RESEARCH AREAS FOR THE INDIAN COMPUTER WORLD

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Abstract

If the computer industry in India is to succeed, it calls for breakthroughs, which could be achived by formulating the right strategies and working for the success of the strategies. The paper enlists the possible areas of study and puts down the steps, to be taken.

The computer is a machine; and like all other machines, it tries to reduce man's burden. This, in the organisational sense, changes the need for specific human competence for particular tasks. To the extent that computers reduce or simplify routinised tasks. (like calculations, information processing and reporting: set procedures against set norms), they reduce clerical and lower-level burdens. It is only when they are endowed with the capacity to think (and take synaptic leaps), they enter the area of Artifical Intelligence and climb to the higher echelons of management in an organisation.

The evolution of machines, including computers, has been towards improvement compelled by

i) needs of users, regulators, and makers,

ii) competitive situations, and

iii) evolutionary process itself.

A better computer would help in clerical and managerial tasks; a better computer system would offer more flexibility, lesser cost, easier operation, and maintenance. These require constant improvements in both hardware and software. In fact, the threats of competition, highcosts, compatibiles, and Intellectual Property Rights should serve as goals for self-improvement.

THE INDIAN SCENE

The Indian Computer industry has about 620 units, 26,200 employees in hardware and about 450 units with 7500 technical staff in its software. Enjoying its initial seller's market, it is complacent. Its associations fight for concessions from government. It is content with importing hardware and assembling it; in some cases, even the cabinets have technology link-ups. The software too is largely imported if not pirated. This is no better than importing the entire system, bypassing the middlemen who are masquerading as manufacturers.

Such a situation, if allowed to continue, even if Dunkel or Carla Hills did not impose their sanctions, would be disasterous because

i) it ignores the need for indigenous development, "breakthrough" self-reliance, and self sufficiency,

ii) it faces a collapse if import trade were to become adverse,

iii) it offers little for Indian needs and conditions

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iv) it has to be content with discarded technology, paying for "Far-from-latest" state-of-art ideas, plagiarised South-East Asian clones, and

v) it shames India which claims to have the third largest technical manpower in the world.

Various computer organisations, foras, research bodies and government have not woken up, especially when the advanced nations are trying to move to the Fifth and Sixth generation machines. Users bodies are like viedo owners: smug that they own one and can operate it too! User associations have not overcome the euphoria of ham-radio operators! Their defensive trade foras seen busy lobbying for fiscal reliefs. Government bodies are content to be licensing and routing agencies that interfere in the name of import and technology controls. Research institutions, including universities, focus on exotic, demonstration-effect, foreign-trip researches, rather than on mundane issues. With the result, the industry continues to lag behind, riskprone, expensive, protection-seeking. All these, despite the administrative and technical skills available in India!

If the computer industry in India is to succeed, it calls for breakthroughs which could be achieved by formulating the right strategies and working for the success of the strategies. This paper gives

i) a list of possible areas for study and

ii) steps to be taken accordingly. Perhaps it would call for a Seminar with the participation of makers, users, researchers, teachers, and government to develop a blueprint for action, and an Action Plan to phase the implementation, to monitor the progress, and to incorporate the reward systems for the continuance of the productive effort.

MISSION AND THRUST AREAS

Mission: The mission, or goal of the entire exercise should be two-fold,viz.,

1. Modernisation How to improve the current qualities and competence, and

2. Indigenisation How to develop the capacity to make everything within the country, using local technologies and resources, averting dependence on imports.

Imitative efforts, and jargonese must be eschewed. Repetitive researches too must be avoided unless it assists indigenisation. A time-frame must be prescribed for the entire exercise, both in terms of thrust areas as well as technology gap with the West.

ThrustAreas

The areas that one needs to focus upon for indepth research arise from the question - HOW TO MAKE THE COMPUTER SYSTEM BETTER? List of possible areas are explained here.

1. Flexibility
2. Low Cost
3. Ease of maintenance
4. Simple operations
5. Greater mobility
6. Speed
7. Capacity
8. Virus resistance
9. Visibility
10. Easability
11. Zeroing-in
12. Misuse control
13. Long life
14. Languages
15. Size
16. Parallel processing
17. Power failures
18. Ergonomics
19. Networking
20. Piracy control
21. Splittable system

Flexibity:

Apple and IBM compatibles show that inter-system converter is an area worth exploring. (Can an Apple input be used by an IBM, like PAL and NTSE in television?) Add-on facilities is another area. (Do we have to discard our existing machines just because we cannot log-in new features?) Can it be linked with other gadgets with interest capability? (like a telephone, dictaphone, a simulator, a robot?)

Low Cost :

High rate of excise and import duties notwithstanding, Cost Reduction techniques and Value Engineering could help here. Isolate the items that raise the cost by eliminating, clubbing, or simplifying of operations, and by using alternative materials. A saving of 10-15% could be expected in variable costs alone.

Easy Maintenance :

Precautions against the elements and voltage fluctutations is not enough. Ease of opening and closing and modular internal layout for convenient replacement, reliability of the chips, soldering, moving parts, cleanliness, etc. must be considered. Replacement-parts and modules must be available, and inexpensive. (unlike the Maruti car!). It is important to ensure that adequate spares are available because the rapid rate of obsolescence in this industry may shut down a good system merely for want of a simple part.

Simple Operations :

Existing systems require lot of training to be used even as a typewriter (that is as, a word processor!). The sales-package training programs are often inadequate for the average individual. Operational techniques and software linkages must become simple. "User-friendly" is a term that has a long way to go.

Greater Mobility :

While they have become smaller over the generations, computers still have problems if they have to be moved about. This is because

(i) they are neither light nor compact to be carried,

ii) they cannot be easily hooked to other gadgets like televisions, tapedecks. or typewriters, and

iii) they need a protected atmosphere. Indigenisation also means that computers must be able to survive without protection like air-conditioning.

Speed :

It is generally felt that complexity, cost, and speed are incompatibles. They are said to cause maintenance problems, have frequent breakdowns, and possess complex circuitry. If relays could be built-in and complex modules avoided, then safer, higher speeds could be obtained, The larger question is Does the average user require high speed (as may be compared with takeoff speed advertised by many moped makers)?

Capacity :

Larger memory, greater speed, spare-chip storage higher range of functional capabilities, higher variety of datacrunching ability are called for. Why beg for non-latest supercomputers from abroad when we have the skills to work to develop them?

Virus resistance :

Though it may not be possible to make system virus-free, it should be possible to make it virus-resistant so that the damage is less. For instance, a servo system to divert operations towards a "run off"' to switch off, to indicate the presence of a virus, to divert to other systems must be explored. Is a vaccine of sorts (building-in a safe and defensive virus) and antibiotics of sorts probable? Perhaps Cybernatics might offer ideas from the world of medicine.

Visibility:

Currently the hard discs and floppies are opaque. Even the new Steve Jobs idea is only transparent. What is needed is indication of recording by mere sight,

i) facilitating the search even if the casing is damaged,

ii) avoiding feeding-in to identify, and

iii) indicating balance available space. Can the recording have a colour flow?

Erasability:

This is double edged : easy to a erase must not enable carelessness or mischief to wipe out years of labour. Some locking device (with codes or an oldfashioned lock outside) is a must. "DELETE" and other major risks could be avoided if the depressed keys are also displayed in a corner of the screen. (Is the clutter worth it?)

Zeroing-in:

It requires too many steps to reach a particular file. Can we not zero-in on the exact location within two steps or less with a built-in program like. "7th level of File 52-Reach"?

Misuse Control:

The danger of locking-in with vital systems like national defence, and computer crimes (from the petty nonrecording of time-shared to diversion of bank funds and industrial espionage) call for variable frequency and circuitry, special codes, warning signals, and punitive legislation.

Long Life :

The durability of the system is the ability of the machine and software to withstand the vaguaries of voltage fluctuations, weather, dust, heat, vibrations, etc as well as the capacity to incorporate modern features without complete obsolescence.

Languages :

Users are bewildered by the array of languages and capabilities. What is required is a system to translate without the user having to learn them all. It must be remembered that the "Best" language is one that

i) reguires least effort to learn,

ii) has the largest vocabulary,

iii) involves minimal user-errors,

iv) can add-on vocabulary and instructions,

v) has widest area of applications, and

vi) can easily evolve from exixting ones. The search should be for such a language network and translator.

Size :

It should be possible to accommodate the machine in limited space. Perhaps its VDU could have a triangular back also so that room-corners could be used. And when floppy tracks have to be created by the machine, why not more than 49 or 96? And why not touch-sensitive a briefcase which opens fully to accommodate a terminal, collapsible VDU, and printer? And a phone and fax? Well, why not!

Parallel Processing :

The Von Neumann hurdle of work-split bottlenecks faced by parallel processing of parts of total work (like the pinmaking example of Adam Smith applied to computers, as it were) has not been taken up seriously. NAL's Flosolver Mk-2 a largely indigenous achievement would perhaps be surpassed by C-Dot. If these ideals are achieved, then the need for imported machines would be less.

Ergonomics :

The man-machine interface offers a lot of scope for research. Keyboard shapes, furniture angles, glare, reflection, lack of contrast, proximity to screen, Dot-matrix could be improved to reduce body-stress,

eye-strain, digital dexterity, and the like. For instance,NEXT offers a pixel resolution of 92 dots per square inch with a display in four shades of grey deep. Also anthropometric studies could help here. (Does screen above key board cause neck-pain,) Can foot-controls be introduced to spread the efficiency?

Power Failure :

The availability of auto battery-backup to protect the machine. Can solar cells (as in calculators) in series or parallels or photonics substitute electricity? The advantages of optics must be availed and the high cost be overcome.

Networking :

Why cannot operating systems (like MS.DOS) be part of the active floppy? LAN, WAN, various networks on information, in additon to link ups with telivision, telephone, tapedecks, fax radio, etc should be possible and easy.

Splittable Systems :

For the most part, a computer systems is made up of a terminal, a television-screen, a memory box (called disc) a processing unit, and a printer. Not all of these are in use at one time. For instance, when the computer is in use for calculations, the printer could be used out of its stored memory. This separate but simultaneous functioning is aking to our left and fight side of brain, thinking and driving at the same time for example. This way, idling of parts of systems could be avoided. A television program could be watched while printout takes place.

Piracy Control :

This is a tall order. As Louis Scoomaji of Data processing Scceurity said, we spend on 4th generation but not beyond 1st generation security. The usual methods are copyright, special secret markings and the like. Finger-and up-prints are being explored. One can also think of a special tester which could nose out the spurious. Of course, the tester needs to be protected too.

Some other developments in the area of research could also be these :

- **Super conductivity** : This reduces the "Noise" in the system as well as the heart, facilitating miniaturisation. Both pure and adaptive research areas.
- **Josephson Junction :** Cooling the circuits to near absolute zero temperature, it removes the hinderances to the flow of electrons. This promises reliable higher speeds. But we must first know why IBM scaled down research in this area.
- **Bubble memories :** Magnetic bubbles (spots created on thin layer of magnetic film) promise more capacity with less volatility.
- **Biochips :** Like the RNA_DNA in us, genetically engineered proteins could be developed (as is being studies at present in USA) which could carry the required instruction. This is an exotic are where Biology, Chemistry, and Computers could pool their ideas.

Reader can, most certainly, add many more to this suggestive list of possible thrust areas.

STEPS TO BE TAKEN

The more important steps to be taken to make our dreams come true are given under four categories.

A. AT the government level:

1. Trigger the national pride-even by wounding it, if necessary - so that organisational level plans could be prepared realistically.
2. Critically evaluate the working of units entrusted with the task of computer development (not mere CAG reports) so that their existence and funding are based on results rather than acronym-filled reports.

3. Enhance the incentives for the use of indigenous technology to spur effort.

4. Reduce the hurdles to productivity like bureaucratic trappings which divert effort towards wasteful paper formalities.

5. Bestow special favours on individuals and organisations that do not speak vague and esoteric equipments, status trappings, and imports in the pursuit of goals.

6. Encourage ideas and plans from everyone, and make incentives real and rewarding to disinterest brain drain.

7. Never shoot down an idea for want of a formality or out of prejudice. Every rejection must be listed, justified, and recorded for review.

8. Appraisal time of projects must be reduced to days. Computers, the speed machines, cannot brook the clercial mentality.

9. Participate in Institution-Industry meets in a constructive manner (and *not merely to inaugurate or to read* ghost-written speeches or by sending "dummy attenders" as participants!)

10. ESTABLISH A COMPUTER RESEARCH WING IN THE EDUCATIONDEPARTMENTANDPUT AN IDEA-MAN (NOT AN ACADEMICIAN OR A BUREAUCRAT) INCHARGE.

B. AT EDUCATIONAL INSTITUIONS

1. Students should be given assignments and projects in the areas listed in this paper rather than routine operations-based ones as at present.

2. Research departments and organisations must concentrate in these areas in a realistic manner instead of trying to impress semiliterate "intellectuals" who are smudged with jargons.

3. Every Computer Management, and related Engineering department should have something productive to show, even if modest, as achievement for the year (not merely prefunctory seminar papers and consultancy statistics).

4. Constituion of project teams and the composition of its member should be voluntary and flexible so that interdepartmental interaction could fructify in a free atmosphere.

5. Teacher-members and students should vible well, so that a creative and encouraging climate prevails.

6. Results of these exercises should be evaluated by a Committe drawn from studentss, teachers, users, and industry.

7. Hobbies Clubs should become more mature (rather than reinvent the wheel with mechanical and photolectric toys) and inculcate this attitude to achieve.

8. Assignments of this type must take precedence over the book-and numbers type that students get to do as tutorials.

C. AT TRADE FORUMS

1. If various permutations of SKD (semi-knocked down) kits ARE to be imported for sale, then why not concentrate on Computer Dumps(like the one in Tokyo city) where inexpensive but slightly dated machines are thrown away as it were?

2. They should organise competititions, sponsor events, and create endowments but not for computer games and entertainment alone; rather for innovative ideas that would improve the hardware, the software, and the system.

3. They should institute awards to members to encourage indigenisation. (Even educational institutions could

institute awards for the best in the field).

4. Delegations must visit Educational institutions to impress upon the ENTIRE faculty AND students on the desparate need to make breakthroughs in this vital sector, to offer incentives and recognition, to suggest orientations in courses and research.

5. R & D wings of the corporate sector should try to be more than tax-saving outfits. They have done useful work : SCL before the fire of '89, WIPRO's 32-bit around an 80 386 microprocessor, PSI's targetting to the Indian condition, NAL's Flosolver, etc. However, though it is necessary to reinvent the wheel to overcome problems of royalties, they must graduate beyond that.

D. AT THE USER's LEVEL

1. Much of its work can only be at the software level; but so be it.

2. Repairs and maintenance units, aided by Polytechnics, could identify areas for improvement and alternations with less expensive parts.

3. Weekly meetings of User's Clubs should be held to display skills, inform about the latest developments, and glean ideas on what could done.

4. Interdisciplinary approach between educational institutions would help here.

5. Periodically, Trade Forums, R & D wings of computer firms and government could meet these groups (Institutions, Clubs, etc.) to evaluate their ideas and efforts, and to encourage them.

This author would be happy to offer his services to such brainstorming activities and to build suitable linkages for the purpose.

CONCLUSION

The computer world is peculiar : Risk-prone, calling for heavy investment in products with short marketing life-cycles. But ignoring it would be to be left behind in the twenty-first century. (Of what use the many Technologists if we need foreign collaboration to make, and preferential status to sell?) It has to become indigenous yet modern. A concerted effort to break free of moribund ideas and to brainstorm and to work towards better things is the only way. How? The paper shows.

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