

Reengineering Industry's Role in University Education

The ever-accelerating pace of change in the world around us—driven largely by progress in science and technology, most notably information technology—is creating benefits and challenges for our educational enterprise. On the positive side, improved

ties and industry, with the government as a third party.

Reengineering 101

Let me remind you that reengineering is a process aimed at radical and fundamental redesign. It is particularly appropriate in situations where environmental change has been rapid and the response of institutions has been slow. Reengineering focuses on the large steps that are required for an institution to catch up with its changed environment.

Reengineering consists of five steps. First, the objectives—the measurements of output—must be defined clearly. Second, the current process must be understood accurately and documented quantitatively. Third, you perform benchmarking—finding out who is best at each aspect of the process. Then you set targets for the redesigned process,

usually aiming at doing better than the best. Fourth, you create one or more proposals for a major redesign of the process. The redesign alternatives are compared with the present process in terms of ability to achieve the objectives, and an alternative is chosen. Fifth, the new process is implemented. At this point the process is also instrumented with a set of measurements to determine the process's effectiveness and to drive further incremental improvement.

Successful reengineering demands the investment of major effort and intellectual energy. Therefore, I cannot pretend to have a

detailed prescription of exactly what needs to be done to significantly improve industry's role in education. Nevertheless, I can offer some specific actions that can be taken in several areas.

Broadly based knowledge

The most important output of universities is a cadre of people prepared to contribute to society and to lead. Today's high-quality graduates—both undergraduates and those with advanced degrees—must possess extensive knowledge in a specific field, and most graduates have such knowledge. Beyond that specificity, however, high-quality graduates should also exhibit broad knowledge in many other areas, as well as a value system that encourages boldness, curiosity, leadership, teamwork and clear communication.

Giving students that breadth proves difficult, because knowledge of the state of the art in a single technical discipline grows continually. At the same time, there is no evidence that the level of knowledge of those entering the university system is increasing at a significant pace. So universities frequently yield to the temptation of increasing specialization so early in a student's education that these other aspects receive little attention, a practice that produces narrowly focused graduates. This practice can even lead to continually more narrow knowledge in a student's particular field, such as concentrating on linear algebra rather than the overall field of mathematics. Therefore, there is a risk that university graduates may possess less and less of the breadth of knowledge that is necessary to lead effectively.

This increasing narrowness of focus is particularly problematical at the graduate level. It is from this group, at least in my experience, that we expect to obtain a disproportionate share of leaders. If the best of our graduate students are not exposed both to broader fields of knowledge beyond their



technology can provide new tools for teachers and students, such as access to digitized libraries and databases around the world. On the other side of the ledger, the changes induced by such progress—created in large part by university research—are at the root of major disruptive forces that put stress on universities, particularly the research universities. Many people, for instance, are asking whether today's university programs prepare graduates to perform effectively in our changing world. I believe that industry can give our educational system a boost—if we reengineer the relationship between universi-

own discipline and to a value system that encourages the pursuit of varied goals, these students will by default aim to become clones of their faculty advisers.

Under that scenario, society would benefit far less than it should from its investment in the educational enterprise. Ultimately, society's ongoing support of education is coupled to the value that society perceives to be created.

And in addition to the specific technical skills, society values breadth, leadership, tenacity, a willingness to continue to learn and an ability to communicate effectively.

Principles

Research universities create another output—the results of the research itself. This research depends primarily on funding from the federal government, with important secondary sources being industry and state governments. Although a successful research university must maintain a healthy and well-supported research agenda, some people—especially in government—are questioning and even attacking federal support of university research. Such conflicts might be addressed through the use of the following three principles that I have found helpful in my research-based environment.

First, to ensure long-term support for broad research, the research organization must maximize the value that is created and delivered to the funding sponsor. This value is defined and quantified in terms that are understood by and important to the sponsor. Nevertheless, one should not assume that the sponsor—be it a government, foundation or company—will think deeply and carefully about what constitutes value. So the researchers or their management must do this thinking. Researchers must also adapt to the rapid and radical changes in value that can develop in a changing world.



Second, an intermediate agenda—in which funding and control are shared by researchers and sponsors—can enhance the pace of progress when a created value must be handed off, say from a university to a government laboratory. I have seen shared agendas lead to a better focus on the relevant objectives and the creation of enhanced and more quickly delivered value.

Third, every level in the value chain, from basic science to product development, must have contact with the marketplace and the end customers. Although this principle may be evident to people who develop products, it is often ignored by people at earlier stages of the value chain. Like a shared agenda, contact with the marketplace can also produce better aim on objectives and accelerated progress.

Interactions


With these three principles as a base, what elements might be part of a reengineered university/industry partnership?

On the academic side, the lack of breadth implanted at some universities results in part from the relatively poor preparation of high school students, especially in scientific and technical areas. If students arrived better prepared at the universities, less time would have to be spent in bringing students up to speed, thereby leaving more time for their exploring a variety of disciplines. Although solving this problem requires action on a local level, a partnership between industry

and universities has the potential to develop and implement a model for a collaborative attack on the problem. In the end, we could prepare graduates who are better aimed for today's challenges, thereby delivering more value to society.

Much could also be gained from mutual exposure of industry and university people to each other's environments. At present the periods of time that we spend on

each other's turf are too short to do much good. Industry can do more to involve students and faculty in research-and-development efforts. Likewise, universities can encourage this involvement and broaden the perspective of their students by inviting people from industry to present seminars and to visit their campuses. Successfully enhancing and facilitating such interactions depend almost certainly on establishing branches of industrial laboratories on or near university campuses. Such proximity between universities and industry could also facilitate handing off value from one to the other, as well as a more focused aim on the marketplace.

To sum up, industry can contribute to education. But the part that industry plays is in need of a fundamental and fresh look at objectives, processes and relationships. Although this reengineering process will take much time and effort, it is time to begin. We cannot ignore the potential for dramatically improved results for everyone involved. 

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