PLANTSUCCESS
Best Practices Driving Plant Performance

ProcessSafety&People

Searching for the Human Capital Drivers of Process Safety

McBASSI & company

Executive Summary

Since 1999, PlantSuccess conferences in Philadelphia, Houston and Calgary, have created a network of industry leaders who convene to discuss topics of vital importance to improving operational excellence in process manufacturing. Recent presentations about the Center for Chemical Process Safety (CCPS), the Columbia disaster and BP's Texas City incident brought the roll of human capital management (HCM) and safety into sharp focus.

Collaborating with McBassi & Company, experts at identifying the human factors underlying operating performance, PlantSuccess conducted a cross-industry assessment to determine the key people-centric drivers of process safety.

The assessment captured the view of plant managers from forty-five plants in oil & gas and chemical manufacturing by looking at the following areas:

- Leadership Practice
- Employee Engagement
- Knowledge Accessibility
- Skill Optimization
- Learning Capacity

McBassi's methodology examines these areas to discover their impact on key business drivers summarized in the chart below.

This chart depicts the assessment results for the top-level human capital drivers of the business results shown in each row. The factors range from 1-5 with the number 1 representing the top human capital driver for the business result indicated.

Figure 1

Human Capital Drivers of Operational Excellence in Gas, Oil and Chemical Manufacturing

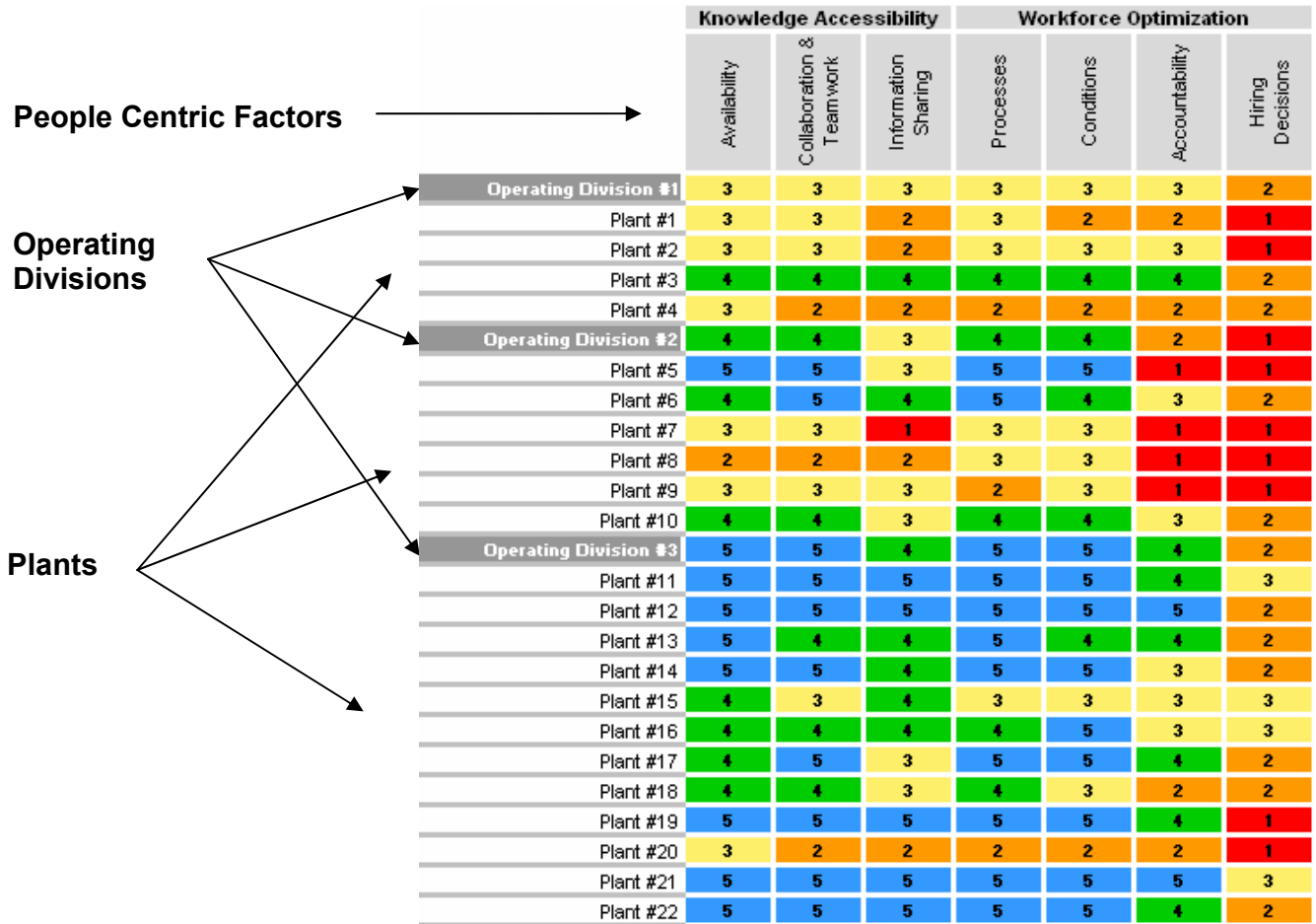|	Knowledge Accessability	Hiring Decisions	Training	Innovation	Process	Collaboration Teamwork	Job Design	Accountability	Managers' Inclusiveness	Information Sharing	Value Learning	Supervisory Skills	Managers' Communications	Leadership System	Development
Process Safety	1	2	3	4	5	-	-	-	-	-	-	-	-	-	-
Profitability	-	1	-	3	5	-	-	2	-	-	-	4	-	-	-
Asset Utilization	5	2	-	3	-	-	-	4	-	1	-	-	-	-	-
Productivity	-	2	-	1	-	3	-	-	-	-	-	4	-	5	-
Attract Employees	2	3	-	-	-	-	1	-	5	-	-	4	2	-	5
Retain Employees	-	1	-	4	-	2	3	-	-	-	-	-	-	-	-
Customer Sat	-	4	-	1	-	3	-	2	-	5	-	-	-	-	-
Overall	-	1	-	2	-	3	5	4	-	-	-	-	-	-	-

PlantSuccess focused the assessment on Process Safety; but **Safety is Part of Work**, so it made sense to incorporate the human capital drivers of additional business performance measures into the assessment. McBassi's methodology supports the complete view of the corporation. In some sense, we have taken a measure of the human capital drivers of operational excellence.

While the numbers in the chart above represent the rank in order of importance, the corporation is assessed for maturity within each human capital category on a scale of one to five, where a score of five represents world-class maturity and scores in the range of one to two indicate areas of priority for corrective action.

Pinpointing where in the corporation gaps exist relative to these people-centric factors requires looking at the corporation from top to bottom, all the way to the plant floor. The results yield a roadmap as shown in the following example of a company with several operating divisions with multiple plants within each division. The maturity scores (1–5) have a color code associated with them for easier visualization.

Plants numbered 12, 21 and 22 have outstanding scores. They set the benchmark with respect to important human capital factors that govern operational excellence. Managers can use this roadmap to target corrective actions with unprecedented precision.

Figure 2

People Centric Factors →

Operating Divisions

Plants

	Knowledge Accessibility			Workforce Optimization			
	Availability	Collaboration & Teamwork	Information Sharing	Processes	Conditions	Accountability	Hiring Decisions
Operating Division #1	3	3	3	3	3	3	2
Plant #1	3	3	2	3	2	2	1
Plant #2	3	3	2	3	3	3	1
Plant #3	4	4	4	4	4	4	2
Plant #4	3	2	2	2	2	2	2
Operating Division #2	4	4	3	4	4	2	1
Plant #5	5	5	3	5	5	1	1
Plant #6	4	5	4	5	4	3	2
Plant #7	3	3	1	3	3	1	1
Plant #8	2	2	2	3	3	1	1
Plant #9	3	3	3	2	3	1	1
Plant #10	4	4	3	4	4	3	2
Operating Division #3	5	5	4	5	5	4	2
Plant #11	5	5	5	5	5	4	3
Plant #12	5	5	5	5	5	5	2
Plant #13	5	4	4	5	4	4	2
Plant #14	5	5	4	5	5	3	2
Plant #15	4	3	4	3	3	3	3
Plant #16	4	4	4	4	5	3	3
Plant #17	4	5	3	5	5	4	2
Plant #18	4	4	3	4	3	2	2
Plant #19	5	5	5	5	5	4	1
Plant #20	3	2	2	2	2	2	1
Plant #21	5	5	5	5	5	5	3
Plant #22	5	5	5	5	5	4	2

The detailed report that follows defines each of the human capital factors examined in the ProcessSafety&People assessment and reveals the key drivers for each area represented. The last section discusses the methodology developed by McBassi & Company. Further reference to the methodology is available at www.PlantSuccess.com and www.McBassi.com, and in "Maximizing Your Return on People" (by Bassi and McMurrer) in the March 2007 *Harvard Business Review*.

I. Human Capital Management and PlantSuccess: A Statistical Analysis

Laurie Bassi, Ph.D. and Daniel McMurrer, M.P.P.
April 2008

The twin forces of globalization and technological change have reduced the advantages of financial capital and superior technology as sources of competitive advantage. At the same time demographic change is rendering labor markets increasingly competitive. Hence, in high-wage nations such as the U.S., the quality of human capital management is arguably the only sustainable source of competitive advantage that remains in the manufacturing sector.

With that in mind, McBassi & Company partnered with PlantSuccess to undertake an analysis of the key human capital drivers of plants' success.[1] This white paper summarizes the findings from this analysis.

Forty-five plants, primarily from the chemical industry, participated in this analysis. McBassi collected data on numerous aspects of leadership, management, and development practices within these plants. Data were simultaneously collected on plants' performance relative to their competitors in seven separate areas:[2]

1. Profitability

2. Productivity

3. Asset utilization

4. Ability to attract employees

5. Ability to retain key employees

6. Customer satisfaction

7. Process safety

A statistical analysis was then undertaken to identify the specific aspects of leadership, management, and development practices that were most significantly correlated with plants' performance.

Every plant can improve each of these factors. The first step toward doing so is to quantify and measure your plant's current strengths and weaknesses on the factors discussed throughout this paper.

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[1] This study was sponsored by PlantSuccess. The design of the analysis was developed exclusively by McBassi & Company, who is solely responsible for the methodology and results of the study.

[2] In statistical language, these seven measures constitute the "dependent variables" in the analysis. The independent variables include the twenty-four factors (within five indices) discussed throughout this analysis. McBassi has developed a rigorous set of survey questions over the past seven years to quantify, in a valid and scientifically rigorous way, each of these variables. Over 60,000 responses have been compiled in nearly 600 organizations.

II. Major Findings

The statistical analysis revealed that the five most powerful HCM predictors (in descending order of importance) of plants' success on those seven business outcomes (taken as a whole) are the following:[1]

1. **Hiring decisions**: Selection is based on skill requirements; new hires receive adequate orientation, induction, and a description of required skills; and employees provide input into hiring decisions.

2. **Innovation**: New ideas are welcomed, employees are encouraged to find new and better ways to do work, and employees' input is sought in solving problems.

3. **Collaboration & teamwork**: Teamwork is encouraged and enabled, places are provided for people to meet informally, and time is set aside for people to share with and learn from one another.

4. **Accountability**: Employees are held accountable for producing quality work, promotion is based on competence, poor performance is appropriately handled, and employees trust their co-workers to get the job done.

5. **Job design**: Work is effectively organized, makes good use of employees' talents and skills, and is interesting and meaningful. Employees have appropriate responsibility to determine how best to do their work, and creative job design is used to help makes jobs fit employees' needs.

Example 1: Drivers of Asset Utilization

Asset utilization is a critical driver of plants' success, and it is an important component of most plant managers' performance objectives. The three most important human capital drivers of asset utilization that emerged from our statistical analysis of variations in plants' asset utilization rates were the following:

1. Information sharing: best practices are shared and improved

2. **Hiring decisions**: skills-based hiring process with input from employees and new hire-orientation

3. **Innovation**: new ideas are welcomed and employees' input is sought in solving problems

Figure 3

Plant's Asset Utilization Scores are "World Class," by Maturity Scores on HCM Items (1=low, 5=high)
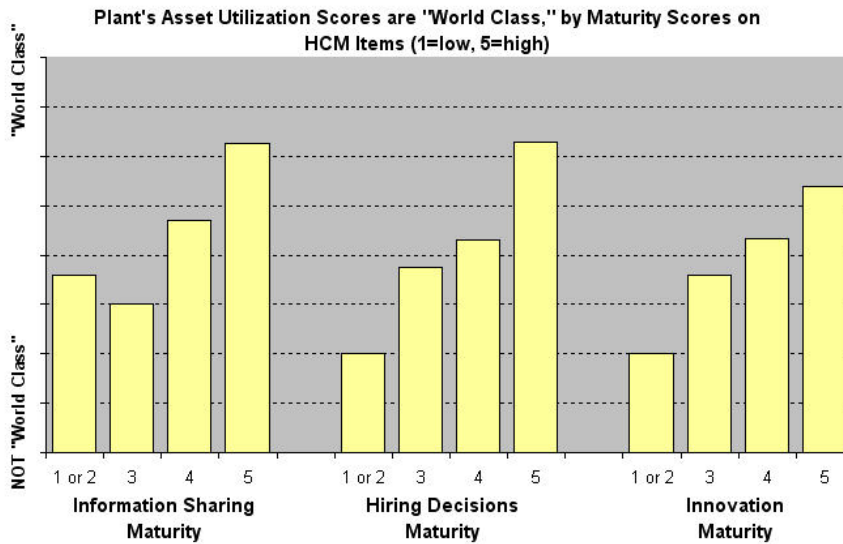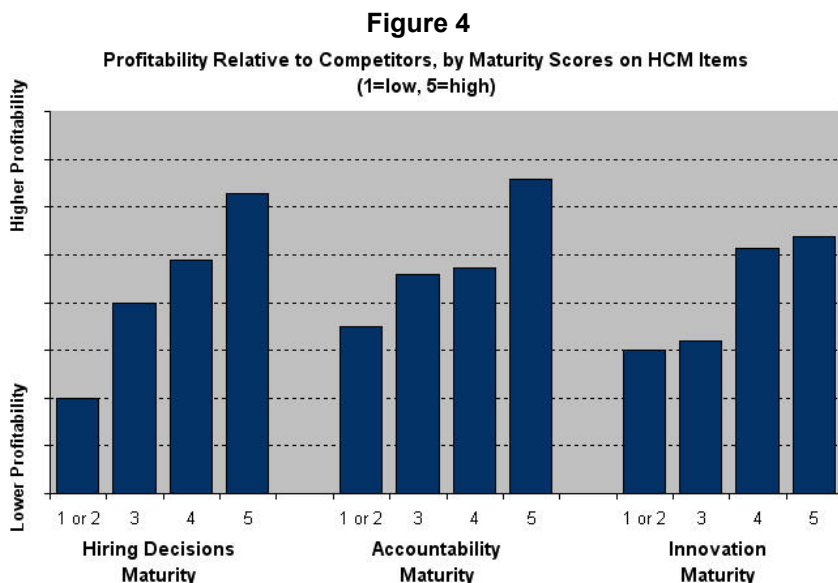
For example, plants that reported above average scores on information sharing were more than 7 times more likely to report "world-class" asset utilization rates than plants that reported average or below average scores on information sharing.

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[1] An appendix contains analysis of the HCM drivers of the additional business outcomes not discussed in the text below (customer satisfaction, ability to attract employees, ability to retain key employees, plant productivity).

Example 2: Drivers of Profitability

The three human capital factors that emerged from our statistical analysis of variations in plants' profitability relative to their competitors were:

1. **Hiring decisions**: skills-based hiring process with input from employees and new hire-orientation

2. **Accountability**: high performance is expected and required

3. **Innovation**: new ideas are welcomed and employees' input is sought in solving problems

Figure 4

Profitability Relative to Competitors, by Maturity Scores on HCM Items (1=low, 5=high)
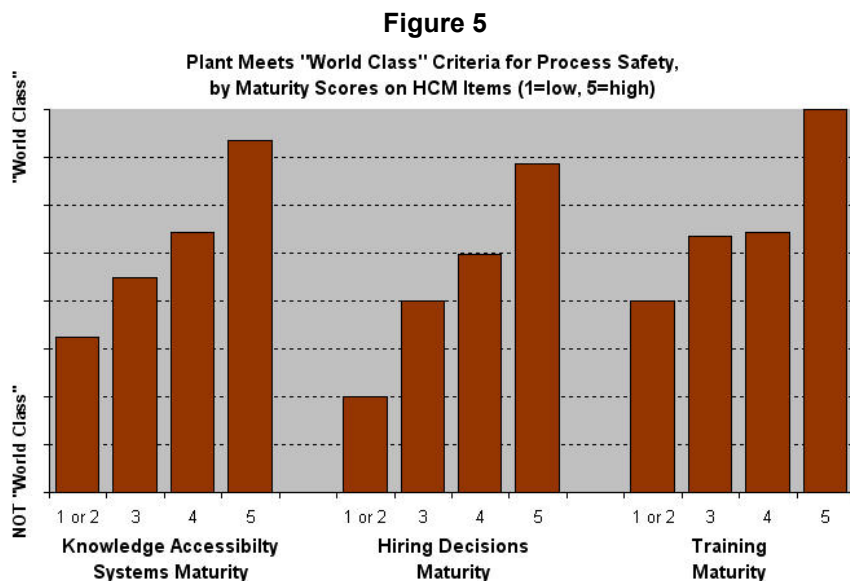
For example, plants that reported above average scores on hiring decisions were more than 2.5 times more likely to report higher profitability (relative to their competitors) than plants that reported average or below average scores on hiring decisions.

Example 3: Drivers of World-Class Process Safety

The three HCM factors that emerge as the top drivers of process safety are the following:

1. **Knowledge accessibility systems**: collection systems make information easily available

2. **Hiring decisions**: skills-based hiring process with input from employees and new hire-orientation

3. **Training**: training is practical and supports organizational goals

Figure 5

Plant Meets "World Class" Criteria for Process Safety, by Maturity Scores on HCM Items (1=low, 5=high)

For example, plants that reported above average scores on knowledge accessibility systems were more than 2.3 times more likely to report that they meet "world-class" process safety criteria than plants that reported average or below average scores on knowledge accessibility systems.

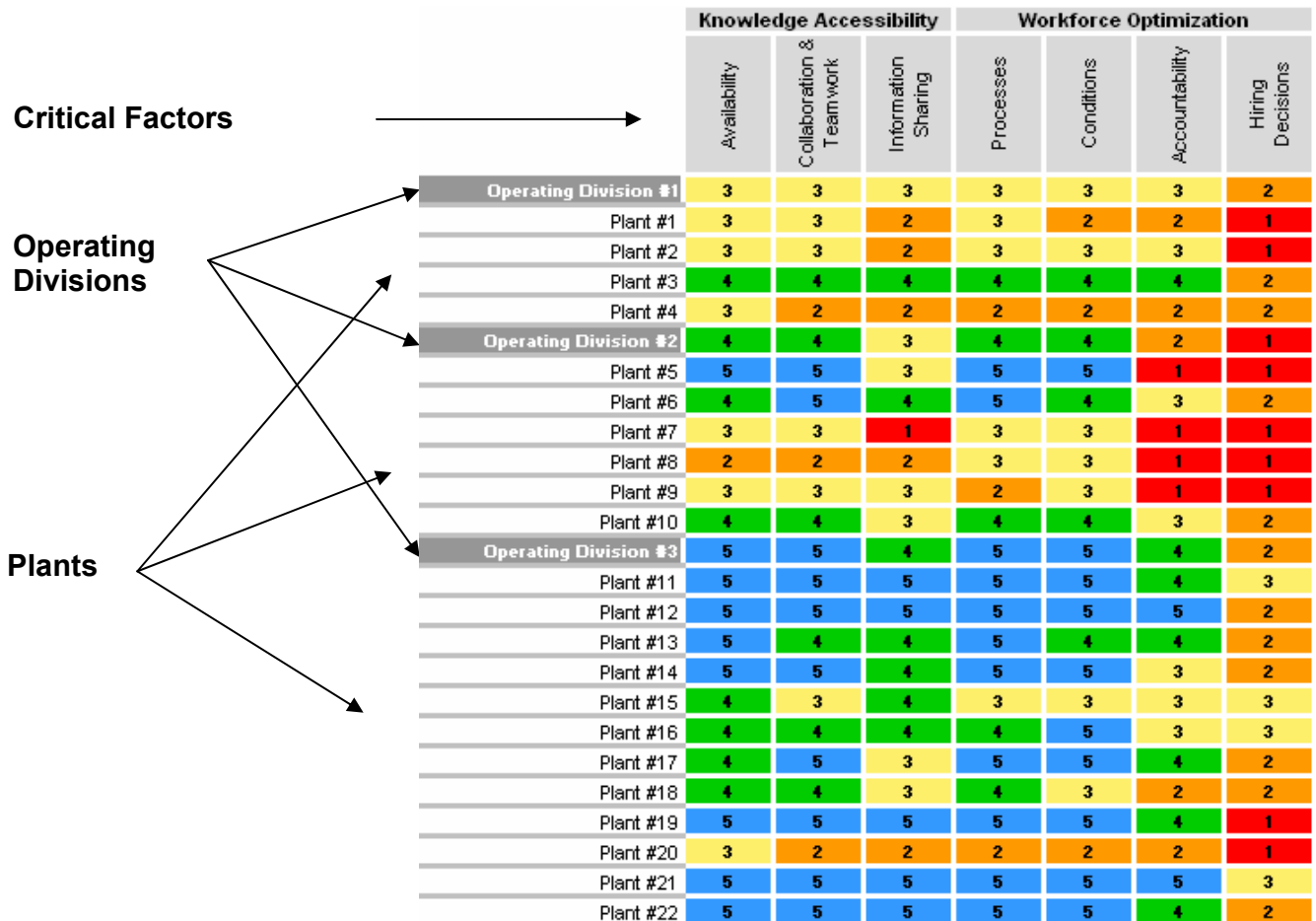# III. Translating Insights Into Action

As the global economy continues to evolve and the baby boomers retire in increasing numbers, superior HCM will continue to grow as the main source of sustainable competitive advantage. This requires that plant managers develop processes for both measuring and improving their plant's HCM strengths and weaknesses.

The research-based measurement framework summarized above in Figure 2 represents an excellent starting point. Deploying this methodology involves three steps:

1. Employees and managers are queried, using a tightly structured questionnaire, for the purpose of quantifying variations in HCM maturity across teams, plants, operating divisions, and regions. Figure 6 shows an example of this step.

2. Variations in HCM maturity are linked to variations in key performance indicators, either financial or non-financial. This step identifies which HCM factors are most critical to organizational performance. The previous section provided a preliminary example of this step.

3. Findings from the first two steps are then used to identify the HCM factors that significantly drive organizational performance as well as those that also represent areas of relative weakness. The results of this analysis highlight where the organization should concentrate its efforts.

Figure 6

Pinpointing Areas for Improvement

Critical Factors

Operating Divisions

Plants

	Knowledge Accessibility			Workforce Optimization			
	Availability	Collaboration & Teamwork	Information Sharing	Processes	Conditions	Accountability	Hiring Decisions
Operating Division #1	3	3	3	3	3	3	2
Plant #1	3	3	2	3	2	2	1
Plant #2	3	3	2	3	3	3	1
Plant #3	4	4	4	4	4	4	2
Plant #4	3	2	2	2	2	2	2
Operating Division #2	4	4	3	4	4	2	1
Plant #5	5	5	3	5	5	1	1
Plant #6	4	5	4	5	4	3	2
Plant #7	3	3	1	3	3	1	1
Plant #8	2	2	2	3	3	1	1
Plant #9	3	3	3	2	3	1	1
Plant #10	4	4	3	4	4	3	2
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Plant #11	5	5	5	5	5	4	3
Plant #12	5	5	5	5	5	5	2
Plant #13	5	4	4	5	4	4	2
Plant #14	5	5	4	5	5	3	2
Plant #15	4	3	4	3	3	3	3
Plant #16	4	4	4	4	5	3	3
Plant #17	4	5	3	5	5	4	2
Plant #18	4	4	3	4	3	2	2
Plant #19	5	5	5	5	5	4	1
Plant #20	3	2	2	2	2	2	1
Plant #21	5	5	5	5	5	5	3
Plant #22	5	5	5	5	5	4	2

Note: An HCM "score" of 1 (color coded red) represents a very low level of maturity, whereas a score of 5 (color coded blue) represents a world-class maturity.

The three-step process outlined above represents a methodology for developing actionable, business intelligence on the "human side" of plants' operations. The days for managing human capital by gut and intuition have passed. Not only is it not necessary, it is reckless to do so.

Appendix

Additional Analysis Results

While the discussion above focused on three specific plant outcomes (asset utilization, profitability, and process safety), similar results were found for the other four outcomes examined (ability to attract employees, ability to retain employees, customer satisfaction, plant productivity). The results from those other analyses (including the top three HCM drivers of each) can be found in the charts that are included in this appendix.

Figure A-1

Ability to Attract Talented Employees Relative to Competitors, by Maturity Scores on HCM Items (1=low, 5=high)

Figure A-2

Ability to Retain Key Employees Relative to Competitors, by Maturity Scores on HCM Items (1=low, 5=high)

Figure A-3

Customer Satisfaction Relative to Competitors, by Maturity Scores on HCM Items (1=low, 5=high)

Figure A-4

Plant Productivity (Yield) Relative to Competitors, by Maturity Scores on HCM Items (1=low, 5=high)
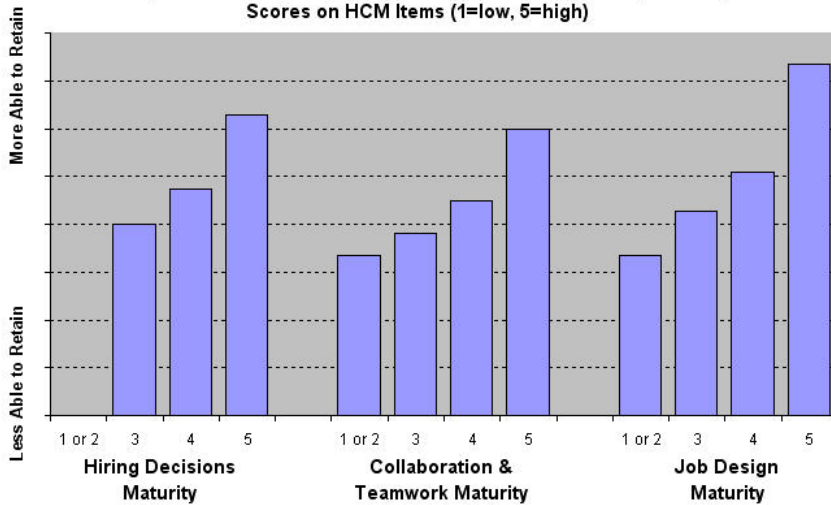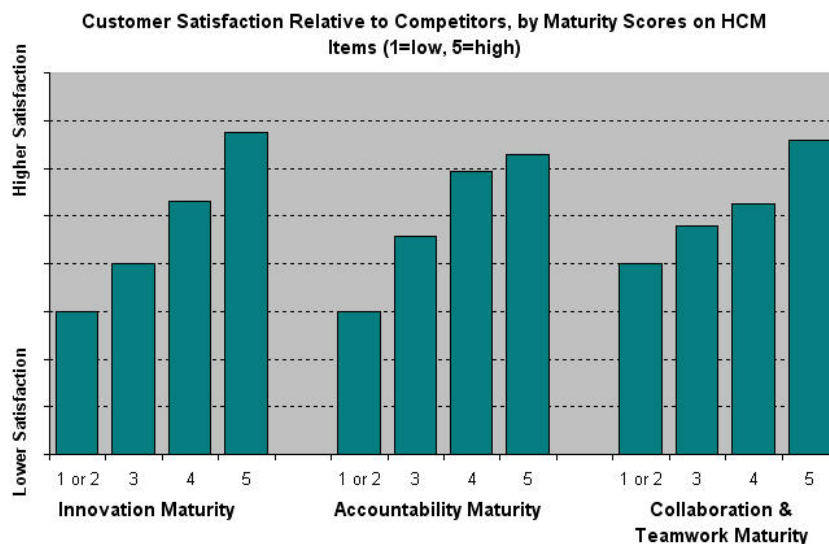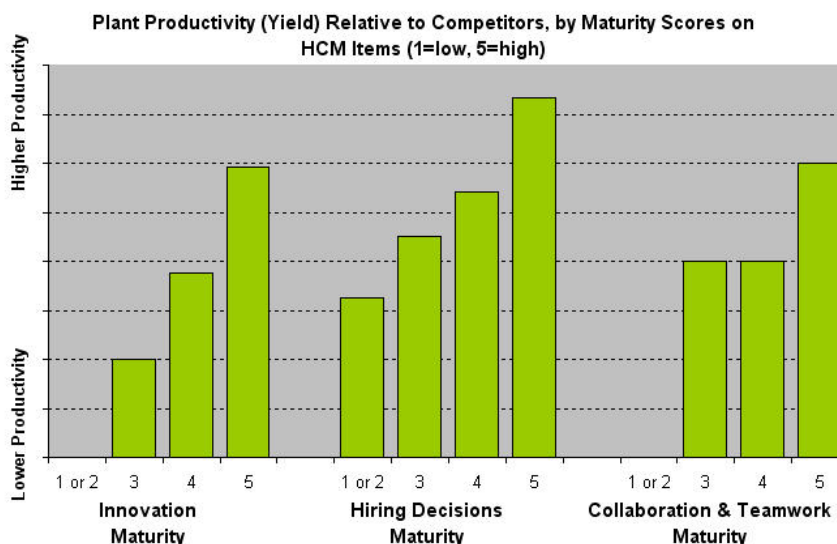
## Measurement and Analysis Methodology

The statistical analysis identifies the specific aspects of "human capital management" (HCM) — leadership, management, and development practices - that have the greatest impact on plant's profitability, ability to attract employees, and the other success variables noted above.

For the purpose of this analysis, McBassi used a modified version of its Human Capital Capability Scorecard (HCCS). This is a research-based measurement framework that quantifies and measures the quality of the HCM in a plant, using information gathered through carefully constructed survey instruments.

The measures that emerge from these instruments are then used to predict key outcomes (both financial and non-financial) of plants. This methodology is used by McBassi's clients to spot important deficiencies, remedy them, and thereby improve their future performance.[1]

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[1] A more complete description of the HCCS can be found in "Maximizing Your Return on People," by Laurie Bassi and Daniel McMurrer, *Harvard Business Review*, March 2007, pages 115-123.

This framework, which is summarized below in Figure A-5, measures five major aspects of plants' HCM practices: (1) quality of leadership practices; (2) practices that foster employee engagement; (3) measures of how accessible knowledge is to plant employees, (4) the plant's ability to optimize its workforce's productivity, and (5) measures of the learning capacity of the plant.

Figure A-5

Human Capital Capability Framework
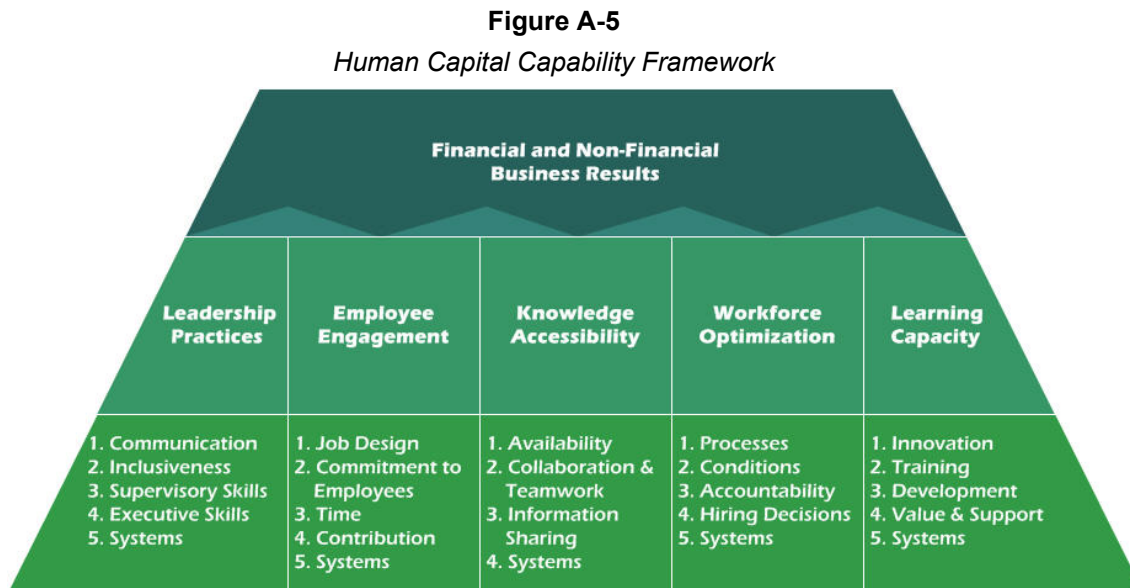
A brief synopsis of each of the 24 factors included in the framework is provided in Table A-1. Those factors that were found to be most significantly correlated with plants' success are highlighted in yellow (more detail on these findings is provided in the following section).

Table A-1. Description of Factors Measured in Plants

Leadership Practices	Employee Engagement	Knowledge Accessibility	Workforce Optimization	Learning Capacity
Communication Leaders and managers communicate openly and effectively	*Job design* Work is well organized and taps employees' skills	*Information Availability* Job-related information and training are readily available	*Processes* Work processes are well defined, and training is effective	*Innovation* New ideas are welcome
Inclusiveness Leaders and managers collaborate with employees and invite input	*Commitment to employees* Jobs are secure, employees are recognized, and advancement is possible	*Collaboration* Teamwork is encouraged and enabled	*Conditions* Working conditions support high performance	*Training* Training is practical and supports organizational goals
Managerial skills Managers eliminate barriers, provide feedback, and inspire confidence	*Time* Workload allows employees to do jobs well and enables good work/life balance	*Information sharing* Best practices are shared and improved	*Accountability* High performance is expected and rewarded	*Development* Employees have formal career development plans
Leadership skills Leaders eliminate barriers, provide feedback, and inspire confidence	*Contribution* Organization contributes to its community		*Hiring* Hires are chosen on the basis of skill; new hires complete a thorough orientation	*Value and support* Leaders demonstrate that learning is valued
Systems Leadership development and transition systems are effective	*Systems* Employee engagement is continually evaluated	*Systems* Collection systems make information easily available	*Systems* Employee performance management systems are effective	*Systems* A learning management system automates aspects of training

In a typical application of McBassi's HCCS methodology, all employees within a plant are invited to respond to an online questionnaire (approximately 80 questions) that captures information on specific elements of each of the 24 factors outlined above in Table A-1.[1] Their responses provide information on the plant's strengths and weaknesses in each area.

McBassi then examines statistically the relationship between employees' responses and a variety of measures of "business outcomes." These outcome measures can be quite varied, including measures of employees' engagement and intention to stay with their employer, customer satisfaction, and profitability.

Examining the statistical linkage between leadership, management, and development (HCM) practices and plants' business outcomes enables a plant to identify those specific practices that are the most critical determinants of the business outcomes that the plant would most like to improve. This provides a foundation for developing fact-based, prioritized, objective recommendations to help the plant improve its success.

For the purpose of helping PlantSuccess and its members understand the relationship between HCM practices and success across multiple plants, we modified the process (and questionnaire) described above in order to efficiently capture key information across a large number of plants. So, rather than developing highly detailed measures based on responses from multiple employees within a single plant, we captured more general information from a single respondent within each plant. Responses were received from 45 plants, with most individual respondents reporting that they hold managerial positions within their plants.[2]

In addition to assessing their plants' maturity on each of the leadership and development factors listed in Table A-1, the respondents were also asked to assess how well their plant performed (relative either to their competition or to "world-class" standards) on seven outcomes:[3]

1. Profitability

2. Productivity

3. Asset utilization

4. Ability to attract employees

5. Ability to retain key employees

6. Customer satisfaction

7. Process safety

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[1] It typically takes a front-line employee 12 to 14 minutes to complete the questionnaire. Only employees with significant people-management responsibilities are queried about the 5 separate "systems" factors noted above.

[2] There were a total of 58 responses from these 45 plants, including 14 who identified themselves as "Area, Regional, or Group Managers," 13 "Plant Managers," 11 "Plant Management Staff," 4 "Process or Shift Managers," and 16 who reported "Other" job roles.

[3] For 5 of the 7 outcomes, a 5-point scale was used to measure these outcomes, ranging from "strongly disagree" to "strongly agree" that the plant consistently outperforms its competition on each specific outcome. For the other 2 outcomes (asset utilization and process safety), respondents were asked whether their plant is "world-class" (whether its asset utilization scores are world-class, and whether it meets world-class criteria for process safety).

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Our cross-industry assessment on process safety is based on questionnaires completed by 58 experienced plant management personnel — leaders with the following 28 companies:

Air Products & Chemicals, Inc	LyondellBasell Industries
Albemarle Corporation	Marsulex, Inc
AURA, LLC	Mitsubishi Polysilicon
Bayer MaterialScience, LLC	Nexen, Inc
BP p.l.c.	Noltex, LLC
CEMEX	Petro-Canada – Refining & Supply
DuPont	PSRG Inc
FedChem, LLC	Rohm and Haas Company
FMC Corporation	Sasol Limited
Gerdau Ameristeel Beaumont Wire	SAT Corporation
Hercules Incorporated	SCB/ HB Fuller Company
Hexion Specialty Chemicals	Shell Chemical LP
Honeywell Specialty Materials	Shell Oil Company
INEOS NOVA, LLC	Suncor Energy (USA), Inc

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