DIFFERENTIATING CREATIVITY, INNOVATION,ENTREPRENEURSHIP, INTRAPRENEURSHIP, COPYRIGHT AND PATENTING FOR I.S. PRODUCTS/PROCESSES

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ABSTRACT

Considerable confusion exists on the difference in meanings of the terms creativity and innovation. Likewise, the termsentrepreneurship and intrapreneurship need clarification so far as they pertain to the I.S. field. When discussing creativity and innovation, the need for protection of the result through patenting or copyrighting arises. This paper distinguishes these terms and concepts and suggests an approach for integrating them for consideration of I.S. products and processes.

INTRODUCTION

With the 1990s, the IS field begins its most challenging era. American companies will rely on strong information systems to be able to hold, or in some cases to try to regain, competitive position. These new systems will require more creativity on the part of system designers. The simple systems have all been developed; the difficult ones lie ahead. To develop these more sophisticated systems, designers will need to become knowledgeable about a wider range of technological alternatives. They will also need to learn approaches to become more creative in their design activity.

The need for improved systems provides management incentive to work on environmental changes to foster creativity and innovation. To be unique enough to provide competitive advantage, these systems will warrant patenting and/or copyrighting.

Fortunately for the IS field, a number of creativity generation approaches have already been developed and proven in other disciplines: e.g., engineering, science, psychology, education. The task of transporting these techniques/approaches over to the IS field was one of the reasons for the establishment of the Center for Research on Creativity and Innovation at the University of Colorado, Colorado Springs.

However, our early research revealed that some groundwork is needed to be able to communicate about creativity in system design. There is confusion about the distinction between the terms creativity and innovation. A similar problem in distinction exists for the concepts of entrepreneurship and intrapreneurship. Patenting and copyright are the third set of terms that need distinguishing. This paper will differentiate between the terms creativity, innovation, entrepreneurship and intrapreneurship, then will discuss the aspects of systems that warrant their being patented or copyrighted. In some cases the hardware components of a system can be patented and the software components copyrighted. In some cases the system can be both patented and copyrighted. The objective of the paper is not only the differentiation of these terms, but to show how the six concepts need to be integrated to elicit a new inventiveness among system designers.

DEFINITIONS OF CREATIVITY

Over 100 definitions of creativity have been published[1]. We will provide a range of definitions, from simple to complex, then suggest an approach for classification of the definitions. Bruner[2] provides the simplest definition of creativity, "effective surprise." Miller[3] defines it as the birth of imaginative new ideas. According to Ciardi[4], "creativity is the imaginatively gifted recombination of known elements into something new."

Parnes[5] defines creativity as function of knowledge, imagination and evaluation. The famous mathematician, Poincare[6], provided an elegant description of the creative process as a "fruitful combining which reveals to us unsuspected kinship between facts, long known but wrongly believed to be strangers to one another." Freud's[7] definition contains a delightful mixture of the abstract and the earthy, "a means of expressing inner conflict that otherwise would issue in neuroses....a mental purgative that keeps men sane." Moving along the continuum of complexity in definitions of creativity, we come to Dewey[8] who describes creativity as "the aesthetic experience, which is to be distinguished from other experiences by the fact that it is self-consummatory in nature. This is to say, the

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aesthetic experience is enjoyed for the actions which define and constitute the experience, whatever it may be, rather than for its instrumental or social accompaniments in the form of social relations with others."

Keil[9] believes that creativity is more than a process or approach. "It is also a state of mind that is always alert and ready to turn any kind of stimulus into an idea. It is the ability to look at things differently." Schachtel[10] concentrated on a similar aspect of creativity, "the art of seeing the familiar fully in its inexhaustible being, without using it autocentrically for purposes of remaining embedded in it and reassured by it."

Classification for Creativity Concepts. The classification of creativity by Rhodes'[11] helps in relating the definitions. He considers the concept from three standpoints: the person, the process and the product. It may be considered " from the standpoint of the person who creates, that is in terms of physiology and temperament, including personal attitudes, habits, and values. It may also be explained by way of the mental process--motivation, perception, learning, thinking, and communication--that the act calls into play. Finally, creativity may be understood in terms of its products, such as theories, inventions, paintings, carvings, and poems."

Pragmatic Definitions. Since creativity applies to all areas of life, not just our profession, most definitions tend to be somewhat abstract. For the definition to be helpful in system design, it must be pragmatized. Analysis of the definitions identifies several categories of attributes. One relates to the attribute of the fresh idea -- something new, unique or different. Another relates to utility -- the result of creative activity must be something of value. Therefore, to be classified as creative, a system design must:
1. be new or unique
2. have value

However, Amabile[12] adds a third requirement. She says that "a response will be judged as creative to the extent that it is both a novel and appropriate, useful, correct or valuable response to the task at hand," so long as the task is heuristic rather than algorithmic. "If a task is heuristic, it offers no clear path. You must create one."

Domino[13] adds another stipulation to the creative process that shows the problem of distinguishing it from innovation. He says that creativity is characterized by: 1) originality, novelty or freshness of approach, 2) adaptiveness to reality in that it must solve a problem, achieve a goal, in general be a reality oriented response and 3) the original insight or approach must be developed or elaborated. A way of simplifying the choice of definitions of creativity, for system design purposes, is to confine our selection of attributes to those which are sufficient for patent or copyright protection. It seems reasonable to assume that a system design that justifies copyright or patenting will be sufficiently creative for the competition of 1990s. Before a determination on this issue, let us look at the highly related concept of innovation.

INNOVATION

The American Heritage dictionary defines innovation as that which is newly introduced. The term innovate derives from the Latin word, innovare, to renew. The Latin word for create is creare, to bring into existence, to originate. Creative is defined as having the ability to create things, characterized by originality.

The definitions of creativity, despite the wide ranging variations in descriptive terminology, are much more uniform in meaning than are those for innovation. For example, Roberts[14] defines innovation as "innovation = invention + exploitation." He believes the invention process covers all efforts aimed at creating new ideas and getting them to work. The exploitation process, in Robert's view, includes all stages of commercial development, application and transfer, including the focusing of ideas or inventions toward specific objectives, evaluating those objectives, downstream transfer of research and/or development results, and the eventual broad-based utilization, dissemination and diffusion of the technology-based outcomes.

However, Roberts represents a minority view in his inclusion of invention and exploitation **within** innovation. In fact, his own writings dispute this approach. One of his "favorite visual aids" is Figure 1; it portrays a "process view of how technological innovation occurs." Contradicting his view of innovation being all encompassing, Figure 1 depicts the first phase of the process of innovation as beginning with recognition of technical feasibility and/or recognition of potential demand. Figure 1 depicts, not invention, but its exploitation.

One of the best ways to clarify the distinction between creativity and innovation is to show that they have the same relationship as the concepts of discovery and invention. Hall and Smith[15] provide a clear differentiation.

> "**Invention** requires a purpose. The inventor must know what it is that he wishes to achieve, and however uncertain his progress is at any moment, he usually has a pretty clear idea of the paths he should explore. It is impossible for him to work successfully without being familiar with the existing state of knowledge in his field of interest or with the variety of techniques he may redirect to his purpose. An accidental invention is almost a contradiction in terms.
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> "**Discovery**, on the other hand, requires no

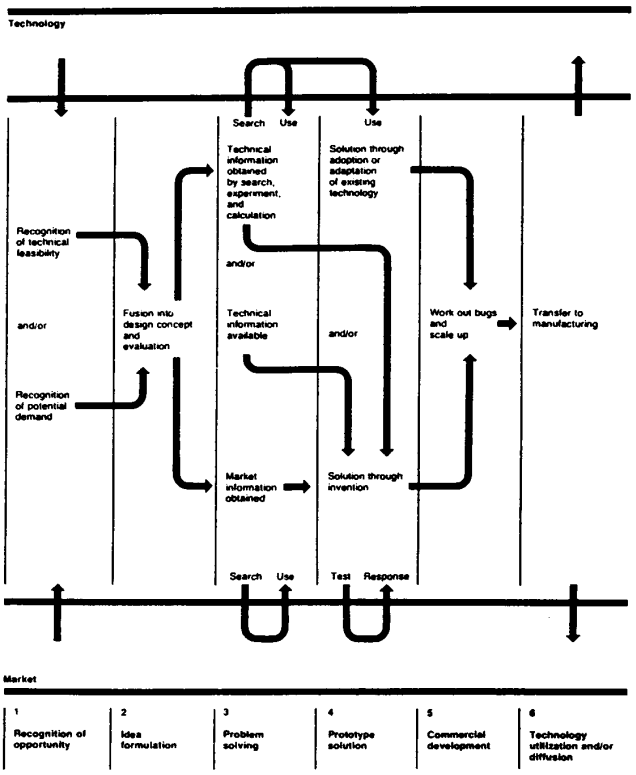

Figure 1. Six Stages in the Innovation Process

clear purpose of object, though most successful discoverers have proceeded systematically in their research. Discovery is concerned with the perception of some new property, phenomenon, or truth about things. It is abstract and often quite useless. Whereas the making of some inventions is virtually predictable, many discoveries contain an element of the accidental, though to profit from an accident requires a prepared mind. Invention, involving a deliberate attempt to utilize some particular phenomenon to achieve a given result, depends upon conscious matching of means with ends. Discovery is less controlled; the end is often unknown and the basic event may lead the scientist into a very long course of investigation, that in the end, causes his discovery to appear in a very different light. Yet, that discovery and invention are interdependent is easily shown by many examples.The discovery of electromagnetic effects permitted the invention of engineering devices such as telegraph instruments, lamps, motors and generators. The development of electrical engineering led men to study large currents and high voltages; the result was the discovery of new knowledge about the properties of materials, about the flow of electricity, and so forth. This knowledge was not only fed back into the engineering industry by way of new invention, but yielded new discoveries in pure physics also."

The discovery/invention relationship can be used to distinguish invention from innovation. Where invention is concerned with implementation of discovery, innovation is concerned with implementation of inventive ideas. As Figure 1 shows, innovation is pragmatic -- the conversion of an invention into a business or other useful application. Therefore, in contrast to the view of Roberts, the more common view of innovation is exemplified by Rickhards[16]: "Innovation is a process whereby new ideas are put into practice. The identical view is held by Kingston[17], "To invent is to find a new thing; to innovate

is to get the new thing done." These views are reinforced by Westwood and Sekine[18], who define "innovation as the process by which inventions are...transformed into a profitable product or system."

Some subclassifications of innovation from Kuratko and Hodgetts [19] facilitate the understanding of innovation (Table 1).

Type	Description	Examples
Extension	New use or different application to an already existing product, service or process	Ray Kroc - McDonald's Nolan Bushnell - Atari Kemmons Wilson - Holiday Inn
Duplication	Replication of an existing concept	Lucy Goldstar - personal computer K stores - fast food Dentaland - dental services
Synthesis	Combination of existing concepts and factors into a new formulation or use	Fred Smith - Federal Express Merrill Lynch - home equity financing Casio - wristwatches

Table 1. Classification of Innovation

Kurato and Hodgetts differentiate invention as resulting in totally new products, services or processes. They give the examples of the airplane (Wright brothers), the light bulb (Thomas Edison) and the telephone (Alexander Graham Bell).

We will discuss the creativity/innovation relationship in regard to system design. First, we will analyze patents and copyrights and their relation to hardware and software.

PATENTS AND COPYRIGHTS

Ideas and inventions are considered to be forms of "intellectual property," sometimes referred to "products of the mind." Methods of protecting intellectual property include patents, copyrights, trademarks and trade secrets. We will concentrate on the first two for the purposes of this paper.

The first known patent was issued in Forence, Italy in 1421. Venice enacted the first general patent law in 1474 [20]. The general model for patent systems in the Western world was the English Statute of Patents and Monopolies (1623), which specifically gave the right of patent protection to the first inventor of a new device or technique. The Constitution of the United States followed the accepted pattern of the Western world, empowering Congress to "promote the progress of science and useful arts by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries."[21]

The present patent act (35, USC 101) provides: "Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title."[22]

Computer hardware is normally patented while software is normally copyrighted. However, until recently, there was considerable question about which components of software were copyrightable. Although the U.S. Copyright Office has registered programs since the mid-1960s, there remained doubt as to whether software was in fact copyrightable subject matter[23]. There was little question that source code was copyrightable; the debate centered on whether binary code, particularly when embedded in object code, was appropriate for copyright protection. The 1980 amendment to the 1976 Copyright Act ended the debate. The federal copyright laws cover computer programs, regardless of whether they are embodied in source or object code. Under the most accepted analysis, the original written source code is the authorship; the program (consisting of the logic and design of the software) is the expression and all forms of software (written, printed, ROM, diskette, etc.) from which a version of the program can be produced or communicated with the aid of a machine or device are protectible copies[24].

In summary, for a program to qualify for copyright protection, it must be an original work of authorship fixed in any tangible medium of expression form which can be communicated, either directly or with the aid of a machine. The problem with copyright is explained by Samuleson[25], "the law assumes that since there are usually a great many ways to express the same idea, a second author will not be impeded in creating a valuable new work by having to

make up something new, rather than building upon the work of predecessors. The principles and doctrines of copyright law are set up to promote diffuse expression."

Patent law, in contrast, has recognized that technology tends to grow in a more incremental fashion, which, according to Samuelson, is why inventive improvements are protected for a significantly shorter time than the copyright duration, and why patent law gives patent owners no right to control derivative inventions. "Indeed, one who invents an improvement on a patented machine can separately patent his or her improvement without the patentee's permission. Samuelson gives the example of the QWERTY keyboard where under copyright the first manufacturer to use this arrangement becomes the owner of it for his life plus 50 years.

Since patents protect for only 17 years , copyright appears advantageous to software developers. A major disadvantage of copyrighting is the fact that copyright laws protect expression but not ideas. The copyright statute (codified in 17 U.S.C.) provides for original works of authorship that are fixed in any tangible medium of expression. Amernick[26] explains that "tangible medium of expression" is considered to be any medium from which the work can be perceived, reproduced or otherwise communicated, either directly or with the aid of a machine or device. Copyright protection does not extend to the underlying idea but only to the specific manner in which the idea is expressed.

Another reason not to copyright resulted from the landmark ruling was made on Feb. 7, 1989 by U.S. District Court Judge William Gray in the case of Intel vs NEC, that NEC's reverse engineering process had not violated Intel's copyright. NEC attempted to create copyrightable code which duplicated the functionality of Intel code without infringing upon the copyright. One team worked with the original program, putting it through test after test to determine exactly what it did under every set of conditions. These engineers did not write the clone software. They passed the specifications on to a second team who never saw or touched the original hardware or software. Working only from functional specifications, the second team wrote a functionally compatible implementation of the original ideas without the opportunity to copy any part of it. In describing this case, Bryan Kocher, ACM president, commented[27] that "Judge Gray's message to the software industry, is that while plagiarism will always be wrong, reverse engineering is o.k!"

Only those inventions that fall within the federal statutory definition are entitled to patent protection. The application to the Patent Office must include claims which accurately characterize and describe the invention in detail. If the Patent Office finds that the invention as claimed is novel and not obvious in light of the "prior art," and directed to statutory subject matter, then a patent will be issued. The description must set forth the best known method of practicing the claimed invention and must be adequate to allow one skilled in the art to use the invention. According to Graham, there is still some question as to an appropriate description of software implemented invention. Some recently issued software patents have included a written description, charts depicting the logical flow of the program, and pictorial representations of the data structures used in the execution of the program. Others have included a printout of a section of the program or the entire program, presumably as the best method contemplated by the inventor of implementing the invention. "The developer who opts for the patent route must contend, however, with considerably more stringent requirements for novelty and nonobviousness than are required for copyright and trade secret protection."[28]

To obtain a copyright on software requires demonstration that the work is original. The industry has been slow to use patents because they are more difficult to obtain. They offer a virtual monopoly for 17 years. Despite their longer duration, copyrights are less protective. There is more freedom for replicators to build off technology protected by copyrights.

In the concluding section, we will discuss the implications of patent and copyright requirements on the processes of creativity and innovation.

ENTREPRENEURSHIP/INTRAPRENEURSHIP

So far, we've concentrated on the product of invention. It is useful also to consider the inventer or innovator. Kuratko and Hodgetts describe innovation as the process by which entrepreneurs convert opportunities into marketable ideas[29]. Our prior discussion did not bring up the subject of the entrepreneur. Peter Drucker has been the principal contributor to the understanding of the relationship of entrepreneurship and innovation in his book **Innovation and Entrepreneurship**. "Innovation is the specific function of entrepreneurship....It is the means by which the entrepreneur either creates new wealth-producing resources or endows existing resources with enhanced potential for creating wealth.[30]. A more practical view of entrepreneurship is represented by Brownstone[31], "An entrepreneur is one who undertakes the conception and development of a new business enterprise, doing whatever is necessary to make the enterprise go, and taking ultimate responsibility for every aspect of development, from financing, to distribution; and who takes major risks and can reasonably expect a major share of any profits." Berenyi[32] expands the concept with the statement that "the entrepreneur may also have a substantial investment in the enterprise, but he contributes more than just capital. He may be responsible for initiating, planning, and providing managerial know-how to the functioning of the enterprise."

The word entrepreneur is derived from the French word entreprendre, meaning "to undertake." Therefore, in the strict sense of the word, the entrepreneur is the one who undertakes to organize, manage, and assume the risks of a business. However, the concept of entrepreneurship has grown beyond the idea of a person merely starting his own business. The difference is wildly overstated by Kent, Sexton and Vesper in their **Encyclopedia of Entrepreneurship**: "Humanity's progress from caves to campuses has been explained in numerous ways. But central to virtually all of these theories has been the role of the 'agent of change,' the force that initiates and implements material progress. Today we recognize that the agent of change *in human history* (italics ours) has been and most likely will continue to be the entrepreneur." [33] Representative of the less esoteric view is Schumpeter who says that "entrepreneurship...consists of doing the things that are not generally done in the ordinary course of business."[34] According to Timmons, Smollen and Dingee [356], "Entrepreneurship is the ability to create and build a vision from practically nothing....It is the knack for sensing an opportunity where others see chaos, contradiction and confusion."

While entrepreneurs might not be the "principal change agents in human history," they have made an unquestionable impact on American business. They represent a very small percent of U.S. management, however. If somehow, management could facilitate the entrepreneurial spirit throughout American corporations, a huge competitive benefit would accrue. Gifford Pinchot had his finger on the pulse of that need when he coined the term "intrapreneur" in the early 1980s. The title of the book he wrote on the subject makes clear his intentions on the concept: **Intraprenuering: Why You Don't Have to Leave the Corporation to Become an Entrepreneur**. He characterizes the intrapreneur as one "who may be the creator or inventor but is always the dreamer who figures out how to turn an idea into a profitable reality."[36]. He then goes on to define an entrepreneur as someone who "fills the role of an intrapreneur outside the organization." Although we recognize his strategy in two definitions -- to try to encourage individuals **in** corporations to be intrapreneurs -- he confuses rather than contributes to the distinction of the two concepts. Entrepreneurs typically continue with the enterprise once they found it. Under the Pinchot definition, they would then have to be re-classified as intrapreneurs once the company was operational. A more fruitful approach for managers in American corporations would be the goal of creating an environment to foster an entrepreneurial atmosphere within the corporation, for two purposes:

1) so people who are entrepreneurs at heart, or people who come up with an entrepreneurial idea, do not have to leave the corporation to follow their entrepreneurial goals,

2) to encourage persons who have not undertaken entrepreneurial activities to begin to do so.

Those two objectives may be achieved by management that formally sets up a program to encourage intrapreneurship. A recent survey by Williams and Campbell[37] revealed that companies who were successful in meeting these objectives used the strategies listed in Table 2 below:

Despite the heading "intrapreneurship," note that Williams/Campbell used the term "innovators" instead of intrapreneurs throughout their list. This is appropriate because these corporations excluded a factor inherent in the concept of entrepreneurship -- profit incentive. Few companies include in their intrapreneurship programs provisions for special financial rewards for innovators. Although authorities in the field, such as Rosabeth Moss Kanter, recommend bonuses for intrapreneurs, there appears to be good reason against it. If certain people begin to receive special awards, it throws the wage structure out of alignment. Corporate pay scales are inequitable already, without adding to the problem by rewarding intrapreneurs in a manner similar to what their reward would be as entrepreneurs. On the other hand, there is less personal risk in failure; corporations are more likely to be forgiving of failure than is the market place. Companies can reward intrapreneurs by fast track promotion. The concept of intrapreneurship is not only viable, but also has tremendous potential for American enterprise.

Although we disagree with Kanter on the point of special compensation, we concur with her list of the other important factors in supporting intrapreneurship, shown below in Table 2.

Now that we have reviewed concepts and definitions, we will discuss an approach for integrating this material.

DISCUSSION

In general, discovery precedes invention which is then exploited for a useful product or service. The exploitation process is often referred to as innovation, but there are inconsistencies in the literature. Sometimes the term, innovation, is used to denote both invention and exploitation. How does creativity fit into these activities? As shown in Figure 2, creativity must be present in each of these steps. For an idea to recognized as a discovery it must be unique. Invention converts the idea into something utilitarian. Innovation derives a specific product or service.

In the 1990s, system designers need to become more creative. In the past they have dealt more with innovation, putting into practice the creative ideas generated by others. While innovation will be needed just as much in the 1990s

Table 2. Strategies to Foster Intrapreneurship

* Fostering the belief that innovation is important
* Using special teams or task forces to solve difficult problems
* Recognizing innovators in all areas of the organization
* Using small group units such as "skunk works"
* Promoting people for managing venture activities rather than just managing people
* Having corporate policies flexible enough to allow the intrapreneur some latitude
* Providing a steady stream of important problems for innovators to solve
* Maintaining ongoing expectations that innovators will achieve at a high level

Table 3. Objectives and Programs Designed for Intrapreneurial Strategies (Source: R.M. Kanter, **Journal of Business Venturing**, Winter, 1985, pp. 56-59).

Objective	**Special Programs**
1. Make sure that current systems, structures, and practices do not present insurmountable roadblocks to the flexibility and fast action needed for innovation.	Reduce unnecessary bureaucracy. Reduce segmentalism and encourage communication across departments and functions. Change internal budgeting and accounting procedures.
2. Provide the incentives and tools for entrepreneurial projects.	Use internal venture capital and special project budgets. Set aside discretionary funds to allow for expansion of projects. Allow discretionary time for projects (sometimes referred to as bootlegging time) Establish performance review and compensation for intrapreneurs. This means bonuses must be set up to encourage and support intrapreneurial activity.
3. Seek synergies across business areas so that new opportunities are discovered in new combinations and at the same time business units retain operating autonomy.	Encourage joint projects and ventures among divisions, departments and companies. Use conferences and exchange ideas to foster the communication and and information flow across company boundaries. Allow and encourage employees to discuss and brainstorm new ideas.

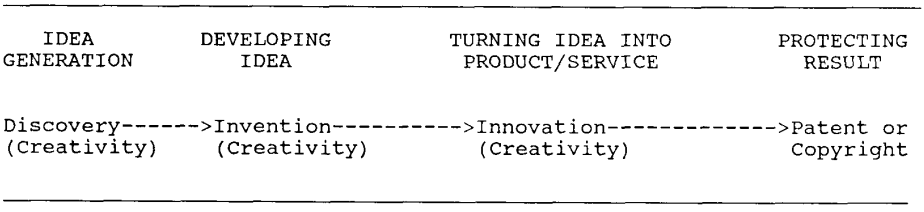

Figure 2 Differentiation of Discovery/Invention/Innovation. (Creativity Should Be Involved in Each Activity).

as in the past, the companies in which system designers are also creative will gain an added advantage over their competitors.

To be creative, a designer must produce something that is unique and useful. It is interesting that in the creativity literature, little mention has been made about copyrights and patents yet for something to be copyrightable or patentable, the principal requirement is for the product/process to be unique and useful. Therefore, if our software systems of the 1990s are truly unique and useful, they will be copyrightable and patentable. The issue of which is more appropriate, copyright or patent, is beyond the scope of this paper.

Companies should consider protection of their creative system designs to enforce their competitive advantage. Although you can patent or copyright anything which is new or useful, you cannot patent an idea. First the idea must be reduced to practice. In the eyes of the law, when the "idea" becomes an invention, the invention is eligible for patent or copyright protection [38].

To provide an environment to foster creative system design, management can focus on the factors that foster entrepreneurship. If an entrepreneurial environment is established, more system designers will become intrapreneurs. Those already possessing the entrepreneurial spirit will be less compelled to leave the company to undertake creative activities. Those system designers who have not yet been "infected by the entrepreneurial virus" will be more susceptible. Managers will need to be creative themselves in establishing this intrapreneurial environment; however, they have the factors listed in Tables 2 and 3 to aid them in achieving this objective.

For the systems of the 1990s system designers must be more inventive and innovative to enable their companies to gain a competitive advantage. Our system designers have been proficient in innovation -- the extension, duplication and synthesis activities described by Kuratko and Hodgetts. The U.S. needs continuation of those types of activities. To gain the competitive edge required to recapture the market share of the 1960s and 1970s, U.S. firms need to more inventive. As Figure 2 shows, creativity is not confined to any one of the steps in the discover/invention/innovation process, but must existent in each of the steps.

Management can concentrate in their hiring and selection to employing persons with innate creativity. However, according to some researchers, creativity occurs innately only in certain individuals[38]. Therefore, it is more important to enable the existing workforce, and those people we hire who did not inherit creative ability, to become more creative. As mentioned in the introduction of this paper, the Center for Research on Creativity and Innovation[1] has investigated other disciplines to determine if creativity generation techniques were in use. A number of techniques that have been successful were identified. Those appropriate for I.S. are in the process of being transported over to our field. Therefore, high potential exists for developing system designs for the 1990s that are creative -- ones which will undergird the activities of U.S. firms to enable them to compete more effectively in the 1990s than they competed in the 1980s.

[1] Note that we used both Creativity and Innovation in our Center title to ensure that its comprehensive purpose was clear.

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