FORUM

University of Edinburgh
Postgraduate Journal of Culture and the Arts
Issue 08 | Spring 2009

Title	The Independent Inventor: Hero or Fool?
Author	Ron Westrum
Publication	FORUM: University of Edinburgh Postgraduate Journal of Culture and the Arts
Issue Number	08
Issue Date	Spring 2009
Publication Date	05/06/2009
Editors	Jana Funke & Lena Wånggren

The Independent Inventor: Hero or Fool?

Ron Westrum
Eastern Michigan University

In this paper I will tackle a subject often neglected when grand treatises on innovation are written: the independent inventor. Although independent inventors are not as significant as they once were, their death is, as Mark Twain said, responding to reports of his own demise, "very much exaggerated." Not only do independent inventors still invent, they are more successful than is generally thought. Here I would like to take the time to give an in-depth examination of this interesting species.

Victims of Bad Press

First of all, the public image of the independent inventor is often negative. An inept and fumbling image is reflected in many of the words that seem to the public interchangeable with "inventor," such as "crank," "crackpot," "kook," "backyard inventor," etc. Carl Barks' depiction of "Gyro Gearloose," Donald Duck's inventor friend, is directly in line with this image. The even more pejorative "mad scientist" is often a characterization of someone who is in fact an inventor rather than a scientist. Depictions of inventors in films, though more diverse, are seldom more complimentary. The recent film "Flash of Genius" is an exception.

Following this general stereotype, it is easy to think that the productive work of the independent inventor is essentially nil, or close to it. This view is present in spite of the large number of significant 20th century inventions that are indisputably the work of independent inventors. So, for instance, the laser was invented by Gordon Gould, at the time a graduate student in physics. The patent for the laser has been estimated as worth about $3 billion, and Gould had to fight for 38 years to secure it. And a vital aspect of his patent case was the stamp of a notary public who worked in a candy shop (Taylor). The Apple II computer was invented by Steve Jobs and Steve Wozniak, in Jobs' garage, and was financed by the sale of Jobs' van (Freiberger). The implantable pacemaker was created by Wilson Greatbatch in his garage. The intermittent windshield wiper was created by an independent inventor, Robert Kearns, and has been made the subject of a widely released film.

And of course these are just the highlights. There are many more examples in everyday products. The "Bobcat" mini-loader, which seems to be an essential presence on every large construction site, was invented by Louis J. Keller, who dropped out of school in 8th grade (Skromme). The Workmate workbench was created by Ron Hickman, formerly of Lotus Engineering, and so forth (Landis 220-222). When people are asked if independent inventors create anything important, these examples seldom come to the public's mind.

My own students at Eastern Michigan University have been asked routinely by me, over the years, to name American inventors. Mostly they seem to recall the classic 19th century American inventors such as S.F.B. Morse or Alexander Graham Bell (never by the way Watt or

Stephenson, both British), ending with the Wright Brothers in 1903. Apparently inventing stopped after the Wright Brothers? When asked about the computer or the jet plane, they usually have no clue as to the inventor. Wozniak and Jobs (Apple II) occasionally do come up. America has stopped teaching its high school students about inventors. Similar responses are usually gotten from my extension students in Industrial Sociology, who are ten years out of school, on the average, and typically work in industry. Today, it would seem, it is all done through faceless teams in big corporations.

Overvaluation of Corporate R & D

The causes of "the demise of the inventor" are not far to seek. With the coming of large corporate research and development operations, especially after World War II, it was easy for Americans to believe that independent inventors were obsolete. The "might force of research," as one book by*Fortune* magazine was titled, would easily put in the shade any puny efforts that independent inventors might mount. When more and more patents were filed by corporations, it was assumed that the day of the independent had passed.

John Kenneth Galbraith, notable economist, opines in *American Capitalism* that:

> A benign providence ... has made the modern industry of a few large films an almost perfect instrument for inducing technical change. There is no more pleasant fiction than that technical change is the product of the small man forced by competition to employ his wits better than his neighbor. Unhappily it is a fiction. Technical development has long since become the preserve of the scientist and the engineer. Most of the cheap and simple inventions have, to put it simply, been made. (91)

This conclusion, however, seems to have been arrived at without supporting evidence. When evidence was gathered, it showed a more complex situation. Independent inventors, in fact, had much to contribute. For instance, in a classic study, three scholars who studied the "sources of invention," found in fact that the picture was more complex (Jewkes). Though large firms certainly had their place, small firms and independent inventors also played important roles. Sometimes they were the acorns from which later grew mighty oaks.

An important insight also comes from the following quotation, garnered from an interview with Tom Hitshuzen, the head of the giant maker of agricultural machinery John Deere's Harvester Works Product Development Center:

> "The individual inventor's specialty is what I call 'leap design'---dreaming up dramatically new concepts." He said: "What we do in an operation like this is more incremental. We build on concepts that have proven their value in the marketplace. We do it quick, using the latest and best tools for gathering data, moving it, analyzing and processing it. All these tools---CAD systems, computer modelling, electronic monitoring, market research---help us take the risk out of the process. They help us improve on existing ideas. What they do not do, however, is create brand-new ideas. They don't create the spark. In fact, you can almost get trapped in a mountain of data. I can gather data to ten decimal points of precision, but then what do we do with it? That's why we're constantly going out into the field, talking with customers and

> users of these machines. We hold focus groups, consult our dealers, and get our hands dirty in the field with customers."

"So where do the new ideas come from," I asked.

> "A lot of them come from individual inventors and small shops," he said. "A big company like Deere then can then evaluate them. If they look promising, we might either buy the patents or, in some cases, acquire a small company. For example, the basic ideas for our Max Emerge planter came from a farmer. We bought the patents and developed them into a marketable machine." (Canine 119)

It is also useful to contemplate the electric effect that the invention of the Apple II personal computer had on the industrial giant IBM. The mammoth corporation realized that its regular processes could not produce a competitor to the Apple machine in time to be useful, so it had recourse to a "skunk works" in Boca Raton, Florida, which in a year produced the IBM PC (Chposky and Leonsis). Both, however, were upstaged by a skunk works run by the Xerox corporation, which produced the Alto, a far superior machine in all points except that of cost. The Alto would contribute importantly to the Apple MacIntosh. All this mention of skunk works (and garages) also points to the impact of small size on rapid prototyping.

Even inside large corporations, it turns out that "inventors" still exist. The "idea champion", as Thomas J. Peters and Robert H. Waterman term him in their *In Search of Excellence*, is often the guiding force for a research team. (We might note, too, that it was Peters and Waterman who first drew attention to the role of the skunk works in large corporations.) For instance, Bill McLean is certainly in this sense the inventor of the Sidewinder Missile (Westrum). It is also worth considering that while inventors often make the prototype, the creation of a product may entail the work of a larger body. Large corporations can do the job from start to finish, but inventors can often provide the "start" and then have to grow or employ a larger entity to get a product out.

Even the Lone Ranger Had Tonto

We need to take a moment and inquire into the issue of the "lone inventor." It is easy to conflate the independent inventor with the phrase "lone inventor," but the two are not the same. Although it is true that the act of invention is often solitary---one thinks of Boss Kettering on his yacht, and Wilson Greatbatch in his barn, with a telephone that would not accept incoming calls (personal communication)---the completion of the inventive process itself frequently involves others. The Wright Brothers could not be lone inventors, by definition. But beyond that, they had help in constructing their engine. King Gillette needed Nickerson, a mechanical engineer, to figure out how to make the disposable blades. Whatever is the truth about the relative contributions of Samuel Morse and his mechanical engineering assistants, there is no doubt that he had help designing his telegraph (Stein). Finally, Edison was an independent inventor early on, but later got a whole laboratory of helpers at Menlo Park. So isolation is relative.

Generally, independent inventors have assistants and helpers. Thomas G. Lang, inventor of the SWATH ship, thought it up by himself, and built a one-foot prototype that he tested in his bathtub. Yet when it came to making a bigger one, even a five-foot-long experimental prototype,

he needed help, which fortunately he got from his colleagues at the Naval Oceans Systems Center, and they then tested it in San Diego Bay. The first useful SWATH ship would be 90 feet long, the SSP Kaimalino (Lang). A later*planing* Swath ship was built in Lang's garage (it was 18 feet long, which was the length of the garage) in Solana Beach with the help of his son. The fact is that the invention process is often very fluid. It may begin in the individual's mind or notebook (as with Lang and SWATH), and later continue into a multi-person team or workshop, or as in the case of Chester Carlson and the Xerox process, it can go through stages, with more people at each stage.

And of course an inventor may go through many phases in his or her lifetime. This was true of Jacob Rabinow (1910-1999), progenitor of 230 U.S. patents (Brown 183-217). He worked for the National Bureau of Standards, started his own company, got it (and himself) acquired by Control Data, created another company (Rabco) and eventually ended up working again for the government. His early inventions were produced by the military, others by his companies and later by Control Data, and finally when he invented the first pick-proof lock, he was a truly independent inventor. Since he had had about 2,000 patentable ideas, he decided to plot them against his working environment to see when he had been most productive. This appeared to be when he ran his own firm, Rabinow Engineering, when he had been able simply to hand a sketch over to a technician, who returned a 3-dimensional version within a few hours: "It was like living in a magic world where one just waves a magic wand and out comes beautifully built working models. This is an experience that comes very rarely to any engineer" (Rabinow 250-251). Rabinow illustrates the great fluidity of the inventive process.

So this is the important point: there is not one scenario or trajectory for the independent inventor, but several. It is true that some independent inventors indeed follow the stereotype of the one-invention inventor, whose invention has to compete, often unsuccessfully, with the products of other inventors and other companies. Many independent inventors struggle obsessively with the one invention, which may be poorly conceived, seldom finds a large market, and leaves its progenitor with large debts and broken dreams. Such inventors are frequently the target of fraudulent "invention developers," who waste their money, let's say four thousand pounds sterling, and leave them no further along than when they started.

(But then sometimes one invention is enough, as with the intermittent windshield wiper, which provided its inventor with millions in profits.)

On the other hand I think of one independent who sent me a glossy 20-page catalogue of fishing lures, many of them patented original inventions. What is the difference between an independent inventor and a small company? Sometimes it is only a matter of time. Today's start-up inventor may well be a company owner ten years from now, if things work out, and might be working from a dozen patents, each of which may be a success on its own. That company may, in time, be bought out by a larger firm for a large sum. This indeed is the story of a local Ann Arbor medical inventor, Richard Sarns, inventor of the Sarns Heart-Lung machine. Sarns and some fellow mechanical engineers surveyed local doctors on what they wanted to have them invent, and then proceeded to develop those products. Many years later, the Sarns company---then a thriving local enterprise---sold out to giant 3M for what one imagines to have been at least many millions of dollars.

So there is not one model for the independent inventor. Many, it is true, go through heartbreak and failure, and for the usual reasons: a difficult invention to perfect, not enough capital, under-estimation of time for development, and so forth. If the invention actually reaches the market, there are new struggles with patent infringers, copiers, and the courts. One obviously gifted inventor, a polymer chemist named Maurice Hiles in Ohio, who has about 100 patents, told me that infringers come in three categories: small, middle, and large-size. If you sue the little ones, they go out of business, if you sue the big ones, they crush you with their legal staffs. One billion-dollar company simply ignored Hiles' patent, and produced the product anyway, knowing that they could tie him up in court forever if he complained. But against the middle-sized infringing company, said Hiles, you have a chance. You can sue them, and if you win, they will pay the royalties they owe you.

The Work of Inventing

The part most likely to be neglected about inventing is the everyday work that goes into product development. This work includes sketching something up, putting it together, trying it out, and then redesigning it when things do not go according to plan. Outsiders typically concentrate on the moment of inspiration, the "instant image," as Polaroid inventor Edwin Land put it, or the moment of great success, but what happens in between? Thomas Edison announced that "invention is 5% inspiration and 95% perspiration," but no one seems to have heard him.

It is worthwhile to remember that when Howard Head, inventor of the most popular form of metal ski, first gave a prototype to a ski instructor, it broke. The second one broke too, and so did the next thirty-six prototypes. It was the 39th prototype that didn't break. With every failure, said Head, "something inside me snapped with it" (Leuthner 53). Yet trial and failure are part of the invention process, and success often takes a long road. It is sobering to read the long list of decisions and trade-offs that went into a modestly sized product like the Segway personal transporter, although certainly its inventor Dean Kamen was not in any sense a "lone" inventor (Kemper). It is no accident that in 1930 some 710 professional inventors chose "persistence" as the key trait for an inventor, 2.5 times as often as the next trait, "imagination" (Rossman 40).

It is useful to realize that independent inventing involves a lot of everyday work, tinkering and so forth. And many of the people who do it have well-equipped workshops, assistants, and regular clients. Even "garage" (seldom back-yard) inventors have garages that look different from those of the rest of us. And so it is not terribly surprising that they often develop important things.

The Independent as Entrepreneur

The independent inventor is a rare breed, who has been argued to be different psychologically from the corporate inventor (Stuteville). The independent is, above all, a businessman or businesswoman. Success ultimately comes through development, production and the marketplace. And here, of course, many independents have trouble. A person who is mechanically adept may have few business skills, and lose in business the technological battle

that he or she won by the invention. Many of the more important inventors of the last two hundred years have come to grief where money is concerned (Campbell). To determine the likelihood of financial success, the Zimmer Foundation, which assists independent inventors, hired me to find out the fate of independent patentees from Michigan, Ohio, and Indiana.

The sample we chose consisted of all independent inventors in Michigan for a ten-year period, with some inventors from Ohio and Indiana added in the later phases. An independent inventor was defined as a patentee who had an unassigned patent. (Ordinarily, a patent will be *assigned* to the employee's firm if it is invented on company time.) Altogether, there were roughly 9,000 inventors in the sample. There were three phases in data collection. Phase I---a test phase---involved sending out 221 long questionnaires to a group of patentees chosen systematically from the larger group. This was to give us some idea of the kind of responses we could get. Phase II used a much smaller questionnaire, essentially an over-sized post card, which was sent to 7,794 patentees in a one-shot mailing. Finally, Phase III used 877 questionnaires in a multi-wave effort involving a two-page questionnaire. Phase III used a four-wave approach, designed to boost the number of returns received. All addresses were sent a postcard several weeks after the first questionnaire. Anyone who did not respond to the postcard was sent another letter with a questionnaire. Anyone who did not respond to *that* got a certified-mail questionnaire. With Phase II we got an 11% return; Phase III yielded a 37% return. The latter was not bad at all, considering that we did not use a university logo (Eastern Michigan University would have been happy to participate, for a hefty share of the grant involved, but I decided to do it alone.) And then the members of the group that was surveyed, independent inventors, it is said, come in two categories: "the paranoid and the more paranoid."

Once the returns came in, there were surprises. The most important finding was that, roughly speaking, one-third of these independent inventors' patents led to financial success. Now, with this group, I decided not to ask for specific amounts of money, but to ask the sample what kind of business results they got. This avoided the possible inventors' suspicions of my motives, and I believe got a better return rate. (One or two inventors did call me up to see who I was and what I was up to: these were valuable conversations.) So there were four possible categories: loss, break-even, modest profits, and substantial profits. I defined modest profits or substantial profits as success. What these meant to the respondents is uncertain, and in retrospect I feel that a more specific definition would have helped. Nonetheless the results are very interesting.

The returns showed that two major factors influenced success: 1) the method of exploitation and 2) how many patents the inventor had. For instance, in Phase III, we asked inventors what strategy they used for "exploiting," or making money from their patent. There were three main methods, and many potential variations: self-manufacturing, licensing, or "other" manufacturing (i.e. others made the product, and the inventor did the marketing). There were other combinations as well. The results for first-time patentees are shown in Table I:

Table I

Strategy vs. Financial Success for One-Patent Inventors (Phase III data)

Self-Manufacture	N = 11	Success = 6	Percent Success = 56%
Licensing	N = 26	Success = 2	Percent Success = 8%
Others do the Manufacturing	N = 33	Success = 6	Percent Success = 18%
Other mfg. or Licensing	N = 6	Success = 0	Percent Success = 0%
Other Combinations	N = 11	Success = 2	Percent Success = 18%
Overall Totals	N = 87	Success = 10	Percent Success = 18%

This table records what to me was the largest surprise. Those who decided to manufacture the product themselves got the biggest returns. At first I thought that this might reflect a higher motivational level. Actually, however, according to Ron J. Riley, head of the Professional Inventors Association of the United States of America, this difference is not surprising. Those who manufacture themselves can get about a 20% return, whereas licensing is likely to yield only a 2-3% return. By contrast, licensing seldom works for the inexperienced inventor, and only about 17% of first-patent inventors (Phase II data) who tried it made any money from it. As we will see, getting others to do the manufacturing works too, but mainly for the more experienced (Merrick).

So manufacturing, though involving more work, provides the prospect of better profits. A fine letter from Eldon Hostetler, President of Ziggity Systems and an important inventor of egg-laying equipment, made the following point:

I found that nobody beats a path to your door. When you have done all the risk taking that is required proving it does work, then they approach you and ask what they might need to pay. However, I never made any real money until I formed my own company and sold equipment myself. During the time I had license agreement years I was always spending all of my income introducing new products. Therefore my advice to all those that come to me about patents is the same. If you are interested in having control over your product and don't want to take any financial risk, license someone to do it and also work for them. However, if you want to truly capitalize on your invention make the product yourself and take the financial risk. It will be a struggle but is worth it. (Letter of 22 July, 1999)

Mr. Hostetler's remarks are strongly supported by my data from Phases II and III. As a group, those who manufactured their own products outperformed the other categories by impressive margins and sometimes two to one.

The second surprise came with the importance of experience. I found experienced inventors---defined as those with more patents---make more money regardless of the method of exploitation. The more patents, the more profits on each patent. This was a surprise because Jack Rabinow, who died with 230 US patents to his credit, only really made big profits on one of them, a self-regulating device for clocks. I thought this would be the general pattern; it is not.

The experienced inventor in my sample has a greater rate of success on each individual patent. Or so it appears, since we only asked about patents within the ten-year window.

Table II

Financial Success by Number of Patents (Phase II data)

Strategy	One Patent	Two Patents	3-5	6-10	11-20	21+
Self-Mfg	49% (41)	45% (22)	76% (24)	75% (24)	89% (18)	67% (3)
Licensing	12% (40)	16% (31)	23% (35)	41% (17)	40% (25)	40% (35)
Mfg/Licensing	8% (24)	28% (14)	42% (24)	58% (14)	57% (14)	50% (2)
Other Combin-ations	6% (116)	17% (42)	34% (29)	39% (13)	50% (4)	62% (8)
Totals	221	109	112	68	61	48

This is a striking relationship. We see here a very interesting pattern: those with many patents fight a different battle than the fledging inventors with, say, only a single patent. As the inventor becomes more experienced, he or she can predict to a much greater extent that the product will not only be produced, but that it will show financial returns. This moves inventing from a hit-or-miss proposition into a more rational and plannable process. And it builds, as Enrico Fermi remarked, "the will to think about future inventions" (Shockley 62). Inventors with a dozen patents are hardly backyard inventors. I might remark by the way, that "modest" returns were about as likely as "substantial" ones. So the successful inventor is not rare, as many people believe. And who could forget the comment on one of the postcard responses, on which "substantial profits" was checked: "Millions! Sold through Super K-Marts!"

Conclusion

The stereotype of the independent inventor is, as we have seen, deeply misleading. It is true that we can find patentees who match the stereotype, but they constitute a minority. Against this inept and unsuccessful minority we must set the capable and often highly successful professionals. Independents not only invent great things, they routinely invent a myriad of everyday products that produce benefits for us while they produce profits for their conceivers. *One-third of independent inventors patents produce profits for their holders*.

What we need to see, then, is not a Great Divide between the corporate and the independent inventor, but rather a continuum of effort from the solo practitioner; to the small team or skunk works, through the smaller company, and finally to the giant corporate laboratory. Invention takes place on several scales. They are all, as systematic studies have shown us, important. Some small ones are but the fledgling stages of the big ones. Chester Carlson started in his kitchen, but his idea ended as Xerox.

Works Cited.

Brown, Kenneth A. Inventors at Work: Interviews with 16 Notable American Inventors. Redmond, Washington: Microsoft Press, 1988.

Campbell, Donald Sterling. The Financial Awards of Significant American Inventors---A Biographical Study. Diss. Davis: University of California, 1974.

Canine, Craig. Dream Reaper: A Story of Modern Agriculture. Mississauga, Ontario: Random House of Canada, 1995.

Chposky, James and Ted Leonsis. Blue Magic: The People, Power, and Politics Behind the IBM Personal Computer. New York: Facts on File, 1988.

Dessauer, John. My Years with Xerox: The Billions Nobody Wanted. Garden City, New York: Doubleday, 1971.

Freiberger, Paul. Fire in the Valley: The Making of the Personal Computer. New York: McGraw-Hill, 2000.

Galbraith, John Kenneth. American Capitalism: The Concept of Countervailing Power. London: Hamish Hamilton, 1957.

Jewkes, John, David Sawers, and Richard Stillerman. The Sources of Invention. 2nd rev. ed. New York: WW Norton, 1969.

Kemper, Steve. Code Name Ginger: the Story Behind Segway, and Dean Kamen's Quest to Invent a New World. Boston: Harvard Business School Press, 1963.

Landis, Scott. The Workbench Book. Newton, Conn.: Taunton Press, 1987.

Lang, Thomas G. "SWATH: From Ideas to Ships." Paper Presented at the Intersociety Advanced Marine Vehicles Conference. Arlington, Virginia, June 6-8, l989.

Leuthner, Stuart. "A Bad Skier’s Revenge." American Heritage of Invention and Technology 19.3 (Winter, 2004), 50-59.

Merrick, Robert. Stand Alone, Inventor! Singapore: Raffles, SNP Editions, 1998.

Peters, Thomas J. and Robert H. Waterman. In Search of Excellence: Lessons for America's Best-Run Companies. New York: Harper & Row, 1982.

Rabinow, Jacob. Inventing for Fun and Profit. San Francisco: San Francisco Press, 1990.

Rossman, Joseph. Industrial Creativity, the Psychology of the Inventor. New York: University Books, 1964.

Shockley, William. "The Invention of the Transistor---An Example of Creative-Failure Methodology."The Public Need and the Role of the Inventor. Washington, DC: Government Printing Office, 1974.

Skromme, Arnold. The Seven-Ability Plan. Moline: Illinois, Self-Confidence Press, 1989.

Stein, Ralph. The Great Inventions. Chicago: Ridge Press, 1976.

Stuteville, John. The Life History Patterns of Highly Creative Inventors. Diss. Davis: University of California, 1986.

Taylor, Nick. Laser: The Inventor, the Nobel Laureate, and the Thirty-Year Patent War. New York: Simon and Schuster, 2000.

Westrum, Ron. Sidewinder: Creative Missile Design at China Lake. Annapolis: Naval Institute Press, 1999.