

A SECOND HARVEST

Producing Value from Research Innovation

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RESEARCH, A NATURAL RESOURCE

Each year research facilities develop and invent a wide variety of new technologies, devices, materials, systems, methods, and ideas. These new creations are capable of creating new industries, revitalizing old ones, becoming products, or being the seed for new businesses. Because of this great potential, research laboratories should be thought of as *renewable natural resources* that need to be tended and harvested. If harvested correctly, they can become more productive the more they are used.

There is great diversity in research laboratories, and research itself is notoriously hard to define. However, there are a few common aspects to most research organizations:

- 1) Organizations are formed of small teams.** Most research labs are essentially umbrella organizations with many small, almost independent, teams within them. Each team works on a different project, often with its own funding, goals, and management. Typically, upper management does not get involved in the inner working of the teams for it is believed that scientific discovery best arises from individual insight and undirected work.
- 2) The teams work on scientifically interesting ideas.** The research teams usually work on ideas of scientific interest. They seek ideas that have some fundamental or universal theory behind them, with little concern about whether the results lead to a commercial product. The research itself is often couched in scientific terms and equations that are hard to understand by the lay person and at times, by management.
- 3) Papers and conferences are very important to researchers.** For many researchers, the papers that are produced, and the conferences that accept the papers, are more important than resulting potential products or commercial value.
- 4) Researchers look for scientific novelty and peer acceptance.** The work must be different than other researchers' work, and it should be cutting edge. There is often competition between research teams and it is typically difficult to get teams to work together.
- 5) Product development is not a number one priority.** Research teams think of their scientific advances as their primary goal. They are aware that these advances are useful because they can become products, but the teams themselves are typically not good at understanding markets nor are they good at bringing advances to the market. Most researchers want only to be funded to do more research.

6) The best research is often many years away from the target product. A common question asked of researchers is “How many years away is this work from becoming a product?” The harsh reality is that it can typically take between 13 and 20 years (Swinehart citation) from the gleam in a researcher’s eye to profitable product. Clearly there is some research that is closer and some further away, but the important aspect of the Timeline is that it is longer than corporate planning cycles.

7) There is a tremendous amount of know-how in labs. While most researchers think of themselves, at least in part, as scientists, they also have a tremendous amount of engineering know-how. This is a vast knowledge reservoir that allows them to make things that are impossible outside the research lab. Many companies actually rely on this know-how as much as they do on the generated ideas, so it is important not to lose the researchers, especially as they are not inclined to work on a single research goal for 13 to 20 years.

THE FIRST HARVEST

There are several traditional methods for getting research out of the labs and commercializing it. While certain industries and certain laboratories are better at this process than others, almost all agree that it is very difficult. It could be said that there is *an impedance mismatch* between the labs and business, making it difficult for the two to communicate. The process is sometime called *throwing things over the wall*. This captures both the lack of communication and the haphazard nature of the existing methods of research transfer.

Just as there is a wide variety of research labs, there is a variety of methods for research transfer currently being used. In this paper we call these methods *The First Harvest*. They are successful enough to keep industry supplied with new technology and to keep the research labs afloat, but we do not believe that the methods of The First Harvest come anywhere close to fully capturing the potential value of the labs. Briefly stated, here are the methods of The First Harvest:

1) Directed or seeded research. Much research, particularly in corporate laboratories, is highly directed research. The domain, and often the outcome, is determined by corporate or laboratory upper management. The research is then judged based on how well it fulfills the specifications. Engineering managers from corporate divisions often monitor this research on a quarterly basis. In some research labs, such as IBM in the US, such research accounts for two-thirds of their work with only a third being undirected or *blue-sky* (find citation).

2) Intellectual property as commodity. Even when research is directed, only a relatively small amount of it is actually used. Undirected pure scientific research, serendipitous research, pet project research, blue-sky research, and skunk-work research often has an even lower chance of making it over the wall. To capture the value of this

research, laboratory managers have collected the intellectual property generated into portfolios, usually in the form of patents and trade secrets, and have had some success in selling this I.P. either as individual items or as blocks. Corporations are also known to trade blocks of I.P. as part of inter-corporate deal making.

3) Lucky breaks. Many research projects are turned into products by a process that might as well be called *lucky breaks*. Perhaps a marketing manager wanders down into the labs and sees something that interests him or her. Perhaps a lab manager convinces a division manager that a new idea has potential. Perhaps a businessperson sees a research demo at a trade fair or sees an article in a magazine and has an idea for a start-up. Perhaps while searching the web a company comes across the website of a researcher and sees potential in the patent.

PROBLEMS WITH FIRST HARVEST METHODS

While we believe that the methods of *The First Harvest* are important, and to some degree effective, we do not believe that they by any means fully capture the value of the research labs. Furthermore, we believe that these methods do not *fertilize and cultivate* the research labs in a way that makes them potentially even more productive in the future. Here are some of the problems we see with relying only on *First Harvest* methods:

1) Filtering done by primarily by research managers. In any research lab, some projects will be funded and others de-funded; some will be encouraged while some discouraged; some of the output will be highly advertised and brought to outside attention while other output will be hidden away. We call this process *filtering* and it is clearly necessary. However, in the current research environment filtering is done primarily by research managers who have come up the ranks of researchers and who have little feel for what projects might be commercially useful (outside of directed projects).

2) Filtering done by corporations. In many cases, further filtering is done by corporations or university research sponsors, based on their own preconceived notions of product potential. This can be a severe damper to innovation as presented in the book *The Innovator's Dilemma* by (Christianson citation). A company has a set method of doing things and an existing customer base. New ideas that fall outside these parameters cannot easily be introduced without risk.

3) The *too small* project. Any corporation has projects that it considers too small to pursue even if the same project in smaller company would be considered successful. In many cases, while it is believed that these small projects may grow into much larger ones, there is no mechanism for long term nurture. Even in university research labs, certain projects are filtered out, because they do not meet some, often undefined, size threshold.

4) *Edgy* research gets killed. Most research lab managers can see a *good* idea and are supportive of them. However, there is another class of ideas that we might call *edgy* ideas

– those that are so unusual that half the people who see them think they are terrible and half see them as great, with little middle ground. Such ideas tend *not to be pursued* because it is risky for the manager to present them to upper management, or sponsors, as they could cloud his credibility. Yet these edgy ideas are often revolutionary and breakthrough.

5) New uses of the technology are filtered out. Many companies and research labs understand their own domains, but little outside of those domains. A technology that doesn't work within the domain is often filtered out, even if it might be very useful in another domain. For instance, a technology discovered in a military lab might be very useful in the toy market, but can rarely be transferred by traditional First Harvest methods.

6) Bridge products are hard to justify. One of the interesting aspects of *The Swineheart TimeLine* is the *bridge*. According to the *TimeLine* it takes thirteen years to go from first research to first product. But as it turns out you can only keep researchers interested for about five years, after which the idea is no longer novel to them. It is very difficult, on the other hand, to get a company interested in an idea until they can see the product horizon, perhaps four years before shrink wrap. That leaves a gap between research and commercial interest of around four years that must be bridged. There are various methods of doing so, including expensive cutting edge products for limited audiences (for example the early Aibo Dog), art and concept pieces, trade show demos, and the like, but it is very hard for First Harvest methods to justify or find these bridge projects.

7) New product categories are hard to create. Most *First Harvest* methods look for technologies that support existing product lines. These technologies improve products by making them cheaper, more robust, or by giving them new features. Managers filter research based on the benefits they can bring to existing lines. However, it is very difficult to create *new* businesses from research since the business infrastructure is not in place to even evaluate the idea.

THE SECOND HARVEST

We believe that the First Harvest of research ideas, technologies and innovations is very important. In particular, companies and sponsors must retrieve their value from directed, funded research. However, this paper proposes a *Second Harvest* that would work in conjunction and synergistically with the First. The Second Harvest can extract and retrieve extra value from research labs – value that in many cases would go to waste and stay latent. Developing such research would help support the research environment both financially and psychologically. Nothing helps widen the mind like success.

1) Creative survey teams. Creative Survey Teams are composed of generalists, business people, inventors, marketers, and futurists. While these teams listen to the lab manager's ideas about what are good candidate projects, the teams dig much deeper. They listen

intently to presentations by the individual research groups and go from cubicle to cubicle discovering hidden projects. The teams make contact with key researchers who, more than the managers, often know everything cool that is going on in the labs. They read the scientific papers and try to discover hidden away skunk work projects. Most important, the Creative Survey Teams look at the research from a very broad, multi-industry perspective, and not simply from the domain that the research lab *thinks* is important.

2) Innovation brainstorming groups. It is expected that the Creative Survey Teams will generate a tremendous amount of potentially valuable research data. This data is brought before *Innovation Brainstorming Groups* for analysis. These groups are composed of members of different survey teams (which allow them to look across laboratory boundaries), cutting edge business types, inventors, innovators, and researchers with product experience. The Innovation Brainstorming Groups think of new and unexpected uses, products, businesses, and processes based on the data brought to them by the Creative Survey Teams. Most of these ideas would not have arisen from within the laboratories themselves due to their intentionally narrow focus on pure research.

3) Prototypes and other knowledge transfer tools. From the outsider's perspective, it can be difficult to understand scientific research in its raw form. Therefore, once the Innovation Brainstorming Groups isolate ideas with high potential they work with *Prototype Teams* to make highly evocative prototypes, demos, vision tapes, story boards, and collaterals that not only explain the new ideas, but help *form* the ideas. It is based on these physical manifestations that people will understand the new idea, get excited by them, and join business organizations based on them. This form of prototype often also creates new secondary ideas and pulls in other technologies.

4) Business startup teams. As the prototypes begin to form natural ideas for businesses around them, special *Business Startup Teams* are also formed to work out detailed business plans and marketing ideas. These teams study the upside potential, the problems to be overcome, the amount of capital that needs to be raised, risk/reward balances, and so on. The result of this work is a business plan.

5) Start-ups. At this point, start-ups and small businesses are created and funding is raised based on the business plans. The final business team is one that can run with the idea in a competitive business environment leaving the original researchers to get back to the laboratory bench. This turn-over is critical both for the success of the company and for the creation of future research ideas – and it avoids making frustrated businessmen out of great researchers.

6) Business planning and on-going support. It is common for such new startups to take two or more years before a product finally emerges. During this time, the markets can change and new technologies can appear. It is critical that The Second Harvest methods and groups continue to be involved in order to feed in new research ideas and provide other marketing and financial support.

THE ADDED VALUE OF THE SECOND HARVEST

The Second Harvest is designed to solve many of the problems of *The First Harvest* and to create a new kind of business energy. It would also greatly re-energize the research laboratories themselves.

Here are some of the benefits of *The Second Harvest*:

- 1) **Create new kinds of businesses.** While the methods outlined for *The Second Harvest* can be used to extend current products and businesses, they have a tremendous potential for creating entirely new kinds of businesses. When these businesses grow up, they could become new industries.
- 2) **Exploit technologies outside their intended domain.** While most research is done within a specified domain, much innovation occurs when the technologies from one industry are *cross-fertilized* into another industry. *The Second Harvest* methodologies are based on these ideas and work *sideways* to traditional approaches which are primarily vertical.
- 3) **Create *early and bridge* products.** By exploiting technology in unusual ways and in different industries, certain technologies can come to market quickly. Technologies designed, for instance, for the car industry may take years to satisfy safety requirements, but would work well in other industries almost immediately. *The Second Harvest* would also be able to look at *bridge* products such as limited edition, high-end consumer goods, trade show displays, museum exhibitions and avant garde art works.
- 4) **Create businesses out of *small and edgy* ideas.** Unlike large companies, *The Second Harvest* can exploit small ideas out of research labs. These ideas, while too limited for giant conglomerates, are just perfect for start-up businesses. Furthermore, in these environments such ideas can grow and eventually be re-absorbed by large companies. The same is true for *edgy* ideas. Ideas that are too risky for large enterprises can find support in small ones with dedicated teams that *believe* in the ideas.
- 5) **Sell product ideas and not technology.** In *First Harvest* exploitation of research, it is usually the technology which sells into already existing product platforms. In *The Second Harvest* it is new product and business ideas which are being sold. This has the effect of creating a much more diverse product ecology. Diverse ecologies tend to be more stable and productive in the long run.
- 6) **Revitalize laboratories.** *The Second Harvest* benefits are bi-directional. While they certainly create new business opportunities, they are also highly beneficial to the laboratories themselves. For instance, *The Creative Teams* can help the research groups see new potentials for their work, and the money flowing in (without losing researchers) from new ventures helps tremendously as in the research environment as even small amounts of money go a long way.

7) Create small businesses. *The Second Harvest* is designed to help create a robust economy of small businesses that complement the large corporations already in place. We believe that this makes for a much more dynamic business environment for both.

CONCLUSION

We believe that there is great potential in the metaphor of a Second Harvest, which includes the realization of value from new research, the creation of new businesses, and the invention of new product lines. In a very real sense, this is value that already exists but that has not been harvested.