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Editorial Preface

This is the first issue of volume first of The Innovative Studies: International Journal (ISIJ). The Journal is published bi-monthly, with papers being peer reviewed to high international standards. The International Journal of Innovative Studies is not limited to a specific aspect of innovation but it is devoted to the publication of high quality papers on all division of computer security in general. ISIJ intends to disseminate knowledge in the various disciplines of the computer security field from theoretical, practical and analytical research to physical implications and theoretical or quantitative discussion intended for academic and industrial progress. In order to position

ISIJ as one of the good journal on Innovative Studies, a group of highly valuable scholars are serving on the editorial board. The International Editorial Board ensures that significant developments in computer security from around the world are reflected in the Journal. Some important topics covers by journal are Case Studies and Change Management, Innovation in SME and R&D Management, Technology Strategy and Planning , Project and Program Management etc.

The coverage of the journal includes all new theoretical and experimental findings in the fields of computer security which enhance the knowledge of scientist, industrials, researchers and all those persons who are coupled with computer security field. ISIJ objective is to publish articles that are not only technically proficient but also contains information and ideas of fresh interest for International readership. ISIJ aims to handle submissions courteously and promptly. ISIJ objectives are to promote and extend the use of all methods in the principal disciplines of computer security. ISIJ editors understand that how much it is important for authors and researchers to have their work published with a minimum delay after submission of their papers. They also strongly believe that the direct communication between the editors and authors are important for the welfare, quality and wellbeing of the Journal and its readers. Therefore, all activities from paper submission to paper publication are controlled through electronic systems that include electronic submission, editorial panel and review system that ensures rapid decision with least delays in the publication processes.

To build its international reputation, we are disseminating the publication information through Google Books, Google Scholar, Directory of Open Access Journals (DOAJ), Open J Gate, ScientificCommons, Docstoc and many more. Our International Editors are working on establishing ISI listing and a good impact factor for ISIJ. We would like to remind you that the success of our journal depends directly on the number of quality articles submitted for review. Accordingly, we would like to request your participation by submitting quality manuscripts for review and encouraging your colleagues to submit quality manuscripts for review. One of the great benefits we can provide to our prospective authors is the mentoring nature of our review

process. ISIJ provides authors with high quality, helpful reviews that are shaped to assist authors in improving their manuscripts.

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Table of Content

Volume 1, Issue 3, December 2010

Pages

An Exploratory Re-Search for Variables Representative Of Academic Quality

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Abstract

Academic institutions have been fundamental contributors of education in the society. From tapping the talents of potential students to shaping them into responsible citizens, academic institutions have at all times played a vital role. This is the reason why quality of academic institutions has been under steady scrutiny for quality. What an institution of higher studies has to offer to students seeking to pursue their studies with it then becomes imperative. The purpose of this study is to provide an insight into the various perceptions as perceived by individuals with respect to quality of academic institution. The objective of this paper is to re-present an overview of the variables critical to the quality of an academic institution of higher studies and to indicate and /or re-emphasize upon factors that stand out important to quality in this domain. A random sample of 398 graduates from varied areas of work and study expressed their opinion about factors that they considered was most significant to academic quality. Interactions, Discussions, interviews, dialogues and questionnaires were used to consolidate the results. This paper presents a list of most extensively cited variables perceived as essential to quality education. These variables are generated from a pilot survey conducted in UAE and is a segment of an ongoing research in the areas of academic quality.

Keywords: Academic quality, Academic Quality Variables, Definitions of Academic Quality, Perception.

1. INTRODUCTION

Quality in academics is a highly contested concept and has multiple meanings for people who both are providers and users. Relying on different authors we could divide the definitions of quality into categories. When defined in terms of excellence, the definition sets a goal for Universities and academies of higher education to be the best. It can include admitting the best school leavers according to specific rankings as presumably the higher quality of input affects the quality of output. (European dimension of institutional quality management 2000) Quality again is irrefutable: a person recognizes quality instinctively (Harvey, Green, 1993). Traditionally, quality is synonymous to special (Lomas, 2002). The Goals of higher education is presented by accreditation councils on a generic note in their mission statements in terms of the program objectives and expected learning outcomes (NAAC other et al.) i.e. the institution says what it does and does what it promises (Scott C Burns, 1996). On the contrary some institutions choose to set a threshold that it proposes to cross in order to certify quality standards (Dill, 2003). Subject to the limitation that this will vary under rapid changing market circumstances, minimum standards are often briefly defined in order to ensure the particular minimum quality of higher education and curricula comparability. Such refinement though excellence stresses academic freedom and autonomy of university in quality assurance (Westerheijden. D, 1998). Autonomous

institutions focus on constant development and thereby raising the threshold by adding goals and increasing the quality by meeting these goals. In higher education the quality of teaching is linked to the effectiveness and of efficient teaching. Effectiveness is connected with the objectives of the curse while efficiency is connected with the resources used in order to meet the objectives. While viewing quality as transformation (Harvey, 1995), the understandings, attitudes and objectives of the student change and evolve in the course of the study processes. The students are the focus of attention and so are their educational needs. The better the university, the better it can meet the goals that include equipping the students with special skills, knowledge and attitudes that enable them to work and live in the society of knowledge.

1.1 The objective

The purpose of this research is to investigate what individuals seek in terms of quality from an academic institution. The need to reconfirm on the (changing) expectations from the academia is the key drive of the study. The variables that flash to the mind instantly, when academic quality is mentioned were recorded from the participants in the survey. With many of the variables being re-stated as important, this paper will also make an attempt to understand the citations (by the participants) as indicators of more fundamental variables. Considering that universities more often (than not) offer substantially most of what is required, it is interesting to know what parents and students would consider as important when being provided.

2. THE METHODOLOGY

The study was initialized through dialogues with individuals (on a broader beginning) to gather generic information. This was followed by both casual dialogues and focused discussions. Eventually a questionnaire with the fundamental question was distributed and responses gathered. What an educational institute must offer and what it should be doing is a part of the nomenclature. An open question as to what comes to a person's mind when one says 'quality of an academic institution' helped amass an inventory of parameters.

This report is necessarily a part of an ongoing survey of a wider spectrum in the areas of academic quality. The sample was random and the responses were received through mails and in written form (Hard copies). 398 individuals were posed with the question "*What in their opinion were the top 5 parameters critical to the quality of an academic institution?"* along with a host of other questions (beyond the scope of this paper). Alternatively when self administered, the question was also posed as *"What are the 5 factors that come instantly to the mind when one speaks of quality of an academic institution?"*. Discussions with members at different levels of the work-force ranging from Academicians to Physicians, Engineers, Lawyers, working professionals from various sectors, Parents and students as well, also contributed in a substantial way. Some participants insisted on suggesting more than five parameters maintaining that these variables are all bricks of the same wall, even one missing or slightly lesser in quality can make the wall weak. Individuals from different schools of study (Management / Art / Engineering / Medical Sciences etc…) mentioned factors prioritized accordingly, however factors generic to an institution / university was sought for the purpose of this paper.

The population is categorized (not necessarily in any criterion of prominence) as follows; the number indicates the number of participants from the specified group

Group A: Students **(80)**
Group B: Academicians/Researchers/Consultants **(58)**
Group C: Managers / Directors / Sr. Administrators **(66)**
Group D: Executives (Marketing/Sales/Service)/Team leaders/ Supervisors) **(43)**
Group E: Business persons **(19)**
Group F: Engineers/ Designers (Technical)/ Architects **(42)**
Group G: Physicians **(38)**
Group H: Other Professionals (Advocates/ Film makers/ Fashion Designers/ Writers/Photographers/Event Managers) **(12)**
Group I: Miscellaneous (Housewives/ Workers/ Front office executives/ Receptionists/ Personal assistants/ Foremen/ Un-specified) **(40)**

All respondents are graduates (presently employed or with work experience) with 249 post graduates 11 of whom are also Doctorates in their respective fields of specialization. The age-wise fragmentation of the sample is as follows:

Age	**<20**	**20-30**	**30-40**	**40-50**	**50-60**	**>60**
Number of respondents	**7**	**175**	**103**	**75**	**35**	**3**

TABLE 1

The sample-group classified according to the number of years of work experience is as follows:

Experience in years	**0-2**	**2-5**	**5-10**	**10-20**	**>20**
Number of respondents	**9**	**67**	**54**	**51**	**46**

TABLE 2

This survey was conducted between July 2009 and May 2010 as a part of a research study as quoted earlier. The respondents are all expatriates working in the United Arab Emirates.

3. THE SURVEY RESULTS

The respondents listed out a total of 60 factors (each in their own words – see Table. 2), though many factors were overlapping in definition or as mentioned earlier are indicators of a variable at a higher echelon. The top 10 mostly quoted parameters are

Sl. No	**Factor**	**% of respondents who quoted the same**
1	Faculty	72%
2	Infrastructure	62%
3	Placement	55%
4	Fee structure	41%
5	Industry Interface	39%
6	Institutional ranking	32%
7	Discipline and culture	28%
8	Research facilities	26%
9	Evaluation methods	24%
10	Admission process	19%

TABLE 3

4. DISCUSSION: (Refer to Table. 4)

4.1 Citation : Faculty Teaching methods, Mentors, Student faculty interaction, Peer learning, teacher student ratio Efficient head of the institution

With 72% of the respondents stating “FACULTY” as the most important criterion for the good of an institution, it is once again reinstated that good and effective faculty forms the core of an academic institution. Other mentions like ‘Mentors”, “Student-faculty interaction”, “Teacher student ratio” were also used to highlight the importance of faculty. Further, good teachers lead to good teaching methods. A committed and highly rated faculty is always well prepared, structure their lectures well and most of all will deliver effectively. As mentors they encourage student participation in learning and have them actively engaged in proactive thinking towards the subject matter (Kuh, 2003). The intellectual capital of the institutions is the largest contributor to the quality of an academic institution, re-emphasizing the ‘Engagement Theory’ (Howorth J.G & Conrad, 1997) organized around the central idea of faculty involvement in teaching and learning. Intuitively high quality programs (institutions as well) are those which contribute to the learning experiences for students by the faculty that have positive effects on their growth and development.

4.2 Citation : Infrastructure, Laboratories, Library, Resource availability

Following closely at 62% is the need for good infrastructure - an apt physical structure that aids effectual learning. Well equipped Library with easy access to resources both in terms of text books and online resources is next most important factor that individuals look for in an institution that claims of quality. University libraries play a central role as the nucleus of scientific literature (Matos, 1999) and technological advancements in information and communication has hugely raised the significance of a library in university. Equivalently, adequetly facilitated laboratories in universities help both students and their facilitators to be able to conduct research in a less constrained environment, driven less by mission and more by intellectual curiosity, enhancing their scientific productivity. The laboratories were viewed by many as having a strong connection to understanding and comprehending real-life work-situations. (Academics, 2005). It goes without saying that access to up-to-date scientific information is the first condition to quality education and research. Dialogues revealed that while good infrastructure costs, individuals look for the availability before they pay the price. Good physical facilities help create an ambience for good learning and also contribute towards the overall student learning experience.

4.3 Citation : Placement, Industry Interface, Internship, Hands-on experience, Dynamic management sensitive to market changes and industry requirements, Exchange programs & Global interaction, Research facilities

Highly influenced due to recession, respondents have quoted Placement (55%) as the next most potential criteria for academic quality. Campus recruitments should be a part of the package opined most of the professionals from the management and engineering background. What started off as a USP for academic institutions to market themselves is turning out to be a necessity. The need to congregate as much realistic knowledge rather than mere bookish information was also reflected in responses that quote industry interface (39%), internships, hands-on practical experiences, sensitivity to market changes & industry requirements, full-time research conveniences (26%), Exchange programs & Global interaction. This mirrors a certain aggressiveness that is gathering momentum to be able to sustain the rigid competition that explicates today's job market. All Academicians and researchers included in the survey have quoted research facilities as an important factor. Business entrepreneurs and top management members spoke of how important it is for students to be exposed to work culture and job environments before they actually are employed. One of the discussions accentuated the reasons why internships and industry interaction are important quality factors. This has a dual effect said the participants of the discussion-firstly the employer is more at ease to employ graduates who are familiar with work settings in general and secondly a student is more confident as this usually is her/his first full time job-venture. Ample exposure to the industry in terms of the market changes, interactions and opportunities of work (internships and internal research) will broaden the students potential opined the Director of an advertising agency.

4.4 Citation : Fee structure, Scholarships & Economical

"Quality education is an expensive affair", assert parents who are a part of this survey. Despite the high costs of education, demands for good colleges remain high. (Transworld). Though most of the respondents have expressed that they do not want to compromise too much and would as much go to any extent to provide (to themselves or to their kin) quality education, yet it is one of the factors that they will pay attention to. Interestingly, most respondents also acknowledged that after the economic recession that had a world-wide detrimental effect, both *fee structure* and *placements* have escalated up the priority list. Corroborative to this viewpoint is also the need for scholarships and financial aid, be it need based or merit based. Such a facility by the institution not only motivates students to develop a competitive spirit (when merit based) but also opens out the doors to deserving who less privileged (when aid is need based). Education being a private good, one can argue that the economic benefits which a college confers on an individual are sufficient to offset tuition payments-even if the costs are higher than they need to be. (Massy W. F., 2003) An extremely costly course with not much ROI (subject to elucidation) is not preferred. Alternatively, the convenient modes of payment of fees, an economical fee structure, merit-scholarships and financial aid act as antidotes to the ever-increasing cost of education.

4.5 Citation :Institutional ranking, Global recognition, Previous result trends, value of educations, Affiliation and credibility, Accreditation, College reputation, Brand image, Co-education, College management & Administration staff, Admission process Quota free education, Quality of incoming students

Affiliation and accreditation are rightfully the expected parameters of a quality institution. Brand Image, Institutional ranking (32%) and global recognition are tools synonymous of competitive advantage. These parameters ease the decision making process. Other internal factors that govern the quality were quoted as Admission process (19%), un-reserved/Quota free education (owing to the governing rules of the education system the respondent has been to) and the quality of incoming students. Contrary to this some respondents clearly stated that the quality of incoming students is not reflective of the output. An institution of high quality will make the best of the students no matter what the incoming quality is. The outgoing quality is truly reflective of teaching processes and the student learning experiences within the four walls of the institution. This is beneficial for the brand image of the institute thereby affecting the institutional ranking. Accreditation plays a vital role as the community and the government use the system to promote and assure quality and protect public interest (vi). Participants were of the outlook that awareness of the brand image and the global rank of a academic institution makes the job of the choosing between institutions a lot easier. These factors act as value add variables.

4.6 Citation :Discipline & Culture, College environment, Anti ragging, Value & ethics of the institution, Freedom of expression, Student unions, Healthy competition, Security & safety

28% of the respondents were of the outlook the discipline & culture contribute towards a fitting study environment in universities. Discipline transforms inherent ability and learned knowledge into achievement (Davis, 2008). Undesired behavior of students can mar the reputation of an institution and can have an impact on its selling-potential in the market. Concurrently a well-managed classroom can provide students with an exciting and intense learning experience. The Effective Management Model (Kounin, 2007) concentrates around the class-room behavior of the teacher. These above mentioned citations are representative of encouraging behavior forms for teachers which lead to better achievements among the students and fulfill lower rates of problems related to discipline. This also re-establishes the reason why faculty was quoted as the most important criteria for student quality.

4.7 Citation :Evaluation methods (fair and unbiased), Transparency in evaluation, Validity of results, Effective individual assessment, Moral support, Regularity of exams

“Evaluation in a university should be an acid test for every student before she/he strides out through the portals of an academic institution into the outer world”, remarks an academician emphasizing the importance of a meticulous and rigorous evaluation system. 24% of the respondents have included effective and fair evaluation methods as a criterion for a good academic institution. The primary purpose of assessment is for student improvement (NFA, 2007). It stands justified when Regularity of exams, transparency in evaluation, effective individual assessments and flexible grading systems were also quoted as indicators quality. To best serve learning, assessment must be integrated with curriculum and instruction, that redirecting a pointer at the faculty and teaching methods! On the contrary, individuals ascertained that good faculty and learning methods are reflective of sound evaluation. It is but obvious that valid and transparent evaluation comes as a package deal with good faculty.

5. RESULT SUMMARY

The Faculty has emerged as the most preferred variable that governs the quality of an academic institution. A dedicated and competent team of teachers pave the way for a robust education system. Efficient faculty bring with them effective thinking and valuable research thereby emphasizing the need for pertinent infrastructure and resources that facilitate their work. Excellent teaching methods and healthy evaluation practices is a derivative of superior faculty. An economic fee structure and placement facility is more the need of the hour. It is but obvious that quality is also referred to as value for money (Green, 1993); a secure job is fast becoming a quality variable in these post recession times. Graduate Placement and salaries when viewed as quality outcome measures are informative and generally valid in terms of information for potential students and could also be valuable general indicators of effectiveness for academic programs (Dill, 2007). A demand for competence in this regard is indicative of quality education and its monetary value. As is the case in all businesses, the education sector is no exception when it

comes to brand image. An institution that has evolved over time, based on its practices within and contributions to the society in general is subject to the (global) acknowledgment that follows. When an institution acquires a recognition enjoying a positive sentiment (in the market), it logically carves a niche for itself. This makes the option as that of least-risk for potential students who look for quality institutes. To be globally recognized is becoming crucial for all academic institutions in the context of the growing global demand for education and a fiercely competitive environment. Transnational agreements between universities are now common. (Chan, 2006). A wholesome study culture encompassing a healthy competitive environment, student discipline and safety will facilitate transformation of students to a better echelon during their studies and thereafter (Kuh, 1999).

This paper is limited to the variables as prioritized by the participants. Alternatively lesser citations need not be a sign of insignificance. As is obvious and as mentioned by some of the participants all of the variables referred to are bricks in same wall called 'education'. Each variable adds value to the quality of education (and the institution) in larger or smaller proportion. What institutions would need to do is to segregate these variables as Vital, Essential and Desirable, according to their preferences. The responses are also reflective of the educational experiences and the expectations that have been met in terms of success, employment and knowledge gain to name a few. This paper is the beginning to a more intensive and inclusive study to be undertaken, encompassing specific segments of the study disciplines. It is hoped that this will provide an overview of perceptions in general among individuals concerning their expectations and experience of academia. Although this will be of interest, the main value and purpose of this survey (as is the case with any) will be of the use of the results that will indicate significant preferences. (Moller.I, 2002)

6. CONCLUSION

Academic institutions are under continuous review for what they tender terms of quality. University learning comprises of gaining a range of expertise across breadths of facilities made available in the same. Global competition and the ever dynamic market has increased the importance of higher education and synonymously the quality of the same. The aim of this paper is to create an inventory through a primary research the variables critical to academic quality. Responses based on the survey conducted brought out some of the prominent variables most important to the quality of an academic institution. Faculties, Infrastructure, Placements, Fee structure, Industry Interface were observed to be some of the most importantly sought parameters. Dialogues with several individuals also pointed out to the Faculty being the most sought variable. Discussion with respondents also revealed the fact that fee structure and placements become important in the present day scenario of the post-recession market. Although variables such as college discipline and evaluation methods have taken a back seat, it was observed through talks that these were not completely negligible. Some are vital to quality, some essential and some desirable! This paper could serve as hoped for further study and research into a fine tuned list of critical factors, their current trends both global and specific to an institution, their significances, and proposals for improvement or simply *status quo*.

TABLE 4: Table showing variables listed by respondents

Sl.no	Variable	Total number of respondents who quoted the variable	% of respondents
1	Faculty	286	72%
2	Infrastructure	247	62%
3	Placement	219	55%
4	Fee structure	163	41%
5	Industry Interface	154	39%
6	Institutional ranking	126	32%
7	Discipline and culture	113	28%
8	Research facilities	102	26%
9	Evaluation methods	97	24%
10	Admission process	75	19%
11	Geographical location	69	17%

12	Global recognition	41	10%
13	Teaching methods	37	9%
14	Course curriculum	33	8%
15	Mentors	31	8%
16	Transparency in evaluation	23	6%
17	Internship & hands-on experience	17	4%
18	College Environment	16	4%
19	Previous result trends	15	4%
20	Dynamic Management (sensitive to market changes)	12	3%
21	Scholarships	10	3%
22	Validity of results	9	2%
23	Program flexibility	8	2%
24	Student faculty interaction	6	2%
25	Sports and co-curricular activities	6	2%
26	Anti-ragging	5	1%
27	Hostel facilities	5	1%
28	Value of education	5	1%
29	Lab& Library access	4	1%
30	NCC/Community service	4	1%
31	Affiliation & credibility	4	1%
32	Extracurricular activities	3	1%
33	Values and ethics of the Institution	3	1%
34	Accreditation	3	1%
35	Peer Learning	3	1%
36	College reputation & Brand image	3	1%
37	Course popularity & demand	3	1%
38	Exchange programs and global interaction	2	1%
39	Teacher -student ratio	2	1%
40	Quality of Incoming students	2	1%
41	Efficient head of the Institution	2	1%
42	College management & Admin staff	2	1%
43	Resource availability	2	1%
44	Security and safety of students	2	1%
45	Course material preparation	1	-
46	Effective individual assessment & Moral support	1	-
47	Freedom of expression	1	-
48	Networking and tie-up with other colleges and universities	1	-
49	Student commitment	1	-
50	Student Services (Medical/counseling)	1	-
51	Student activity rooms	1	-
52	Student Unions	1	-
53	Alumni Feedback	1	-
54	Academic Performance of students	1	-
55	Time flexibility	1	-
56	Economical	1	-
57	Healthy competition (without reservations)	1	-
58	Regularity of exams	1	-
59	Co-education	1	-
60	Quota free education	1	-

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Leadership Driven Innovation: The Role of the Engineer in Our Future

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Abstract

The proliferation of new technologies, particularly those identified as advanced and/or disruptive, rely on the development of two individual but highly interrelated competencies, leadership and innovation. These two are the basis for the successful development of most of the major technologies in production, today. At their best they are also the genesis for most of the large commercial and industrial organizations currently operating in the global marketplace. More importantly, it is the state of health of these two competencies that often determines the longevity and profitability of these organizations. This paper tracks a hypothetical progression from inception to long-term solvency for what can be idealized as a maturation process of a new company/technology. While this study is directed to represent most any type of new products and services, it is particularly well suited to advanced, and possibly disruptive, technologies and those organizations seeking and dealing in products for accelerating markets.

Keywords: New Technology Development, Leadership, Innovation, Disruptive Technologies

1 INTRODUCTION

There is a lot of rhetoric posited on the role of innovation in the progress and success of a new opportunity; be it a new technology, product, process, or service. The author's will attempt to illustrate a progression of activities, or states, whereby any of these could become successful and hopefully have a long, profitable life. What is apparent, to the authors, is that the novelty, uniqueness, or responsiveness to an identified need and its solution will not necessarily spell long-term success. A critical element to the mix will require the addition of strong, capable leadership. Leadership that understands and embraces innovation and the innovative spirit.

For most of the needs of modern society, the solutions, and the resulting products and services, will come from the technical arena created and nurtured by the people who generate them, thus the title of this paper. It is with the technically inclined that a significant number of the technological successes become manifest. It is to these individuals and their skills, motivation, and attributes that most long-term technological successes are attributed.

This paper will first define the terms and provide a hypothetical scenario for the growth of an organized effort or enterprise. It will also lead the reader through what it takes to bring a technology to market and, more importantly, what it takes to continue to support and sustain that growth. It will then lay out a timeline for the representative, but generalized, lifecycle for a new concept, technology, service, etc. along with the associated profits and losses, and risks and rewards.

Finally, it will differentiate between the types of technologies and the maturation processes normally associated with a successful enterprise. All of this will be covered in a generalized scenario where the timeline and the fiscal values would be scaled to fit most any type of enterprise. First the definitions, then the organizational maturation process followed by a challenge to the reader.

2 DEFINITIONS

This paper will use standard word definitions easily obtained through most any textbook or online. It is not a specific definition that was selected but, instead, ones that hopefully will easily resonant with the reader. While the specifics could be argued, the general theme serves to help define and highlight the focus of this paper.

2.1 Leadership

In its essence, leadership in an organizational role involves four main items: [1], [2]

- First, a clear vision must be established.
- Second, that vision must be shared with others so that they will follow willingly.
- Third, the information, knowledge and methods to realize that vision must be provided.
- Finally, leadership must coordinate and balance the conflicting issues of all members or stakeholders.

A leader should have their vision defined and clear to their constituencies early in the program, if not on day one. Leaders often come to the forefront during a crisis [1]. They are able to think and act quickly in creative ways to a variety of situations. They thrive on change and don't mind crisis. True leaders have no problem with crisis, while managers often do. Managers want things to stay the way they are or if they are to change, they want that change to occur in an orderly fashion. Leaders recognize that their role, plus the environment they work in, is dynamic and often volatile. [3]

Unlike management, leadership flows from the core of a personality and cannot be entirely taught [1]. It may be career acquired, but the skill set and attributes are inherent to the individual. It may also be learned or enhanced through coaching or mentoring but most likely it comes from the experiences that resulted from the individual's initiative [1]. The engineering skill set can also contribute to the core elements and values of that leadership make-up.

In other words, if you are a born leader then all of your experiences will build those qualities, most likely because you seek them out. If the makings of the leadership traits are there, then the process will happen, albeit most likely at a faster rate, if the opportunity is ripe and recognition is given to that growth by everyone in the environment.

2.2 Innovation

There are three definitions for innovation that will be used in this treatise.

> First: Innovation involves the deliberate application of information, imagination, and initiative in deriving greater or different value from resources. It encompasses all processes by which new ideas are generated and converted into useful products. [1]
>
> Second: The term innovation means a new way of doing something. It may refer to incremental, radical, or revolutionary changes in thinking, products, processes, or organizations. [4]

These are both very important definitions. Most people in an organization want innovation and will build their entire organization around the concept. They strive for it and try to reward it, but in fact, they often cannot even define what it is and, more often than not, let it pass them by for lack of vision and understanding. [2]

Arguably, innovation normally occurs "outside of the box." Truly innovative companies and their design and decision-making teams are often radical in their make-up. They have people with disparate personalities and skill-sets who work for and often around each other. Their innovators, at all levels, are often regarded as visionary trouble-makers, with unbelievably creative attributes who take calculated risks every day, often because they don't realize or even understand risk.

In addition, the third definition, business innovation, furthers this concept.

> In business, innovation results often from the application of a scientific or technical idea in decreasing the gap between the needs or expectations of the customer and the performance of a firm's products [1].

The key words in this definition are scientific or technical idea. It is normally a technology that reaches out to make a change, especially for the current state of our society.

3 INNOVATION/INVENTION TYPES

The terms innovation and invention are defined differently. A distinction is typically made between invention, an idea made manifest, and innovation, ideas applied successfully [4]. Everyone can invent, but few can innovate. An innovative idea is one that is carried all the way through to a product or a solution. It takes a very powerful, directed organization to take a product all the way to customer acceptance. Another way to define invention is the first occurrence of an idea for a new product or process, while innovation is the first attempt to carry it out in practice. [4]

Since new ideas are a "dime-a-dozen", the individual, or organization, that can make ideas manifest are the innovative leaders. Innovation leading to increased productivity is the fundamental source of increasing wealth in an economy [4]. It is what innovation does to your economy and how you use it to plan for your future state that creates your ultimate, long-term success.

There are two primary types of innovation: revolutionary and evolutionary (see FIGURE 1). Revolutionary innovations are the breakthroughs, or disruptive technologies, often called gamechangers. [5] They are key for the success of any innovation-based organization where the goal is to be number one or to increase the market share by multiples. It is particularly true for the start-ups based on a new product or solution.

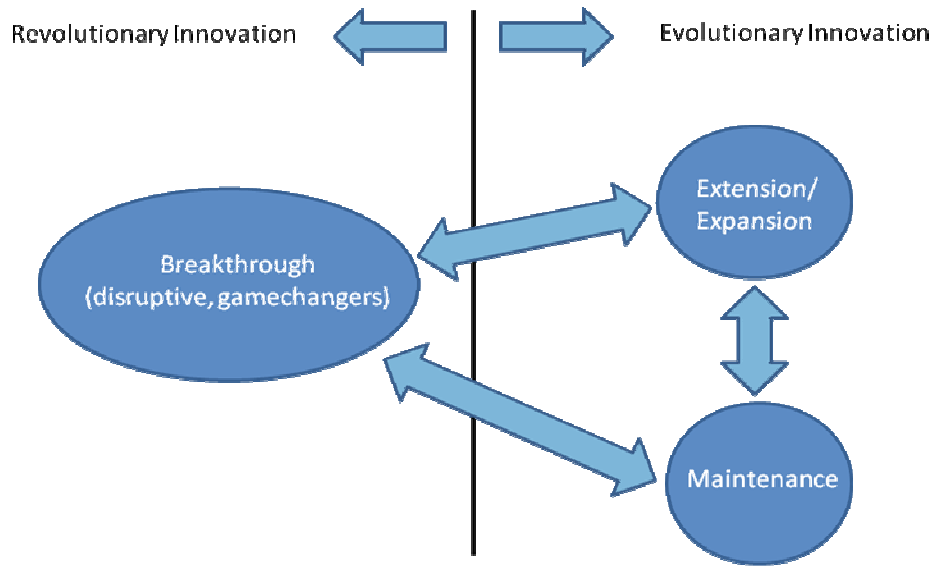

FIGURE 1: Innovation Types

Aggressive organizations want to have a gamechanger and look for and try to cultivate them. Sometimes though, the very organization that was created to encourage them gets in the way of their development due to a lack of strong and visionary leadership. [5]

The other part of the equation is evolutionary innovation. These are the extensions or expansions of current product lines, processes, or services. An example of this type of innovation would include product enhancement, or streamlining of a product line, creating a new cost structure, or cultivating a new customer base.

4 NEW TECHNOLOGY DEVELOPMENT

From the definitions provided, consider a hypothetical timeline for the lifecycle of a generalized, or generic, product or technology contrasted financially, noting that this exercise could also be applied to services or processes. The shape of this curve, FIGURE 2, could be applied to any product line or technology. While it will vary from one example to the next, if the time scale and magnitude differences are allowed for then the plateaus and slope variances can be identified against almost every product line or technology that has ever been created, at least during the modern technology age.

Conception and developmental cost projections are both steep, however when you get to initial production costs, the curve gets even steeper. Then the product goes out to the market and, if there is customer acceptance, the cumulative costs rate will start to decrease due to revenue being applied. After the customer starts to accept the product, the next step will be to create expansion and increase capacity, or possibly create other versions of this product for other sectors or markets.

At some point in time, this product or service will become mature which is when the cumulative cost rate starts to level off. By its nature, this curve will never go flat, but the rate of increase should flatten significantly.

FIGURE 3 reflects the cumulative revenue for a new product or technology. At the beginning of this curve, the cumulative revenue starts, and maintains, a zero growth rate until the initial customer production run. As soon as the consumer accepts the product or service, there is an increase in revenue and then at some time the beginnings of profit. The time line eventually

reaches the capacity expansion/extension region, where the slope increases significantly. At some point, the product or service will mature. As it matures, the market becomes saturated and effectively the product or service maintenance phase begins.

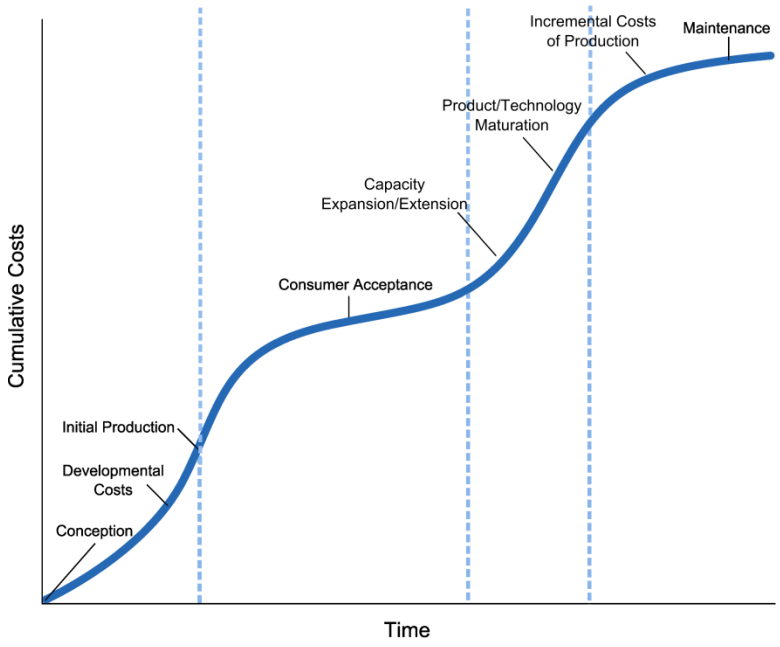

FIGURE 2 : New Product/Technology Development Cost

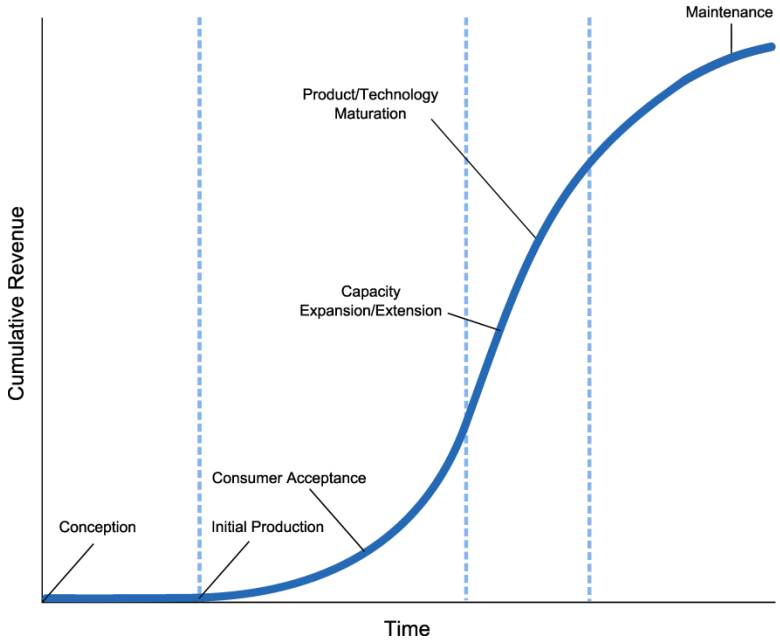

FIGURE 3: New Product/Technology Development Revenue

The last figure in this section is for cumulative profit/loss for a new product/technology development, FIGURE 4. At conception, significant resources are expended on a new product or technology so initially, the cumulative profit/loss rate will be negative. This is likewise the same for

the initial production, consumer acceptance and capacity expansion/extension phases where all are part of the investment losses, while there may be an inflection in the rate in the positive direction. The time scale is different for every product and service but it normally starts off with the same trend. These investment losses can be quite substantial, often retarding the growth of a product, and possibly the enterprise, or causing the delay or outright termination of the project due to corporate indecision or financial instability.

After the expansion zone, profits will start to occur. It is hoped that the product lifecycle is sufficient such that the profit side will grow much larger than the investment losses, resulting in a successful investment and decision strategy.

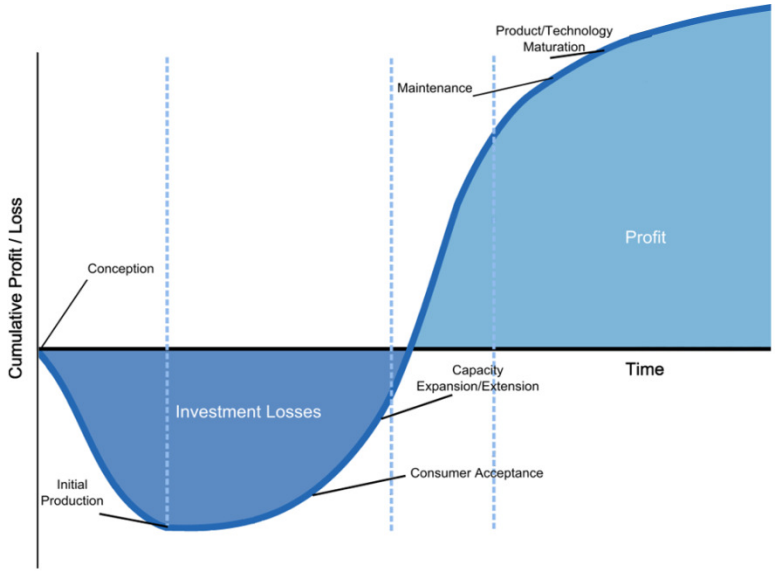

FIGURE 4: New Product/Technology Profit/Loss

5 INNOVATION RISK-TO-REVENUE COMPARISON

FIGURE 5 is a representation for the different levels of risk for the types of innovation involved. The two curves represent the rates and magnitudes of the differences between evolutionary and revolutionary innovations. Initially, they both start with a zero cumulative risk at conceptualization. The evolutionary innovation has a shallower risk threshold and eventually becomes horizontal as time is increased resulting from customer acceptance. Note however that the risks are much greater with the disruptive, game-changing technologies, referred to as revolutionary innovations. Some of this risk, or in this case cost, is associated with getting the technology refined and ready for production along with the associated needs for cost reductions required by the customer. The rest of the costs result from corporate management and production changes, disruptions in the day-to-day business focus, and of course, stakeholder acceptance.

There is also a significant level of risk in training the consumer and establishing a consumer base, not to mention getting the corporate leadership to initially embrace the new product in the first place, or after a lengthy and costly developmental start-up phase. The key is to get to the point where the consumer wants this product or technology and the enterprise can produce and maintain the production rate for the roll-out.

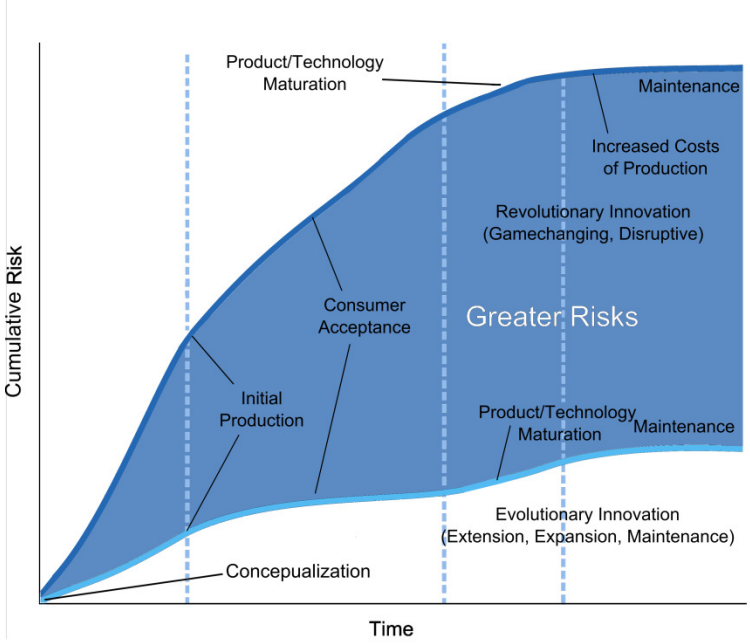

FIGURE 5: Innovation Risk Comparison

The final illustration in this section, FIGURE 6, is the innovation rewards comparison. Both curves are flat through conceptualization; however the revolutionary innovation stays horizontal a lot longer whereas the evolutionary innovation climbs much earlier, during the initial production phases. The revolutionary revenue curve can stay flat a lot longer than is depicted in this example and is often one of the reasons the technology is never considered, or abandoned early in the development phases.

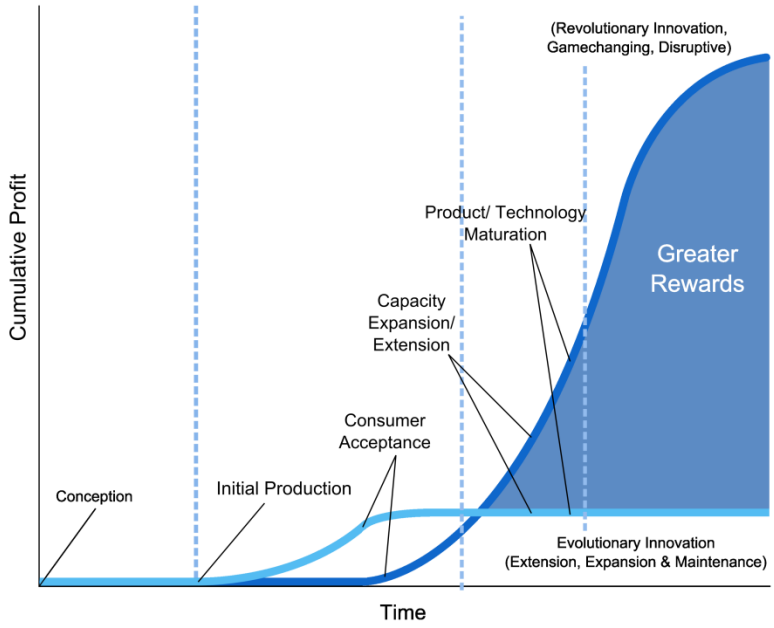

FIGURE 6: Innovation Rewards Comparison

Getting past the breakeven zone is critical for these technologies and the effective negotiation past this point as early as possible is often the key to the products or services continued enterprise and customer support. Clearly, getting past the high-risk zone results in multiples on the profit horizon, as compared to evolutionary improvements and, with hindsight, an easy justification for the original decision to take the greater risk.

It is the cost against potential margins that most organizations site as the value of an innovative technology, where often the same reasons are used as to why they are not considered, or overlooked, in the first place. This is where strong visionary leadership becomes essential.

6 BREAKTHROUGH TECHNOLOGY

It has been said that there has been a stagnation in the rate of technology development starting around the 1950's as viewed on a long term historical scale. The authors of this piece acknowledge that while we are most likely in line for a truly disruptive technology in the energy, transportation, communication or medical fields, there is still a steady introduction of evolutionary and some revolutionary technologies to sustain our imaginations and keep our marketplaces thriving. [6]

For thoroughness, consider FIGURE 7, a representation of the profit lifecycle of a breakthrough, or disruptive, technology. While this is slated to illustrate the more advanced and aggressive technologies, it is equally reflective of current developments and appropriate for this discussion since most of the current successful, long term, high technology companies started as disruptive ideas with strong, recognized (usually after-the-fact), leadership. These individuals were usually considered visionaries who were less than comfortable, or agreeable, with the then status quo. [6]

On the left, the curve starts at zero, then the consumer acceptance phase starts along with the market expansion/extension to establish the profit profile (difference between revenue and the costs). The market then starts to saturate and the technology matures. The line then becomes more horizontal where a somewhat constant profit line is maintained until competition is introduced. This could be a result of patent life expiration, loss of the founding leadership, foreign competition, etc. where the customer base starts to get eroded. Note that with competition or loss of intellectual property protection, the next step taken is to improve the economies of production which can extend the profit line. Sometimes these improvements can even cause a positive rate change in the profit line. Remember this curve is not particularly representative of any one technology, but is more intended to be a generalization of potential events.

Erosion of the customer base, production refinement/maintenance, and competition continues until the technology matures. The profits are normally at their lowest. All of the money was made in the first third to half of the time interval. At this point, the company is faced with the legacy burdens of maturing retirement packages, production line ageing and growing global competitiveness. Unless there is a further breakthrough or a significant redirection from the leadership, the company will end up making products for pennies on the dollar and the profit could have significantly decreased by orders of magnitude from the peak.

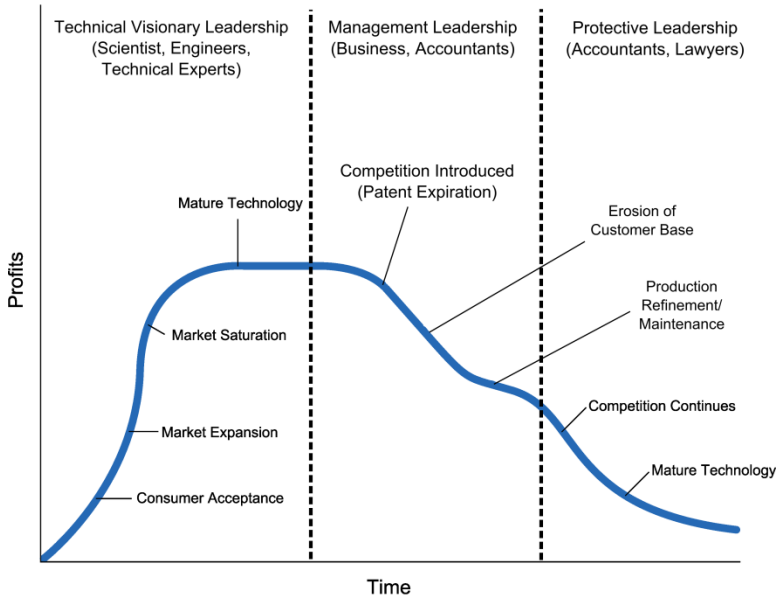

FIGURE 7: Breakthrough Technology Maturation Process

In general, for a breakthrough technology, the consequences are that it completely disrupts the status quo, displaces the work force, can cause economic upheaval and require that a new skill set be learned by everybody. If you are the second generation in that effort, it looks exciting. If you are the first generation, it can be intimidating and threatening. Another consequence of a breakthrough technology is the polarization of management and staff. You really need to have strong leadership to survive the initial birthing pains of these types of efforts.

Additionally, there could be the potential destruction, or at least delay, of share-holder value. If you create a new product and it knocks out your current product line, then your stock holders may not be content. Lastly, as soon as you create a breakthrough, everyone is going to want to make improvements or get caught up in the changes for change sake that occurs when progress and especially profits begin to swing to the positive. Again, this is another essential justification for strong leadership.

The last figure also speaks to a seemingly prevalent historical outcome. Most of the breakthrough technologies that have resulted in the development of market shifting enterprises have started in the minds and on the books of visionary leaders who were either technically literate or knew enough to team up with the same. These scientists, engineers, or technical experts formed and contributed initial intelligence as well as financial and sweat equity revenue to make their vision move forward. It was with them that the success, and often failure, resided. It was also with their beliefs that the course was drawn, based on their vision of what “will be” as contrasted to most individuals’ “might be”. It is with them and their foresight into training the future leadership of the organization that often is critical to the longevity of the enterprise. Even with their strong leadership their careers are often short in comparison to the life of a successful company and it is what happens after they leave, are ousted, or retire that makes or breaks the company.

Figure 7 also maps the types of leadership that can occur as a revolutionary enterprise matures. The technically competent, or well supported, leader helps bring the technology into being and then helps mature that technology through the various product stages. With the help of effective and strong management that product line and corporate financial base is strengthened sometimes at the expense of further visionary growth. Exploration of the technology becomes the driving force, as it should be, especially with the expected competition waiting around the corner.

Clearly, from some people's perspective, the next evolutionary step in the business is going to require strong management made up of business people and accountants to manage the resources, grow the product lines and ensure stakeholder value. Unlike the initial creators, their vision can often be limited to quarterly returns and maintenance of the core technologies and organizational framework. Eventually, this management style will start to feel the effects of competition, loss of intellectual property or governmental involvement and either start the dissolution of the enterprises or break out into another opportunity using the resources that have been built over the years to reinvest and reinvent the enterprise. If the correct visionary, often technical leadership is found, this can be extremely successful since some of the pains of an initial start-up can be reduced or eliminated.

If this doesn't happen, or is unsuccessful, then the third phase of the life cycle will most likely occur, protection leaders. This usually results in leadership centered around accountants and sometimes lawyers whose job it is to protect the share-holder value and maintain the operational integrity of the core enterprise, including the selling off or dissolution of assets often essential to the development of further visionary accomplishments, i.e. shutting down or limiting research and development centers or activities, reducing scientific and engineering manpower, etc.

The scenario above is not a required outcome but it is one that can be seen in numerous larger enterprises. There might be a corollary with the basic life cycle where there is a process of youthful vigor and vision, developing into a more mature security and growth phase and finally in a restructuring of priorities resulting from a loss of energy, will and an unwillingness to risk diminishing security. Whether art imitates life or the reverse it is clear that those companies that are long-term successful are also the ones that are "reborn", if you would, and are constantly trying to remake themselves as youthful, vibrant visionary entities. Most of these have learned that strong leadership with an eye to innovation is the key to their longevity. It is with these efforts that we find a healthy respect for the technically gifted and where if that talent has leadership skills they are encouraged to grow and help drive the effort. It is in this role that the engineer can be most effective no mater our overall competency to manage a business, because some of the required leadership skill set was cultivated with the educational and training process. Good managers are being produced in record numbers. The technically competent visionary leader is a little harder to locate and cultivate, thus the next section of this paper.

7 INNOVATION LEADERSHIP

"Strong leadership is a prerequisite for success at innovation". The characteristics that distinguish the best innovation leaders are the following [7]:

- The ability to tolerate ambiguity,
- The ability to assess and be comfortable with risk,
- The ability to balance passion and objectivity,
- The ability to change, and
- The ability to command respect, even from those who are skeptical.

These characteristics are the key. The best leaders need to maintain respect. They can't be right all the time, but hopefully they are not wrong too often. "Innovation requires and flourishes under strong leadership. The most innovative companies have a leader who wants to make a difference and leave a legacy of innovation". [7]

Very strong, positive leaders, while concerned, are not driven or constrained by next quarter's profits. They want to focus time and effort to getting the job done with the support and efforts of their constituencies. When they leave, they want the company to be in better shape than when they were hired and they want it to stay that way. When great leaders commit themselves to something, they want to know that it is something of value.

It is unclear where good or great leadership crosses the line with good or great management. It is most likely rare that you get a package where a person is great in both areas. It is also very

clear that just being a visionary innovator, or worse an inventor, is not enough to spell long-term success. It is normally the strong leader with an innovative sense to recognize the essential elements of an innovative technology, or better yet a potential breakthrough, that will provide the needed strategy and start-up energy. The best match might be a technically competent engineer or scientist who has innovative visions of the future combined with a strong leadership skill-set. [8] For those few individuals, understanding the essential elements to innovation is paramount, albeit they tend to be somewhat annoying to the rest of us who cannot see their vision.

8 KEYS TO INNOVATIVE THINKING

According to HR Magazine Columnist, John Graham, there are seven keys to innovative thinking [9].

1. Keep pushing the envelope
2. Think about the unthinkable
3. Be a confirmed contrarian
4. Become a creative doubter
5. Be daring
6. Ignore the detractors
7. Speak up

It is these key attributes, and many other forms of the same, that distinguish truly innovative thinking and activities. This combined with the proper leadership, while not guaranteeing success, does place an organization in the same ranks of those that have, and for the correct reasons.

9 CONCLUSION/LEADERSHIP CHALLENGE

This paper has attempted to look at the process that an organization takes to start and then arrive at a profitable, mature enterprise. Clearly this effort, at best, only generalizes and outlines the areas and scope of the effort. What the authors' want the reader to take away from this exercise is the need and value of having strong leadership and an innovation-based culture. Whether the innovation is evolutionary or has the potential for a breakthrough the process is still delicate and, at best, risky.

Knowing this up front and factoring in the need for planned leadership is the key to a successful future. Behind all of this are the technical people, the scientists and engineers, and the craftsman and technicians, who make it all work and who are, as often as not, the initial creators of innovation and the leadership that starts the new enterprise. Therefore, this piece will end with the following challenge pointed to the engineer and leader in all of us:

- Engineers must strive to become the agents for change: adaptive, supportive, and disruptive.
- Engineers must view innovation with a passion to be used as a tool to set policy for technological, cultural, and societal change.
- Engineers in positions of leadership need to promote an innovation culture, and seek support for the same.

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