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Offshoring RFID Research and Development

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Background: Importance of New Product R&D

Most large corporations are facing a double edge sword today. While R&D Costs have shot through the roof increasingly aware customers are demanding more and more better products at lower prices. That is why companies need to figure out how to reduce R&D expenditure without compromising on the quality of work. Hence the search for low cost research bases.

Corporate strategy in the US places high importance on R&D because of its proven capability to improve competitiveness and profitability. However, research is becoming increasingly interdisciplinary and corporations can no longer house all competencies necessary to stay competitive. Further new tools and growing complexity are increasing R&D costs. So although corporate labs spend as much as $800 million for a new drug, they are confronted with the law of diminishing returns. Pharmaceutical companies tripled R&D spending to $30 billion in the past decade, but could launch only 37 new drugs in 2001-the lowest in 20 years.

Companies will need several strategies to overcome this crisis in R & D productivity because pursuing multiple R&D projects is critical to staying competitive in the long term. One strategy, to quote Harvard Business School professor Henry Cherbourg, is "open innovation", which includes embedding research labs at universities, turning customer-vendor relationships into partnerships, or simply Offshoring R&D.

Offshoring is driven by cost, and R&D is no exception. Offshoring to low cost locations (particularly India) makes for a good case. The cost of researcher in India is 6-8 times lower than that in the U.S. This coupled with the fact that India has a huge pool of highly educated knowledge workers supports that case. Leveraging India's infrastructure and cheap, yet talented, labor to harvest new ideas is an attractive opportunity.

Moving up the skill ladder in specific operations
Many US companies continue to believe that off shoring is viable only for very low skilled customer support activities, but others have found that with experience they can move rapidly up the skill ladder.

These phenomena of Offshoring, which began with call centers and information technology jobs have spread to accountants, industrial engineers, production controls specialists, medical transcriptions, telemarketers, and others.

Benefits from off shoring
A 2003 study by the McKinney Global Institute (MGI) showed that Offshoring creates wealth for the United States as well as for India, the country receiving the jobs. For every dollar of corporate spending outsourced to India, the U.S. economy captures more than three-quarters of the benefit and gains as much as $ 1.14 in return. Far from being a zero –sum game, off shoring creates mutual economic benefit.

Additional exports
Indian companies that provide offshore services also buy goods and services ranging from computers and telecommunications equipment to legal, financial and marketing expertise. Most of these purchases are made from the U.S companies thereby adding revenue to U.S companies.

Repatriated profits
Many Indian Offshoring firms are owned in whole or in part by US companies such as GE and EDS, and repatriate some of their earnings. Operations owned by foreign (mostly US) companies generate 30 percent of the Indian offshore industry's business. In this way part of every dollar spent on off shoring returns to the US economy.

Offshoring R&D
Some of the most innovative R&D companies like 3M IBM and HP do up to 35% of their research outside the U.S.

Offshoring to low cost locations (particularly to India) makes for a good case. As stated earlier the cost of a researcher in India is 6 – 8 times lower than that of technical personnel in the U.S..

India's success with information technology is widely known. In comparison, awareness of India's emerging contract R&D capabilities is limited. However, some companies have leveraged Indian R&D effectively for a long time. General Electric (GE) began collaborating with India's National Chemical Laboratory in the area of polymer chemistry in the early 1990's. The relationship continues even today and has resulted in several patents, which have been assigned to GE.

GE in its development center in India employs thousands of employees at its the center and has over a very high percentage of Ph.D's (31%) and specialists (44%) who have master's degree in their field of specialization.

GE Medical Systems, HP, Akzo Nobel and GE plastics has already developed and marketed products developed in India like a family of poly carbonates, portable ultrasounds scanners and a first batch of paint being tested in the market place.

This way R&D can be done 24/7 as is being done in the IT and other industries.

Exchange of information is not a problem with the use of e-mail, fax and SMS.

Offshoring of R&D is no longer seen as a tactical move or a reactionary measure induced by competitiveness or seen as a last punitative step for cost reduction.

Knowledge worker Pool

Apart from costs; the big attraction for large corporation to go to India is the vast pool of technically qualified people.

Every year, India graduates 3,000+ PhDs and over 100,000 engineers. Some write code in Silicon Valley and work in Fortune 500 companies while most populate India's first – class scientific infrastructure of 2,000 R&D institutions. Together, They could accomplish outsourced R&D at 10-20% of the costs in the US

Structure of Organized R&D Infrastructure in India:

Council of Scientific and Industrial Research (CSIR) is a central government body that oversees policymaking and funding of majority of publicly funded research activity presently happening in India. They employ approximately 15,000 scientists and technologists in 45 labs, which specialize in different research areas. They operate on a budget of approximately USD 250 million of which about 25% comes from contract research activities for the industry (Indian and foreign). The rest 75% of the budget is government funded. They have so far about 1,000 patents in force and another 1,000 filed to be approved.

In addition to that India has a number of privately funded R&D labs in specific areas, engaged in contract R&D work etc. These are mainly in the areas of pharma research, biotechnology, IT and specific industrial applications, and other industry association affiliated organizations. As mentioned earlier, there are now a growing number of multinational companies (MNCs) setting up their captive R&D facilities. According to recent inquiries a CSIR, the questions that MNC's ask are not whether to set up a lab in India, it is how big it should be in terms of critical mass?

Models of R&D Working with India

Depending on their specific requirements, companies are striking different working relationships for their R&D work in India. The major ways of working are:

1. Contract Research: Companies contract out certain sub-tasks that are well defined to an appropriate company or agency in India with expectation of results that are required. These engagements are smaller in size, used primarily to test out capabilities, piloting etc.
2. Project based research: This is still contract-based research with a complete project responsibility to an Indian entity. These engagements are larger in size, have well-defined deliverables, schedules etc. This arrangement is used if capability exists to execute a complete project vision.
3. Engage a contract team on a permanent basis: This arrangement has the benefit that you can keep the same personnel on staff as an extension to your R&D team and keep the domain knowledge within the team to increase productivity as the experience level of the Indian team increases.
4. Own your facility in India. This is truly your own division or branch in India with your own staff etc. Obviously this requires more investments and management.
5. In addition, availability of capital equipment needs to be looked at based on what kind of work will be done. Either an investment is required or sometimes this equipment if available there can be rented on contract basis.

In actual practice a combination of these models may be suitable to a given situation.

Offshoring RFID Research and Development

One of the biggest challenges being faced by RFID tag users is the high cost of the tags.

The packaging industry feels that it is necessary to find ways to lower the cost of RFID tags so that the application can become more wide spread.

There are number of approaches that can be taken to reduce this cost of RFID tags. One of the best approaches is to have printed RFID tags using conductive inks. . This involves printing the antenna with conductive inks and then attaching the chip to this printed antenna. It can be done in a roll-to-roll, flat bed press or on the conveyor belt of a packaging line. Antennas can be printed using conductive inks more inexpensively than from solid copper. Use of printing techniques like roll to roll will help in this matter.

This could also be done on the conveyor belt of a packaging line to produce in line on demand RFID tags where the ink selection and (antennae) and thickness of the substrate along with the printing method play a very important role. This approach will match the right quantity of ink (antenna) with the nature of the substrate and then attach the chip to it. Right now no appropriate conductive ink or application equipment exists to do this at a reasonable cost. This will require R&D commitment both on the parts of the ink manufacturers as well as equipment manufacturers. In order to keep the development costs low, it is necessary that companies find a low cost location to do this development.

This pool of technical personnel -chemist and engineers – are a very useful group to have for development as customers and vendors veer towards developing Chemistry based printed (inks, antennas, chips) RFID tags to lower the costs.

Printing Machinery and Inks
India has a large base of printing machinery manufacturers and very advanced ink manufacturers in all areas of printing: Flexo, Offset, letterpress and gravure.

Very fine Gravure cylinder manufacturing has been done in India for several years and the author has been involved in the technology transfer of paper, printing equipment and ink and printing technology from the U.S to the Indian companies.

RFID Markets
The market for smart labels – an ordinary bar code label with an RFID transponder embedded in it – could reach $4billion in 2007 and $10 billion in 2013, according to IDTechEX, a Cambridge, England, consulting firm that tracks RFID and related technology, including conductive inks. Yet, for transponders with printed antennas to capture a significant share of that market, they must first overcome both technical and practical hurdles.

Conductive inks could revolutionize the tracking of products throughout the supply chain by making it possible to print RFID antennas- and subsequently complete transponders-for very low cost.

Antennas printed on ordinary labels or cardboard with conducive inks could, within a few years, replace conventional solid- copper RFID antennas, which gather energy from the reader to power a passive RFID transponder (one with no battery).

Printed antennas are less expensive and more flexible than metal ones. And research underway today could make it possible to print both the integrated circuit and antenna – that is the entire passive RFID transponder- with inexpensive inks, much the way bar codes are printed today. That would bring a passive tag's cost down to less than a penny and make it possible to put tags on just about any product.

A printed antenna operates with conventional RFID readers and is far more cost effective. Whereas a label with an embedded passive RFID transponder costs anywhere from 20 to 60 cents each, an RFID transponder with a printed antenna could cost 15 cents to 30 cents today and less as high speed printing machines come on line. Printed antennas have other advantages over solid antennas. They can be attached to a microchip and turned into a transponder up to 10 times faster than conventional antennas. Solid –metal antennas also pose environmental concerns because of the chemicals used to create them and the fact that they can't be recycled.

Manufacturers need to formulate inks that offer enough conductivity to make an antenna reliable in a wide range of situations

The inks need to be engineered so they can dry quickly and be applied to a variety of surfaces. And perhaps the biggest hurdle will be changing equipment on printing lines. Printing and packaging companies will need to buy and install new machines that can

print the antenna and place a tiny microchip so it bonds with the antenna to create a transponder. The transition to new equipment will likely be slow.

Though some ink antennas compare favorably with solid-copper ones at ultra-high frequencies (860 to 960 MHz), as well as microwave frequencies (2.45GHz) but at high frequencies (13.56MHz), an additional needs to be done. It's a roadblock that the industry is attempting to address to make conductive ink more attractive for commercial packaging.

Printed antennas are also expected to be more environmentally friendly compared to their copper, silver and other metallic counterparts, which are a big concern in Europe.

Challenges
Printing the entire transponder circuits and all, poses some major challenges. Like printed RFID antennas, printed transponders would need to cure quickly and achieve reasonable performance to be useful. And then there's the issue of the infrastructure of the commercial printing industry. Today, most printing machines can print lines no finer than 50 microns. To print integrated circuits, the machines would have to print lines about 5 microns in thickness (a human hair is about 100 microns across).
Nevertheless, the future of printed RFID antennas looks bright, whereas conventional antennas are unlikely to be cost effective or environmentally acceptable for item tracking-cereal boxes, toys and more- conductive inks could break through to the product level.

Outlook:
As printing companies and ink manufacturers see opportunity in printed RFID, they're likely to invest in the printers, applicators and inks to make the concept a reality. And Printed RFID will become an important part of the overall marketplace.

How to get there ? : R&D focus on RFID
In order to get there, many companies are spending a great deal of resources to develop inks, printing and application equipment.

Since application of RFID tags will spread very quickly on a global basis as supply chains spread all over the world, it is imperative that a low cost approach in developing these RFID printed tags be taken quickly.

If the great Indian rope trick beguiled western scientists in ancient times, modern Indian science is no less fascinating. R&D in India could help US companies develop printed RFID tags (inks, equipment – printing as well as application) at a fraction of US costs.

This great Indian R&D Trick could change the way US companies innovate and invent new products in general and RFID in particular.