

# Reverse Engineering Holds Promise for Technology Development

by Prof M Mainul Haque

Promoting reverse engineering activities in Bangladesh will have lasting impact on creating indigenous technological base... Such initiative however in no way undermines the on-going efforts towards development, adaptation and assimilation of modern technologies in the country.

TECHNOLOGICAL progress has been a determining factor in the evolution of human societies and it is now recognized that the promotion of technology is at the root of development in any country. While the application of science and technology can undoubtedly influence economic growth in particular by increasing the productivity of labour and capital, it is the process of change which is the most deeply and lastingly influenced. It is through the process of technology transfer that societies were, and are, able to benefit from evolutionary development, that is, the growth resulting from technological innovation. The transfer of technology is made through the process of developing in-house technological capability wherein both indigenous and formal modern scientific and technical knowledge play an important role. One of the recognized measures promoting technology development through technology transfer and adaptation is Reverse Engineering. This is an indigenous initiative towards building domestic technological capability, but with great promise in a developing country like Bangladesh.

**The Concept**  
Reverse Engineering is a process of learning to replicate a technology by observing and analyzing an existing technology. In its simplest form the technology may be a component of a machine (e.g. spare parts). It may also be complex in nature like a simple machine consisting of a number of simple machines (e.g. diesel engine). The complete industrial unit consisting of a number of simple and complex machines.  
The main objective of reverse engineering is to acquire the capability to replicate an existing technology and make further modification and development on it, thus facilitating the process of dynamic transfer of technologies. It is aimed first to develop capabilities to replicate a specific technology, then to use the experience in modifying and developing new technologies.  
Application of reverse engineering for technology development is not limited to only low cost technologies, rather its application is equally important

for upgradation and development of high-cost/capital intensive technologies. As part of learning absorption process, the reverse engineering technique is followed in both developed and developing countries depending on the nature of technological activities.  
A product/technology developed as a result of the reverse engineering process is not necessarily the "appropriate technology". Before commercialization, the appropriateness of the technology has to be judged. It may be mentioned that an appropriate technology is the most desirable technology that can be adjudged corresponding to a particular surrounding and objective function. Appropriateness is not an intrinsic quality of any technology. Therefore, irrespective of the technology generation process followed, its appropriateness needs to be evaluated with respect to surroundings, time horizon of decision goals and value system of the decision

makers. Hence, it would be a futile exercise to equate reverse engineering process to that of appropriate technology development initiative. The first concept refers to one of the options for technology development process while the second concept qualifies the result of the evaluation of any technology developed following a given process.  
There prevails a misconception among certain quarters that reverse engineering is nothing but "stealing and copying" technology. Indeed it is not at all correct. This is because the art/skill of following something is simply an effort to replicate in a way possible by using the available knowledge and skill. Here, knowledge and skill are part of technological capability and one has to acquire these capabilities through learning by doing process. Reverse engineering capability therefore attributes to knowledge and skills with regard to technology develop-

ment/upgradation. Let us take an analogous example to substantiate the point. Suppose, a renowned or even a less known sculptor has carved a sculpture. In this case, should we say that the said sculptor has stolen the images or figures? Certainly not. It is the skill/capability of the sculptor that enabled him/her to replicate the images or figures. We need to appreciate this capability of the sculptor and so the reverse engineering activities to further upgrade indigenous technological capabilities.

### Reverse Engineering in Bangladesh

In Bangladesh there are hundreds of roadside workshops scattered all over the country, starting from Thana towns to Metropolitan cities. Greater concentration of these workshops is found in Dhaka, Bogra, Jessore, Comilla, Chittagong, Rangpur and in many other places. Some of them are equipped with as little as only

an electric welding machine, while others are equipped with equipment like milling machine, different types of lathes (e.g. horizontal, vertical, turret), all types of drilling machines, grinder, both gas, electric and arc welding sets.  
These workshops are involved with the fabrication of simple machine parts like bolts and nuts and complex machines like lathe machines, concrete mixing machines etc. Besides these, there are small/medium manufacturers involved with the manufacturing of household items like taps, bibcocks, etc. made of different materials. On the basis of limited knowledge, these workshops are capable of producing items that look alike technology but not the same technology like the original one. General complaint from the consumers is that the products they produce do not give same performance as the original ones, although they may look similar. In simple term they are not capable of

making quality and standard products. In certain cases even if they can make a prototype of quality product they cannot mass produce them i.e. scale of production is very limited.  
In the recent years, through informal linkages with the small workshops, the Institute of Appropriate Technology of BUET has gathered some experiences about the reverse engineering practices followed by them. Based on their existing weaknesses it is felt that some policy interventions are imperative to provide formal support to reverse engineering activities in Bangladesh. The major areas for intervention are:

- (i) recognition of reverse engineering activities at planning and policy levels;
- (ii) undertaking in-depth research on reverse engineering activities in Bangladesh to identify specific support needs including technical supports;
- (iii) imparting training on various aspects of reverse engineering to light engineering entrepreneurs, technicians and workers; and
- (iv) providing financial and fiscal incentives to promote reverse engineering activities as well as for commercialization of technology.

### Conclusion

Promoting reverse engineering activities in Bangladesh will have lasting impact on creating indigenous technological base of the country. Such initiative however in no way undermines the on-going efforts towards development, adaptation and assimilation of modern technologies in the country. It is felt that supporting reverse engineering activities of the small engineering workshops will substantially contribute to income promotion and employment generation with overall impact on GDP. With low domestic resource costs, reverse engineering activities are expected to have positive effects with regard to import substitution of light engineering products in the short-run and export promotion in the long run. Providing formal support to reserve engineering activities is thus essential for the benefit of the country.  
The writer is Director, Institute of Appropriate Technology, BUET

# A Cool Trick

by Nikhat Jamal Qaiyum

Given the economics of commercial plant development — it takes about 30 years to sufficiently recoup investment — it is essential that developing countries do not lock money in inappropriate technologies that the developed world will subsequently discard.

INDIA has become the dumping site of technology so obsolete that it has been rejected by Brazil and Argentina. In March, Whirlpool India Ltd — a part of US-based Whirlpool Corporation — began producing the country's first non-chlorofluorocarbon (non-CFC), frost-free refrigerators at its new plant at Ranjangaon, in Maharashtra. However, Whirlpool's non-CFC refrigerators use hydrofluorocarbons (HFCs), which are transient gases that have been replaced with the more benign hydrocarbons (HCs), by the company for its European markets.  
Hydrochlorofluorocarbons serve only as temporary substitutes to CFCs and have a definite ozone-depleting potential (ODP). HFCs, the commonly used alternative to CFCs, have zero ODP. Thus, the Montreal Protocol on Substances that Deplete the Ozone Layer does not have a mandate to legally control them. However, HFCs are potent global warming gases. Thus, the Protocol is sweeping the ozone crisis under the carpet.  
Recent estimates of the potential impact of HFCs indicate that by 2040 the global HFC market could be around 1.35 million tonnes a year — equivalent to 15 per cent of current fossil fuel emissions. A recent study by Atlantic Consultants

of the UK shows that leakage of HFC-134a from vehicles sold in 1995 in Western Europe will generate the carbon dioxide equivalent of five power plants. The HFC-134a leakage from automobiles sold in Japan in 1995 will contribute 16 million tons of carbon dioxide — equivalent to ten power plants. Besides, there are concerns that upon decomposition HFC-134a forms trifluoroacetic acid, which is a toxin that virtually cannot be metabolised by most plants and animals.  
HFCs are also being replaced with HCs in Russia, China, Cuba and Turkey. After HFC refrigerators were rejected in Brazil and Argentina, Whirlpool switched to the UNEP award-winning German eco-fridge technology, Greenfreeze.  
That Whirlpool is pushing its HFC refrigerators onto Indian consumers should not surprise anyone. The US itself largely continues to use HFCs, while Europe, led by Germany and Switzerland, is focussed on alternatives using HCs.  
In 1995, Whirlpool Corporation bought controlling interest in Kelvinator India and merged its operations under the banner of Whirlpool India Ltd. The company has a market share of 25 per cent in refrigeration products.  
Fortunately, the Indian

market is responding to the HC option. In 1992, the Swiss Development Cooperation initiated the Ecofrig project in India through information dissemination on CFC phase-out options in the refrigeration sector. The technology was so successful in Europe that MNCs launched HC refrigerators and freezers using isobutane. By mid-1994, most European manufacturers had converted to isobutane, dropping HFC-134a, introduced two years ago.  
Another option that has attracted attention is the Greenfreeze, developed by FORON in cooperation with Greenpeace. Greenfreeze is energy efficient and uses an extremely purified form of liquefied petroleum gas as a coolant. HCs like a mix of propane and isobutane have zero ODP. Besides, their global warming potential is one per cent of HFC-134a. HC mixtures cost about 50 per cent of CFC-12 and about 10 per cent of HFC-

134a and are thus being welcomed by several Indian manufacturers, who see this as a cheap, readily-available alternative that requires on HC technology.  
Thus, Whirlpool's decision to manufacture HFC refrigerators in India becomes all the more significant. Interestingly, the company has also invested US \$250 million in a similar project in China, to expand its market.  
This is bad news. Already, the Korean conglomerate Samsung has announced it is all set to follow in Whirlpool's footsteps by becoming the second to launch its CFC-free refrigerator

in India. But this will not result in any real transfer of technology as the refrigerators would be imported directly from Samsung's "state-of-the-art" facility in Korea. Unsuspecting Indians are soon to be flooded with these so-called "environment-friendly frost-free" products of technology.  
It thus becomes all the more important that HFCs should at least be referred to as "transitional substances", so that a clear signal is sent to developing countries that this technology shall have a short shelf life. By failing to do so, inadvertently, the Montreal Protocol, along with the chemical industry, is in obvious violation of the precautionary principle.  
Moreover, there can be no "interim" solutions for developing countries. Developing countries, even with the help of the Multilateral CFC Fund set up by the Protocol, will not have the resources to retrofit and/or replace their technologies more than once. Given the economics of commercial plant development — it takes about 30

# Sound System

WASTE polyethylene terephthalate (PET) bottles will now be recycled for use in vehicle

sound-absorption material by Nissan Motor Co of Japan. It plans to recycle more than 10 million PET bottles in the year 2000 and use the material in all future models. With the assistance of Mitsubishi Chemical Co, the automaker has succeeded in recycling PET resin into fibres 15 microns in diameter, for use in production of a sound-absorbing material. The company said that it takes around five PET bottles to provide enough material for sound insulation for one vehicle.

# Beer Cures

A recent report in the *Sci*ence says that Japanese scientists have learnt that beer may inhibit the carcinogen (tryptophan pyrolysate product no-2), a heterocyclic amine, produced by burning meat, fish, or tobacco leaves. Beer was known to contain polyphenolic compounds that inhibit mutagenesis, but it proved to be a far better inhibitor of mutagenesis than the compounds alone. The other compound (s) in beer are being vigorously pursued by scientists with an idea to test them against other carcinogens in cooked meat.

# BAR CODING

## Second Generation of Computer Revolution

by Syed Ershad Ahmed

Whatever your industry is, bar coding may just be the tool to help your company more profitably into the 21st century.



THEY are Bar Codes, inch long groupings of black and white parallel lines containing information that can be decoded by scanners and computers. They first popped up in super market about 25 years ago. Then they appeared in department stores and other retail operations. Today they provide marketers with paperless, key less method of data collection, speed up data entry, and offer the potential to do away with the mountains of computer print-outs that has become part of the standard decor in most offices.  
The introduction of the personal computer (PC) 30 years ago marked the beginning of the computer revolution. But instead of fulfilling the promise of eliminating paperwork, PCs created more overloading shelves and storage areas with reams and reams of computer generated "hard copy". But some of the paper is finally beginning to disappear.  
Bar coding is the second generation of the computer revolution. It is actually reducing paperwork for growing numbers of firms. What makes bar coding even more exciting is that you don't have to be a corporate giant to take the advantage of the technology. Business of all sizes can use bar codes to track their inventory, manage/find assets, up order entry and many more.

telling that bar coding is the competitive weapon, a strategic weapon, too.  
Whatever your industry is, bar coding may just be the tool to help your company more profitably into the 21st century.

### How it Works

Bar coding system consists of three basic elements: a scanner, decoder/software and the bar code symbol.  
The scanner: Often a pen-sized wand or gun resembling an electric razor or a small hair dryer contains a light source that reads the bar codes (the black bars absorb light; white spaces reflect it). A photo detector collects the light, converts it to digital form, and sends it to the decoder. The decoder/software then processes the information in the computer, according to programmed instructions.  
Some scanners, such as those at the checkout counter of grocery stores, are attached to the host computer. Others are portable, hand held devices that will store information for later input into the computer.  
Compared to manual systems, scanners are lightning quick. They read bar codes within seconds, compare that to the time it takes an employee to write sales, or customer information manually. In addition, studies show bar-code to be 10,000 times more accurate than manual (key punch) input. While the hardware and software that run a bar code are crucial, so too is the clarity of the bar code itself. Badly printed, smudged, or dirty codes can create errors or cause the system to fail.

The best bar codes are laser printed on high quality label stock, a process that is becoming more affordable as price of laser printers drops. The output from dot matrix or ink jet printers has the potential problem causing inconsistencies.  
If you are tracking a relatively stable inventory, such as

an equipment rental store, and don't have other needs for a laser printer, you may find it more cost effective to buy pre-printed labels. But if you use a high volume of labels and have other applications for a laser printer, consider printing your own.  
Whichever way you go, test the labels before using them to be sure they are compatible with your decoding system.  
The key to determining the potential viability of a bar coding system for your company is to analyze labour intensive tasks to see where staff hours can be reduced by adding technology. Order entry, for example, may be updated to work like this: each customer is assigned an account number with

**Government of the People's Republic of Bangladesh**  
Directorate of Food Movement, Storage & Silo Department  
16, Abdul Gani Road, Dhaka-1000  
Pre-enlistment of Central Road Transport Contractor for 1998-99 & 1999-2000 Financial Years

**Notice**  
Memo No. 528/MSS/CRTC-32/97 Dated: 28-6-1998 (14-3-1405BS)  
Applications under sealed cover are invited from interested & eligible Bangladesh citizens for Pre-enlistment of Central Road Transport Contractors (CRTC) for 1998-99 & 1999-2000 Financial Years for carrying foodgrains, edible oil, empty sacks & other goods of Movement, Storage & Silo Department under the Directorate of Food, Papers & information of pre-enlistment application form, rules & regulations and terms & conditions will be available at Tk 100.00 (one hundred) only (non-refundable) per set from the Cashier, Accounts & Finance Department of the Directorate of Food & Office of the Regional Controller of Food, Dhaka/Chittagong/Rajshahi/Khulna/Barisal up to 12-00 Noon everyday during office hours up to 19-7-98. Pre-enlistment application will be received in the tender box kept in front of the Office of the Director (Movement, Storage & Silo Department) at 4th floor of the Directorate of Food and at the office of the Regional Controller of Food, Dhaka/Chittagong/Khulna/Rajshahi/Barisal up to 12-00 Noon of 20-7-98. Such contractors as have earlier been black-listed or removed for misappropriation of goods of Food Department or failure in carrying work as per timetable need not apply.  
Md Imdad Hossain  
Additional Director (Movement) Movement, Storage & Silo Department  
Directorate of Food, Dhaka &  
DFP-14586-30/6 Member Secretary  
G-1552 Central Tender Committee

**Government of the People's Republic of Bangladesh**  
Ministry of Education  
Bangladesh Secretariat, Dhaka  
No S 13/1-22(Fulbright)/98/215-Education Dated: 28-06-98

**NOTICE**  
Subject: Regarding invitation of application for US Govt offered Fulbright Scholarship for the year 1999  
Applications are hereby invited from the faculty members of different Universities of Bangladesh for study at Post-graduate level in the following subjects at the United States of America under two-year Fulbright Scholarship during 1999 fiscal year of US government.  
Subjects:  
a) History of America  
b) Literature of America  
c) Economics  
d) Political Science/International Relation  
e) Finance and Banking  
2. Eligibility to apply:  
i) Should have 60% marks in BA (Hons) and MA (This condition is not applicable for those who have studied under GPA grading. In that case they should have A average).  
ii) Candidates who have earlier studied in US are not eligible to apply.  
iii) Should have ability to speak in English fluently.  
iv) Should have good health.  
v) Should be a Bangladeshi citizen.  
vi) Should submit undertaking of returning to Bangladesh after completion of study.  
vii) The price of ticket should be refunded in case of coming back to country before completion of course.  
3. Candidates will have to apply through proper channel on time.  
4. Should apply in English with the following information and with two copies of attested recent photographs, two attested copies of mark sheets and certificates of each examinations passed etc. Applications will be of two sets with each set containing one photograph, CV. The following information should be mentioned in CV:  
Application for US gov't offered scholarship at post-graduate level :  
Subjects prayed for  
a) Name  
b) Father's name  
c) Present address  
d) Permanent address  
e) Date of birth and present age  
f) Occupation  
g) Telephone number (if any)  
h) Information regarding examinations (from Secondary/SSC to all examinations)  
Name of examination Board/Year of passing Major subjects studied Division/class obtained Total number in examination (Marks in which appeared at exams) Total marks obtained by candidates  
5. Name of scholarship (Fulbright Scholarship) and subject applied for will have to be mentioned on envelope.  
6. Applications must reach the undersigned by post by 15-7-98 or should be submitted in number 2 wooden box kept at the gate number 5 in Bangladesh Secretariat.  
7. A person cannot be candidate for more than one subject and cannot apply if nominated for any other scholarship.  
8. The decision of proper authority in selecting candidate is final. Incomplete application will not be considered.  
9. Action as per penal code will be taken against candidate giving false statement/information willingly.  
10. Candidates selected provisionally after scrutiny of application for final selection will have to appear at an viva voce.  
DFP-14593/30-6-98 Md Didarul Ahsan  
G-1553 Senior Assistant Secretary

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# by Jim Davis

