A Case Study and Survey-Based Assessment of the Management of Innovation and Technology

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Abstract

This paper provides a case study of a real-world organization and its management of technology and innovation (MTI). The study examines the structure, environment, and resources of the organization as they pertain to the MTI. Specifically, the organization is examined for the alignment of the MTI to the strategy and the competitive advantages. Subjective assessment of the state of MTI is made based on this examination. To support the assessment, the case study is augmented with survey data that examines perceptions of employees to the MTI, the alignment of the MTI as stated above, and several documented antecedents of creative and innovative organizations. The research concludes with recommendations for improvement based on propositions regarding the antecedents and correlation to the state of the MTI.

Keywords: Management of technology; case study; innovation; strategy; change.

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Introduction

The strategic alignment of the management of technology and innovation (MTI) is vital to the success in a technically-focused organization (White and Bruton, 2007). The terms "innovation" and "technology" tend to spur thoughts of high-technology devices and applications derived from the traditional sciences and related disciplines (computers, cell phones, software, the Internet, satellites). In fact, technology is defined much more broadly as the application of information and knowledge in the form of products, processes, tools or systems (White and Bruton, 2007). Innovation is the process that allows technology to be applied in a marketable or otherwise valuable way (White and Bruton, 2007). To illustrate via example, the MP3 digital audio encoding scheme is a technology. The process by which individual consumers can convert or buy music in MP3 format, load it to a mobile device, and listen when and where desired is an innovation. While innovation is not required to manage technology, technology is required to manage innovation (White and Bruton, 2007).

Organizational application

In organizations, technology and innovation are not limited to the auspices of research and development (R&D), information technology (IT), or product development departments. There are many more parts of the business that do not directly touch hard technology but which are required for the business to function. Liu (2005) illustrates the importance of administrative innovation to the success of technological innovation. Rose (2009) defines innovation as the purposeful turning of a variety of tangible and intangible inputs into desirable (valuable) outputs for strategic application whether the application is for financial, social, or other purposes. Technologically-focused organizations are subject to rapid changes in environment and technology and the MTI and organizational structure must be aligned to accommodate them (White and Bruton, 2007).

Antecedents of Successful MTI

There are several documented antecedents to the successful implementation of MTI in support of the strategic goals of the organization. In order to produce the best products and services, people and technology must be integrated via highly-effective processes (Addison and Haig, 2010)(Rose, 2009). The continuous accumulation of small, incremental improvements from every individual in the organization leads to significant higher order innovations (Spanyi, 2006; Scwharz, 2010). Clearly defining and empowering the owners of all processes, particularly core processes, is key to continuous improvement (Spanyi, 2006; Scwharz, 2010). Information sharing, knowledge management, empowerment, and structures that support organizational learning and application are key to effective innovation (Rose, 2009; White and Bruton, 2007). The structure of the organization must align with the innovation imperatives (White and Bruton, 2007). Horizontal structures, collaboration, empowerment, and information sharing are critical to turbulent environments whereas vertical structures, formal systems, and task routinization are critical for stable, cost-conscious structures (Daft, 2007). Process owners, mandates, and measures of success must be clearly communicated and continuously evaluated (White and Bruton, 2007; Spanyi, 2006). Varying degrees of control and flexibility are required based on the type and amount of innovation required (White and Bruton, 2007; Schwarz, 2010). The implementation of any complex organizational imperative requires managerial commitment and cultural unification around that imperative (Carmel and Tjia, 2005; Vance and Paik, 2006; Cabrera, Cabrera, and Barajas, 2001). It is against this set of antecedents that the organization is evaluated.

Research Methodology Methodological Approach

The aim of the research is to assess the overall environment for the successful management of technology and innovation in the subject organization (The Division). As a member of the organization, a fair amount of information is readily available to the researcher. The aim of the research is expressive rather than instrumental – aiming for a richer content in the context of this organization rather than extrapolation to general principles. Further, the researcher makes no claim of absolute truth but seeks to see how actual behavior compares to claimed behavior. The above characteristics favor a constructionist ethnographic approach (Easterby-Smith, 2008).

However, as a member of The Division and with a stake in the outcome, the researcher must be aware of the risk of prejudice (Easterby-Smith, 2008). Further, a va-

riety of research exists to support propositions regarding critical antecedents for establishing the environment for successful MTI. Therefore, the opportunity exists to examine the state of these antecedents objectively and correlate the results to the perceived state of the MTI. These characteristics favor a relativist approach and survey technique (Easterby-Smith, 2008).

Case and survey methodologies are both acceptable for constructive and relativist forms of research (Easterby-Smith, 2008). Therefore, the descriptive case information and subjective assessment are augmented with survey data with the intent of validating the case study and examining possible correlation of the perceived state of the MTI to proposed antecedents. The survey contains structured and unstructured components to support both goals.

Survey process

Transparency of the research process further serves to mitigate the risk of prejudice in the research design and execution and the interpretation of results (Easterby-Smith). Appendix A provides a summary of the survey process and the stipulations applied to its implementation in the organization.

Survey Instrument

The survey was implemented in softcopy as a single form in which answers were limited to defined fields. Except for items where selectable answers were provided, field values were not controlled or limited. This freedom led to multiple formats of answers to some questions which made analysis difficult. Where answers did not conform to the intended format, the data was excluded.

Demographic data related to the respondent's time, level, and role in the organization were gathered to ensure a breadth of coverage and to support attempts at correlation of perceptions to specific demographics. To avoid leading or confusing questions, questions assessing perceptions were isolated to single ideas and avoided the use of negatives and suggestive wording. Open-ended questions were used to gather amplifying information, perceived organization imperatives, and suggestions for improvement. Two ranking questions were provided to gauge perceptions of relative importance of targets of innovation.

Organizational background
Corporate and Market Context

The Division is a relatively small division (216 personnel) in a large corporation (The Corporation) (>100 divisions, >60,000 personnel) (The Corporate website, 2010) and is approximately 10 years old. The Corporation provides products and services primarily to government and Depart of Defense (DoD) customers. As such, agility, security and ethical business practices, while maintaining a focus on business performance, are cornerstones of the corporate culture and are prominently promulgated throughout the divisions. The Corporation has selected a strategy of being the premier provider of components to larger systems and the prime integrator on small systems (The Corporation annual report, 2009). The Division provides some of those components with a focus on "networking, requirements development, modeling, simulation, communications and systems integration (including sophisticated networking as well as coordinated, web-based techniques)…developing advanced wireless [network-based tactics] concepts that will greatly enhance the use of our country's [data gathering] assets." (The Division website, 2010). Clearly, The Division is in a technologically-focused industry.

Strategy and Competitive Advantage

The strategy, as defined by the COO, is

"Sustain our reputation with existing customers while expanding the associated core business areas, win competitive pursuits targeted for strategic growth, and expand the portfolio of product / technology offerings. Ensure the execution of these objectives leads to meeting the division's financial goals for the year."

This appears to be a strategy of focused differentiation wherein a narrow market is the target of specific products with a focus on premium capabilities (uniqueness) over low-cost. Indeed, the company receives the majority of its contracts and revenue from a single government customer office. The competitive advantages, according to the COO, are

"Exceptional staff with significant military experience relevant to the core business areas, solid relationship and reputation with existing customers, highly responsive to customer needs and priorities."

Divisional Processes

The Division is both ISO 9001:2008 and CMMI level 3 certified, a requirement deemed necessary to compete on at least some of the contracts. The Division has implemented a quality management system (QMS) satisfying both certifications. From the COO:

"The company's quality management system, which ensures compliance with specified product requirements, SEI CMMI Maturity Level 3 v1.2 goals, requirements of the ISO 9001:2008 standard, and applicable statutory and regulatory requirements, is made up of a set of documents and an on-line process architecture that defines the approach and responsibility for innovation and technology management at the division. Improvement suggestions are solicited from employees via a process tool which is accessed via the Process Asset Library (PAL) employee webpage."

The QMS applies to all aspects of the organization. The QMS is governed by a quality policy and supporting quality objectives. The policy is "Satisfying Customers through Innovation, Quality, and Continuous Improvement" and the objectives are Performance Goals (Cost, Quality, Schedule), Customer Satisfaction, Communication, Continuous Improvement (The Division QMS, 2010). Specific annual measurement objectives are created for each quality objective and results are tracked and reported monthly. Results are posted to the PAL (intranet).

The process architecture defines in detail the steps required of Program Management, Engineering Management, and Organizational Support functions to provide integrated operations given the requirements for certification and derived organizational process guidance. Figure 2 illustrates the project lifecycle process. The process can be tailored by eliminating select functions when not required (see below). Additional process tailoring must be approved by QA.
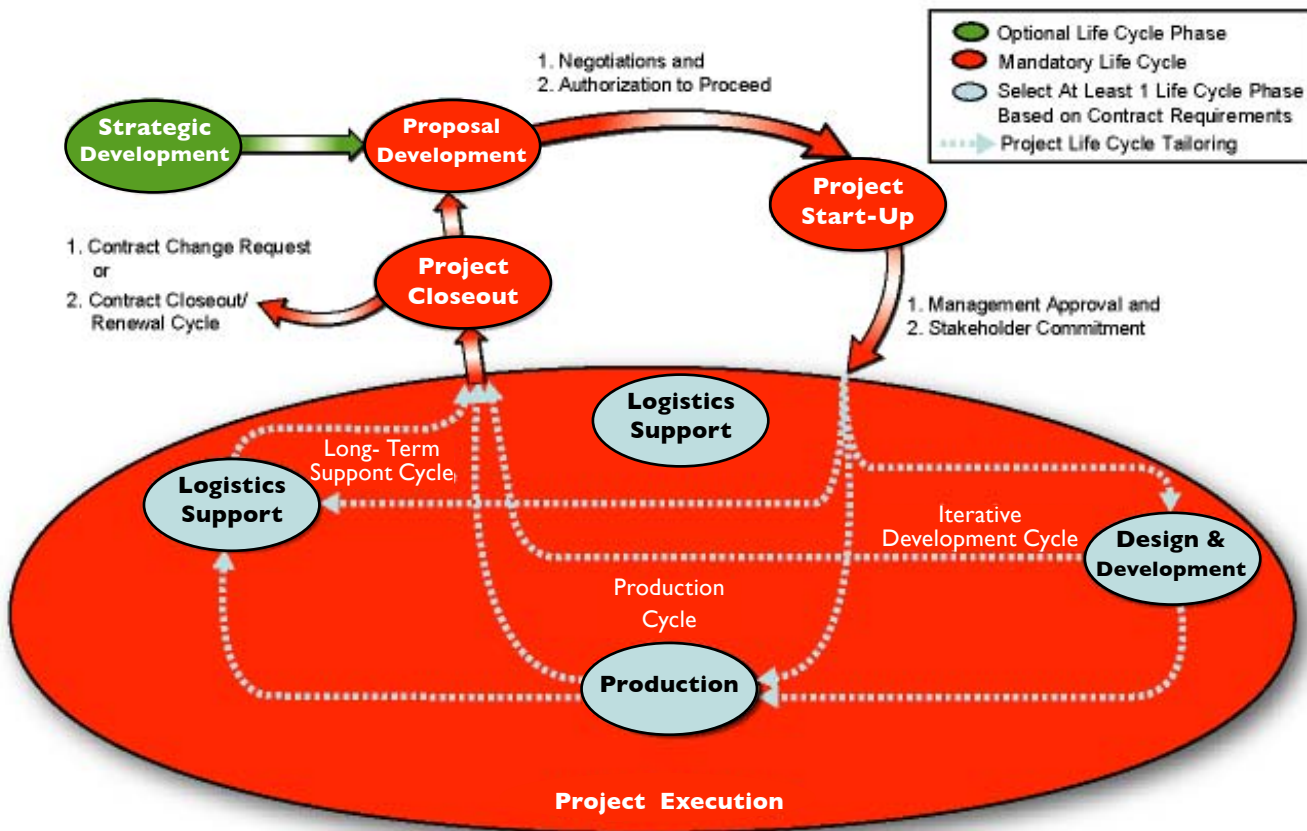

Figure 2: Project Life Cycle

Process improvement suggestions submitted via the Process Improvement Process are vetted by a team of select employees from across the organization via the Process Configuration Control Board (CCB) chaired by QA. The process for selection of Process CCB membership is unclear. Process-related tools are also managed by QA and maintained by members of the Finance and Controls team. Process owners are defined and listed on the PAL (intranet) web page.

Divisional Organization

The organization has a largely product-based organization as represented in Figure 1 (adapted from division intranet, 2010). Executive positions report to the President as do a few function leads (HR, Business Development). With the exception of accounting and finance, most organizational support functions report to the COO. R&D reports to the CTO but IT does not. Product line managers report to the VP of programs with the exception of Special Projects and Special Programs which are not responsible for specific products. Each product line has a Program Manager who reports to a Director.

The products are in various stages of maturity and can be classified as follows:

Product	Stage of development	Approx full-time personnel
A	Emerging	14
B	Growth	18
C	Mature	87
C*	Emerging	11

Table 1: Product Maturity and Size

All functions supporting a product report directly to that product owner with the exception of product C which, despite the organizational chart, affords more authority to Chief Engineer C due to the size of the project. Product C* represents an emerging spinoff of the primary product C. As such, C* makes use of some of the non-engineering functions under C.
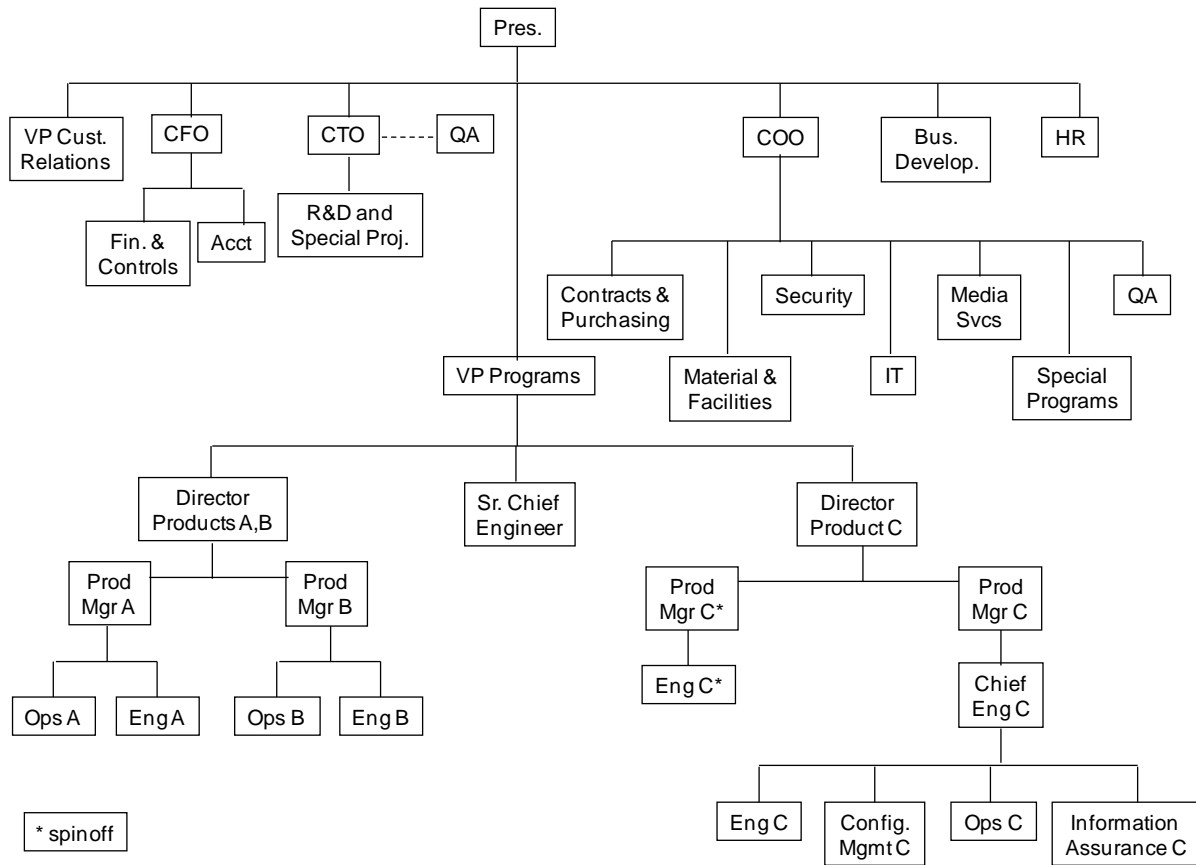
Figure 1: Organizational Chart

Survey Results
Distribution and Response Results

Surveys were requested of 49 potential respondents out of 216 members of the population. 12 responses were received. The population was categorized into level 1 (individual contributor or team lead), level 2 (manager, senior team lead or engineering fellow) or level 3 (director and above). The table below summarizes the survey distribution and response results. The distribution of employee levels in the response set and the requested set align fairly well with the distribution of levels in the population.

A higher percentage of level 3 employees is intentionally used to establish a baseline against which to compare the responses of lower level employees for questions of strategy and competitive advantage. The distribution of employees across functional groups is not well distributed. The distribution of employees by tenure is believed to be fairly well distributed with an average time in position of 3.4 years and in the organization of 4.3 years. However, there is insufficient data to compare this to the organization overall.

	% of responses	% of requested	% of population
Surveys requested			22.7
Responses received		24.5	5.6
Level 1	66.7	71.4	82.4
Level 2	16.7	18.4	13.0
Level 3	16.7	10.2	4.6

Table 3: Perception Results

Table 2: Survey Responses and Distribution

The response rate of 24.5% is respectable. Nonetheless, the sample size is not considered sufficient to support correlation of responses to demographics. In retrospect, a larger requested set should have been used. Analysis relative to demographic values is used only to indicate possible areas of additional research.

Assessment of Perception

Questions of perception of the effectiveness, support, flexibility, and communication of various aspects of the organization's environment were assessed using a 5 part ordered categorical Likert scale. Responses were commonly ordered, bipolar, with a neutral value using "Not", "Somewhat", "Basically", "Mostly", and "Very" to describe perceptions. The discrete categories cannot be assumed

to be normalized. In particular, the use of "Very" at the top end of the rating implies something less than 100% whereas "Not" on the bottom implies 0%. In retrospect the use of "Completely" rather than "Very" may have provided a normal distribution (regular interval). Without a normal distribution, statistical modeling is impractical (Lubke and Muthen, 2004). Thus, locational analysis (median, mode) is more appropriate (Clason and Dormody, 1994). Finally, while several factors (antecedents) to the establishment of an environment conducive to effective MTI are assessed in the survey, there is no prescribed method for determining the correlation or relative weight of each factor to the perceived effectiveness of the MTI. Thus, results are analyzed subjectively and in consideration of the findings of the case analysis. Table 3 provides the summarized results of the perception questions.

Question	Median	Mode
Your perception of importance of innovation	Very	Very
Mgmt's perception of importance of innovation	Mostly	Mostly-Very
Importance, Cumulative	**Very**	**Very**
MTI processes and tools effective	Basically-Mostly	Mostly
Integration of inputs for best possible outputs	Basically	Basically
Innovation processes communicated	Basically	Mostly
Process owners communicated	Basically	Basically-Mostly
Processes flexible for varying degrees on innovation	Basically	Basically
Current Process, Cumulative	**Basically**	**Basically**
Environment supportive of innovation and creativity	Mostly	Mostly
Job function and evaluation clearly communicated	Mostly	Very
Technologies well-suited to job functions	Basically-Mostly	Basically
Information sharing and knowledge mgmt effective	Basically	Somewhat
MTI resources sufficient	Basically	Somewhat-Mostly
Environment, Cumulative	**Mostly**	**Mostly**
Innovation associated with the strategy	Mostly	Mostly-Very
Innovation associated with competitive advantage	Mostly	Mostly-Very
Overall MTI effective	Basically	Mostly
Summary, Cumulative	**Mostly**	**Mostly**
Overall	***Mostly***	***Mostly***

Table 3: Perception Results

Innovations Suggested and Implemented

Respondents were asked to quantify the number of innovation suggestions submitted via formal and informal processes and how many of those suggestions they felt were implemented. Respondents were also asked how many innovations they had implemented on their own or with others outside the formal processes and chain of command. Finally, employees were asked how many innovations they had not submitted. The results are provided in the table below. As a point of comparison, the reported number of innovations implemented via the formal processes for the period Dec 2009 through March 2010 is 5 (The Division PAL, 2010).

Findings Analysis
Perceptions of Effectiveness

In general, the perceptions are positive for the importance of MTI (Very, Very), the environmental antecedents (Mostly, Mostly), the summary (Mostly, Mostly), and the overall MTI (Mostly, Mostly). The cumulative ratings for the current processes (Basically, Basically), are the lowest of any category.

Some specific trends are notable. While the importance of innovation is rated highly, without exception each respondent indicated their perception of the importance was the same or higher than management's perception.

	submitted	% of total submitted	implemented	% of this type implemented	% of total implemented
Formally	4	3.9	1	25.0	1.0
Informally	52	51.0	19	36.5	18.6
Self	46	45.1	46	100.0	45.1
Total	**102**	**100.0**	**66**		**64.7**
Not	26	25.5			

Table 4: Innovation suggestions

Several issues are noted in the analysis of the number and type of suggestions. The survey did not ask for explanations of why innovations were suggested, not suggested, or implemented in the various ways. Because a clear definition of what constitutes an innovation was not provided, there is no way to gauge the relative complexity of the suggestions counted. What one employee considers a substantial innovation may be considered a trivial change by another and therefore not counted. There is no measure of the reasons suggestions were not implemented or if such a feedback channel exists. Managers and process owners tend to have access to additional information not available to individual contributors which afford them a broader view and better understanding of the potential implications of a change. Finally, there is no mechanism to determine whether a single innovation suggestion might be counted in multiple categories if, for example, an informal suggestion was rejected and then subsequently implemented manually or if a single innovation was counted by multiple employees.

Given the focus on innovation in the QMS, one would tend to think the importance has been communicated and a perceived difference between communication and action is the cause for difference in perception. Visibility of the processes of various types of innovation may be a factor.

The cumulative ratings of each category are lower than the ratings of importance. This is a general indication that there is room for improvement in the MTI. In general, this indicates the need to correct the current processes to better support the MTI. When considering the current processes, the perception of the integration of inputs (people, technology, procedures) to produce the best possible outputs and the perception of the flexibility of the processes to accommodate varying levels of innovation are rated the lowest. There are likely several factors involved here. The organization is both ISO 9001 and CMMI Level 3 certified. In addition, significant portions of the programs and operations are subject to government-mandated regulations and systems, personnel, and information security requirements. As a result,

some processes or process steps are designed to ensure compliance and effectiveness over efficiency. Further, the process allows for automatic tailoring based on project objectives and custom tailoring by the PM with QA approval. Nonetheless, the current processes appear to be an area where internal systems and procedures should be reviewed for better integration and alternate options for tailoring based on the level of innovation required. Visibility may again be an issue.

The cumulative ratings for environment antecedents to effective MTI are positive (Mostly, Mostly). This is an indication that the organization has taken steps to encourage an environment accepting of innovation. The lowest rated of all items are the effective sharing of information and management of knowledge. The effective sharing of information involves open communication of information both horizontally and vertically within the organization (White and Bruton, 2007). Effective information sharing is associated with improving the integration of inputs for processing into outputs. Knowledge management goes beyond simply sharing information to include the structures, procedures, and discipline to effectively capture, interpret, and make available for ready transfer the experiential knowledge and wisdom of the organization (White and Bruton, 2007). Knowledge and experience drive the effective adaptation of processes for the most effective use in specific situations. Thus, attempts to improve information sharing and knowledge management in general should also improve the current process for innovation and will likely have positive repercussions in other areas as well.

The rating of the sufficiency of resources for MTI is bimodal, indicating a potential dichotomy of perception. When segregated by employee levels, level 2 and 3 employees rate resources as more sufficient (median = Basically-Mostly, mode = Mostly) than do level 1 employees (median = Somewhat, mode = Somewhat). As mentioned previously, the sample size is not considered sufficient to justify demographic analysis but this should be a consideration for further research.

Innovation Suggestions

Despite the shortcomings mentioned above, there are some interesting points to be gleaned from the data on suggestions. The percentages of total suggestions submitted and implemented informally or by the employee directly are significant (96.1% and 63.7%). This may be an indication that the formal processes are inefficient, overly restrictive, lack sufficient resources, or at least give the perception of these conditions such that employees avoid the formal process. However, it may also be an indication that there is an emphasis on and significant support for informal implementation. There is evidence to indicate both statements may be true. Perceptions of the sufficiency of resources for the MTI are inconclusive but indicate further review is warranted. The quality policy, clearly communicated regularly to all, includes a focus on innovation. The missing piece may be the clear delineation of the processes and mandates for employees with regard to suggesting, vetting, and implementing innovations and for receiving feedback from the vetting process. The rate of implementation in each category may be completely adequate but requires purposeful planning for MTI implementation and evaluation and control (White and Bruton, 2007). While there is clear evaluation of the formal processes for innovation via established metrics, the guidance and assessment of less formal means for innovation are less clear. In addition, it does not appear there exist tools to support less formal innovations other than communication to the supervisor.

The relatively low percentage of implementation of formal suggestions (25%) as compared to informal suggestions (36%) may be a result of insufficient resources or an indication of the complexity and priority of the innovations typically addressed by the formal processes. The attributes of varying complexity and priority are associated with the concept of a portfolio approach to the MTI (Schwarz, 2010). Specifically, different aspects of the operation necessitate different types of innovation and technology and thus varying levels of the MTI. Mature products and services focus more on sustainment, incremental improvement, and efficiency while emerging products and processes focus more on rapid implementation of creative solutions. A plan for the application of the MTI based on the type and level required helps ensure resources are being applied according to the operational priorities and complexity of implementation and allows for different processes to be implemented as appropriate. Associated with this is the requirement to clearly establish, communicate, and monitor the operational imperatives for changes to ensure the MTI remains properly aligned.

Finally, while there is no evidence to indicate why some suggestions are not submitted at all, the fact that the numbers are lower than the submitted suggestions indicates

there is a perception of some capability for implementation and that employees are not so utterly frustrated that they have stopped making suggestions at all. The fact the number is non-trivial (25.5% of all submitted suggestions) indicates there is additional innovation capacity of which the organization can take advantage given the proper process, resources, and communication.

Open-ended Questions

Results of the open-ended questions are decidedly more difficult to interpret. Comments can be categorized and organized but differences in language and interpretation lead to the extraction of only the most basic threads. Outside of this type of analysis, specific comments are provided for information only. With regard to personal responsibility for innovation, most respondents (83.3%) recognize the role of innovation in their daily job function.

Current Process

When asked to describe the currently defined processes and tools for MTI, many answers aligned well with the formally described processes: the quality management system and its related components. This is a sign that, at a minimum, the existence of the quality system and the process architecture have been well communicated. There were also several that indicated no knowledge of a process. This is likely due to the lack of association of the MTI with the quality process.

There were also several descriptions of project- and team-level innovations that occur outside the formal process. A recurring complaint is the continual "reinvention of the wheel" due to lack of cross-team information sharing and collaboration and contractual boundaries.

"This is also an artifact of the strict rules regulating contract work and forbidding the cross-contract use of assets and contract money, and while this is a vital regulatory rule set to follow, it should not extend to in-house/ overhead-supported innovations and knowledge exchange where permissible by security and contract regulations."

While contractual regulations do forbid the use of assets from one contract to be used on another without permission, the assets are the resultant product, software code, information, or services. The knowledge that created them remains the property of the organization and should be purposefully managed.

The over-reliance on a primary customer, when associated with the strong inclination toward current customer satisfaction, was described as a potential roadblock to innovation by creating an effect of tunnel vision.

"Because of the prominence of sole-source [contracts], there doesn't appear to be a large emphasis/commitment to innovation, but rather meeting a requirement and delivering it on time and on budget; almost a status quo approach to providing capabilities. It's understandable, given the need to satisfy customer requirements, but it can choke creativity and thinking outside the box to improve beyond the requirement."

"The problem is that if our relationships go away and our product performance cannot sustain itself, then we're in trouble."

"Non-contract, Non-IRAD Innovation - no charge number, so just don't do it. Many employees have some brilliant ideas, but they will just remain ethereal ideas unfortunately [sic]."

The strategy of The Division clearly seeks to expand to adjacent customers to support growth and minimize this risk of over-reliance. This should be the focus of specific methods of MTI.

Finally, there is skepticism about the willingness of management to support grass-roots efforts at innovation and to manage MTI due to limited resources.

"There is no [one] interested in hearing about mid to long term innovations [here]. There is no technical visionary."

"If your [sic]not in line with the status quo, no one wants to hear what your [sic] suggestion."

"Some non-technical innovations…have helped to provide engineers with a glimpse of innovated technology in house, but management support has been minimal… The limited time allotted and infrequency only allows a brief glimpse, but not enough to really allow the re-use of new and powerful technology that is continually invented and re-invented throughout the small branches…Unfortunately there is not a cheap solution on hand to mitigate this as it is inherent to the isolation and inter-team-competitiveness/ anti-collaboration structure already long established."

"There are limited resources to specifically establish and maintain a dense and consistent management communications mechanism for innovation and process improvement."

However, management does not need to manage every aspect of MTI; they need only provide the focus, the guidelines, and the resources and some innovations will occur naturally. There may in fact be cheap solutions if management is willing to accept measured risks to encourage creativity and the sharing of knowledge. Not every suggestion will work. However, failures should be treated as lessons learned and applied to future endeavors rather than to stifle further attempts at innovation.

Strategy

When asked about strategy, several respondents referenced short-term goals of achieving sales and profit targets, avoiding security incidents, and retaining certifications. While these are important items, they are not strategies but rather operational objectives. A few respondents reference the desire for organic growth and tapping adjacent markets and customers which is more in line with the defined strategy. Most employees reference the quality policy. While the quality policy in part describes the mission, it is not the strategy. It does not describe the target market(s) or the products and services provided. This fact would seem to invalidate the favorable perception of the alignment of MTI with the strategy. However, this is only partially true. The fact that employees perceive the MTI to be aligned with the quality policy is an excellent start. The lesson here is that management clearly has the ear of the employee in that the existence of the quality policy and its effect on operations is prevalent. A similar focus on communicating the defined strategy and the objectives for achieving that strategy, and then focusing the MTI, could have far reaching effects. For this to be effective, the strategy and objectives must be clear and pervasive and the resources must clearly support them.

Competitive Advantage

If there is one place in which management and employees are in complete agreement, it is in the components of competitive advantage. A talented and experienced workforce, a close relationship with the customer, a deep understanding of customer needs and a shared commitment to their success, and the ability to respond quickly to changing customer priorities are universally accepted as the primary sources of advantage. Additional responses included the small size of the organization and the technologies of the current product lines. Protection of these advantages should be the focus of the MTI.

One to Change

Respondents were asked to describe one thing about the MTI they would most like to see changed. Responses varied but fell into general themes of increased cross-team communication and information sharing, clear mandates to process owners, willingness to take measured risks, support for additional informal means for generating ideas and nurturing them to fruition, and tighter integration of research and development efforts with project engineering. The development of a Science and Technology Board was specifically suggested as was the need to establish mid- and long-term technical visions.

One to Keep

Respondents were asked to describe one thing about the MTI they would most like to see preserved. Agility, small team size, continued encouragement of team- and project-level innovation, and current processes for collaboration (CCB, PRET) are among the items listed. Associated with agility is one potentially controversial suggestion to avoid being "over run [sic] with large division bureaucratic [sic] processes." While the group to which The Division reports reserves the corporate right to levy any rules and processes they wish, the fact is that the agility of this division is a competitive advantage that must be preserved.

Recommendations

Review the current plan for the management of technology and innovation. In addition to the alignment with quality objectives, ensure alignment with the strategic goals other than customer satisfaction (adjacent customers, adjacent markets, additional products).

Establish specific goals for the MTI to accomplish the strategic goals. For example, to reach adjacent customers may require new and innovative ways to define, reach, and elicit needs from those potential customers.

Once the strategic plan for MTI and the specific goals are identified, clearly communicate the plan and goals

and continually monitor, evaluate, and correct as needed. Make the goals and the tools for implementation part of the culture. Example: Create a goals and status dashboard on the PAL; place the process improvement tools on the front page of the PAL.

Review the current options for processing ideas for innovation. Ensure the process includes both formal and informal means with appropriate and well-communicated processes for each. Establish and/or reiterate process owners.

Focus on incremental improvements and implement them quickly and visibly. Example: Create an easy to use intranet-based idea submission tool for informal submission of small innovations; make the list and results visible to all employees; identify specific owners for reviewing and implementation. Make innovation a recurring topic of quarterly newsletters.

Review the current set of core processes and ensure alignment with the sources of competitive advantage and critical factors of success. Competitive advantages must be protected and nurtured and critical success factors, while not competitive advantages, must be executed properly (e.g. for regulatory compliance). Consider reducing the size of existing PM and Eng processes by pulling out certain processes as establishing separate owners. Example: Move existing material management, configuration management, information assurance, and fielding and support functions out of product C and make them professional organizations across the division;

Each of the associated processes should have a defined process owner and should span the entire organization with the mandate of making each project successful. Specifically, process owners are responsible for the timely evaluation and implementation of process improvements with the combined goals of effective, efficient, and appropriate execution. Process owners must think proactively, globally (project initiation to closure) and ensure sufficient flexibility to make all project types successful. Project execution and support to the strategic and operational goals is the imperative.

Ensure management, and individual contributors are provided clear mandates for their role in the management of innovation and technology. Managers ensure appropriate application of resources for the type of innovation needed. Individual employees take every opportunity to self-

implement innovations where feasible and recommend suggestions where additional resources are needed for complex or far-reaching innovations.

Regarding process tailoring, examine the current processes and consider establishing flavors of the process architecture pre-configured for specific project types to facilitate the tailoring process. Example: emerging, growth, mature.

Establish and clearly support specific formal and informal means for sharing information. Establish a formal Knowledge Management function supported by tools and processes that make corporate knowledge available to all. Defined a knowledge management champion (typically the CTO or CIO) and integrate knowledge management practices into the existing processes. Example: Create project-based wiki pages searchable and visible to all employees; establish and publish on the PAL a listing of the portfolio of current projects and their technologies.

Define and strive for a balance of projects of varying levels of maturity within each product area. Establish a portfolio approach to the MTI; ensure the MTI and related process are applied appropriately based on the maturity of each subproject (emerging = more creative, flat structure, rapid change; mature = vertical structure, incremental change). This may mean restructuring existing product lines. Example: Break Product C into subprojects where those parts of the project that need to adapt quickly are treated as emerging.

Stress to employees that focused creativity and innovation are part of the job; failures based on honest attempts at improvement will be treated as lessons learned and not grounds for rebuke. Support to innovation in general and process improvement should be recognized. Include these in employee evaluations. Establish a "Star Innovator" award.

Loss of agility for the sake of compliance with group processes could lead to lost customers and revenue. Make the maintenance of agility, at least for the customers who demand it, a strategic focus of MTI. This may mean occasionally arguing against additional imposition from the higher level group processes.

Realign the organization such that IT, knowledge management, and the tools supporting the MTI report to a single position – the CTO or CIO.

Merge Business Development, Customer Relations, R&D, and other marketing functions under a single position (e.g. VP of Marketing). This group has the mandate to elicit customer requirements and work with product managers to compare needs against the available products, services, and knowledge of the organization. Gaps are targets for R&D and rapid prototyping for demonstration and as the intellectual property of The Division. The MTI for this group is focused on rapid acquisition, development, and integration of technologies.

Conclusions

The Division has established an underlying architecture to support the successful implementation of appropriate levels of MTI. Fine tuning of that architecture will ensure the processes for MTI align with the strategy, competitive advantages, and critical factors of success. The need for innovation is an inherent part of the existing culture. The plans for aggressive growth conflict with existing space limitations – getting more out of existing personnel and processes is necessary. Continuous vertical and horizontal communications, and the establishment and open support of processes and tools to facilitate them, ensure employees are well-informed and part of the culture of innovation. The changes recommended here will help ensure the actualization of innovation in line with the stated need.

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Appendix A: Survey Implementation

The study was conducted with the approval of the Chief Operating Officer (COO) and in keeping with corporate guidelines. The survey could not be completed on company time but the use of email and phone resources was permitted. The COO was given review authority over the content of the survey and the list of potential respondents. No changes were suggested for the survey. One potential respondent was removed. The list of potential respondents was selected by combing the organizational chart and selecting enough names to represent approximately 20% from each group. A minimum of 2 names was selected from each group. Names were partially selected based on the perceived likelihood to respond to the survey in any manner. Attempts were made to ensure a variety of skill sets, tenure, and overall experience level. It was agreed that only aggregate results would be reported and the raw data would remain the sole property

of the researcher. Any quotes used for illustrative purposes would not attributed to the respondent and could be edited or redacted to protect the source. A disclaimer was included in the survey that described the use of company resources, the confidentiality of responses, and non-attribution to the respondent. Respondents were directed not to disseminate the survey or collected data without permission.

Respondents were directed not to ask for clarifications or to perform independent research. At the suggestion of the COO, a paragraph was added that provided definitions for technology and innovation, the general types of innovation, and its importance in technologically-focused organizations. Surveys were distributed and collected via individual emails. A reminder was sent to all non-respondents before the deadline.