

How is Creativity Best Managed?

Some Empirical and Theoretical Guidelines

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In an Internet-based study with an ethnically-diverse sample of 1,337 managers from 19 countries (mainly the US and Canada), eight managerial competencies that elicit creativity in subordinates were ranked according to how well they predicted desirable self-reported outcomes. The most valuable of eight managerial competencies proved to be: Provides Adequate and Appropriate Resources. Females outscored males in all eight competency areas, a dramatic finding that is consistent with other research on executive skills. The eight competencies can be derived from Generativity Theory, a formal, empirically-based theory of the creative process, and are also evident in many successful cases of creativity enhancement in business and industry. Scores on a test that measured the competencies were substantially higher for people who had had creativity management training and were positively correlated with the number of hours of training people reported. In general, the study revealed a fairly dramatic range of competence across the eight areas and suggests that most managers lack trainable skills that are essential for encouraging workplace creativity.

Introduction

Although creativity is at the heart of all start-up business ventures, once a business enjoys some degree of success, creativity often wanes (Drucker, 2006). In large, highly successful organizations, such as General Motors at its height, creativity is even discouraged; whatever was done before has obviously worked, and people are encouraged to keep doing it. Meanwhile, as competing businesses are created and as the needs of the market change, the world invariably sees less value in what the static, uncreative company has to offer. By the early 1980s, General Motors was starting to lose market share to aggressive, innovative companies from Japan and elsewhere, and by the 1990s, the company was openly taken to task for failing to innovate (Train & Winston, 2007; Cohan, 2009). When a bankrupt, humbled and greatly reduced General Motors took on new leadership in 2009, Ed Whitacre, its new CEO, set the pace for a very different kind of organization, calling for employees to 'step up'. 'We're not

going to make it', he said, 'if you won't take a risk' (Chicago Tribune, 2009).

In any business, management is important for both creativity – the generation of raw new ideas – and innovation – the generation of a select subset of new ideas that have substantial commercial value. Management establishes cultural practices in an organization that can either foster or inhibit creative expression (Williams, 2001; Amabile et al., 2004; De Jong & Den Hartog, 2007; Gemünden, Salomo & Hölzle, 2007; Wang & Casimir, 2007; Byrne et al., 2009; Hülshager, Anderson & Salgado, 2009; Isaksen & Ekvall, 2010; Hemlin & Olsson, 2011; Castro, Gomes & de Sousa, 2012). Companies such as 3M and Google, for example, give employees free time to work on their own ideas. Other companies, at least from time to time, have stimulated creativity by bringing together diverse teams, letting people write on walls, or tolerating failure when people are working on difficult problems.

What is the broadest range of management practices that are known to promote creativity and innovation? And which of these various

practices work best? To address these questions, we set out to rank eight managerial competencies that may play a role in stimulating creative expression according to how well they predict desirable organizational outcomes reported by managers.

Generativity Theory and the Four Core Competencies of Creative Expression

Generativity Theory, a formal, empirically-based theory of the creative process first proposed by Robert Epstein in the 1980s, provides a convenient framework for understanding and analysing a competencies-based approach to creative expression (Epstein, 1985b, 1990, 1991, 1996a, 1996b, 1999, 2000, 2011, in press). According to this theory, new ideas or behaviours arise as previously learned ideas or behaviours become interconnected over time, producing both blends and new sequences, or, as Steve Jobs famously put it, 'Creativity is just connecting things'.

Like the componential theory proposed by Amabile (1983), Generativity Theory suggests that specific skills and conditions must be present for creativity to occur. But Generativity Theory also identifies and quantifies a possible process that underlies creative expression. It asserts that the process by which behaviours and ideas become interconnected is both orderly and predictable; in the laboratory, the theory, instantiated as a series of equations called transformation functions, has proved effective in predicting the novel behaviour of both animals and people moment-to-moment in time. The theory also has a practical side, because it specifies conditions under which multiple repertoires of behaviour are likely to compete and thus produce new behaviour. It can be applied both to accelerate novel behaviour and to direct it toward useful ends.

Generativity Theory suggests the value of four core competencies of creative expression which are both measurable and trainable. In alphabetical order, these are:

1. *Broadens Knowledge and Skills*: One deliberately acquires knowledge and skills well outside of one's current areas of expertise.
2. *Captures New Ideas*: One preserves novel ideas as they occur, without first judging or editing them.
3. *Manages Surroundings*: One surrounds oneself with diverse and novel physical and social stimuli.
4. *Seeks Challenges*: One seeks challenges and manages failure constructively.

Interconnections cannot occur unless the various behavioural components are available. *Broadening* one's skills and knowledge makes more interesting and surprising interconnections possible. Edwin Land was able to formulate the basics of instant photography quite rapidly in response to a query from his young daughter because he had unusually diverse training for a scientist in the 1920s: in chemistry, optics and light polarization (McElheny, 1998; Davidson, 2003). If key parts of this training had been absent, it would have been impossible for him to envision the new technology.

Developing skills for *capturing* new ideas as they occur has value for the simple reason that most people have poor memories, especially for unusual thoughts. Carrying a recording device during the day or keeping a recording device by one's bed reduces the likelihood that new ideas will be lost. Great artists, composers, inventors and writers are known for going to great lengths to preserve their new ideas, even the strange content that emerges in dreams, daydreams and the hypnagogic state, the semi-sleep state between waking and sleeping. Salvador Dali captured hypnagogic images for his art by relaxing on a chair or sofa while dangling a key toward the floor. Just as he drifted off to sleep, the key would fall onto a plate, jarring him awake to record interesting images on paper (Dali, 1976). Thomas Edison used a similar technique to get ideas for new inventions (Mavromatis, 1987).

Generativity Theory and research also show how one's *surroundings* make a difference in creativity. Unusual, novel or multiple stimuli get people thinking about more than one thing simultaneously, the precursor for interconnections (cf. Moultrie et al., 2007; Magadley & Birdi, 2009). If one is driving toward a malfunctioning traffic light on which both red and green are illuminated, one's right foot will likely shift back and forth between the brake and accelerator pedals until one can determine whether it is safe to proceed through the intersection. One might also feel confused or frustrated – the subjective side of behavioural competition (cf. Badke-Schaub, Goldschmidt & Meijer, 2010; Isaksen & Ekvall, 2010). Creativity is enhanced when one regularly alters both the physical and social stimuli in one's life: the position of one's desk, the items on the wall, and even the people with whom one associates.

Finally, behavioural competitions are set in motion when we are *challenged*. When we are failing – in other words, when we are faced with a tough problem and are having trouble solving it – our behaviour is, by definition, inadequate. Technically, it undergoes 'extinc-

tion', which sets in motion, among other things, a behavioural process called 'resurgence': the recurrence of previously reinforced behaviours. According to the principle of resurgence, *when one behaviour is ineffective, all other behaviours that were effective in the past under similar stimulus conditions tend to recur*, setting the stage for many possible interconnections (Epstein & Skinner, 1980; Epstein, 1983, 1985a). Thus, one of the best ways to bring out one's creative side is to seek challenges (cf. Isaksen & Ekvall, 2010). Because problem solving is often stressful, the fourth core competency – Seeks Challenges – also includes methods for managing stress.

The strength of the four core competencies can be measured with a test called the Epstein Creativity Competencies Inventory for Individuals (ECCI-i), and in a recent study with 13,578 people in 47 countries, ECCI-i scores were shown to be positively correlated with self-reported life satisfaction, professional success, and the amount of creativity people express (Epstein & Phan, 2012). In a business setting, training the core competencies also leads to measurable increases in the number of new ideas people express to managers, as well as to new ideas that have substantial financial benefit (Epstein, Schmidt & Warfel, 2008).

Eight managerial competencies, the first four of which are related to the four core competencies, also follow from Generativity Theory. They are shown here in alphabetical order:

1. *Challenges Subordinates*: One gives people difficult problems to solve and ambitious goals to reach, while also helping them to manage stress.
2. *Encourages Broadening*: One provides people with training in topic areas well outside of their current areas of expertise.
3. *Encourages Capturing*: One encourages people to preserve their new ideas and provides tools that make it easy for them to capture such ideas.
4. *Manages Teams Appropriately*: One creates diverse teams with changing memberships and uses shifting, brainstorming and other techniques to maximize creative output.
5. *Models the Core Competencies of Creative Expression*: One shows others that you, as a supervisor, practise one or more of the core competencies of creative expression.
6. *Provides Adequate and Appropriate Resources*: One provides materials, tools and time adequate for subordinates to solve problems or generate new products or methods.
7. *Provides a Diverse and Changing Physical and Social Work Environment*: One creates a diverse and interesting physical and social work environment and alters it periodically.
8. *Provides Positive Feedback and Recognition*: One rewards people for contributing new and valuable ideas.

Table 1 briefly summarizes how each of these competencies can be derived from Generativity Theory. Additional information about each of the managerial competencies will be provided below.

Eight Managerial Competencies: Case Studies and Relevant Research

The eight managerial competencies that we believe are important for managing creativity can also be derived from a review of the scholarly literature on management, as well as from case studies that demonstrate the effectiveness of various management practices in spurring creativity and innovation in business settings. Below we summarize relevant cases for each of the eight competencies. Following this section, we will describe the new study in which we attempt to prioritize the competencies.

1. Challenges Subordinates

Challenge forces people to think in new ways (Amabile, 1983; Hightower, 1993; Epstein, 1996a, 1996b, 1999, in press; Lally & Michalko, 1996; Edmondson, 2006a; De Jong & Den Hartog, 2007; Byrne et al., 2009; Kiley, 2009; Isaksen & Ekvall, 2010; Hemlin & Olsson, 2011), and the history of business is full of examples of managers who pushed subordinates in new directions, the most famous, perhaps, being Thomas Edison, who imposed 'idea quotas' on his staff at his laboratory complex in West Orange, New Jersey. Every staff member was required to produce one minor invention every 10 days and one major invention every 6 months, the general result being that the West Orange laboratory was perhaps the most successful industrial idea-generating operation the world had ever seen (Lally & Michalko, 1996; Dyer & Martin, 2006).

BMW has long been known for its sink-or-swim management strategy, according to which new employees are sometimes given ambitious but vague goals and little support. According to Chief Designer Adrian van Hooydonk, 'No matter how young you are, BMW gives you a rough description of the goal – you aren't told how to get there. The manager watches to see if you can do it. If you're able to deal with responsibility independently, your career develops very rapidly' (Edmondson, 2006a; Van Hooydonk, 2006).

In October 2006, Adam Gryglak, Chief Diesel Engineer at the Ford Motor Company,

Table 1. *Eight Competencies for Managing Creativity*

1. Challenges subordinates
<i>Link to Generativity Theory:</i> Difficult tasks set resurgence in motion, which gets multiple repertoires of behaviour competing.
<i>Sample test item:</i> 'I sometimes challenge my employees with problems that have no solution.'
2. Encourages broadening of knowledge and skills
<i>Link to Generativity Theory:</i> The more diverse the repertoires of behaviour, the more novel, interesting, and potentially useful the possible interconnections.
<i>Sample test item:</i> 'I encourage my staff to broaden their knowledge and experience.'
3. Encourages capturing
<i>Link to Generativity Theory:</i> Novelty is the rule in behaviour; new ideas are often lost unless recorded.
<i>Sample test item:</i> 'I provide employees with many tools for recording new ideas.'
4. Manages teams appropriately
<i>Link to Generativity Theory:</i> Teams provide both multiple controlling stimuli and inhibiting stimuli; techniques such as 'shifting' minimize the inhibiting effects of group settings.
<i>Sample test item:</i> 'I change the membership of all workgroups on a regular basis.'
5. Models core competencies of creative expression
<i>Link to Generativity Theory:</i> New behaviour is often acquired through imitation, especially of authority figures.
<i>Sample test item:</i> 'I always record my new ideas as they occur to me.'
6. Provides adequate and appropriate resources
<i>Link to Generativity Theory:</i> Diverse physical stimuli strengthen multiple repertoires of behaviour, and 'free time' potentially allows behaviour to be more sensitive to contingencies of reinforcement – less constrained by rules.
<i>Sample test item:</i> 'I allocate time for people to work on new ideas.'
7. Provides a diverse and changing physical and social work environment
<i>Link to Generativity Theory:</i> Diverse and changing stimuli strengthen multiple repertoires of behaviour, setting the stage for novel interconnections.
<i>Sample test item:</i> 'I regularly change the office or desk locations of my employees.'
8. Provides positive feedback and recognition
<i>Link to Generativity Theory:</i> Both novel behaviour and 'risk taking' increase in frequency when reinforced.
<i>Sample test item:</i> 'I consistently praise employees for expressing new ideas.'

initiated what seemed to many to be a nearly impossible task: designing and delivering an all-new diesel engine in 36 months. To accomplish this, Gryglak took a diverse team of people off the Ford campus to a new location in Dearborn, Michigan, where they could work with minimal restrictions. The result was an all new, lightweight engine that would require little or no maintenance for 300,000 miles and that utilized state-of-the-art antipollution technology. The project – dubbed 'Scorpion' by Ford – was completed on time (Kiley, 2009).

One of the most effective ways to embed challenge into the day-to-day operations of an organization is to state all assignments and goals in an 'open-ended' fashion (cf. Hemlin & Olsson, 2011). Instead of asking to increase sales by 30 per cent by year's end, ask to

increase sales by *at least* 30 per cent by year's end *at the latest*. Instead of asking for three names for your new widget, ask for *at least* three names. Open-ended statements can increase both productivity and creativity substantially, sometimes by 50 per cent or more, depending on the parameters (Epstein, 1996b, 1999, 2011). Unfortunately, we are not aware of any company that uses open-ended management practices system-wide, even though they require no more resources than traditional bounded practices.

2. Encourages Broadening of Knowledge and Skills

The broader one's skills and knowledge, the more interesting and diverse the possible interconnections (Loeb, 1995; Epstein, 1996b;

Root-Bernstein & Root-Bernstein, 1999; Earnshaw, 2001; Gendron, 2001; Heath & Heath, 2009). Companies that recognize the importance of broad training sometimes go to great lengths to add value to their human resources. Genentech, for example, offers four-year postdoctoral fellowships to up to 120 of its researchers, allowing some of its most talented employees a chance to expand their knowledge into new areas at company expense (Tkaczyk, 2009). This is not only a sound policy for retention purposes, it also creates a steady stream of researchers who are able to look at pharmaceutical industry challenges in new ways.

Animation giant Pixar gives its employees opportunities to expand their knowledge through its in-house Pixar University, which allows people to choose from among roughly 14 different classes per week, branching out into drawing, screenwriting, improvisation, sculpting, painting, and other new skill areas. Ed Catmull, current (as of March 2013) president of Walt Disney Animation Studios and Pixar Animation Studios, says that 'Pixar University helps reinforce the mind-set that we're all learning and it's fun to learn together' (Catmull, 2008). The explicit idea behind the university is to push employees into new areas of expertise (Hempel, 2003).

In the video game industry, broadening can take on strange forms, as one might expect. At Nintendo, developers of *Rhythm Heaven* were encouraged to attend dance workshops to sharpen their sense of rhythm (Seki et al., n.d.). Even a staid company like Procter & Gamble (P&G) sometimes reaches out in surprising ways. A few years ago, when Pete Foley, a P&G administrator, was looking for new ideas for the company's feminine-care business unit, he took his team to the San Diego Zoo, where experts gave them a crash course on biomimicry. Some of the team's new product ideas were inspired by the physiology of geckos, flowers, armadillos, squirrels and ant-eaters (Heath & Heath, 2009).

3. Encourages Capturing

When you make it easier for people to record their new ideas, many more such ideas are recorded than would otherwise be the case (Gundry, Kickul & Prather, 1994; Epstein, 1996b; Higgins, 1996; Simpson, 2001). Lockheed Martin's legendary Skunk Works engineering facility, founded in 1943 in Burbank, California, made it especially easy for employees to capture their new ideas by allowing them to write on the walls (Miller, 1995). This had the added benefit of creating a physical environment in which people were

surrounded by stimulating and ever-changing intellectual material (see 'Provides a Diverse and Changing Physical and Social Work Environment' section below). Although wall writing has not become common practice in business, contemporary companies such as digital design firm Mad*Pow and Detroit's Quicken Loans use dry-erase walls in common areas to encourage employees both to record their ideas and to react to the ideas of others (Maines, 2009; Dybis, 2010).

Companies such as Hewlett-Packard and Texas Instruments have also encouraged capturing by asking employees 'to spend some time each day reflecting, thinking about how to improve the firm, and creating' (Higgins, 1996), and occasionally advances are made when employees are encouraged to capture ideas from dreams or daydreams (e.g., Tanner, 1992). When Edwin Land left Polaroid in 1980, he used his personal fortune to build The Rowland Institute, a private research centre in Cambridge, Massachusetts (now The Rowland Institute at Harvard). In one notable respect, the entire building was designed to foster the capturing of new ideas by resident staff. A serene, winding Japanese garden ran the length of the building underneath skylights far above. The idea was to allow researchers to take quiet walks during which they could listen to their own subtle thoughts (Epstein, 1996b).

Although not widely practised, companies can also encourage capturing by putting 'idea box' icons onto the desktops of employee computers, using screen savers that occasionally show messages such as, 'Reminder: Record your new ideas before they disappear!', displaying such messages on workplace posters, or ordering pencils and pens with similar reminders printed on them. To our knowledge, however, encouraging the capturing of new ideas is not usually a high priority in modern business.

4. Manages Teams Appropriately

Teams are the heartbeat of many thriving businesses, and some businesses construct and manage teams in ways that boost creative output (Finke, Ward & Smith, 1992; Hightower, 1993; Gundry, Kickul & Prather, 1994; Loeb, 1995; Paulus & Yang, 2000; DeCusatis, 2008; Hülshager, Anderson & Salgado, 2009; Barczek, Lassk & Mulki, 2010; Bissola & Imperatori, 2011; Kessel, Kratzer & Schultz, 2012). The development department at Pixar, for example, doesn't propose movie ideas itself; instead, it assembles small, diverse 'incubation teams' that help directors develop the ideas. Team membership usually includes

a director, a writer, some artists and some storyboard makers (Catmull, 2008).

A few years ago, in an effort to create new console designs, Nintendo assembled more than a dozen three-person teams that were given considerable latitude to come up with controller ideas for various GameCube titles. They ended up developing a number of game-specific controllers (as opposed to the near-universal controller most gamers use) and, more important for Nintendo's future, developed concepts that eventually matured into the highly successful Wii controller – a game-changer for the industry (Takeda et al., n.d.).

Sometimes team creativity is enhanced when interactions are constrained by various rules, such as the role-playing rules of the 'six thinking hats' method or the judgement withholding rules of brainstorming (Osborn, 1953; De Bono, 1999). One problematic aspect of teams is rarely controlled for to any great extent, however. Diverse teams with memberships that change from time to time are likely to produce more new ideas than homogeneous teams with static memberships, but the stimulating effects of interesting and informed team members are often offset by inhibiting effects. Aggressive people tend to dominate discussions; shy people tend to withhold great ideas; and one word of criticism – or even a raised eyebrow – can shut anyone out of the discussion permanently. That is the point of instructing people to withhold judgement while brainstorming, and De Bono's role-playing rules are also supposed to compensate for inhibiting social phenomena.

No amount of role playing, however, is guaranteed to elicit creative contributions from every team member. Instead, a 'team shift' is necessary – that is, having team members leave the meeting for a few minutes to work on the problem on their own. A group that meets for an hour but that lets people shift out of the group for 10 or 15 minutes will tend to produce at least 50 per cent more ideas than a group that stays together for the full hour (Epstein, 1996b, 2000, 2011). When people are on their own, generative processes can flow freely, and people can hear their own thoughts more clearly. When people regroup after a shift, they tend to pool their ideas, which yields a larger number of ideas than the group would have generated if it had remained intact.

5. Models Core Competencies of Creative Expression

Not all managers make themselves visible to employees, but for those who do, one of the

most effective ways to stimulate creative thinking is to model creativity core competencies of creative expression (cf. Amabile et al., 1996; De Jong & Den Hartog, 2007; Gemünden, Salomo & Hölzle, 2007; Byrne et al., 2009; Hemlin & Olsson, 2011). Helmut Panke, former CEO of BMW (retired in 2001), was well known for encouraging subordinates to challenge his thinking. He frequently roamed cafeterias, factory sites, sales offices, test tracks and research labs, engaging people in intense discussions about every aspect of their work. To understand his product better, he also enrolled in the company's expert driving school and insisted that the entire management board do so as well (Edmondson, 2006a).

Mark Hurd, CEO at Hewlett-Packard from 2006 to 2010, routinely captured his new ideas in a conspicuous way: aides accompanied him from meeting to meeting with flip charts on which they recorded his ideas as quickly as the ideas flowed (Lashinsky, 2009). Edison, too, modelled capturing conspicuously. According to biographers, 'in discussing any project or new idea his first impulse [was] to take up any piece of paper available and make drawings of it' (Dyer & Martin, 2006).

6. Provides Adequate and Appropriate Resources

'The power of imagination', said naturalist John Muir, 'makes us infinite'. But imagination can only take us so far, especially when we are trying to develop a new engine or pharmaceutical. We also need the right materials, tools and people, as well as the time to develop and test our ideas (cf. Coates & Jarratt, 1994; Barker, 1995; Bartlett & Mohammed, 1995; De Jong & Den Hartog, 2007; Adair, 2009; Byrne et al., 2009). Creativity, in other words, is highly constrained by available resources.

Time is perhaps the most precious resource of all, and 3M has been especially generous in allocating that resource, allowing employees to spend up to 15 per cent of their time on pet projects – projects they can initiate without management approval (Bartlett & Mohammed, 1995; Gunther, 2010) – and newcomer Google allows employees to spend up to 20 per cent of their time on projects of their own choosing (Adair, 2009; Rasmussen, 2009; Arrington, 2010). But perhaps the ultimate example of allocating resources to encourage creativity comes from Bell Laboratories (think: the transistor, UNIX, the laser, the first modern solar cell, the first transatlantic telephone cable, the first computer music and computer art). Under Mervin Kelly's leadership from 1951 to 1959, employees could work on projects with access to nearly unlimited physical resources

without reporting back to him for years at a time (Gertner, 2012).

7. Provides a Diverse and Changing Physical and Social Work Environment

Under Kelly's leadership, new facilities at Bell were designed with an extremely long central hallway that forced people in different specialties to interact with each other throughout the day (Gertner, 2012). This was quite deliberate on Kelly's part; he knew instinctively what research confirms: that ever-changing social interactions set multiple repertoires of behaviour in motion – the key to the creative process. Similarly, Pixar's headquarters in Emeryville, California, was designed to 'maximize inadvertent encounters' from people in different specialties (Catmull, 2008).

Bricks and mortar can enhance or inhibit such interactions year round (Hequet, 1992; Gundry, Kickul & Prather, 1994; De Salvo, 1999; Stokols, Clitheroe & Zmuidzinas, 2002; Edmondson, 2006b; Moultrie et al., 2007; Adair, 2009; Magadley & Birdi, 2009; Nielsen & Kowalski, 2009). The first author of this article attended graduate school in a building (William James Hall at Harvard) that had the ideal design for *inhibiting* creativity: each of the 15 floors in the building housed separate research groups whose members interacted only rarely during short, often awkward, elevator rides. It was unusual in that setting even to learn the names of people outside one's own group. When it comes to creativity, the cumulative effect of stimulus deprivation of this sort over a period of years is probably staggering.

But why be encumbered by the limitations of physical space when communications technology now has the power to bring anyone anywhere into contact with anyone, anywhere? To encourage cross-talk among people in different specialties, Genentech uses Web 2.0 technologies such as Gen-pool (an internal Wikipedia-like application), microblogging tools, online alumni and mentor communities, and internal social networks to keep a diverse group of people interacting. Employees also swap updates using iPhone photos, rather than transcribing descriptions of their projects (Nielsen & Kowalski, 2009).

Social interactions aside, the physical space itself can enhance creativity (Schröder & Hölzle, 2010). On the bottom floor of Nike's Mia Hamm building is an area called 'the Kitchen', which is the creative thinking space for sneaker designs. In this area, 'designers find inspiration in everything from Irish architecture to the curving lines of a Stradivarius violin' (Holmes & Bernstein, 2004). An entire

wall showcases models of every Air Jordan shoe ever produced, and cubicles with low-rise walls are covered in sketches (Gall, 2005).

On the downside, Generativity Theory suggests that optimal use of the physical and social environment to maximize creativity requires *changing* the stimuli regularly. Running into *the same* people in other departments is not as effective as running into an ever-changing cast of characters. Similarly, those unusual objects in Nike's Kitchen won't seem unusual after one has seen them a few times.

8. Provides Positive Feedback and Recognition

Although it is well known that providing feedback, recognition and rewards for creativity and innovation helps keep them flowing (Carson & Carson, 1993; Loeb, 1995; Shalley, 1995; Zhou, 1998; George & Zhou, 2001; De Jong & Den Hartog, 2007; Hemlin & Olsson, 2011), some managers have gone to great lengths in this regard. On Nintendo's Wii website, for example, Satoru Iwata, the company's current global president, spotlights and honours developers of Wii and other gaming technologies by interviewing them personally about the creative processes that led to the advances (Iwata, n.d.). In a country where conformity rules, Nintendo is also unusual in honouring people for taking risks (Takeda et al., n.d.).

Rather than rewarding people financially for their new ideas, 3M regularly holds recognition events to honour both teams and individuals. According to former CEO Lewis W. Lehr, when new ideas turn profitable, 'lights flash, bells ring and cameras are called out to honour the team responsible'. 'We have found', said Lehr, 'that, especially for technical people, few things are more important than simply being recognized by one's peers for good work' (Adair, 2009). Highly creative individuals at 3M literally become the stuff of legends, and there is no higher ground than that at the company (Bartlett & Mohammed, 1995; Loeb, 1995).

Some have argued that reward can sometimes interfere with the creative process; such arguments are based on a misreading of the relevant research, we believe (Eisenberger & Cameron, 1996; Epstein & Laptosky, 1999). There is little doubt that cultures such as 3M's, which provide strong positive feedback for innovation, generate more innovation than corporate cultures that discourage novel thinking. Moreover, when people know that creativity is part of an evaluation, they tend to express more of it (Shalley, 1995; Shalley & Perry-Smith, 2001).

Research Methodology

Of the eight managerial competencies we have identified, are some more effective than others in generating creativity in subordinates? In the present study, a diverse group of managers completed a test that measures the strength of these competencies and also answered three criterion questions in a way that allowed us to prioritize the competencies.

Test Design

The test instrument developed for this study – the Epstein Creativity Competencies Inventory for Managers (ECCI-m) – is a 48-item, Likert-scale inventory (five points labelled *Agree* and *Disagree* at the extremes) which assesses the eight competencies discussed earlier. The test includes five items per competency, one of which is a dummy item that can be used to assess the consistency of responding as soon as an individual completes the test (cf. Epstein, Schmidt & Warfel, 2008). If the Internal Consistency Score (ICS) – a correlation of scores on the dummy pairs – is low, that suggests the individual was not reading the test carefully or did not understand some test items. In that case, he or she can be asked to retake the test. In the present study, the ICS was not used for this purpose, and none of the eight dummy items were included in any of the statistical analyses.

Items in each of the eight competency areas were related to that specific competency. A typical item in the Challenges Subordinates category, for example, was, 'I sometimes challenge my employees with problems that have no solution'. (See Table 1 for examples in each competency area.) Test items were presented in a random order.

Test takers were also asked basic demographic questions, along with the following three criterion questions that were answered on a 10-point Likert scale: 'In general, how much creativity do your subordinates (employees, supervisees, students, etc.) currently express?' (scale from *Very little* to *A great deal*), 'How valued is creativity in your organization?' (scale from *Not at all* to *Extremely*), and 'How frequently do you express your own creativity?' (scale from *Rarely* to *Very frequently*). Participants were also asked whether or not they had had any training in managing creativity, as well as how many hours of training they had had, where they had received the training, how many years they had been in a management position, and how many people they currently supervised. These questions were administered before the start of the test

itself, so that answers would not be affected by the test items.

Test Subjects

Participants were 1,337 managers who took the ECCI-m at the website <http://MyCreativitySkills.com/managers> between 28 March 2008 and 12 January 2011. Participants were not actively recruited. People presumably found the test through search engines or through links to the test posted at a variety of different websites, including <http://CNBC.com>, <http://CreativityInternational.com>, and <http://stumbleupon.com>. When people took the test more than once, data from only the first test administration were used in this study.

A total of 43.4 per cent of the subjects were male, and 56.6 per cent were female. The mean age was 44.3 years, with an age range from 18 to 79. The sample was racially and ethnically diverse (78.4 per cent White, 0.6 per cent American Indian, 5.2 per cent Asian, 5.2 per cent Black, 5.6 per cent Hispanic and 3.4 per cent Other, with 1.6 per cent Unknown), as well as diverse in educational background (1.0 per cent No Degree, 9.0 per cent High School, 5.7 per cent Associates, 35.9 per cent College, 38.5 per cent Masters, and 9.1 per cent Doctorate). Some 90.3 per cent of the subjects were located in the US or Canada; 4.4 per cent were from 17 other countries; and 5.3 per cent were from unknown locations.

Procedure

After completing the test, the test taker clicked on a 'Submit' button, which produced a detailed report defining the eight managerial competencies and showing his or her total score and the score in each competency area.

Data Analysis

Adverse Impact

The United States Equal Employment Opportunity Commission (EEOC) provides statistical standards that must be met by tests that could be used to hire, fire or promote employees (US Equal Employment Opportunity Commission, 2007, 2010). The EEOC requires that these tests not distinguish groups by race, ethnicity or gender by 20 per cent or more. This standard was met in two previous studies focusing on the four core competencies of creative expression (Epstein, Schmidt & Warfel, 2008; Epstein & Phan, 2012), as well as in the present study. The total score for females differed from the total score for males by 5.9 per cent, and the maximum difference between any two racial or ethnic groups was 6.2 per cent.

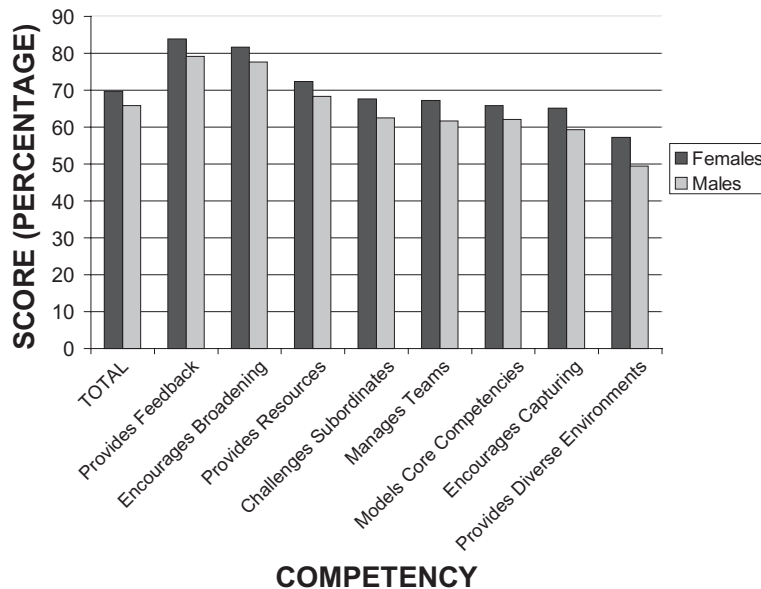


Figure 1. Gender Differences by Competency

Shown for both total scores and, in order from highest to lowest, for each of the eight managerial competencies. Females outscored males on all eight scales. Differences on the 'Provides Resources' and 'Models Core Competencies' scales were significant at the 0.01 level; differences on all other scales were significant at the 0.001 level.

Reliability and Validity

Internal consistency reliability was moderate: Cronbach's alpha was 0.92, and the Guttman split-half measure was 0.90. Test-retest reliability was not measured (see Discussion section).

The predictive validity of the test is suggested by significant positive correlations between total scores and a number of self-reported variables. Most important, test scores were good predictors of the subjects' estimates of their own creativity as managers (Spearman's $\rho = 0.53^{***}$).¹ Test scores were also associated with both the value of creativity in the organization ($\rho = 0.35^{**}$) and the reported creativity of subordinates ($\rho = 0.27^{***}$). In addition, test scores were higher among the 19 per cent of our participants who reported having had training in the management of creativity (Mann-Whitney $U = 114,827.5^{***}$, $M_{\text{yes}} = 70.7$, $M_{\text{no}} = 67.4$) and were positively correlated with the number of training hours ($\rho = 0.29^{***}$).

Demographic Differences

A small effect was found for country, with individuals in the US and Canada slightly outscoring people from other countries in aggregate ($U = 30,707^{**}$, $M_{\text{US/Canada}} = 68.0$, $M_{\text{other}} = 67.6$). Small but significant effects were also found for age ($\rho = 0.10^{***}$) and education ($\rho = 0.07^{***}$, Kruskal-Wallis $\chi^2 = 11.7^{**}$,

$M_{\text{None}} = 66.7$, $M_{\text{HighSchool}} = 65.6$, $M_{\text{Associates}} = 67.2$, $M_{\text{Bachelors}} = 67.7$, $M_{\text{Masters}} = 68.6$, $M_{\text{Doctorate}} = 69.8$), as well as for race and ethnicity ($\chi^2 = 8.6^{**}$, $M_{\text{Whites}} = 68.3$, $M_{\text{Blacks}} = 64.7$, $M_{\text{Hispanics}} = 67.8$, $M_{\text{Asian}} = 67.2$, $M_{\text{AmerInd}} = 65.7$, $M_{\text{Other}} = 68.7$).

Females outscored males both on total scores ($U = 755,602.0^{***}$, $M_{\text{Males}} = 65.8$, $M_{\text{Females}} = 69.7$) and on all eight of the managerial competencies (Challenges Subordinates: $U = 183,324.0^{***}$, $M_{\text{Males}} = 62.5$, $M_{\text{Females}} = 67.6$; Encourages Broadening: $U = 190,119.5^{***}$, $M_{\text{Males}} = 77.6$, $M_{\text{Females}} = 81.6$; Encourages Capturing: $U = 183,780.5^{***}$, $M_{\text{Males}} = 59.3$, $M_{\text{Females}} = 65.2$; Manages Teams: $U = 177,754.5^{***}$, $M_{\text{Males}} = 61.6$, $M_{\text{Females}} = 67.2$; Provides a Diverse and Stimulating Work Environment: $U = 175,644.0^{***}$, $M_{\text{Males}} = 49.4$, $M_{\text{Females}} = 57.2$; Provides Resources: $U = 195,418.0^{**}$, $M_{\text{Males}} = 68.4$, $M_{\text{Females}} = 72.4$; Provides Feedback: $U = 181,130.0^{***}$, $M_{\text{Males}} = 79.2$, $M_{\text{Females}} = 83.9$; and Models Core Competencies: $U = 195,011.5^{**}$, $M_{\text{Males}} = 62.1$, $M_{\text{Females}} = 65.8$) (see Figure 1), a dramatic finding that is consistent with other research on executive skills (see Discussion section).

Competency Differences

The average total score on the test was 68.0 per cent (SD = 10.9). Average scores on each of the eight competencies, from highest to lowest, were as follows: Provides Feedback

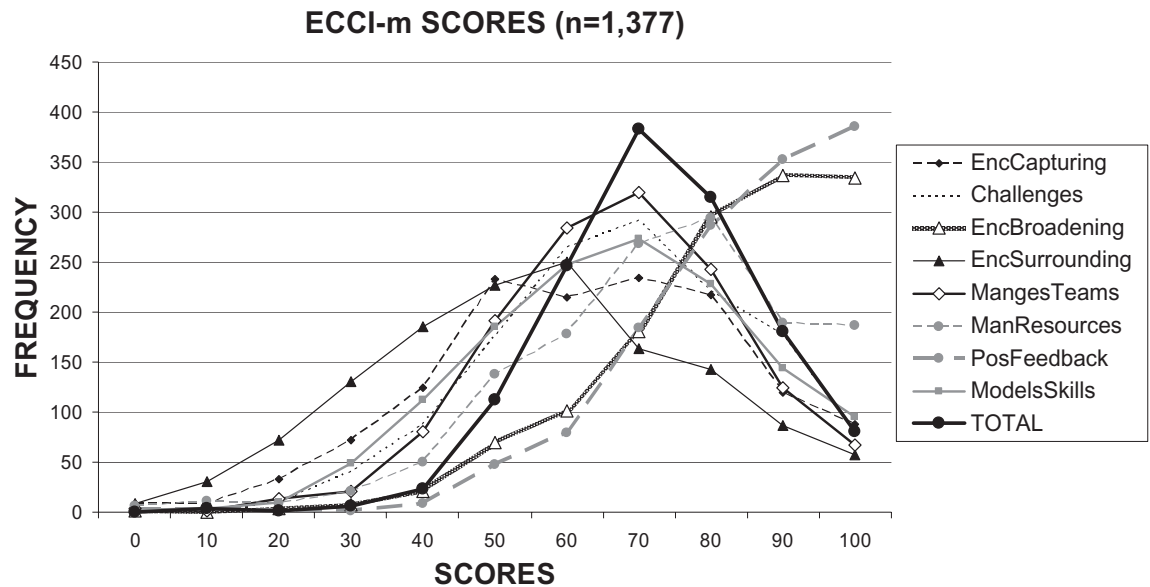


Figure 2. Distribution of Managerial Competency Scores

Shown for total scores and scores on each of the eight competency measures. Total scores were roughly normally distributed, skewed toward a modal score of about 70 per cent. There was considerable variability on all subscale scores, with only two of the eight competencies showing relatively high scores: 'Provides Feedback' and 'Encourages Broadening'.

($M = 81.9$, $SD = 15.1$), Encourages Broadening ($M = 79.9$, $SD = 16.3$), Provides Resources ($M = 70.7$, $SD = 19.3$), Challenges Subordinates ($M = 65.4$, $SD = 18.0$), Manages Teams ($M = 64.9$, $SD = 16.8$), Models Core Competencies ($M = 64.2$, $SD = 19.0$), Encourages Capturing ($M = 62.7$, $SD = 21.9$), and Provides a Diverse and Changing Work Environment ($M = 53.8$, $SD = 22.0$). Score variability was high (Figure 2). The study also revealed a mismatch between the apparent value of some competencies (as suggested in regression analyses, below) and the level of competence managers actually have (Table 2).

Regressions and Factor Analysis

Regression analyses suggested that the most important of the eight managerial competencies was Provides Adequate and Appropriate Resources. It was the best predictor of both the creativity expressed by subordinates (standardized beta coefficient $\beta = 0.30^{***}$, $t = 11.3$, adjusted $R^2 = 0.09$) and the value of creativity in the organization ($\beta = 0.28^{***}$, $t = 10.4$, adjusted $R^2 = 0.08$). As one might expect, the best predictor of the amount of creativity expressed by the manager was Models the Core Competencies of Creative Expression ($\beta = 0.48^{***}$, $t = 19.8$, adjusted $R^2 = 0.23$). Table 2 shows the ranking of the eight competencies according to their overall predictive value.

Table 2. Comparison between the Potential Benefits of Each Competency and the Rankings of the Competencies Based on Managers' Scores

Competency	Benefit	Actual skill
Provides resources	1	3
Manages surroundings	2	8
Provides feedback	3	1
Models core competencies	4	6
Challenges subordinates	5	4
Encourages broadening	6	2
Encourages capturing	6	7
Manages teams	6	5

An exploratory principal components factor analysis yielded seven interpretable components which overlapped considerably with our eight original competencies: (1) Providing Material and Human Resources, (2) Providing a Changing and Stimulating Environment, (3) Encouraging Broader Skill Sets, (4) Giving Positive Support and Feedback, (5) Creating a Comfortable and Rewarding Environment, (6) Providing Challenges and (7) Fostering a Diverse Team Environment (Table 3).

Of special note, loadings were highest for a component that can reasonably be called

Table 3. Factor Analysis Loadings*

Item	Component						
	1	2	3	4	5	6	7
9	0.691						
31	0.678						
23	0.669						
20	0.624						
45	0.616						
41	0.591						
35	0.503	0.425					
5	0.487	0.449					
12	0.475						
22	0.412						
38	0.408						
3							
8							
42							
24							
1		0.741					
33		0.653					
6		0.642					
30		0.522					
32		0.500					
47		0.424					
7		0.411					
14			0.690				
36			0.687				
18			0.598				
27			0.515				
10				0.681			
13				0.610			
46				0.502			
40				0.477			
4				0.437			
44					0.659		
26					0.499		
29					0.446		
16						0.708	
43						0.613	
15			0.456			0.485	
19						0.460	
25							-0.647
17							-0.574

* Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Providing Material and Human Resources, a factor similar to the most predictive of the competencies. Also notable is the fact that the factor analysis did not yield a 'g' (general)

factor, which suggests that the competent management of creativity depends mainly on specific competencies that can be both measured and trained.

Discussion

Theory, research and a variety of case studies all suggest that eight relatively distinct competencies are important for the management of creativity in organizations. The present study further supports this idea and also provides some preliminary evidence for the superiority of certain of these competencies, particularly the competency we call 'Provides Adequate and Appropriate Resources'.

The resources competency rose to the top, we believe, because it entails several different processes that Generativity Theory suggests are important in the management of creativity; to look at this another way, it is an especially rich area of management which overlaps with several other competency areas. Ample and diverse physical resources can stimulate diverse ideas (Table 1, Competency 7); the right recording devices can make it easier for people to record their new ideas (Competency 3); easy access to talented co-workers in different specialties can lead to formation of more creative teams (Competency 4); classrooms, instructors and educational software can facilitate the acquisition of knowledge well outside people's current areas of expertise (Competency 2). Properly allocated and utilized, resources are powerful tools for stimulating creativity.

The present study also provides evidence that training the management of creativity is beneficial: scores on the ECCI-m were substantially higher for people who had had such training, even though that training probably did not focus specifically on the eight competency areas we have described. Our data also suggest that the more training people receive in managing creativity, the better (cf. Williams, 2001). The lesson here, we believe, is clear: the management of creativity should not be left to chance. Measuring and training relevant managerial competencies will likely result in more creative output by subordinates.

The present study also raises concerns about the current state of managerial competence as it pertains to stimulating creativity. We found considerable variability in scores on the ECCI-m, with scores on six of the eight competencies relatively low (Figure 2). We also found that scores were highest in two competency areas (Provides Feedback and Encourages Broadening) that may of relatively low value and, moreover, that scores were somewhat low in two competency areas that appear to be of relatively high value (Provides Resources and Manages Surroundings) (Table 2). Ideally, management competence should be strongest in the most valuable competency areas.

One of the most dramatic findings in the present study is that female managers outscored male managers in all eight of the competency areas we examined. Female superiority in the management of creativity might be the result of both culturally and genetically determined tendencies for females to be more supportive and nurturing than males – important characteristics in the management of creativity (Stokes & Wilson, 1984; Flaherty & Richman, 1989; Reid, Cooper & Banks, 2008). It is not clear, however, whether superior skills of this sort in female managers necessarily produce more creative output in subordinates (Reuvers et al., 2008).

Our conclusions are limited mainly by the fact that this was an Internet-based study. Internet studies are advantageous in allowing the rapid and economical collection of data from a diverse sample of people, but they give researchers little control over specific demographic characteristics of the sample or over possible deception by participants. Some research suggests, however, that people may be more honest when taking computer-administered tests than when taking tests face-to-face (Kaplan & Saccuzzo, 2009), and because most participants were presumably taking the ECCI-m out of personal curiosity rather than as a job requirement, we doubt that participants were inflating scores to impress others.

Participants in Internet studies are also self-selected, and self-selection can bias results. For example, 83.5 per cent of our participants reported having educational degrees at least at the level of a 4-year college degree, whereas only 30.4 per cent of the general population and 57.2 per cent of managers have such a degree (Siebens & Ryan, 2009; US Census Bureau, 2011). It is likely, moreover, that managers who elect to take the ECCI-m have some special interest in the management of creativity, which could mean they have special skills or knowledge in this area. Nineteen per cent of our participants indicated that they had already had some training in the management of creativity, a number that is probably much higher than we would expect in a random sample of managers (Williams, 2001). If indeed the scores we obtained on the ECCI-m are inflated, that is discouraging news given that the average total score we obtained was only 68 per cent.

Breaking down the process of management into measurable and trainable competencies has long been known to have considerable financial benefit (Spencer & Spencer, 1993; Zwell, 2000). The eight competencies considered in the present study are derivable from Generativity Theory and are both measurable

and trainable, and our new data also suggest that they can be prioritized to maximize gain. Generativity Theory provides a scientific framework not only for the management of creativity but for embedding techniques that enhance creativity into policies, procedures and systems of organizations at every level of operation: how evaluations are conducted, how space is designed, how suggestion systems are structured, etc. (Epstein, 1996b, 2000, 2011; Andriopoulos, 2001; cf. Amabile et al., 1996; Björk, Boccardelli & Magnusson, 2010). The key, in our view, is understanding how practices can be altered to stimulate competition among multiple repertoires of behaviour in the individual. The present study explores just one small part of the larger picture, namely, how management practices might be optimized to encourage creative expression in subordinates.

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Note

1. Nonparametric statistical tests such as Spearman's rho, the Mann-Whitney U, and the Kruskal-Wallis H are used throughout this study because scores on the ECCI-m lie on an ordinal scale. The triple asterisk is used to signify a significance level (p) of less than 0.001. The double asterisk is used to signify a significance level (p) of less than 0.01. A single asterisk is used to signify a significance level (p) of less than 0.05. Unless otherwise indicated, all test scores are reported as a percentage of total correct rather than as raw scores.

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