Branching out

What happens when a company transforms its technological capabilities by entering a “new to the firm” niche? In this interview, Gerry George, an associate professor of entrepreneurship at London Business School, tells Georgina Peters about a long-term study to find the conditions that most favour branching out as a probable path toward innovation.
What was the goal of your research?
Basically, Yanfeng Zheng of Clemson University, Reddi Kotha of London Business School, and I wanted to determine the extent to which expansion of technological capabilities impact a firm’s innovative activity, especially a start-up firm. Old or new, when a company enters a “new to the firm” technological niche, either by invention or acquisition, we called that “branching”. In all, we analysed data from 128 public and private biotechnology firms over 20 years, beginning with their start-up phase.

You also focused on “branching distance”. What is that?
That is simply the distance of a firm’s technical exploration from where it is now. For example, if a company is adept at making a simple vaccine for a known virus – and then explores how to integrate an untested technology for curing a remote type of cancer – that would be extreme branching distance.

Why is this important?
It’s very important, and not just for start-ups. Every company, if it desires to grow (and what company does not?) must decide whether to stand on the technology upon which it was founded or to jump into new technologies. Even a company in a basic industry must confront this question. In the field of biotechnology, the question is one that is constantly confronted, by necessity.

Isn’t the answer, then - especially in high-tech companies - always going to be: “Yes, we have to move into new technologies”?
That may be the answer, but we found that this is not really the question. And this brings us back to branching distance. Yes, a company is always prudent to consider moving toward new technological knowledge in order to grow. But the question is how far it should explore. If a company’s inquisitive reach exceeds its grasp, it could lead existing knowledge repositories. Thus, when “new to the firm” technology enters a company, it would appear logical that such a move increases the stock of opportunities to which the firm has access: the pieces of knowledge that the firm acquires in the new technical domain can then be recombined with its existing knowledge. Logically, there would be more variety in a company’s problem-solving capability, given the new technology and thinking about it. This could open up bottlenecks inside the company. In some cases, when new technology enters a company, the non-obvious applications of it can actually lead to a radical breakthrough in thinking. In short, the most reliable research shows that, when branching succeeds, it’s because organizational logjams in thinking have been opened or radical new thinking emerged.

What happens when a company tries to integrate multiple new technologies into the firm?
Research suggests that when firms concurrently enter multiple domains of new knowledge, it becomes difficult to effectively absorb and process knowledge from these domains. Similarly, assimilating new knowledge becomes a time-consuming and expensive endeavour. In this case, branching can be counterproductive.

Then, is this an accurate statement: branching pays off if the branching distance is properly gauged and if a company doesn’t try to branch too widely?
Yes. But I would stress that technological exploration has pay-offs only when it does lead to an innovation that can be marketed.

How does branching actually work? Can you provide an example?
In a start-up, an inventor can draw on pieces of knowledge from reasonably proximate technical domains. For example, one molecular biologist looks to plant pathology to identify genetic traits that enhance survival of microbes under extreme temperatures. Alternatively, another molecular biologist draws on distant technical domains such as optical lithography to invent a platform technology on gene chip arrays that help detect the genetic structure of biological materials. Such branching, being related, leads to some innovation.

However, reviews of scientific breakthroughs reveal that important inventions occur more often when

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either to a profound breakthrough or a profound setback. Branching is usually a given, but branching distance is the key to the puzzle.

Have other studies affirmed branching as a good way to innovate?
Yes. There has been much research on innovation. Several scholars have asserted that new knowledge is predictably created by unique recombinations of
Firms that have existed from 6-to-12 years, curiously, had the highest innovation output when they either did not branch at all – that is, they stayed with or expanded their existing technology base – or when they branched extensively.

The constrained nature of start-ups, we found that resources for combining distant domains were often diverted from other productive R&D investments, further depressing innovative activity.

So, when it comes to branching distance, there's a case for and a case against...

Absolutely. The case for high branching distance is that it could provide new avenues of business that have not as yet been considered by the firm. Then again, we found that combing distant knowledge realms often produced radical inventions.

On the other hand, when a company went far afield in its branching distance, it risked the challenge of having to invest too heavily in its existing knowledge base and the one it is newly exploring. We did not find that the recombination of existing knowledge and new knowledge was done, productively, in a casual way. Deep exploration had to be done to figure out how to combine technologies. In too many cases, when a company went far afield in search of new technology gold, what they discovered, in fact, was fool’s gold.

You looked at all these companies over a 20-year timeline. What salient findings did you derive in regard to branching by younger, versus older, firms?

Our findings suggest that investments in capability development through branching into new technological domains have significant pay-offs, even in start-ups. However, the caveat is that such investments need to be moderately proximate to its existing capability base. We see the lowest levels of innovative output when nascent start-ups branch into technical domains that are proximate (low branching distance) or distant (high branching distance).

When we consider the technical impact of the start-up’s innovative output, we find that impact is lowest when young firms branch into several domains that are distant from its existing technological capability base.

To illustrate using cases from our sample, three-year-old firms without branching produced an average impact factor of 1.3 citations (potentially marketable discoveries) per year. In contrast, three-year-old start-ups that branched into one other technical domain received 2.1 citations per year, a 62 per cent increase. These young firms’ entry into two new domains received 2.5 citations per year, a four-fold increase over the same firms that did not branch at all. However, there is a steep drop-off on impact when start-up firms branch into four or more domains. Therefore, even in the resource-constrained environments of start-ups, we see that the early expansion of technological capabilities by entry into new technology niches accrues significant advantages by enhancing innovative output with high technical impact.

What about mature firms?

We found that when a mature firm engages in branching, their patenting rate increases. However, mature firms benefit less from branching than start-ups. Further, mature firms are less likely to introduce high-impact innovation than start-up firms.

Firms that have existed from 6-to-12 years, curiously, had the highest innovation output when they either did not branch at all – that is, they stayed with or expanded their existing technology base – or when they branched extensively. But again, moderate branching distance generates the highest innovative output.

Is it safe to translate what you are saying into this statement: companies are most likely to benefit from branching when they stay relatively close to their existing technology base?
Yes. Even start-ups that leveraged moderate distance proved to have the highest impact in terms of innovativeness.

We have yet to discuss the variable that affect the chances of branching making a difference for a company. What did you find made the difference in whether a company benefits from branching or not? This is, to be sure, a complex field of study. There are many variables at play when you try to study a number of companies, their branching decisions, and whether and why one company succeeds when another does not.

Certainly, we considered intuition as a key variable. I’ll say more about that later as it is perhaps the hardest variable to point to as a discriminating factor. On the other hand, we did note three variables that were a bit easier to observe in terms of their impact: experience, learning capacity, and integration capacity.

Does a start-up have experience?
Of course. Most start-ups would be founded by a team of people who, together, have extensive experience. Yet, again, young or old, experience can help or hurt. It can help if the experience of the company enables it to explore constructively. Let’s consider again the company that is making a well-tested vaccine for a long-studied and well-understood virus. Experience can help that company make the virus in better ways or in shorter times. Experience can give the company a learning curve, which, if understood, can help it manage how fast it can learn about new production techniques in the future. Also, experience can teach us a great deal about how to avoid errors in the future that affected us in the past.

How can experience hurt?
When one’s experience becomes paradigmatic - the way we have done things in the past is the only way to do things - then it can be a limiter. Here, too, the experience of a company in terms of how it sees other companies, competitors or not, could be limiting as well. The experience factor could close one’s eyes to the possibilities that exist with other companies that you have worked with or competed against. Similarly, in older companies especially, experience in the established function of research and development could become “routinized”, which means that they approach the development of new knowledge in the same way time after time, and that can limit the extent of any significant breakthrough.

What of learning capacity?
Experience is closely related to learning in the sense that one gains experience mainly if one actually learns from what happened in the past. The ability to learn is key to successful branching in at least one way: if a company is cognizant of how it reached the limits of its current business or existing technology, it can be more aware of how the learning of others could combine with its own to create new potential.

And then, with this in hand, they can more easily integrate their knowledge bases?
As we all know, when individuals with two related kinds of expertise truly join minds, great things can happen. Yet, when it comes to companies, there are always the challenges that come about when you try to unify corporate cultures even if the two companies have related technologies, business and customers.

To bring all these factors together, if a company has the ability to build off its experience, to be able to learn effectively, and to integrate the knowledge of others, the chances for successful branching go way up.

You said that intuition is a key variable...
It can be. Intuition, as I define it, is leaping from one point to another and successfully connecting the two. This may be a crude example; but when someone took the power of one personal computer and intuited that joining many personal computers could radically expand the computing power of each one, that was a true intuitive leap.

The problem, when it came to our study of branching, is that many companies that engaged in distant searches, trying to link their knowledge and technology with extremely different organizations or fields, often intuited a connection that proved not to be there. It came down to an interpretation problem: how does one know if the work of another company is truly relevant to one’s own? I would say that intuition was more prevalent in the high-distance branching attempts, and those did not pan out as well in the long run.

In branching, recombining previously unrelated knowledge is what leads to an innovative breakthrough. In fact, relatedness may actually hamper benefits of branching. In short, branching and diversifying should not be confused.
So, is intuition something never to be trusted?
Intuition matters, but it has to be applied closer to one’s home. When companies intuited that their own technology could be expanded, or happily combined with a closely related technology somewhere else, the rate of successful innovation was much higher. Perhaps talking about this in terms of “peripheral vision” might help. When companies stayed close to their periphery of technological vision, the results were better than when they tried to use high-powered binoculars to look at companies or fields of technology that were vastly remote from their own knowledge base.

Did you consider serendipity in your research? That is, was some of the successful innovation you looked at the result of, well, luck?
Some scholars suggest a paradox of ”serendipity” in scientific discovery. The paradox goes as follows; if you know what you want, it is hardly a discovery. However, if you do not know what you want, you have no conception of what you are looking for. Hence, you cannot know when you have found it; consequently, discovery is out of question. There is rich anecdotal evidence of serendipitous discovery from scientists including Pasteur, Fleming, and Nobel who made socially transformative discoveries that did not emanate from purposeful, goal-driven experimentation.

Our research did not validate serendipity as any kind of strategy for innovation, and it was not a focused part of our exploration at all. Perhaps I can safely go this far: when a company unites its technological prowess with another company’s in a blazingly fast, and seemingly serendipitous, way, it may be more a testament to intuition than luck. At this point in our research, we believe that future studies could fruitfully expand on our findings on branching distance and technical impact in new research that perhaps could reveal the role of serendipity in the discovery of entrepreneurial opportunities.

Would you clarify the difference, if any, between innovative branching and diversification, which is an age-old path to business growth?
The results of our study emphasize that technology branching and the reallocation of innovative effort differ markedly from the traditional explanations of diversification. Diversification is broadly understood to be the extent to which a firm is simultaneously active in multiple product-market businesses or geographical locations. The firm has slack resources that can be deployed in the marketplace in new ways. Metaphorically, branching and diversification appear similar because both imply that a firm is active in multiple spheres of economic activity.

In contrast, when a firm branches into a “new to the firm” technology domain, the firm may not require cost savings or market share growth, but it anticipates increases in innovative output. Further, branching is likely to be accretive; that is, by entering new technology domains, a firm may correspondingly increase the stock of opportunities in the firm’s prior domain(s) and in the new domain by cross-fertilization of knowledge.

Conversely, when a firm diversifies, it does not expect that diversification would increase the pool of opportunities in its prior market. Finally, relatedness is a key beneficial construct for diversification. The availability of strategic assets that can be used across multiple domains leads to economies of scope. In branching, recombining previously unrelated knowledge is what leads to an innovative breakthrough. In fact, relatedness may actually hamper benefits of branching. In short, branching and diversifying should not be confused.

At the risk of oversimplifying your research, what for you are the major contributions to the field of innovation?
Our analyses reveal that the age at which the firm branches into new technological niches significantly influences the quantity of innovative output and its technological impact: in very general terms, the younger the firm and the more moderate the branching, the higher the probability of innovation success. But “new to the firm” technological knowledge can only be converted to an asset if the company has the necessary experience to see and apply its value, has the ability to expand its learning potential, and has the management skills to integrate the knowledge into the operating capacity of the company.

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