involves everyone in the organization and is aimed at improvement of managerial performance at all levels.

In Hewlett Packard Herrenberg factory, there is no factory QA department, one person from each department is assigned to spend 15% time on quality issues. Rather than committing workers to a fixed 40-hours weekly contract, flexible labour option for 160 hours distributed over a month. The contract was devised in close collaboration with the worker’s council. The most skilled workers can work everywhere in the plant, while the least skilled are dedicated to a limited number of tasks and work centre. The skill level and flexibility of the workers determine remuneration.

Performance assessment alignment: Two common denominators are used in manufacturing as the basis for control and performance measurement (Terry 1990). The first is money, at the corporate level, forecast activity levels, performance measures, levels of investment and similar activities use the money base. The second common denominator is the time base on which manufacturing principally works in term of product mix and volume, capacity, efficiency, utilization and productivity are all normally measured by time.

A financial control system tends to be designed to meet the needs of accountants, thus many financial control systems seek to trace actual expenditure to points of authorization and compare it to planned expenditure. These evaluation procedures create major problems for a manufacturing company seeking to update its technology in response to order-winning criteria. The order-winning criteria may be one of two types: product oriented or process oriented. Existing financial control

systems tend not to provide management with a realistic basis for analysis against these criteria. Financial control system must meet the needs of investment evaluation process, it must link the investment decision to product life cycle, working capital and infrastructure requirement, reduce or reshape non-value activities, provide performance related financial information.

Regarding the second denominator, in factories recognized for improved productivity, manufacturing processes are changed form individual stand-alone operations to directly linked operations, and products are passed directly from one operation to another. In a traditional factory, if one operator leaves the process, it could potentially have the effect of stopping the entire process. But in highly productive operations, the assembly and machining lines have been so designed that one operator can step out of the line and the remaining crew will automatically adjust and compensate. In large factories of long flow processes, the most common method of sustaining productivity is to maintain a pool of workers in excess of normal requirements. To control cost, the absolute number of worker may not be high, instead multiple-job-skill capacity is required to each worker. Continuous reduction of costs, improved products and product features, and reliability hold the promise of an incredible increase in the quality of life (Harman et al.).

Continuous productivity improvement: HAS Batam factory produces a rich diversified but low volume products, one of the productivity impact is the frequent setup operation – calibrations, switching of tools or dies, equipment warm-up ahead of full functioning, production routing reloading. To tackle this problem, Shigeo invents the Single-Minute Exchange of Die (SMED) System, a theory and techniques for performing setup operations in fewer than 10 minutes.

Shigeo discovered that setup operation were of two fundamentally different types: Internal setup (IED), such as mounting or removing dies that can be performed only when a machine is stopped. External setup (OED), such as transporting old dies to storage or conveying new dies to the machine, can be conducted while a machine is in operation.

In traditional setup operations, internal and external set up are mixed. First step of setup improvement is to separate Internal and External Setup, If factories treat as much of the setup operation as possible as external setup, the time needed for internal setup can be cut 30%-50%. Next to convert Internal to External Setup, including re-examining operations to see whether any steps are wrongly assumed to be internal, or finding ways to convert these steps to external setup. In last stage, factories must make a concerted effort to streamline each elemental internal and external setup operation. At every stage, however, setup improvements can be realized.

4.3 H.O.S & V.P.D paradigms

Honeywell Operation System and Velocity Product Development – two strategic operation initiatives manifest the fundamentals from BPR, Six Sigma and Lean. H.O.S represents re-designed operation processes, overhauls value-added manufacturing operation, creates standardized procedures/processes, maximizes operational performance and drives continuous improvements in manufacturing. V.P.D renovates the product / service life time management process, integrates manufacturing, engineering and marketing, shortens new product introduction cycle time and reduces development and maintenance cost.

Process-Oriented vs. result-Oriented thinking exposes the fundamental difference between Six Sigma and Lean. Kaizen as the cornerstone of Lean philosophy concentrates on improving the process; while Six Sigma targets to control business output within 6σ. H.O.S builds on Six Sigma foundation and inherits Kaizen element from Lean, evolving from tool kit to integrated business system (Exhibition 4.3.1).

Six Sigma	H.O.S
Tool Based	System Based
Experts lead the process	Leaders own the process – coach teams
Project focused improvement	Continuous improvement (Kaizen)
Informal best practice sharing	Institutionalized knowledge sharing

Exhibition 4.3.1 – Six Sigma vs. H.O.S

On the other hand, V.D.P constructs on Lean conception, converting its success in manufacturing to engineering operation (Exhibition 4.3.2).

	Manufacturing	**Engineering**
The "Thing"	Product	Changes in Process VOC, Reqs, Specs, etc.
Machines	Equipment	Critical Resources Software, People, Test
People	Line Operators	Individuals from multiple functions
Information	In Procedures	Developing and Changing through Learning
Material	Piece Parts	Information (Concepts, Specs, Drawings, STRAP, AOP, etc.) Piece Parts,
Flows	Product Build	Multiple flows by stakeholder occurring in parallel
Standard Work	Step by Step	Set of rules with Procedure any order criticality

Exhibition 4.3.2 – Lean Manufacture and Engineering in V.P.D

The H.O.S SIF is a concerted sequence of events involving all functional units. Usually H.O.S steering committee launches a pilot project to one production line in a large plant, as the project of

this size is small enough to manage effectively yet large enough to generate enthusiasm and organizational energy that help sustain large-scale change.

In H.O.S, production line supervisors spend most of their time on shop floors, observe processes in action and coach employees on improvement. In addition, the site nourishes a culture where employees are involved and engaged in business operation, and everyone is capable and willing to learn from one another.

In H.O.S, work is designed and simplified to enable visual management, major issues and progress are visualized in easy to reach medium. H.O.S operation standardizes all repetitive works, which forms the basis for continuous improvement. In most circumstances, problems are designed to be fixed as they occur – and stay fixed through disciplined process, instituted knowledge and shared best practices. Leaders not only coach, mentor and promote H.O.S concept to employees, but execute and own process improvement, the H.O.S ownership is embedded in leadership standard work.

Over years, most operational-improvement efforts are driven by black belts, Lean experts and other change agents, who spur new ideas and champion continuous improvement projects. Honeywell used to support this pattern of improvement change because it was easier than involved complete leadership. Some executives argue that line managers should focus instead on day-to-day concerns, as shop floor deadline has to be fulfilled and many of front line leaders lack the skills to direct large scale initiatives.

Profound changes in strategic or world class operation methodology such as H.O.S and V.P.D require all employees—from the board room to the shop floor—to think and work differently. Companies that use only experts to concert change programs may achieve success in less painstaking route. Somehow, outsourcing the responsibility of initiatives to experts, these companies often miss significant opportunities in long run. Moreover, once the low-hanging fruit is gone, such efforts often lose steam as employees slip into old habits; experts may convey the new language or technical tools but rarely desire to neither change behaviour permanently, nor can these experts build the organizational capabilities that permanent change requires. **(**Corbett et al. 2008).

In spite of orchestrated preparation, the development of H.O.S and V.P.D in most of Honeywell divisions encounters resistance when it advance to higher stage. All employees have to spend substantial time to attend training and brainstorm the new processes to comply with new business initiatives. However they still need to meet delivery commitment and performance metrics inked in previous year, management teams are in dilemma to balance short term site performance and adaptation of H.O.S and V.P.D. There is more pressure to Green Field sites, which struggle to learn domain knowledge of newly transitioned product and the process from mature sites, the ‘sudden’

introduction of another operation system disoriented and demoralized the Green filed sites to some extent.

Hirotaka points out companies need to embrace contradictions as the norm. They have to invest time and resources to create such kind of culture. Companies should carefully not to stick to processes and practice the past successes have generated, but overcome them by trying to reach new markets or by tacking fresh challenges such as H.O.S or V.P.D. Furthermore, companies should develop routines to resolve contradictions. Toyota uses a number of tools such as the A3 reporting system, and the widely known ask-why-five-times routine to orchestrate sparks generated from contradict. Companies should encourage people to voice contrary opinions. Top managements must be open to criticism and hearing opposing viewpoints.

H.O.S has now covered 50% of manufacturing cost base. The company cautiously exercise the deployment based on the lesson learned in Green Field sites. The benefit is the sustainable platform setup for consistent improvement, such as substantial reduction of dependency of plants performance on the calibre of the plant manager. It does not downplay the importance of plant manager, but it does mean that improvements stay improved, and everyone in the plant plays a substantial role. H.O.S improvements across implemented sites by 2007 is listed below

Quality Improvement 90%
On-Time Delivery 20%
Cost Reduction 15%
Inventory Reduction 20%
Safety Improvement 30%

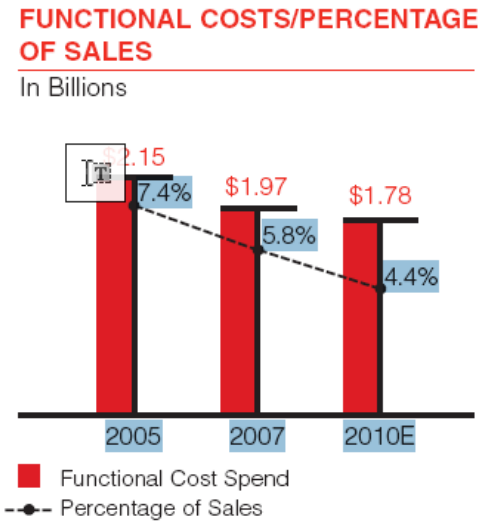
Jim Homer was the Engineering director in one Honeywell Avionics business division in USA. Leveraging on V.P.D, He changed processes to improve new product introductions by developing a common platform for Honeywell flight display products.

Previously, each display was customized to the specific requirements of each customer, adding significant time and cost. Jim worked with senior leaders in Marketing & Product Management, Manufacturing, Engineering and the Aerospace business units to develop a common platform for all future flight displays. This platform reused concept, enabled by utilizing a common commercial graphics processor and common tools and architectures, reduced design cycle times by 50 percent. It also reduced the cost per display from 17 to 37 percent depending on the configuration.

Transportation engineering group has implemented Velocity Product Development™ process, Its Turbo Technologies division reduced cycle time by 10 percent on new product introductions in

2007. This group also introduced a new design method that uses advanced simulation tools to analyze the lifetime reliability of transportation products.

Aerospace Engineering reduced cycle times by as much as 50 percent by deploying and executing a common graphics processor strategy derived from 3 view System Engineering and TRIZ from V.P.D which enabled more than $30 million of revenue in Business & General Aviation alone. Honeywell observes overall costs percentage in total sales drops consistently when H.O.S and V.P.D started since 2005.



Exhibition 4.3.3 – cost reduction with Honeywell H.O.S and V.P.D

4.4 H.O.S and V.P.D deployment

Supported by HOS specialists, HAS managers has formed steering committee consisting site leaders and every department head and conducted H.O.S SIF phase 1 and 2 maturity assessment, they are introduced to Leadership Standard Work, change management and coaching. Kaizen process started for critical items. In team leader level, staffs have completed H.O.S Overview training, Supply Chain Baseline Workshop, Strategy Deployment and Organizational Design with future action. In operator level, daily tier meeting is conducted, 5S activities are carried out daily, and line associate participate systematic cross-function training.

In Kaizen process, management team develops Recreation & Recognition program to recognize contributions from employee on safety, team work, productivity improvement on quarterly Kaizen day. Steering committee share Kaizen practice and update the latest development in a web server accessible to all employees, who could learn that Kaizen is categorized into 17 categories (e.g. Safety, Quality, etc..). At production floor, each line visualize Kaizen achievement on visual board. A form of special Kaizen activity - Focus Improvement Event (FIE) is created to engage employees to

improve work flow and processes on identified focus areas that influence on cross function performance. In one case, the HSE team implements a colourful 5S labeling / taping standard as a safety and 5S Kaizen. They introduce Yellow Tape into main aisle ways, put on Red Tape around Hazardous Emergency Equipment, Flammable containers, Combustible Material Containers, place Black Tape at Caution and Keep Clear areas, paint White Tape around General Equipment, and demarcate material locations with Blue Tape.

Inevitably the steering committee faces seemingly unrealistic timelines to inject the H.O.S into the HAS culture. They found inconsistence of Coaching skill & Leadership Standard Work implementation from managers. They have to translate a large amount of training materials into local language, maneuver tight budget to conduct mandatory H.O.S training, integrate the premier H.O.S metrics into personal performance appraisal process.

HAS managers believes H.O.S not only drives results, but enables sustained breakthrough results by referencing to other sites. The new site objectives driven by H.O.S initiatives are tabulated in Exhibition 4.4.1.

Metric	Improvement Rates
Safety	Enabling the path to World Class performance
Quality	Targeting 2.5x the historical improvement rate reducing defects
Delivery	Improve OTTR to a minimum level of 90%
Cost	Expect 1.5x the historical improvement rate in Factory Conversion
Inventory	Targeting 1.5x the historical improvement in Inventory Performance

Exhibition 4.4.1 – HAS H.O.S goals

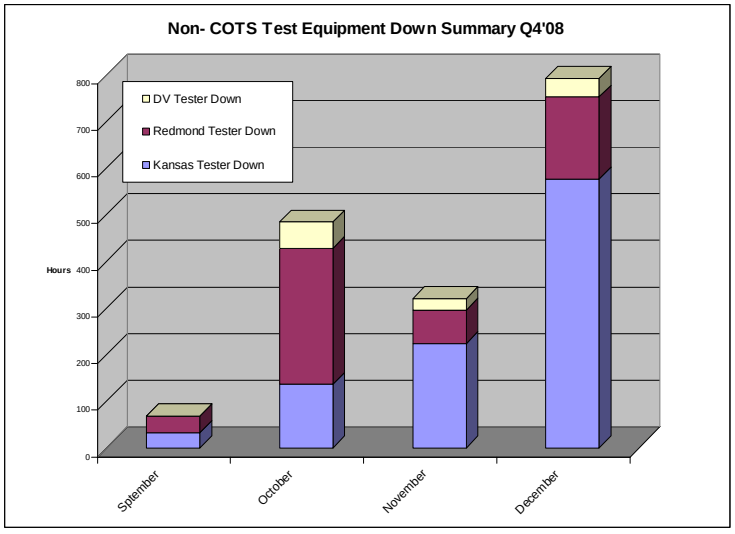
After examine the scene of H.O.S implementation in the corporate and in the division, we then scrutinize the impact of H.O.S and V.P.D in HAS ETS department. In general ETS staffs are grouped in direct and indirect production support categories. The ETS manager Jeff expects the direct support team becomes more responsive, resilient and resourceful to close line issues in real time; meanwhile indirect support team becomes more proactive to support direct team on line equipment yield improvement and obsolescence detection, more productive on new equipment design and sustaining engineering.

ETS department taps into both H.O.S. and V.P.D models to renovate operation. Factory support and Calibration lab teams act in accordance with these H.O.S activities from customer - HAS production; CNS and Specialty teams adopt V.P.D initiatives when they run development projects for Singapore R&D, internal direct team and Batam factory. Based on H.O.S value stream map or V.D.P principles, Jeff Lee identifies those value-added activities to two main ETS customers - the factory and R&D.

The major concern of the Batam ISC factory is the impact of unscheduled equipment breakdown to On Time Delivery (OTD) metric. When an equipment malfunctions, a number of WIP products strand on the factory floor which imposes safety and 5S hazard and pushes inventory up, product quality assurance and OTD are in jeopardy. Once the machine is up and running, Production has to call up more operators to work over time and clear backlog which incurs extra operation cost.

To support production flow, machines and equipments should operate when the order is placed, and yield the required quantity. Factory support and Calibration Lab teams benchmark Overall Equipment Effectiveness (OEE) to 90% by increasing operational availability time and reducing downtime losses, which comprises equipment failure and set-up & configuration. At production floor, they try to increase net performance rate and reduce speed losses contributed from idle and minor machine stops and reduced speed, measured by yield and quality losses derived from defects in test process. These metrics have been be added in team member's performance appraisal and are checked each half year through standardized leadership work.

Factory support and Calibration Lab have started monitoring the effectiveness of regular equipment maintenance by observing parameters such as the mean time to restore (MTTR) and the the mean time between failures (MTBF). To drive down the average test equipment downtime, engineers have baselined the monthly downtime hours according to the 2008 fourth quarter data (Exhibition 4.4.2). Jeff and ETS department set 20% downtime reduction target in 2009 ETS metrics.



Exhibition 4.4.2 – ETS equipment down time baseline in H.O.S Phase 2.

H.O.S visual management infuses machine performance metrics into ETS daily operation management. The RAIL component embedded in visual board traces escalated equipment issues and helps direct team monitor and act meticulously. The Andon visual management system signifies the severity of issues or projects in Red/Green/Yellow colors and enables other department managers and staffs understand the status and advise priority almost immediately.

ETS direct team embraces H.O.S tier meeting, which effectively breaks communication barrier within the team as every member must group in one closed circle, listen and participate discussion in predefined location in factory floor and time slot daily.

At the beginning of each financial year, Jeff evaluates unreliable and unavailable equipments which may threat the profit margin of HAS, or he receives requirement from R&D to support new product program. He then justifies the findings with detailed project proposal to the factory director or program managers to secure funding. At quarter one of calendar years, CNS and specialty teams launch these approved development or re-engineering projects and deliver to factory at the end of the year if possible. With the introduction of V.P.D, Jeff and development team make use of 3VSE, DFSS and TRIZ to determine the real value adding factors in equipment projects, they take advantage of Lean concept in V.P.D to eliminate waste in form of human resources, material and cycle time during project development. A significant V.P.D method is the application of Knowledge Management (KM) concept, ETS teams start to document and dissimilate the tacit equipment troubleshooting and design knowledge accumulated from factory support and development activities. The instituted technical knowledge base benefits cross training among ETS employees and enhance competency of ETS staff. The explicit program management knowledge boost development project planning, schedule and milestone fidelity and resource utilization forecast accuracy.

Implementing KM in ETS actually triggers the setup of an integrated equipment support network including design, procurement, operation, Kaizen and maintenance. An important component of this integrated equipment network is to enroll production associates to join the equipment Kaizen and maintenance activities. However, the additional capacity through customer participation needs to be designed carefully. At present, when an equipment maintenance schedule is around the corner, Calibration Laboratory (Cal Lab) personnel will approach the production to retrieve the equipment. However the production is reluctant in fear of impact to OTD due to lost capacity. Usually the production in the last minute hands it over to Cal Lab. The time and effort on equipment retrieval does not add any value to the product. The lateness forces Cal Lab to expedite maintenance procedures, incurring higher risk of undetected equipment which in turn failed to detect failed production. Jeff has planned a major operation overhaul to set up equipment maintenance Pull system. Equipment users will trace the expiration date, balance maintenance lead time and production schedule, they will trigger Cal Lab to collect equipments at designated week date and hours, and monitor return date in production visual board. The Cal Lab concentrates on equipment maintenance and Kaizen and supplies the factory with high precision and accuracy equipments.

Another critical H.O.S element - Total Production Maintenance (TPM) enables ETS to improve equipment user Safety, equipment OEE and product quality control. A few H.O.S pioneer

divisions establish equipment spares parts inventory system, equipment usage and maintenance skill training system for operators and technicians and equipment accountability and traceability system in TPM setup, one measurable result is increased customer satisfaction.

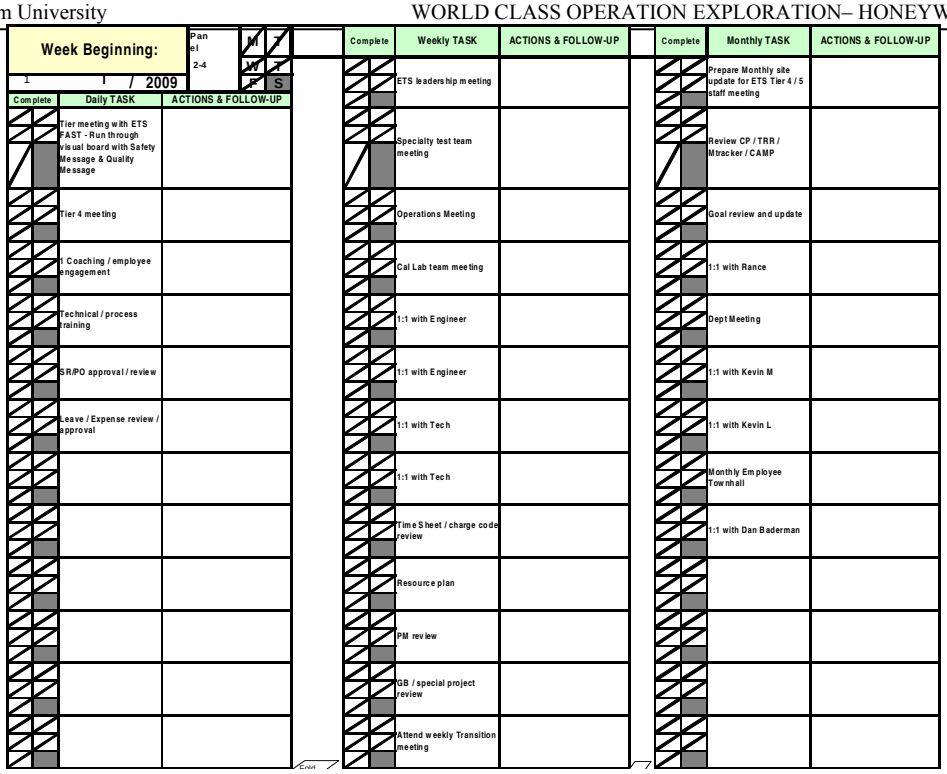
ETS liaises with the production and manufacturing engineering to set up a core TMP team and a number of work groups, which defines the role of ETS, Production and Manufacturing engineering in the TMP program. According to H.O.S framework, TPM deployment is cascaded in 4 levels. First, The ETS engineers perform V.D.P FMEA, MSE and DOE study to analyze test equipment risks and opportunities. Next level, TPM work groups activate the Autonomous Maintenance (AM). A test operator interacts with equipments on daily basis, he/she is able to determine the status of the equipment in real time and provide solution per AM paperwork. A few H.O.S processes – Leadership standard work, TMP Visual Management and Rapid Response systems will facilitate the TPM application in this level. In the third level, leveraging on preventive or predictive maintenance, work groups monitor and predict the part replacement, equipment adjustment, and alert a potential failure. ETS factory support team conducts PM periodically. In the fourth level Equipment Kaizen kicks in, operators and ETS associates observe and solve bottlenecks on set up, configuration problem, speed constrains and accuracy hazard.

To grow leadership, technical excellence, effective communication, project and risk management skill among ETS staff, Jeff incorporate H.O.S Coaching toolkit in his Leadership standard work (LSW). The exhibition 4.4.3 and 4.4.4 demonstrate the coaching assessment procedure and LSW.

When the observer(or coach) gives feedback to the person who is practicing coaching, please ticket out the three levels based on your observation and the questions as follows, and then communicate it with the person.

	Need to improve	Fair	Good
1. Coaching is two-way communication	( )	( )	( )
2 . Coaching is under a good relationship (e.g trust, respect, non-threatening , Safe, with confidentiality, non-position Influence etc.)	( )	( )	( )
3. He/She instructs employee by asking question to realize/understand/explore the problem/ideas.	( )	( )	( )
4. He/She often uses open-ended question.	( )	( )	( )
5 . He/She actively listens to what the other person says by acknowledging, rephrasing or summarizing.	( )	( )	( )
6 . He/She recognizes/encourages the good behavior in Coaching	( )	( )	( )
7. He/She coaches the employee and let employee find out the answer, rather than telling the employee the answer.	( )	( )	( )

Exhibition 4.4.3 – Coaching Assessment Questions



Week Beginning: 1 1 / 2009	Panel 2-4	M T W T F S

Complete	Daily TASK	ACTIONS & FOLLOW-UP
	Tier meeting with ETS FAST - Run through visual board with Safety Message & Quality Message	
	Tier 4 meeting	
	1 Coaching / employee engagement	
	Technical / process training	
	SR/PO approval / review	
	Leave / Expense review / approval	

Complete	Weekly TASK	ACTIONS & FOLLOW-UP
	ETS leadership meeting	
	Specialty test team meeting	
	Operations Meeting	
	Cal Lab team meeting	
	1:1 with Engineer	
	1:1 with Engineer	
	1:1 with Tech	
	1:1 with Tech	
	Time Sheet / charge code review	
	Resource plan	
	PM review	
	GB / special project review	
	Attend weekly Transition meeting	

Complete	Monthly TASK	ACTIONS & FOLLOW-UP
	Prepare Monthly site update for ETS Tier 4 / 5 staff meeting	
	Review CP / TRR / Mtracker / CAMP	
	Goal review and update	
	1:1 with Rance	
	Dept Meeting	
	1:1 with Kevin M	
	1:1 with Kevin L	
	Monthly Employee Townhall	
	1:1 with Dan Baderman	

Exhibition 4.4.4 – ETS leadership standard work

5.0 Conclusions

A strategy is a change in the direction of the objectives of the operations over a course of years. Strategy is needed when external conditions change, so even when these conditions - customer demand, market, technology and industry are very stable, companies should have well prepared and implemented strategy for changes to strive for to achieve competitive advantage and rank in world-class organization (Kenneth, 1997).

To establish an inimitable competitive advantage, the world class organizations must know what a customer wants and needs, work out the future requirement to grow customers and the company. They focus on strategy, flow down strategy to key performance indicator at each level, from CEO to production line operator. They can identify and map value added streams throughout supply chain, eliminating or reducing non-value adding activities. They divest low value business, acquire in-bound or out-bound entities to maximize value to stakeholders, boost the productivity of value adding activities, and grow core capacity and capability. They standardize process then outsource it, convert from internal integrated chain to a complex networking of supply chain (Kumar Neeraj, 2003). All these “world class” factors differentiate industry drivers and industry survivors.

Neglecting the organizational components of an operational transformation can delay or even derail it. World-class organizations, by contrast, attend to the softer elements of business initiatives, starting with the earliest aspiration-setting phases, when senior leaders identify the key goals and start to communicate them **(**Corbett et al. 2008). Abiding this principle helps companies to establish a stronger foundation for change and to set more achievable, and often much higher ambitions than they otherwise could. A better understanding of the cultural starting point enables top companies to determine where they should focus at the beginning of a program, when to implement various elements, and how to achieve their goals.

One common area among world-class operation is to define and standardize process, separate routine from non-routine. Taiichi Ohno – former CEO of Toyota is often quoted "Without a standard, there can be no improvement.” Standardized work provides the baseline required for continuous improvement. Standardized work is designed to minimize process variation introduced by the worker and to eliminate unnecessary motion. Minimizing variation and eliminating unnecessary motion reduces waste, eases problem solving, and enhances productivity within a particular job or series of jobs in a cell.

Deming advocated Plan-Do-Check-Act (PDCA) cycle approach to problem solving which becomes the cornerstone of continuous improvement (Kaizen). Without a lean improvement initiative, most companies are unable to see opportunities of reducing waste by getting rid of or

reducing non-value-added steps (Liker 2004). To Toyota employee, improvements are not projects or initiatives, these instead are the 'routine' work. This is one of the subtle but distinctive characteristics of Toyota factory, employee breathe, think and live with them. Supervisors and managers are not bosses in any traditional American sense (Fishman 2006). Their job is to enable employees find ways to do the work better more efficiently, more effectively. There is no satisfaction at Toyota.

A successfully sustaining operation relies on the great vision or dream of leadership. Dreams discover new possibilities toward new realities, fighting back and forth on the ambiguity of the present and the future. It is not necessary to be as realistic as the targets when people formulate with all common senses, the vision or dream can push and motivate people toward audacious actions (March 1990).

Review the Honeywell vision – "All operations function as tightly integrated value streams from suppliers to customers where customer's wants are met or exceeded… All employees are fully engaged and Safety and Quality are built into every process; All processes are documented and standardized as a basis for continuous improvement in pursuit of perfection; The workplace is organized and clean; Visual management systems are installed with clear protocols for rapid problem solving and waste elimination." H.O.S essences are explicitly embedded in this company motto, which is a combination of reality and dreams for perfection.

Look into the vision of the HAS factory – "…World class operations – Emphasis on developing and continuously improving systems and operational efficiencies through lean and cost efficient processes that meets customer requirements. Strong local talents – Commitment towards acquiring and developing an engaged, matured and self sustaining workforce … Regional supply chain – localization of supplier base ..." The HAS vision is aligned to the corporate but developed in local context.

The logic of reality entails two aspects of relevance to a leader. On one hand, reality is complex and tacit knowledge of it is limited, people are not sure whether a particular action will achieve their desired goal. This awareness can lead to paralysis – which is the point of doing anything if the results depend on chance or cynicism – what is the point of fighting for a better world if people are not certain of the effect of their actions. On the other hand, reality can be created by action. This extends to the discourse of a leader, Reality is in part a social construction, and interpretation plays an important role in this construction. (March 1990).

In the reality of HAS division, the site starts to reap benefits from of SIF phase 2 exit. The management have revised and communicated vision to associates with explicit performance indicators flown down. Leadership commitment and regular broadcast or webcast on latest H.O.S development are established. In the guideline of the vision from the corporate and the site supply

chain value chain is baselined, organization is restructured, site strategy is redesigned. The production has conducted periodic Kaizen Events and Focus Improvement Events involved with each employee.

Honeywell Operating System and Velocity Product Development help reduce waste, increase efficiency and drive improvements throughout these 1,400 locations consisting of plants, research laboratories, sales offices and other facilities. H.O.S has been evolving from Tool Kits of Lean manufacturing to an integrated business system, driving immediate results and sustaining breakthrough. H.O.S leverages on Lean methodologies through chasing excellence in 5S, Visual management, Kaizen, Standardized work, Process design for flow and quality, Knowledge sharing, Leaders ownership of the process, Daily management system.

Honeywell Operating System and the Velocity Product Development are also supported by Six Sigma. In current economic crisis, it is more important to deploy Six Sigma concept and skills to improve processes and reduce waste. Employees in any job function can apply DFSS training to help convert vision into reality by adherence to the performance indicator.

H.O.S system and its concept could be pivotal to Green Field factory or advanced manufacturing and service industries, especially those who have highly sophisticate operation due to the complexity of their products and services. On the other hand, V.P.D methodology is essential to technology, information, consumer industries where the time to market, customer and market volatility determine the competitive advantage While the primary focus of HOS remains on manufacturing, there is latest development that some applications of these principles in non-factory environments, indicating that non-factory facilities can design outstanding, sustainable process and grow organizational capability out of H.O.S , and met key performance improvement targets in safety, quality, delivery, cost and inventory. Peters and Waterman emphasize the rock-solid importance of making the average Joe a hero and a consistent winner in Search of Excellence. Employee empowerment and job accountability in H.O.S are in line with the theory.

Looking at what Toyota has accomplished, TPS enables Toyota to pursue technical and organizational excellence, but Toyota won't succeed only reply on the TPS, depending on a number of market and non-market factors such as the technology breakthrough on Hybrid engine and relatively protected Japanese domestic market. Liker pointed out in "The Toyota way", Toyota's success is developing a system, sticking with it and improving it. A prerequisite is that the executives understand and commit on the Toyota Way and evolve the enterprise to be a "Lean and Learning Organization" – Employees learn by doing first and training second, starting with value stream mapping as a means of demonstrating lean as a system and providing a "go see" model, using Kaizen workshops to teach and make rapid changes. Toyota employee are opportunistic in identifying

opportunities for making big financial impacts, the leadership constantly realigns metrics with a value stream perspective. A world-class company needs to build on own company's own roots to develop its own "TOYOTA WAY".

Honeywell management are making efforts to promote H.O.S and V.P.D. Have they done enough? Maybe they could refer to the mission statement as beloew from Toyota to exploit and explore more opportunities:

"At Toyota, whenever we're faced with a challenge, we ask ourselves the same question. Why not? Two words that are filled with possibilities. They can turn a challenge into an opportunity. An obstacle into an inspiration. We're continuously looking for new ways to improve what we do. By asking tough questions. Can we make a car that has zero emissions? Can we improve the economy of a community? Can we enrich the lives of people around us? And we endeavor to do this by creating jobs, pioneering new technologies that help make vehicles cleaner and safer, and involving ourselves in the communities where we live and work"

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