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Introducing Innovation in the Corporate Bureaucracy

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One of the featured speakers at the 1998 Alliance Conference on Achieving Radical Innovation was Gene Meieran of Intel. We've asked Gene to put some of his thoughts presented in his well-recieved paper into writing, to get them to a wider audience. His article is featuted in this issue.

Larry Gastwirt
Director

In this world of rapid change, companies are bringing out new products, processes and services at an alarming rate. No sooner is one product or service introduced, than a competitor brings out a new product and service that either obviates the need for your product, or renders it obsolete in terms of performance, cost, customization or all three. The question is, how do large companies, noted for their bureaucracy, slow response to innovation and lack of initiative, manage to stay in business given the rapid introduction of products or services, followed by the rapid growth of the companies started up by more entrepreneurial individuals?

Actually, there are two types of innovation:; normal innovation, and radical innovation. Continuous improvement and evolutionary changes in current practices or services or processes characterize the former. Radical innovation is characterized more by revolutionary changes that fundamentally change the way business is conducted. In this paper, we will concentrate on both of these concepts, and discuss how bureaucratic organizations need to approach both normal and radical innovation in order to survive during the next coming uncertain decade.

"Innovation cannot be legislated! Innovation simply happens".

"Companies are not innovative. Individuals are innovative!"

"This company is so bureaucratic! We cannot innovate here!"

These and similar phrases populate the literature and thinking of people who work for large companies. They are stymied by "the system", which they perceive is stacked against them. The management doesn't understand; the reward system doesn't reward; the financial people don't want to take a risk; the engineers are wedded to their old methods and processes; the task is simply too difficult!

Such thinking is characterized by the many examples of missed opportunities; the transistor, the airplane, the operating system, the telephone, etc., none of which were commercialized by existing companies making what might have been considered competitive products. The existing companies simply missed the boat; for example, the railroad companies thought they were selling rail transportation, and did not recognize they were selling passenger-miles; the vacuum tube companies thought they were selling glass tubes, not electronic components.

On the other hand, there are myriad examples of successful companies that have adopted new strategies and tactics, to cope with rapidly changing environment. IBM adopted electronics over mechanical systems, and Boeing adopted jet driven aircraft over propeller driven aircraft.

So the question is, what differentiates the companies able to accommodate innovation, either normal or radical, from those companies that constantly and consistently miss the boat? What, exactly, allows a large, necessarily bureaucratic company, to act like an individual or a small, entrepreneurial company? What characterizes such a company, its managers and leaders (these are different!) and its processes, that makes such a

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company receptive to change, when virtually every force resists such change? This topic is the subject of the remainder of this paper.

Innovation Model

Our model for innovation encompasses both normal innovation and radical innovation. The first part of the model suggests that both forms of innovation involve two significant concepts, creativity and risk aversion. The creativity issue involves newness, challenging the norm, brainstorming, risking failure, accepting the "unacceptable", pushing the envelope. Risk aversion implies protecting the family jewels, resisting change, maintaining business as usual, avoiding expensive decisions on risky ventures.

There is a related issue; timeliness, which refers to company maturity. Timeliness is also related to the physical concept of inertia; the resistance of a physical body to a change in its motion. If we consider the physical metaphor for a company to be a flywheel, Fig. 1, we can differentiate between two physical effects as the company matures, i.e. as the flywheel increases in size (particularly at the rim):

1.The resistance to change in momentum increases as the company grows; in order to cause ANY change whatsoever, it takes more and more energy.

2.The flywheel acts a as a gyroscope of increasing size; even if the energy is there to change the gyroscope's speed, it is difficult to change its direction.

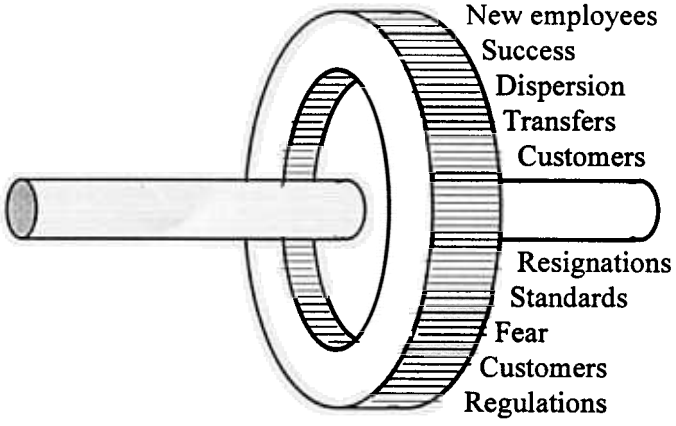

Figure 1: The Industry Flywheel

The causes of increased inertia are pressures brought on by suppliers and customers, the loss of company knowledge and culture through loss of experienced people, fear for one's job, the adoption of standards, etc. Some of these are bureaucratic necessities (standards) while others are undesirable but unavoidable consequences of company growth.

The concepts of creativity vs. risk aversion, and the company's maturity inertia, are illustrated in Figs. 2 and 3. In Fig. 2, one can see that all quadrants of the creativity-risk aversion matrix are useful, but are aimed at different markets or satisfy different needs.

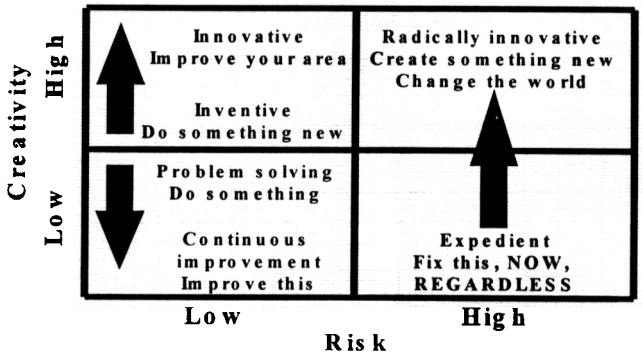

Figure 2. Creativity vs. Risk Tolerance

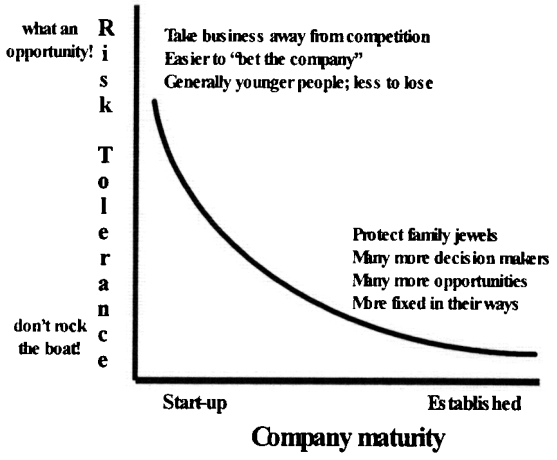

Figure 3. Risk vs. Company Maturity

If one wants an immediate solution to a crisis of known dimension, one does not necessarily wait for the "right" solution; ANY expedient solution, even if risky, might do. Creativity is not necessarily an advantage; pragmatism is. However, when dealing with an unknown domain, creativity in the solution space might be an ad-

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vantage; if practiced through continuous improvement methodologies, this might be relatively risk free.

If there is something REALLY NEW on the horizon that threatens a company's very existence, however, then a risky, highly creative response might be needed. As will be discussed later, such opportunities are more likely to arise as a result of one's personal drive, knowledge and ingenuity, rather than as a problem - solving capability. This upper right quadrant in Fig. 2 is more often reserved for exploring and exploiting opportunities than for solving problems.

In either case, the flywheel effect must be recognized and dealt with. As seen in Fig. 3, as companies mature, they tend to lose their ability to capitalize on innovation, at least radical innovation. When the company was young, it had little to lose and was more willing to take significant risks in order to penetrate the market. As it matures, it has more to lose or more to protect, and become less risk tolerant. "Protect the family jewels" becomes more important than "risk the business in search of a major opportunity".

As companies mature, they tend to concentrate on utilizing normal innovation, which might otherwise be described as using new ways to continuously improve their operational performance. This trajectory for continuous improvement can sustain a company's growth

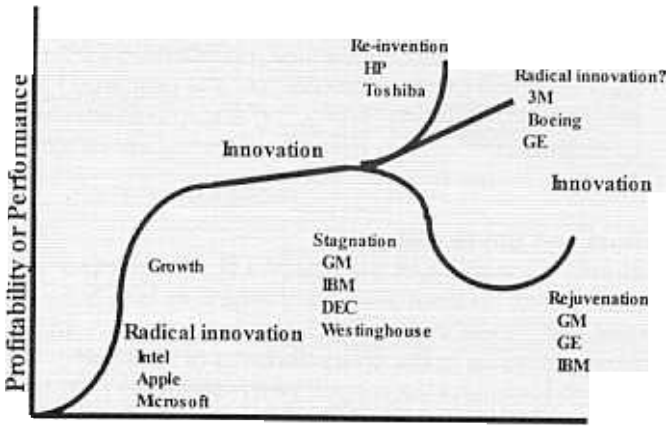

Figure 4: Company Maturity vs. Risk Tolerance

for a period of time; generally speaking, however, after some time, other forces cause the company to undergo some major changes. These may be called downsizing, business process reengineering, reorganization, reinvention, etc.; leading to various outcomes, as illustrated in Fig. 4. On occasion, a company can still exploit radical innovation and generate a new business, but this is not a frequent occurrence.

So let us now discuss the characteristics of both normal and radical innovation, from a corporate perspective. We shall use Intel as an example, since it has a reputation as an innovative "high tech" company, it certainly is now large and may be considered mature, and having worked there for 25 years, I know more about it than any other company!

Radical Innovation

Historically speaking, radical innovation often seems (and indeed is) unplanned; someone has a bright idea, pursues this with considerable zeal, persuades someone with resources to sponsor the idea, and on occasion, this works out as a big success, often to the surprise of the new market. Frequently, the idea is regarded as useless when first introduced, especially by the owners of a current capability that is already obsolete, although the current owners are not yet aware of its demise. Radio, telephone, transistors, airplanes, personal computers, etc., are examples of radical innovations which were underappreciated at their inception.

The characteristics of radical innovation are listed below.

- Essentially single individual achievements
- Essentially opportunistic in approach
- Fundamentally changed the current technology trajectory; challenges the status quo
  Lots of brainstorming, trying things out quickly to see if they work
  Strongly supported by senior company management
  Formed the basis of major company expansion
  Was a LONG, DIFFICULT, often frustrating experience
  Occurred in the early days of the industry

Characteristics of Radical Innovation

Usually, a radical innovation is created by a single individual, whose name is often associated with the product:; automobiles with Ford, airplanes with the Wright Brothers, phonographs and light bulbs with Edison, cameras with Eastman, etc. It is usually created as an experiment with an opportunity in mind, not as a perceived solution to a problem (the Wright brothers wanted to fly, not carry passengers). It fundamentally changes the way the world operates (replacement of horses by cars; replacement of slide rules and mechanical calculators and typewriters by computers; replacement of candles by electric light bulbs, etc.). Radical innovation usually involves lots of brainstorming, trying of new ideas at a rapid rate, discarding ideas as they are proved incomplete, incorrect or infeasi-

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ble. While in order to be successful, radical innovations need strong sponsorship from someone who controls sufficient resources, it is usually a long and frustrating path between concept and success. This path often ends in falure, not always because the innovation is wrong, but because the world is not ready, the infrastructure is not ready, the customer uses are not fully recognized, whatever.

Normal Innovation
The characteristics of normal innovation are listed below. Normal innovation may be regarded as a form of continuous improvement, usually in response to a perceived problem or issue. These innovations are frequently team driven; they have no zealous champion putting his or her reputation, financial health or job on the line in defense of the idea.

- Essentially team driven
- Responds to specific problems, opportunities or trends; more reactive
- Long, thought-out process that is expected to work
- Driven by a champion, but strongly supported by senior management
- Keeps the company ahead, but does not threaten the status quo so strongly

Characteristics of Normal Innovation

For either or both normal or radical innovation to take hold in a company, there must be a receptive atmosphere; the innovation rarely can stand simply on its own merits. Consequently, even if we know what innovation really is, and what it can do for us as individuals or as members of an organization or company, we need to understand the dynamics of how to garner support from our company in order to nurture innovation if and when it comes. The following model is useful for understanding how a company's culture can be used for this purpose.

Model for Innovation*
The Stevens Alliance for Technology Management has developed a model for explaing how innovative companies apply their resources to capitalize on innovation; essentially, carrying a storage bottle to potential locations to capture the energy of lightning if and when lightening strikes. This model is shown in Fig. 5.

Basically, the model suggests that the innovation receptiveness of companies is enhanced through behavior patterns characterized by the terms inquisitiveness, collaboration, advocacy and goal direction. These behaviors are engendered by the corporate culture, which has its foundation in corporate history. The corporate history is "remembered" through the institutionalization of cor

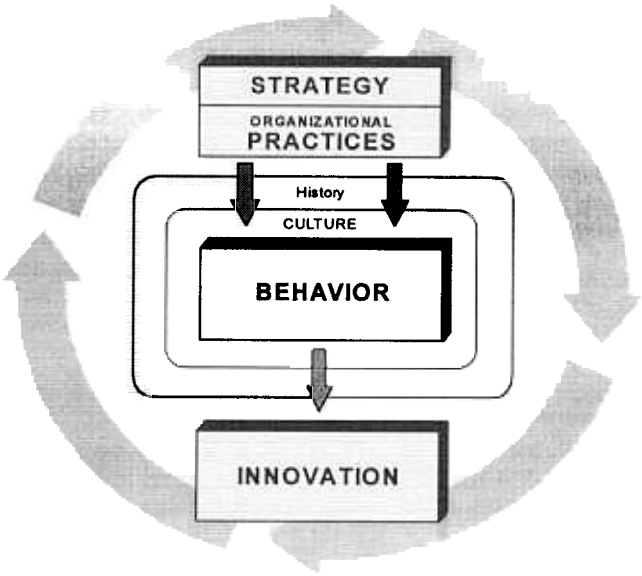

Figure 5. Innovation Model

porate practices; practices that reaffirm the corporate values and norms. Looking at this model the other way around, a corporation creates practices that appear to enhance performance, through a set of values. These values help mold the corporate culture, which, as time passes and historical records accumulate, rewards certain behavior patterns,. If these patterns include the four elements of inquisitiveness, collaboration, advocacy and goal seeking, the company is prepared for recognizing, nurturing, promoting and implementing innovative concepts. A filler discussion of the model is provided in reference 2.

Intel and the Model
During the early 90's, the Alliance studied Intel as an example of an innovative company, from which the Stevens' model was derived. In this section, we will illustrate some of the characteristics of Intel that helped formulate the model, which seems to hold for a number of other innovative companies studied as well as for Intel.

Intel has a historyof innovation that has fundamentally changed the way the world operates (radical innovation). The microprocessor and semiconductor memory chips have enabled a revolution in information and knowledge technology that have made computers , for better or worse, an absolutely essential and irreplaceable part of society. Intel was formed and managed for its first years by a group of scientists and entrepreneurs of unparalleled abilities, including the inventor of the integrated circuit (Bob Noyce), the inventor of the microprocessor (Ted Hoff) and the inventor

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of the programmable, erasable memory (Dov Frohman). The visionary Gordon Moore, the formulator of the famous Moore's Law, which defines the future of our industry and has done so for the past three decades, and the irreplaceable Andy Grove made Intel into a company with sales greater than $25Billion. These examples serve to illustrate the principles of Fig. 4; Intel has a short but distinguished history of innovation that has both built a large corporation and has changed the world.

The Intel culture comes from the founders, Gordon Moore and Bob Noyce, and from the personality of Andy Grove, until recently CEO and President. Andy has a reputation as a no-nonsense manager, as a technical leader, and as a gifted lecturer. The no nonsense attitude comes out in the Intel culture as discipline, as performing at one's highest level, as constructive confrontation, as resistance to complacency ("only the paranoid survive"). This culture is taught as a "Back to Basics" set of courses to all Intel employees, new and old. Indeed, all Intel senior managers are required to teach one or another of these courses at least four times per year.

Since almost all senior Intel management has been at one time a scientist or engineer, the rest of the Innovation Model follows almost as a natural consequence. Engineers and scientists are by nature inquisitive, and all are competitive and therefore strongly advocative, in pushing their ideas and processes into the Intel system. Since Andy has a strong and indeed compelling desire to produce, all people at Intel are expected to be strongly goal driven, and are rewarded for this (one of the Intel core values). And finally, since our processes and products are so complex, we are compelled to be collaborative, since otherwise, we simply could not get the job done.

Intel's Competitive Processes for Innovation

1. Policies and Procedures

As a result both of our company's success, as well as fear (real or imagined) of being toppled from a leadership position, ("only the paranoid survive")**, Intel has adopted a number of policies and procedures that help enable the incorporation of innovative ideas into our culture. Some of these processes are given in Table 1; many of these processes are specific subjects of the Intel University training classes which every Intel employee attends, or are used as Intel values, against which every Intel employee is measured. All are supportive of Moore's Law, that the ultimate goal for our technology is to increase chip complexity, as measured by the number of active elements on a single silicon chip, which doubles approximately every 18 months.

Directly confront problems	Constructive Confrontation course
Quickly learn the Intel culture	Working at Intel course
Share problem solving methods	Problem Solving course
Take appropriate risks without fear of failure	Corporate value
Highly focused , execution oriented	Corporate value
Own the resolution of problems you discover	Corporate policy
Fuzzy boundaries between departments	Open door policy
Rewards teamwork	Achievement awards
Tolerates (and responds to) criticism	Constructive Confrontation course
Geographically, technically matrixed	Organizational policy
70% recent college grad hiring	Corporate policy
Share a common language and common goal	Moore's Law

Table 1: Intel Policies and Procedures

2. Intel Corporate Values

In more detail, Intel has adopted six corporate values, shown in Table 2. In order to ensure these values get more than lip service, they are used during the review of every employee as a measure of the employee's contribution to Intel's success. Risk tasking is a recognized and often rewarded corporate value, even in situations where the consequences of taking a risk have not been entirely positive. As a result of this process, all Intel employees are given a yearly reminder with financial consequences about the importance of all Intel values in their daily job.

Discipline
Quality
Results Orientation
Customer Orientation
Risk Taking
Great Place to Work

Table 2: Intel Corporate Values

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3. Grade Level Promotions and the Intel Fellow
Intel also has adopted a special track for employees who desire to be technical leaders but who may not have a strong desire to manage a large group of employees. This is called the Intel Fellow, where senior technical leaders are permitted to work on topics of their choice. The Intel Fellow is a defined job position, towards which any employee may aim; however, only a relatively few achieve Fellow distinction.

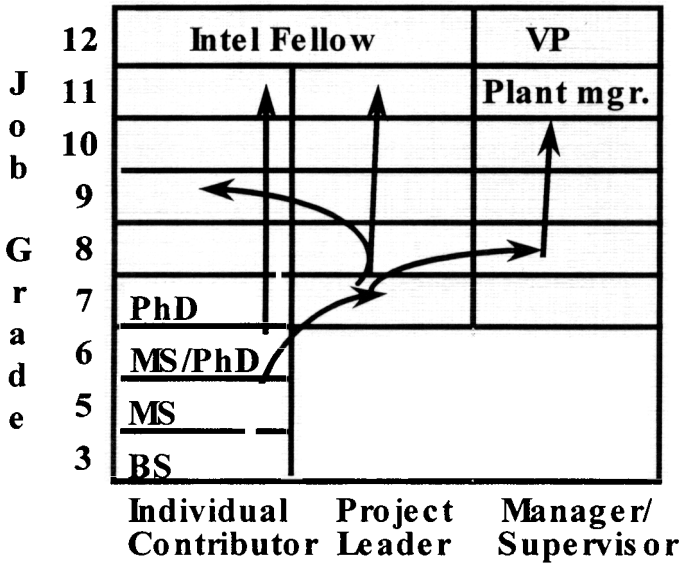

Figure 6. Intel Job Grade Ladder

The Intel Fellow has certain obligations and responsibilities, which help Intel to be receptive to innovation. The Intel Fellows generally spend some of their time interacting with universities and external laboratories, evaluating new ideas and concepts, and if appropriate, championing these within Intel. Intel Fellows are allowed some freedom in the choice of their day to day work, which often involves some degree of risk taking and exploring of new ideas. We are also used as a sounding board by many senior and junior technical staff, just to see if someone else's ideas seem potentially useful. Most Intel Fellows are members of one or more internal committees which help decide future technical direction, such as the Research Council, Intel Foundation, Academic Relations Council, etc.,

Currently, there are 20 Intel Fellows, representing a dozen different technical disciplines, ranging from software to hardware, processing to manufacturing, architecture to marketing, computing to communications. By contrast, Intel has about 150 vice presidents, but only about 20 Fellows; the Fellows thus believe that each of them is as valuable to Intel as 7 or 8 vice presidents.

4. Innovation Day
Every year, Intel holds an Innovation day, where 20 or 30 Intel scientists and engineers at all grade levels are asked to compete for a position that for one year, they are given an opportunity to work exclusively on an innovative project of their choosing. The projects must not be in the line of current day-to-day activities, and should represent out-of-the-box thinking. Intel Fellows and other senior Intel scientists and engineers are asked to be judges of this event. Usually the presenters have posters and working demonstrations to augment their technical presentation.

5. Internal Conferences and External Presentations
Intel sponsors many internal conferences for employees, in all technology fields in which we are engaged. At these conferences, sharing of new ideas and "best known methods", otherwise known as BKM's, are discussed, and their adoption across Intel is ratified or denied. In this way, we ensure that innovative and good ideas are rapidly propagated throughout the company in a controlled fashion.

6. Intel Achievement Awards
Intel employees are eligible for a variety of achievement awards, the highest being the Intel Achievement Award or IAA. This award is made by the Intel Executive staff, and is given to several individuals or groups on a yearly basis in recognition of meritorious achievement. In addition to a financial award, the award recipients and their immediate families are treated to a weekend dinner and reception at an exclusive resort. This coveted award is widely heralded at Intel; we usually have several dozen applicants, from which perhaps 20 are selected. The criteria for selection are rigorous, and often include risk taking and innovation.

For information on Alliance activities and membership, contact Dr. Larry Gastwirt: lgastwirt@aol.com

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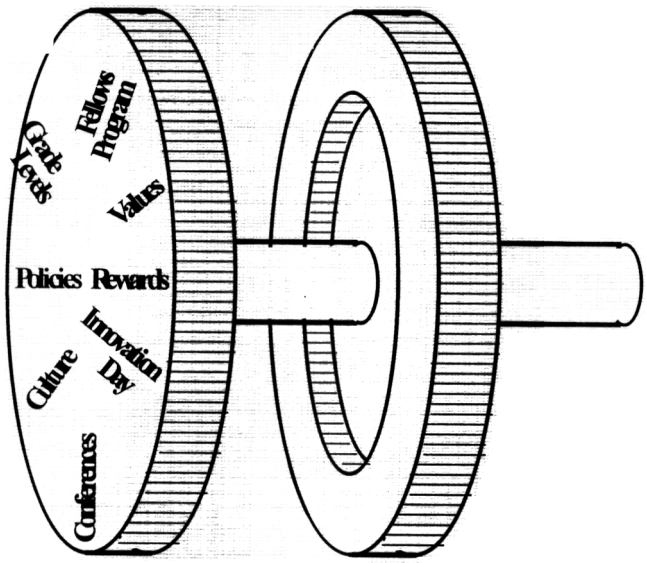

Figure 7: Energy to Drive the Flywheel

Summary
We live in a swiftly moving world, where if we don't adapt and don't innovate and don't keep up, we shall (properly) take our place with a myriad of other companies on the scrap heap of history. This is particularly true of the semiconductor, computer and communications industries, where advances in hardware and software are so fast and so competitive, on so many fronts (globalization, nationalization, technology, marketing, competitors, etc.), that it is bewildering to understand all the ramifications. However, it is recognized that in spite of all this new technology, there is but one driving force. As a parallel to Moore's Law, which drives the technical and economic parts of our industry, it is human ingenuity that drives creation of new ideas that leads to innovation. If we do not manage the process of innovation, we will certainly lose the very ideas and concepts that are essential to being both productive and competitive, as the world changes around us. Intel has created a suite of processes, policies nd procedures to help us increase our ability to respond to innovative and creative ideas, without which we would not be able to survive the highly competitive environment in which we now live.

Intel's response to the flywheel inertial effects illustrated in Fig. 1 may be seen figuratively in Fig. 7. The flywheel is driven by use of a number of policies, procedures, recognition systems, reward systems, and other incentives that compensate for the flywheel's inertia. Without this drive, inertia will dominate, and both normal and radical innovation will be stifled.

Acknowledgements
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