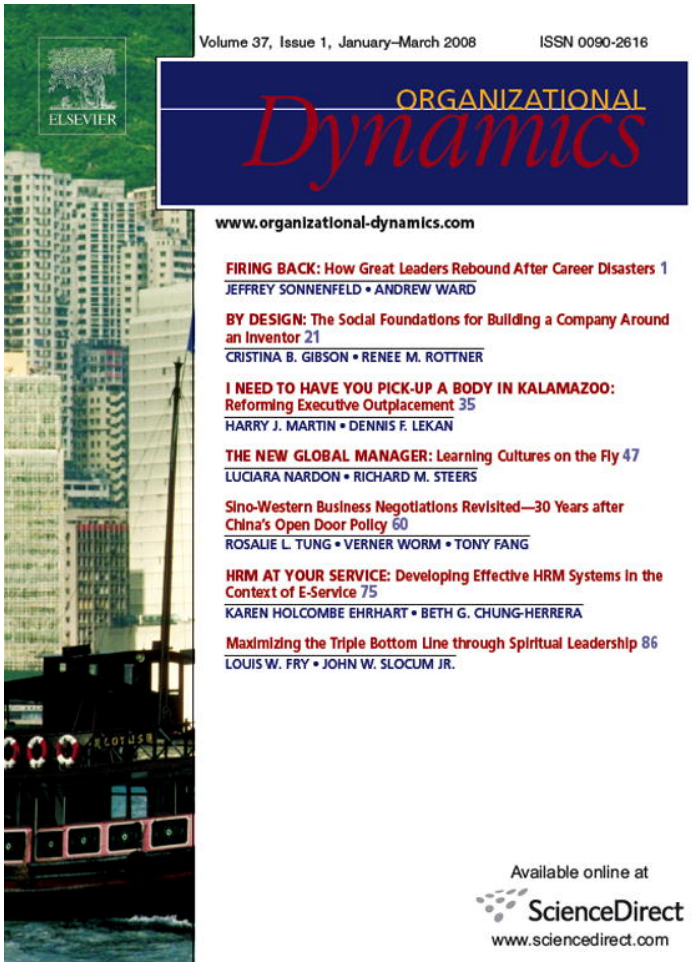

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By Design:

The Social Foundations for Building a Company Around an Inventor

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The word ''inventor'' isn't usually one you see in the same sentence with ''social.'' Rather, ''inventor'' conjures up the image of a solitary figure, toiling away under less than ideal conditions. Indeed some inventions do emerge from rather isolated circumstances, including Bette Nee-smith Graham's Liquid Paper (in her kitchen) and Wilson Greatbatch's implantable cardiac pacemaker (in his barn). These products are well known, even if their inventors are not. And that's precisely the point. These ideas grew well beyond their inventors and spilled into the greater community ... turning into products, companies and even industries. The process of assessing market potential, raising funds, and building prototypes during this transition is often the subject of managerial advice. Yet, in the rush to commercialize, it is easy to overlook the social elements that are necessary for long-term product viability. Hence, in contrast to prior work, we focus on designing social foundations that ensure longevity and sustainability of innovation (see Table 1 for a summary).

Ignoring these elements can be disastrous. One startup we studied had a breakthrough invention and, within three years, raised more than $40 million, generated hundreds of sales inquiries, and launched a patented product. Despite such a promising start, the company was sold for only $15 million, to the disappointment of the founders and investors. While the sellers viewed their creation as a company, the buyers only saw a patent portfolio. The founders neglected the development of a strong identity for the firm and went after too many markets, failing to build the expertise and external relationships that mattered in the long run. In short, without a strong social foundation, the company was nothing more than a good invention.

In this article, we describe the steps inventors can take in order to avoid this common mistake, providing insights based on our research. Over the past three years, we have conducted a series of 11 case studies, involving 53 comprehensive interviews, observations, and longitudinal tracking over time as inventors have developed viable

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TABLE 1 THE SOCIAL FOUNDATIONS FOR BUILDING A COMPANY AROUND AN INVENTOR

Traditional Concepts	Refined Principles	Techniques	Defining Characteristics	Implementation Examples
Create a mission	Develop a unifying identity	• Construct a symbolic and motivational sense of shared objectives and values • Communicate them through slogans and norms • Guide their evolution as the firm grows	• Vivid • Literal and metaphorical • Behavioral implications • Expansive	• Create a sense of discovery and integration by rotating employees through other departments • Build a common space that fosters spontaneous meetings, such as lining the hallways with white boards and alcoves with couches and internet access • Create stories or corporate narratives that illustrate the key values of the firm • Create a sense of ''family'' by sharing meals together, providing daycare, and designing the conference room like a family room
Identify boundaries	Determine the feasible set of innovations	• Examine original idea/ innovation • Assess potential new products, applications, or markets • Narrow focus to highest potential targets for expansion	• Related diversification • Regional geographic strategy • Logical consumer extensions	• Ask customers and employees for ways to leverage opportunities that relate to either existing products, geographic reach, or current customers • Determine the potential risks and payoffs of product extensions by generating product launch scenarios • Revisit the feasible set as the firm grows or changes, to reflect new capabilities or contexts
Establish a network	Construct a collaboration community	• Identify existing personal contacts • Build on existing connections to include expanded community • Nurture connections by investing time and energy into relationships	• Balance of generalists and specialists • Demographic diversity and complementarity • Past and future orientation	• Provide rewards for employees who reach outside of the organization and establish new alliances or customers • Designate firm historians (or bloggers) who can keep alive the past as well as mine it for lessons on what to do in the future • Interact with members of the local community, either by conducting tours or focus groups, or having employees mentor youth or volunteer • Hold events or online forums where potential and existing collaborators can talk with employees • Make use of existing or custom social network software to create a database of personal contacts and expertise

businesses around their ideas. Industries involved were diverse, including computer animation, chemical engineering, biotechnology, semiconductors, advanced polymers, space, satellite/radar, humanitarian aid, and the film industry. For each case, our interviews included the founder(s), top management team members (as they joined the company) such as the chief executive officer (CEO), chief financial officer (CFO), and chief operations officer (COO), as well as administrative and support staff. Interviews were one to two hours in length, were semi-structured (protocol available from authors), tape recorded, and transcribed, resulting in approximately 300 pages of transcripts.

In analyzing our data, we used a grounded theory approach, in which we iteratively sampled, compared and contrasted examples from our interview data. We first looked for consistent actions or outcomes across the firms in order to develop categories that had potential for wide applicability. We then looked for counter examples to refine and challenge our constructs. This process allowed us to identify patterns that were evident across our various case settings, and helped us to understand the boundary conditions and limits of our categories. We used these categories that emerged from our data as the basis for our theoretical model. We reanalyzed our transcriptions to further clarify what mechanisms and relationships recurred in these categories.

Our findings identify three design principles, often overlooked but important for sustainable technology innovation. First, *develop a unifying organizational identity*, one that is *not* solely dependent on a specific idea or individual. Second, *establish a feasible set for focused activity*, which will help to ensure a vital balance between coming up with more ideas and implementing the ones you already have. Finally, *build a community to support the ideas* – comprised of customers, collaborators, investors, and advisors – that can carry the innovation forward into the future. We discuss our findings related to each of these elements in the cases that follow, explaining how the nuances we uncovered further develop these design principles beyond conventional wisdom in current managerial theory and practice.

SENSE OF STYLE

In 1992, in a loft in central New Zealand, Stephen Regelous began designing a software program for simulating crowd scenes. Working in advertising by day, he taught himself to program at night and as it happened, even in his sleep. It was in a dream that he had a ''eureka'' moment: he saw how recent advances in artificial intelligence could be applied to advertising and film projects. Creating crowd scenes with real actors was prohibitively expensive—but a computer could simulate these autonomous agents much more efficiently.

A fellow New Zealander, who was seeking special effects software for a series of films, knew of Regelous' work and was intrigued by his early crowd simulation software. That New Zealander was Peter Jackson. Jackson hired Regelous to work with WETA Digital, an effects studio started in 1993 by Jackson, on *The Lord of the Rings* trilogy. The key battle sequences in the trilogy were the culmination of Regelous' software efforts. To date, the films in *The Lord of the Rings* trilogy have grossed more than $3 billion worldwide. They are three of the most acclaimed films in history, earning a total of 17 Academy Awards.

Regelous personally earned his own Academy Award for his invention of the computer animation tool Massive – for Multiple Agent Simulation System in Virtual Environment. Massive characters (''agents'') use a patented vision process and a sense of hearing and touch that allows them to respond naturally to their environment. By building variation into an agent, the Massive artist can populate a scene with individuals who are unique in everything from physical appearance to how they respond. The reactions of the characters determine what they do and how they do it, even simulating emotive qualities such as bravery, weariness, or joy

(for more information, see the Massive Software website at www.massivesoftware.com).

Regelous' Academy Award is evidence of the value of his software, which has revolutionized digital effects in film, and indicative of its high level of achievement after only a very short time. Visual-effects professionals the world over have a great respect for Massive. The software has a cult-like following in the high-end world of computer graphics because of its unprecedented use in *Lord of the Rings.* It has been installed in leading animation studios around the world, including Rhythm & Hues in Los Angeles and Animal Logic in Australia. Regelous retained rights to the software, which now forms the basis of his startup company, Massive Software Inc. Today, his company operates out of a six-bedroom house just outside Auckland, New Zealand. In the rooms of the big house in New Zealand, you will encounter the employees who work and (in more than one instance) live there. Perhaps even more than the award, it is the people in this house who embody Regelous' dream that his software can become a sustainable company.

CONVERTING A CONCEPT TO A COMPANY

Massive Software and other companies that rely on inventors must make the transition from an individual to a team, and from an idea to a business. When Regelous first began designing the Massive Software program, he started with a single character moving through a maze. Though it wasn't meant as a metaphor, it does reflect the manner in which the obstacles that a new idea faces must be overcome in order to succeed. As the Massive Software was developed, more characters were added. Over time, the interactions between these agents became the key to further software advances. By the time *Lord of the Rings* was in post production, the lone agent had evolved into an army . . . an army of digital characters that looked and acted like real people (or hairy club-wielding Orcs, to be precise).

In the same way that Regelous's simulation started as one character in a maze and grew into an army, we have found that successful innovators focus not just on an individual idea or person, but on establishing a space in which to grow. That is, while having a good idea is important, it's not enough. The innovator (or a manager) has to find a way to introduce and sustain that idea in the marketplace. The following sections illustrate the three design principles uncovered in our research, offering practical suggestions for implementing the techniques.

DESIGN SCHEME: DEVELOP A UNIFYING IDENTITY

Great ideas can easily outgrow the energy and skills of any one inventor. The bigger the idea, the more people will be needed to develop it. So one of the initial challenges in innovation is to move the idea from one that is tended solely by the inventor, to one that is managed by a group. In a very real way, the idea that once belonged to the inventor is now the collective responsibility of the set of collaborators that will grow the company. Often, new firms write a mission statement that is intended to help focus the efforts; however, we have found that this may not be enough.

Rather, a unifying organizational identity appears to be a key, first step in developing the social foundations of new firms. In order to develop such an identity, it is helpful to first understand what motivates a group to rally behind an idea. One mechanism is social identity, which is when an individual views herself as a member of a group and adopts group characteristics as part of her own identity. This social identity guides her future behavior, even when apart from other group members. For example, an engineer who identifies with the engineering profession often will act in ways that are consistent with the work practices and ethics of the engineering community, regardless of the specific situation, company, or project.

In addition to an individual's social identity based on membership in various groups, organizations develop an identity of their own. Organizational identity is that which is central, enduring, and distinctive about an organization. If you overheard someone comparing two companies, one that is traditional and service-oriented, versus one that is driven by design and innovation, you would have no trouble identifying which one is IBM Corp. and Apple Computer Inc. However, if one is trying to build a new organization, then there is very little history on which to base an organizational identity. Moreover, if there is primarily one person driving the effort and essentially creating the blueprint for the organizational identity, then the organization's identity often reflects only that single individual's social identity. If this is the case, then it isn't clear why others would be motivated to join the collaboration and identify with the organization.

DYNAMIC BY DESIGN

If one hopes to move an idea beyond an inventor, a more dynamic view of identity is needed. What we found is that the initial organizational identity, reflecting only the founder, must evolve over time to better reflect all of the collaborators. That is, as the firm grows to include parties other than the inventor, collaborators often want to build on the innovative capabilities of the entire group.

Unfortunately, founders often get stuck focusing on the differences between an ''in-group'' (those initially involved in the innovation) and the ''out-group'' (those who join later or are outside the core group of collaborators). The in-group can be formed around work skills, educational level, socio-economic status, age, race or gender. Individuals who don't share the same characteristics of the in-group are excluded. It is well accepted that learning and innovation are enhanced by having diverse individuals collaborate on an effort. However, it remains difficult to manage a diverse group that hasn't developed a unifying identity. Paul Carlile has shown that having a shared identity makes it possible for people with different training (e.g., in engineering, production or sales) to understand the objective and work together while drawing on their unique expertise.

For example, the original organizational identity at Massive began to develop around Regelous' own personal social identity as an independent artist, designer, and software programmer. However, as Massive has grown, others have joined the organization who are not affiliated with these same social groups and have different sources of identity. Thus, a new identity must be developed for Massive, which will help to bring everyone ''under one roof.'' This organizational identity must be expansive and not insular. It must have elements that appeal to numerous collaborators (e.g., cross-disciplinary and cross-cultural) to maintain the innovative edge that brought the collaborators together in the first place.

COMPONENTS OF A UNIFYING IDENTITY

Our research suggests there are three components to developing a *unifying organizational identity*: construct the foundation, communicate it, and let it evolve. A unifying identity will embody the mission of the organization, but it goes beyond that to serve a symbolic and motivational purpose. For example, in one of our case studies, a scientist at National Aeronautics and Space Administration (NASA) had the insight to link four major telescope research projects together, christening them ''The Great Observatories.'' Each telescope had been proposed separately, by independent scientific teams, each observing the sky at a different wavelength. These projects were each under constant threat of funding cuts, personnel changes and dissolution depending on the political mood. This all changed when the projects were linked together. Under the banner of ''The Great Observatories,'' these uncon-

nected projects became a unified effort with four lenses that could give a complete picture of space. The slogan became a powerful tool by which to generate support within Congress and NASA headquarters. It imbued all four projects with a stability and significance that they hadn't been able to forge on their own. Individuals involved came to view their combined projects as history-making, a contribution that would endure long after their individual telescope projects ceased functioning.

Communication of the identity reinforces it and enables the process by which it becomes part of members' personal identity. Project nomenclature, slogans, stories, logos, and letterhead are all means of communicating a unifying organizational identity, and they also create a presence in the marketplace.

Once established, identity must then be allowed to evolve. As the customer base, operating location, or product mix changes, so too must the organizational identity, in ways that remain true to an underlying set of values, but that also incorporate newer elements. For example, for Massive, the ''crowded house'' in Auckland that has come to form the center of Massive operations reflects the artistic approach, Bohemian spirit, and familial core of Massive Software. Adding a team of remote programmers in Thailand to the organization required some adaptations in language use and, hence, the unifying identity. However, the decision to replicate the familial approach (characteristic of a crowded house) in Thailand proved successful, as it was compatible with the Thai emphasis on extended family and mutual respect among those who often live and work together. In addition, the passion for innovation, creativity and shared values remains strong. For example, employees in the house share in the cooking for the entire group, exchanging both New Zealand and Thai cuisine in a collective effort. These social gatherings serve to reinforce Massive's unifying identity.

Massive's identity is successful because it contains all four of the defining characteristics of unifying identities that we uncovered in our research, which differentiate successful companies built around inventors from those that are not as successful. First, it is *vivid*. Say you are visiting a crowded house, and clear images immediately come to mind of numerous friendly people in close quarters, interacting intensely shoulder-to-shoulder.

Second, the identity has both *literal and metaphorical* components. According to research by Cristina Gibson and Mary Zellmer-Bruhn, metaphors, such as those used to communicate about teamwork involving sports, military or community-related symbolic language, are powerful differentiators among firms and across countries. Many of Massive's employees really do live in a crowded house in Auckland, but the notion of ''crowd'' is also consistent with Massive's most successful product to date (crowd animation software).

Third, the identity has *behavioral implications*. Diane Holland, Massive's CEO, has always considered the company a family operation, and endeavors to maintain a familiar, welcoming, and warm culture. The notion of a crowded house communicates these expectations. Again, scholars have argued that the most successful workplaces will select metaphors that are congruent with cultural expectations, because the metaphors serve to motivate and reinforce desired behavior.

Finally, Massive's identity is *inclusive*; it potentially appeals to a broad array of employees and customers, regardless of gender, ethnicity, or age. The image of a crowded house is relevant in many different contexts and across generations (even though the definition of what number constitutes a ''crowd'' may differ from perceiver to perceiver).

These defining characteristics were illustrated in others of our cases as well. One firm that illustrates the perils of not forming a unifying identity is Zen (a pseudonym), a biotech startup on the West Coast of the U.S. Zen had already established the laboratory facilities and research staff it needed to bring

custom protein products to the pharmaceuticals market, when they learned of a genomic technology at an East Coast university that seemed complementary to their existing proteomic patents and strategy. Zen licensed the technology and hired the scientist who had developed it. However, the scientist did not relocate, instead choosing to commute between the coasts.

As additional researchers were needed at the West Coast location, they were hired from the pool of talent most familiar to the scientist – people who shared his training and ethnicity. As a result, Zen became two companies: one was predominantly English-speaking, product-focused, and trained in proteomics, while the other was Chinese-speaking, research-focused, and trained in genomics. Without the regular presence of the East Coast scientist to unite the two groups, the ethnic and technical language differences pulled the company in two directions.

A unifying identity might have been able to bring the groups of highly-trained experts together to work on a common problem, but the two groups lacked shared values or objectives. After enduring 18 months of the grueling cross-country commute, the East Coast scientist resigned. Without a leader, the genomics project was abandoned, the team was laid off, and Zen returned to its earlier focus on customized proteins. The very things that made the two groups complementary – different training, culture, and technology – were of great value, but without a unifying identity Zen failed to unlock the benefits, despite a $50 million investment.

SENSE OF SCALE: DETERMINE THE FEASIBLE SET OF INNOVATIONS

Just as an organizational identity can unite a group, so too can setting boundaries around the innovative activity in the development team. Without a focus to guide subsequent innovation, startups run the risk of diffusing their efforts by going off in too many directions. Boundaries on activities are often a way to provide focus *and* to unlock creativity. While this might sound contradictory, it shouldn't come as a surprise, as it is often said that ''necessity is the mother of invention'' and that ''discipline is freedom.''

Researchers are increasingly finding that putting boundaries on innovation enhances creativity and knowledge sharing. Such boundaries function as constraints that inhibit conventional responses. For example, in a study of several innovative high-tech companies, Liisa Valikangas and Michael Gibbert found that successful firms regularly set boundaries in their product development process. Deadlines, budgets, and product specs are boundaries that create a shared context among employees and reduce all-or-nothing thinking, by breaking the project down into manageable pieces.

Another way of maintaining the balance between innovation and constraint is at the project level. At this level, many ''natural'' limits are often imposed on innovative activity. Most projects have to work under constraints of time or money or personnel. Without deadlines or budgets to focus a team's attention, the effort to find a workable solution can be scattered. Worse, the effort might never cohere and teams become frustrated from working in such a futile way. Innovations and creative ideas often occur in an ambling, unfettered way, like sitting under a tree waiting for an apple to hit us on the head. And while it is helpful to have time to mull over new combinations of ideas, *productive* creativity occurs within constraints.

AN ARTFUL BALANCE

Such a context occurs in organizations that master both adaptability [the capacity of a business to meet changing market demands] and alignment [the integration of diverse business activities that work toward the same goal]. Cristina Gibson and Julian Birkinshaw found that this ability to simultaneously adapt and align (''contextual

ambidexterity'') was significantly related to firm performance. Ambidexterity is achieved when leaders demonstrate performance management (stretch and discipline) as well as social support (interpersonal guidance and trust), and when the organization builds systems and structures that allow individuals to judge whether to focus on adaptation or alignment.

For example, Robert Kelley and Janet Caplan found that ''star performers'' at Bell Labs actively moved between narrowly focusing on a task and a broader focus on how their work fit into a larger context. Likewise, examining successful multiple-product innovation teams, Shona Brown and Kathleen Eisenhardt advocate a process that blends limited structure around responsibilities and priorities with extensive communication and design freedom to create improvisation within current projects. This combination is neither so structured that change cannot occur, nor so unstructured that chaos ensues.

WHAT IS FEASIBLE?

Our findings indicate that in entrepreneurial settings, such as a startup built around an inventor, the concept of creating boundaries through ambidexterity and balance is not enough. Rather, it is important to consider a sense of scale. Identifying a feasible set around products, markets, geographies, services, or some combination of strategic initiatives helps to establish an appropriate scale. Determining the set requires an assessment of internal resources, growth goals, and competition. We observed many new firms struggle when the feasible set was too large. This was the case in the company mentioned at the start of this article that raised $40 million, but was acquired for $15 million. By pursuing more than a dozen different markets, the company had so diluted its efforts that it failed to unlock the value of its patents or establish itself as a leader in any market.

In another of our case studies, this one involving an innovation in the fuel additives arena, the feasible set was established by first identifying the most plausible geographic market in which to introduce the core innovation. While regulatory procedures were being initiated in this market, the firm identified two other high potential geographic areas, based on personal connections between the original focal market and the new markets. Hence, relationships with key individuals in the original geographic area were leveraged to develop a presence in second and third markets. This systematic and strategic rollout of the innovation proved to be an important asset for the growing firm.

Similarly, Massive Software put forth substantial effort to determine the direction of new software applications. They began by exploring a whole host of diverse markets—from the very beginning 15 years ago, Regelous envisioned the software being utilized as a simulation tool in nearly any situation where ''artificial life forms'' are of interest, with crowds consisting of creatures, humans, animals, automobiles, or cells, in a variety of settings. However, Massive has come to focus on three industries: film, video gaming, and architectural/urban planning. The process of developing new applications has improved dramatically following the establishment of these boundaries. Importantly, determining the feasible set enabled the firm to allocate roles and responsibilities and to set up work processes around these three key markets. However, it is also important to note that within each area of focus, creative experimentation, trial and error learning, and ''out of the box'' thinking are encouraged. Thus, the feasible set doesn't constrain overall innovation, it simply helps to focus and guide it.

DEFINING CHARACTERISTICS OF FEASIBILITY

The feasible set that Massive has developed is successful because it contains three defining characteristics. First, although the three areas they selected for focus (film, video

games, and architecture) appear fairly diverse, they share a common set of technologies (computer-aided design). Thus their feasible set is characterized by *related diversification.* A long history of research has demonstrated the efficacy of related diversification strategies in well-established companies. Here we apply it to the context of inventors looking to extend their business beyond their original invention.

Second, Massive's feasible set is characterized by a *regional geographic* strategy in the Pacific Rim. Recent research by Julian Birkenshaw and Neil Hood has demonstrated that well-established international firms looking to globalize can often do so more successfully by focusing on a particular geographic region in which firms in a related industry or technologies already exist, because resources, supplier, and customer networks have already been developed in such regions. Our cases indicate that the same strategy may hold true for small entrepreneurial firms built around inventors.

Finally, Massive's feasible set represents a logical extension of their original invention from the point of view of the consumer. Again, the three markets are somewhat diverse, yet the same end user may design in all three, and product knowledge in any one of them may facilitate application in another. Such *logical consumer extensions* can lower marketing costs and increase customer retention. If Massive Software works well for a designer who has been contracted for the *Lord of the Rings* film trilogy, he or she is more likely to use it when contracted to design computer graphics for the next generation of a computer game.

Another firm we studied, Air (a pseudonym), had a chemical sensor technology that could detect and identify odors passed over an electronic chip. By the time Air hired a vice president of sales, they'd had nearly 3,000 market inquires, generated by an extensive campaign conducted by a premier public relations firm. However, Air didn't yet have a product!

Air focused their development efforts on the leads with greatest interest: food-processing giants like Nestle S. A. and Tyson Foods. The plan was to build a quality control device that could detect product freshness for one application and then market it to other segments. But what Air found was that spoiled odors are unique, and they soon had independent development projects underway targeting chocolate, chicken, and olive oil and several dozen more. Even a single category such as ''fish'' required several different approaches and depended on whether one was testing salmon or tuna.

Air responded to this challenge by widening their search, and since the startup did not have a way to screen potential markets, before long it had development efforts in such diverse areas as medical diagnostics and hazardous materials, in addition to food spoilage. Air was pursuing everything and running out of money. According to one executive, Air was ''drilling an inch deep and a mile wide.'' Air's investors found a way to get the founders to focus: they forced the sale of the firm, and capped their losses at $35 million. The technology is now owned by an established firm with a suite of related products and has been incorporated into two existing product lines: a military product for detecting toxic chemical odors in the battlefield, and a life sciences product for detecting contamination in the laboratory. A whiff of success came to Air's technology when boundaries were finally imposed.

SENSE OF PLACE: CONSTRUCT A COMMUNITY

While it is important to develop a unifying identity and a feasible set of creative activities, we found that a third principle of success is the purposeful creation of links outside the firm. Innovations are socially connected, both in time and space. Building a community of strategic partners, customers, advisors, and investors ensures access to critical resources, as well as opportunities. So where does an innovator find such a community? The first place is to look within one's social network. By taking all the people

a single individual knows, and the people they know, and the people that those people know, one creates a social network. This might include colleagues, family, neighbors, golf buddies, or the car mechanic. Each one of these people is likely to know many others the focal person doesn't ... but who might have just the thing he needs, whether it is information, money, job openings, customer leads, or product ideas.

But what if an inventor is new to business or an industry? How does she develop the system of relationships we call a social network? Building a social network is not simply exchanging business cards at a cocktail reception. It is a sustained effort to build mutually beneficial relationships with others. It is from these relationships that one develops social capital. Social capital is like any other capital: one earns returns through investments. However, in social capital one is investing in others, and the investment consists of personal resources, such as time, knowledge, money, or contacts. Whether one receives anything back in return depends on the quantity of the contributions, as well as the quality of the people being invested in. The likelihood that one will benefit depends on his or her ability and willingness to contribute. You have social capital when others present you with opportunities to obtain the resources you might be seeking.

SOCIAL CAPITAL IN COMPANIES

Individuals are not the only ones who can possess social capital—companies can, too. In studies comparing startup firms, Juan Florin and colleagues found that startups with greater social capital were more likely to raise venture capital and go public. Social capital also seems to help firms manage the transition from private to public ownership. Harald Fisher and Timothy Pollock have found that firms with greater social capital are better able to survive this transition.

Although the concept of social capital is gaining currency in the academic literature, invention-focused teams rarely spend time on maintaining relationships and building social capital. This is understandable, given all the pressures of launching a new product, but even under these circumstances, collaborators must nurture social capital by investing in it. On the Internet, individuals regularly create social capital by contributing knowledge, such as software developers who post to newsgroups or develop open source code. Such contributions create social capital, which the developer can then draw upon to obtain other knowledge from the software community. Even large companies tap into this resource. For example, Microsoft Corp. drew on software developers outside the company to test and refine Windows 95 before its commercial release.

In one of our research case studies, a new venture was spun out of a university based on a technology breakthrough of clear value to the aerospace industry. The founding team was comprised mostly of research scientists, who had tremendous technical knowledge but little industry experience. They certainly had enough acumen to start building a prototype, but they didn't start there. Instead, they looked at the things they didn't know and recruited a CEO with entrepreneurial experience. This CEO had started and sold other ventures, and her prior investors were glad to sign on again, so the startup soon raised sufficient working capital.

After the cash started flowing, the CEO diverted some of the money and hired a technical consultant. Even with all the technical knowledge possessed by the scientists themselves, the consultant provided them with vital contacts and insights into the aerospace industry. This specialized information laid the foundation for the company's product development efforts. It was only at this point, with enough cash and understanding of the product needs of their intended customer, that the company really began to apply the considerable technical knowledge of the staff towards building a product prototype. Without these external resources, the scientists agree that their technology would have become just another patent in a file drawer.

At Massive Software, although Regelous planned to move beyond the film industry, he retained and nurtured his film industry connections. It was through these connections that he found Diane Holland, the current CEO of Massive Software. Holland's 17 years of experience in the film industry has proven invaluable. She began her career in 1989 at George Lucas's Industrial Light and Magic, and then joined Digital Domain, an innovative startup in computer graphics, where she supervised the build-out of their studio and expansion to 230 employees in their first year of operation. From Digital Domain, Holland joined Sony Pictures as director of marketing. She went on to hold several other key positions in startups prior to coming on board at Massive, creating an extensive community of potential collaborators in the film industry.

However, as Massive moves beyond film, both Regelous and Holland recognize the importance of establishing a community of contacts, advisors and collaborators in other domains. They are partnering with universities, governments, and entrepreneurs to exchange the information and expertise needed to move the firm forward into new markets. Moving forward, a key priority for Massive lies in the maintenance of these new, still fragile connections. Recognizing the importance of community building and maintenance, Holland has hired a vice president of business development so that she can focus on nurturing existing connections, particularly with customers.

CHARACTERISTICS OF SUCCESSFUL COMMUNITIES

Just as one builds company around an inventor, one must also build a community around a company. Massive's collaborative partnerships and alliances illustrate three defining characteristics of successful community building. First, it contains a *balance of generalists and specialists*. The generalists provide access to a broad array of resources and knowledge that will enable their expansion into arenas different than their original invention, whereas the specialists have depth of expertise to enable intense examination of existing technology and to assist in customer retention. This need for balance applies to both individuals and organizations. For individuals, specialists typically form dense networks with other specialists, bringing stability to the organization and producing deep insights. Conversely, generalists serve to bridge the various specialist groups by spreading these ideas to wider audiences, making new connections and stimulating creativity. At the organizational level, value is created by specialist firms that bring deep sector expertise and by generalists that provide access to a variety of market segments and customers.

Second, the Massive Software community *represents both diversity and complementarity in terms of demographic attributes*, which enables formation of moderately (but not overly) strong subgroups. Prior research by Cristina Gibson and Freek Vermeulen in the pharmaceutical industry has shown such configurations help prohibit demographic ''fault lines'' (dividing lines similar to tectonic plates) which split teams into dysfunctional factions, while at the same time encouraging team learning and performance. This is because moderately strong subgroups allow for psychologically safe environments to form within the subgroup, but a healthy flow of contrary ideas to flow between the subgroups. For example, within Massive's community, the film industry contacts likely form a subgroup, while the game industry contacts likely form another, but those who work in both industries link the two subgroups and generate a flow of resources and knowledge across them. Massive has also balanced community involvement among artists and scientists; men and women; and New Zealanders, North Americans and Thai.

Finally, the Massive community maintains links with their past yet also is future-oriented, balancing representation of young mavericks with seasoned professionals. This translates into broad appeal to a more

diverse customer base. Such *sensitivity to past and future* was also a defining feature in other of our successful companies built around inventors. When such community building principles are ignored, companies can stagnate no matter how good their technologies are.

For example, Matter (a pseudonym) is a startup based on a Nobel prize-winning discovery. The strength of the technology and the scientists' reputation made it easy for the startup to recruit smart, energetic people to the firm. But they were almost all scientists. All of the Scientific Advisory Board members had Ph.D.s, as one might expect, but so did each of the founding executives and half of the 12-member Board of Directors. The technical expertise in this group would be the envy of any university, but they lacked experience in raising capital, sales and marketing, producing products, and taking a company public. A strategic partner said of the CEO: ''He's a great scientist, but. . .we're teaching him how to price his product, how to position himself in the market place. When we negotiate, we have to have a teaching session first so he's up to speed. [Matter] would be much more successful much more quickly if they brought in an experienced CEO.''

This is not to suggest a scientist can't be a CEO, but it demands that others in the firm have diverse experiences on which the CEO can draw. One investor described the lack of business acumen as ''1 guy with a paddle, 12 guys with a megaphone.'' Matter has been hindered by one crisis after another, the result of selecting unreliable investors who defaulted on their payments, making naïve patenting errors that resulted in lawsuits, and pursuing a declining market because several board members had a hobby in it. When the majority of the management team and board have the same background, firms can quickly become myopic and unable to see either the past or future, or their strengths and weaknesses. This myopia impedes progress, even in firms that have brilliant people and a Nobel Prize.

CONCLUSION: SYNERGY AMONG THE PRINCIPLES

This brings us to our last point. The most successful cases in our sample were not those that developed a unifying identity *or* established a feasible set *or* created a community. Successful firms implemented all three of these principles – simultaneously. Creating boundaries by establishing a feasible set reinforces and strengthens a unifying organizational identity. An external community becomes the testing ground for whether the identity and boundaries are viable. Implementing one without the other is much less powerful. Massive certainly illustrates the synergy across the elements, and our less successful cases showed the hazards of lacking at least one of the elements. We can't guarantee that companies built around the inventors using these three design principles will succeed; however, in those firms that we studied, the better performers were those in which identity, feasible set, and community were part of their foundation. And the startups that didn't follow these principles wasted two of the most valuable assets: time and money. They experienced expensive delays in turning their inventions into products and getting them to market. As one of our informants said, ''Starting a company is easy. Making money is hard.'' Why make it any harder than it has to be? Build a strong social foundation.

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