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## **Education and Skill Development through the Reconfiguration of Discarded Hardware: Turning Base Metal into intellectual Capital**

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### **Published version**

WALTON, J. (2010). Education and Skill Development through the Reconfiguration of Discarded Hardware: Turning Base Metal into intellectual Capital. In: International conference on Challenges to Inclusive Growth in the Emerging Economies, Ahmedabad, Gujarat, India, 15-17 December 2010. Indian Institute of management. (In Press)

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# EDUCATION AND SKILL DEVELOPMENT THROUGH THE RECONFIGURATION OF DISCARDED HARDWARE – TURNING BASE METAL INTO INTELLECTUAL CAPITAL

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## ABSTRACT

This paper examines an intervention in Europe which enables untypical individuals to acquire skills and competences in order to enter IT related employment. To do this they need to acquire a threshold level of intellectual capital so that they are considered sufficiently competent to gain employment. This can therefore provide the industry with a solid foundation of the necessary support staff, capable of providing services to the local community supporting such educational initiatives. This initiative can then release the more conventionally educated to work at the cutting edge of industry. As a driver for wealth generation in India, the IT industry is remarkable. It demands a wide spectrum of intellectual capital. As diffusion of IT technology is predicted to pervade throughout the subcontinent, the demand for all levels of competence would seem to be buoyant. The training environment covered in this case study complements the traditional educational system and could furnish alternative career opportunities to certain sections of the community.

This paper takes a strategic view throughout. The fallacy of composition has to be taken seriously. What is true for a part is not true of the whole. To place this in the context of this paper; whilst a workshop to help unemployed people build computers in Sheffield may work, it is not necessarily appropriate to draw the conclusions that it will be effective when implemented over the whole of the Indian Subcontinent.

## KEY WORDS

Medici Effect, Intellectual Capital, Strategy, Component Re-use

## INTRODUCTION

The growth of the IT industry in the Indian Subcontinent since the reforms of the 1990s has been dramatic. Large corporations such as Infosys, Netcare and HCL Info Systems are now significant world players. There are also many medium sized organisations and as one would expect, a whole spectrum of SMEs participating in the IT market and consequently generating wealth.

This wealth generating activity is focused however, largely but not exclusively, in cities such as Bangalore, Pune and Hyderabad in Southern India. The distribution of this wealth is not only geographically asymmetric. Certain classes, notably the scheduled tribes, and castes have not shared in the fruits of this success. What is required therefore is an intervention that will provide a business model (Huff *et al* 2009) to channel some of this wealth to benefit the less affluent members of the community.

Modern IT companies require the latest hardware to run the applications demanded by their clients. Machines with out of date hardware that will not support the latest operating systems or those that develop a fault are discarded as the cost of repair or upgrading them is high, relative to the cost of new machines. The consequence is that a substantial amount of hardware is discarded as scrap when in fact some or most of the components from which it is assembled are still functional.

It is possible to build a workable computer capable of running the latest free ware software at very low cost by using such discarded components. Machines have been built in such a manner in the third sector environment in Europe, so that individuals who could not afford one on the open market could own a comparable machine. But it was not just the machine they owned; they derived the satisfaction of building their very own new computer; the commitment necessary to see through the construction, and the social skills needed to accept and adopt instructions that are part of the process of bringing the diverse elements together. In reality, they had *developed* their *own* intellectual capital in the building of their personal machine.

There are two case studies presented in detail: firstly the Access Space facility which works with under employed individuals in Sheffield, England. Secondly, the 'Zero Dollar' lap top project which worked with homeless people in Kensington, London, England. Finally there is an anecdotal report of similar work in Brazil, South America.

## THE INDIAN IT INDUSTRY

To achieve a 9% growth of gross domestic product (GDP) would be a significant achievement for any head of state, any political party in any country. Yet India has achieved and sustained this throughout the decade starting with the new millennium. This GDP of 9%, is the average growth, and many Indian Corporations exceed this, and the IT sector of the economy is especially buoyant

InfoSys headed by Narayana Murthey, for example, now has a market capitalisation of \$16 billion, and turnover is estimated to be \$5 billion (Pota 2010). Tata Consulting Services, (TCS) headed by Subramaniam Ramadorai enlarged the company from 5,000 staff to 130,000 by the time he retired in 2009. TCS has employees in 160 countries, with revenues of 5.7 Billion Dollars US. Their stated intention is to rival IBM, Hewlett Packard and Accenture (Business India 2005). Such strategic statements have to be taken seriously as India is clearly a global player with the wealth generation to match.

The IT industry is itself complex. Many of its customers are off shore, and manage the relationship with the IT suppliers remotely. The main players interface directly with the Banks, Airlines and other blue chip companies that patronise the IT services provided by the subcontinent. But the major players themselves subcontract to second level suppliers who in turn subcontract to third level organisations. Thus there is a complex web of relationships.

## LEARNING AND INTELLECTUAL CAPITAL

If any population is to increase its intellectual and social capital, then learning is essential. Clearly the traditional Indian educational system, excellent as it is, cannot for the foreseeable future provide a vehicle to enhance the intellectual capital of the entire population.

It is not necessarily the case that the IT industry employs only elite graduates. There are potentially a significant number of jobs to be performed by those who understand and appreciate how the hardware and software actually work, without necessarily having the programming or design skills that one would expect of a graduate. These lower level technical jobs will obviously command a lower salary and be unattractive to graduates, but they may be very attractive to those from a less privileged background. It also important to point out that such entry level jobs are likely to be found at the extreme edges of the value chain (Porter 1985) *id est* they will be in second, third or even fourth level suppliers.

In addition employment opportunities would be expected in the less formal IT economy for example, installation, basic trouble shooting, routine maintenance and so forth.

Before one can be prescriptive about what *processes* will deliver enhanced intellectual capital it is useful to consider *how* the necessary learning occurs.

## ENABLING LEARNING FOR NON TRADITIONAL LEARNERS

John Dewey pointed out quite early on the difference between meaning and understanding, so to *be acquainted with* is distinct from *to know of or about* (Dewey 1997). This has a direct impact on the students' ability to use deduction. Using the correspondence theory of truth, only if the observed facts agree with deducible results can a valid conclusion be said to have been derived. (Dewey 1997).

Advanced frameworks have now been developed which include but are not limited to these four exemplars SECI<sup>1</sup> Spiral (Nonaka *et al* 2000); Social Learning Cycle (Biosot 1999); Generative Dance (Cook & Brown 1999) and Tacit Knowledge in Organisations (Baumard 1999)

From our research it became clear that the SECI spiral was the framework to be adopted. It should be noted that the work of Nonaka *et al* is not without its critics. It should be recognised that their work has been in the receipt of criticism (Gourlay 2006). Particular issues in the realm of the first stage, that of socialisation. However, it should be realised that all frameworks are approximations of the phenomena that are used to structure the thinking of the problem solver.

From the foregoing it may be considered that there will be two learning cycles operating. First and most obvious is that of the participants as they develop their knowledge of computers, starting with building the hardware and leading on to the application of the finished product and then possibly even some programming. Secondly, there is the learning of the staff, the people who are going to create and enable the learning space. The synchronicity of these two learning cycles will be the subject of a subsequent paper.

The two learning cycles are different however. For the participants, they are acquiring knowledge that already exists. For the trainers, they are actually generating knowledge, which is how to manage the learning situation in a particular micro-cultural environment.

## THE MEDICI EFFECT

The Medici Effect is named after a fifteenth century Italian banking family in Florence. It has become synonymous with unexpected, innovative and creative initiatives that have improved people's lives in unexpected ways. To explain this phenomenon, it is necessary to understand that the Medicis sponsored the arts and sciences thus concentrating the greater part of a whole generation of talented individuals in one location.

As a result of this, disciplines which would previously have seemed to have little if anything in common were brought together. The commonalities, disjunctions and connections of cultures, concepts and ideas were diffused amongst the participants.

This gestalt of ideation challenged existing cognitive paradigms and enabled the generation of new theories which in their wake brought discovery, creation and innovation to the world. Thus the renaissance which marked the end of the middle ages had arrived. Once conceived, the renaissance engulfed the whole of Europe, changing forever received teaching. It was an intellectual explosion, detonated by the Medici family, who could never have appreciated or predicted the effect of their patronage (Johansson 2004).

## DIRECTIONAL AND INTERSECTIONAL CONCEPTS

The Medici effect is based on three central concepts; directional thinking, intersectional thinking and associative barriers.

Directional ideas are focused. They form part of an integral discipline, following the notion of normal science as defined in the Structures of Scientific Revolutions (Kuhn 1961). As such, they can be extremely successful,

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<sup>1</sup> SECI Socialisation, Externalisation, Combination and Internalisation

as for example the Indian IT industry has demonstrated. But there is a potential downside as well. Directional thinking is focused; it follows the precepts of a particular discipline. This allows directional thought to make rapid advances in a specific direction. A discipline is defined as controlled and orderly behaviour resulting from training (Concise Oxford Dictionary 1993). Such thoughts result in outcomes that improve products, services and other offerings in an orderly and predictable progression (Johansson 2004). This is a linear rational approach to problem solving and progress.

Secondly, there is the concept of intersection, the notion of a nexus where different fields meet. In contradistinction to directional thinking, which is confined to the mind set in which it resides, intersectional thinking deploys concepts and cultural artefacts from the mind sets that connect. It is a perception that is not linear but a network or web on inferences that is often counter intuitive. However intersectional ideas do not exist in a bubble. If they did, the renaissance would not have been conceived, would not have been diffused so rapidly, and would not have exhibited the property of irreversibility.

It is important to stress that directional and intersectional thinking are not mutually exclusive. On the contrary, both are required but in different proportions at different times depending on the demands imposed by the external environment. An example to support this would be the relationship between Total Quality Management (TQM) and Business Process Re Engineering (BPR) in the 1990s. Each approach had strengths that complemented each other and correspondingly the limitations were also mutually reinforcing.

## THE ELEMENTS OF THE MEDICI EFFECT

*The movement of people* is concerned with the fact that ideation is a property of consciousness that only people possess. Where there is little movement of people, especially from one generation to the next, the equilibrium position tends to be that of directional thinking. On the other hand, where there is movement and the mingling of communities, intersectional thinking is likely to occur; generating as it does, new insights, greater intuition, and creativity. For example, the movement of the population from an agricultural economic base in England in the 18th century to the towns created a fertile ground for intersectional thinking. Mass transportation, the retailing of food and the need for literacy became necessities which would have taken much longer to occur, if ever, by directional thinking.

*The Convergence of Science* takes into account that by its very nature, many of the great advances occurred where scientific disciplines overlap. The great strides in the biosciences have taken place because methods from physics and chemistry have been applied to the traditional area of biology. So modern science seeks parallels and similarities between phenomena that aid intersectional thinking.

*The Leap of Computation* recognises that computing power doubles every eighteen months however the digital world is not confined to Personal Computers (PC). Devices such as scanners, cameras and mobile phones for example can all be connected either to a PC or directly to the World Wide Web. This means that the computing power necessary to integrate this data is vital and gives rise to combinations of artefacts that could not have been conceivable even a decade ago.

*An associative barrier* is a concept that is concerned with how an individual or group of individuals perceive problems or issues of concern. Those with high associative barriers discard thoughts, notions and ideas which are not directly related to the problem in hand. Those with low associative barriers allow a more lateral approach to the issue at stake by considering a variety of linkages and conjunctions that could be relevant to addressing that with which they are confronted. There is no right or wrong type of association here, those with low associative barriers might see connections that others do not, but at the expense of the time to address the issue. On the other hand those with high associative barriers may solve a problem in less time, but ignore aspects that might actually eliminate the original problem.

## ALLOWING THE MEDICI EFFECT TO TAKE FORM

Intersectional ideas will remain only ideas, until they are implemented and reification is important so that the intersectional dividend can be realised.

In fact as it has been pointed out "*there is no way to know whether a thought is new except with reference to some standards, and there is no way to tell whether it is valuable until it passes social evaluation*" (Csikszentmihaly 2010).

Increasingly therefore, it is not new technologies that are being developed from scratch, but novel configurations of existing components. A good example is the Personal Computer which uses a microprocessor with a disk based operating system which allows real time computing to occur on the desk top. Intersectional thinking indeed. However even more insightful was the response of the key dominant player in the computing industry at the time - IBM. They did not take the threat of a new entrant to the market seriously (Porter 1985) and hence allowed Microsoft the unique opportunity to develop and indeed shape a new market. Of course, once intersectional thinking has created a new trajectory, it is directional thinking that develops it. Intersectional thinkers, however, are not necessarily good directional thinkers, as Bill Gates famously pointed out in 1978, '640K should be enough for anyone'.

So the Medici Effect is more sophisticated than it might appear. Taking an egocentric view, it is how an organisation or country allows its intellectual capital to develop. Taking an alocentric view, it can give insights as to how those entities that are either partners or competitors *id est* members of the value net are deploying their resources.

Applying this to the Indian Subcontinent, the intersectional characteristics that it has are:  
a large body of potential candidates;  
a dynamic IT industry which must re-tool regularly to maintain its strategic position;  
a model of instruction and development that has worked in three countries and two continents;  
an approach to training and development that is pragmatic in nature;  
the capacity to build local communities in order to enhance social and team working capabilities;  
a commitment to novel strategic initiatives by the intelligentsia of the country; and  
the need for threshold level technicians in the parallel less formal economy.

The thesis of this paper is that these factors will smooth the path of this proposed initiative as all stakeholders will ultimately benefit.

## NATIONAL STRATEGY - LOCAL IMPLEMENTATION

For the Medici effect to reach its zenith in this area, it is important to consider each initiative as a community of practice. It has all the hallmarks of this, with unskilled individuals entering the system and leaving it with a threshold level of competence.

This commitment is easy to underestimate. It would suggest that specific autonomy is given to certain regions or cities to respect and accord with the local customs and conditions to optimise the performance of the participants. What is proposed is a strategic entrepreneurial approach - that of the exploration / exploitation dilemma (McNamara & Baden-Fuller 1999). Does the organisation exploit knowledge it possess already or does it search for new knowledge that could have utility in the future? Case study work on the successful implementation of the initiatives will be abstracted and therefore available for future investigation and research.

## RESEARCH METHODOLOGY

Essentially the approach was that of a cross sectional case study (Yin 2003). During a workshop of a population of 25 individuals the data was collected by transcribing, recording, and photographing exhibits built up during group work.

The research question posed was: *what are the characteristics that give rise to the symbiotic learning behaviour in environments such as Access Space and the Zero Dollar lap top project?*

In order to identify these characteristics an inductive view of observation and data collection was initiated. To this end a series of focus groups was convened. The groups were given a series of open ended questions, which

they discussed for about 40 minutes. The recordings were transcribed and coded using the nVivo software. Underpinning this approach was that of Grounded Theory (Glaser & Strauss 1967).

For the Access Space project, the focus groups comprised members of Access Space, associates and the staff of the Zero Dollar Laptop project including the two founding members.

The focus groups were chaired with an open ended agenda which provided some structure. In the event, all the groups followed the broad agenda with very little, if any facilitation.

The coding initially produced free nodes. Work was then undertaken to consolidate the nodes resulting in nodal structures, in this case trees, which together with axial coding supported the subsequent theory generation.

Essentially, as mentioned above, this was an inductive approach. The researchers had little or no experience of the domain, and were relying on the data collected to speak for itself, and so allowed the researchers to arrive at defensible conclusions. This approach though is not without its critics.

The fundamental divergence of opinion in this area considers the role of prior theoretical knowledge and its effect on the practice of Grounded Theory. The ideal position as maintained by Glassier is that the codes and categories emerge directly from data. The opposing view espoused by Strauss was that even the act of observation was theory guided. Further, Strauss maintained that Grounded Theory was essentially that of asking questions "*every type of inquiry rests on the asking of effective questions*" (Strauss & Corbin 1990).

Given the almost overwhelming power of the argument of the theory neutral observation language (Johnson & Dubley 2000) it is difficult to see how Glassier can sustain his position however attractive in terms of the elegance and parsimony of the theory that results from this approach.

The nodes generated from the coding are provided in appendix one.

## CASE STUDIES: ACCESS SPACE

In this discussion the term *participants* is used to refer to individuals who wish to acquire knowledge of computing by building their own machines out of re-usable components. The word *staff* refers to people who play the role of instructor, mentor and guide to the participants. Access Space focuses on individuals who are under employed although some fully employed people do participate in activities. As such it is very much a social space where the staff mingle freely with the participants.

It should be noted that this mix of engaged and disengaged people with a variety of backgrounds, capacities, motivations or interests enriches the potential of the peer learning network.

Anyone can walk through the door at Access Space; there are no preconditions or entry requirements. The most important requirement is that there must be a desire to engage and come to terms with computing in its widest sense. It is important to recognise that such individuals do not know what they do not know. This is therefore a gamble. Some will be put off from walking through the door. The magnitude of the population put off in this way can never be known. What can be said of those who do have a confidence and drive to enter into the experience?

Upon arrival there is always a spontaneous welcome. This is part of the culture of the place. In fact it is a deliberate sociable intervention by staff, imitated and expanded by volunteers and participants.

A key methodology is to engage each participant by discovering *their* interests, priorities and agenda. Each participant is encouraged to pursue *their own* ICT projects rather than reluctantly following a set curriculum. Typically, drop outs exhibit passivity; they simply want to be supplied with hoops to jump through.

There is a policy of having artists/writers in residence. Therefore there is strong creative identity to the space. As a consequence there are roles that one would not expect to see in a computer science based organisation. This is congruent with the larger community to which Access Space belongs; the virtual community.



There is a deeply held view that it is more important to know "how it works" rather than "how to work it", to quote the CEO, James Wallbank. This is more significant than it might appear at first sight. Considerable emphasis is placed on the ability to solve problems. When an operation or an activity fails to produce the desired result, this is not immediately remedied by the staff even if they know the cause. Diagnosis of the cause is encouraged, but this is only possible if the participant knows how the system works.

This gives a great sense of achievement to the participant for the following reasons;

the problem has been identified;  
possible causes have been tested; and  
a demonstrable solution has been found.

This demonstrates the pragmatic theory of truth, although it is not mentioned specifically. Everything at Access Space is based on this principle and this is especially so when the problem is resolved by the group rather than by one individual. As the participants develop their skills, the range of hardware and software becomes more comprehensive and sophisticated. Due to the incremental nature of the learning process, the diagnostic and prognostic skills are developed at the same pace.

That such ordinary people can produce a working machine in several days is astonishing to those who have not witnessed the incremental development and the intensive nature of the learning process. Typically, a naive learner who has basic skills (literacy, numeracy and no specific difficulties) can rebuild, test, repair and install a computer in four or five two hour sessions.

The longevity of the initiative is only possible due to the eclectic nature of the funding bodies. As such, Access Space is vulnerable to cuts in funding. It is a tribute to James Wallbank, the CEO, whose commitment to this mission and its characteristics has impressed a wide variety of people with the viability and utility of Access Space. Access Space is a registered Charity. The management team lead funding bids and project work so supporters, potential supporters and customers are identified in house. It is also important to recognise that the diversity of funders is possible only because of the diversity of the benefits developed by this project.

The overall environment is very informal, unfinished, unpretentious and welcoming; drinks and printouts are provided on a 'pay what you can' basis. There is also a marked emphasis in their attitudes to education, as illustrated by the following quotes:

*"You have to consider the nature of the game in conventional education. They set up a tournament so that some students succeed... and of course some do not. They may do this as a means of control"*

Access Space staff member one

*"If you asked me what the model of teaching is here I'd say we haven't one. It is a self supporting environment where everyone has a voice. There is a massive range of educational competences here. So ideas are bounced around, and the staff bounces them back. And we treat each other with respect. No one is ignored"*

Access Space staff member two

The environment is also a social space. Hence the development of social and team working skills as a complement to the technological aspects of the experience that enhance the Intellectual Capital that is being created.

One of the key insights came from the CEO, who said:

*"We are developing ideas in a social context, as opposed to principles; this is not an explicit process".*

This statement tends to suggest that a lot of the learning is highly tacit, as has been said, "you know more than you can say" (Polyani 1966).

Although this is anecdotal evidence, it does lend some support for the SECI spiral as an approximation to the model of learning.



In view of the success of their approach there are plans to expand. Firstly into the area of computer mediated fabrication, the so called Fab Lab, and secondly, taking advantage of the South Yorkshire Digital Region, the concepts of networking with their counterparts in London and the Netherlands. This would enable real time video conferencing. They believe this will aid the diffusion of their method of working.

There is also an emotional commitment (Wenger 2002) that is felt by all participants. Due to the feeling of belonging, and the notion that the super ordinate goal is that of the development of the individual, involving as Wenger says the head, the heart, and the hand. This may be one of the few times in their lives that belonging, becoming competent and having realistic hopes have all been experienced together.

Leaving the community can be a painful and for some a traumatic experience. Therefore some continue to return and further develop their computing skills in a supportive environment. This is encouraging to those continuing students who find the initial work difficult and challenging.

## CASE STUDY: ZERO DOLLAR LAP TOP

The previous case study has been running for a decade. The case study now described was an intervention with an extremely vulnerable group. The two individuals who ran the initiative had significant exposure to the approach adopted by Access Space. It is important to note that all the participants started the project together at the same time.

The locus of the activity of this project was a charity, St Mungo's, which is a Catholic Charity for homeless people, living on the streets of London. Although a Catholic charity, it serves clients of all faiths and none. In terms of the society in the UK these people exhibit extreme poverty. They are not however starving. This is another factor as there was not a common faith based culture between the participants, or the staff and the participants. None of the staff were Catholic.

For such people, an initiative like the Zero Dollar Laptop is a 'last chance' episode. They have exhausted virtually all the opportunities available to them to improve their life and join mainstream society.

## CASE STUDIES : BRAZIL

The organisation Metareciclagem Network has 97 centres, whilst Pontos da Cultura has over 600 sites. These facilities vary from fully functional workshops such as Access Space to a few Personal Computers in a school used by the local community. Nevertheless the scale of the operation is impressive. When the major driver behind the countries initiative, Felipe Fonseca was asked what had led to this success he is said to have replied "I can tell you the answer but if I do, you will not understand it. In Brazil we can make so much more progress than you because we are disorganised".

Clearly, there is a rich area of expertise to be tapped here, and this information is included to provide a balance to the detailed exposition of Access Space and to indicate what is possible when one applies the concepts under discussion to an entire nation rather than being restricted to a region within a country.

## DISCUSSION

The cross sectional case studies have identified successful interventions which have developed the participants' intellectual capital and increased their self confidence and self respect. The model of the re-use rather than the scrapping of components which are then used to build fully operational computer systems in a parsimonious environment is well worth considering.

What is evident is that cultural and social factors have a significant impact on the success of the project. In addition the management of a large initiative such as this will also present challenges. Strategies also have to be robust, that is, capable of being successful in a variety of circumstances.

The first stage was that of 'scanning' (Boisot 1999). That is, to scan opportunistically at intersections as proposed by Johansson *ibid*. The context of this paper is to take the vibrant economic activity of the Indian IT industry and build a strategic conduit to enable the trickledown of wealth to occur.

This process is not intended to be the substitution of one low paid job for another. It is to raise the marginal level of reward significantly for the under privileged population as well as to build up their social and intellectual capital. Such social capital, as its name implies, bestows upon those who own it a premium price in the market. Ownership means what it says, once possessed it can never be taken away. This provides both dignity and a measure of insulation against market conditions for those fortunate enough to own it.

The second point of this paper is 'problem solving' (Boisot 1999) to show that it is indeed possible to achieve such transformations and fulfil such aspirations.

Finally at stage three is the concept of 'abstraction' (Boisot 1999). This is the proposition that the lessons described in the case studies can be applied in an Indian context. This is the most difficult. The work presented here emphasises how the proposed initiative is capable of engaging with the local and national economy.

If the propositions propounded in this paper are to be a success, the training however it is experienced, administrated or taught assumes that the participants can assimilate the wide spectrum of content that the proposed programme contains.

The critical success factors underpinning this are that the participants can learn the practical skills to build a computer as this is the foundation of the whole programme. They should be able to do this in a social setting and in a realistic time frame. So it is assumed that potential candidates possess the necessary attributes when they enter the programme. John Dewey recognised this characteristic over one hundred years ago.

*Training in short must fall back on the prior and independent existence of natural powers; it is concerned with their proper direction, not with creating them* (Dewey 1997).

The proposal at this stage is that the most appropriate framework for understanding the participants is the SECI spiral (Nonaka *et al* 2000) and that of the instructors, the Boisot Social Learning Cycle (Boisot 1999). The reason for this is that the demands made on the staff instructors are greater because a more comprehensive level of reflexivity is required than that of the participants (Holland and Holland 1999).

## IMPLEMENTATION CHARACTERISTICS

The foregoing exposition of transferring a successful intervention in the case study environment to one in a significantly different culture, is not without difficulties. These difficulties if not overcome could prove fatal to the initiative.

Early in the implementation phase, a proof of concept will need to be established. If this cannot be achieved, then, in line with conventional management practice the initiative would at that point be terminated.

As discussed earlier, it may be found necessary to allow various centres a certain degree of freedom in the manner that they are run, the pace of the development of the participants and the nature of the relationship of the staff to the participants.

However there is a dilemma, as the argument has been propounded that whilst there is no one unique solution, each centre has to optimise its own performance. This poses the danger of breaking the law of requisite variety (Ashby 1963) as only variety can cope with variety so the whole project would consume more valuable resources than it would ultimately generate. This is a serious criticism.

In many ways, the whole concept of the transformation of inert elements into a complex and sophisticated device is easier for those who embrace the culture of the Indian subcontinent. To support this proposition it is useful to appreciate the language used in the context under discussion. To paraphrase Ludwig Wittgenstein "*The limit of my language is the limit of my world*" (Wittgenstein Tractatus 7).

The Hindi word *Jugaard*, encapsulates the concept described here in English so awkwardly. In this sense, the developed world has much to learn and the language demonstrates this. Instead of a passive use of technology which is then discarded, the significance of *Jugaard* is that with human ingenuity, technological artefacts can be reused, reworked, enhanced but *never* just thrown away.

As a strategy, it has the element of planning (Mintzberg 2009), for example the notion of the proof of concept. The proposition is: *can the case studies and theories propounded in this paper actually be reified in the subcontinent?* Secondly it has the characteristic of position (Mintzberg 2008). It is generating a sector of the workforce that will become necessary as obsolete and second hand computer hardware is diffused away from the main urban centres. Thirdly is the notion of ploy (Mintzberg 2008). Although it might appear that the individuals are receiving a 'free' laptop, the strategic super ordinate goal is the development of intellectual capital and the provision of a role model for other members of society. Fourthly it has the action of pattern. As with *Juggaard*, something familiar to the Indian community is translated into a technological setting, and finally it has the image of perspective. It is intersectional, that is, it is a vision of the technological push that is a global phenomenon, and which seeks to provide a workforce to supplement not supplant those who have a college or University education.

## FURTHER RESEARCH

Without doubt additional research is necessary, and it would be most fruitful to build a community of interested parties to work in a collaborative manner.

It is important to note that whilst the development of the central ideas in this paper are being adapted to the Indian context, many of the advances will diffuse outwards from the Indian epicentre back to the less developed communities in the UK and other parts of the world.

The selection, training and support of the staff tutors will also require attention. It may be possible for a secondment from a computer hardware supplier, or a government support department to be arranged. All such work should be monitored so that rational developmental decisions can be taken. Secondly a trial could be run in an area supported by a body of interested parties to include local businessmen in both the product and service sectors, academics, educationalists and government officials.

Finally this effect is synergistic. It seeks to build on the success of such organisations as the Indian Institutes of Management and the Main Corporations. It is empowered by the humanitarian contribution of these institutions. To the extent that it exceeds these characteristics, it is intersectional.

## CONCLUSION

This paper has addressed two strategic teleological trajectories to strategy central to the development of India. One is to sustain and enhance the wealth creating economic initiatives to drive forward the development of the nation. The other is to provide a path for the scheduled classes to leave the world of poverty and enter a stage of enlightenment and genuine self actualisation.

For the less privileged in India, as in any society, including the UK there are poverty traps. One of the most significant contributions to breaking this was by Muhammad Yunus, who developed and introduced the concept of microcredit. So impressed was the world community that in 2006 he was awarded the Nobel Peace Prize. In the awarding citation the Nobel committee expressed the view that his contribution had been “an important liberating force” (Boudreaux 2008).

However as has been pointed out, many businesses that exist in less privileged communities operate with low skill and low productivity and so the margins cannot lift those so engaged out of poverty.

To address this what is required is a forum where potential solutions to the low margin, low productivity question can be identified and debated so that the situation can be improved. This work seeks to do just this, and if the proposition is felt to be viable then a collection of individuals, with rich experiences could be formed to discuss and refine the ideas which have only been sketched in outline in this paper.

The idea of local centres which can develop the local population yet within an overall strategy that is empowered and directed by central agencies has congruence with the great contribution of Mohammad Yunus and the anonymous but no less significant individuals who implemented his thinking.

The digital divide is a feature of all societies. Although 25 % of the world is connected to the internet, even in the United Kingdom, the focus of the research in my own University, Sheffield Hallam, whole communities are digitally excluded. The discussion at the workshop held in Sheffield suggested that such a project involving the repair and re assembly of computers in a supportive environment could be a significant contribution to alleviate under achievement in Europe.

The Strategic Management Forum, therefore, could offer the possibility of reciprocal learning from the meritorious and impressive work which has already been demonstrated in the Subcontinent.

Furthermore, the thesis of this paper is to provide the real opportunities to workers in the field of IT who can work effectively in the configuration, maintenance and support of machines. This may be at a relatively low level, and maybe not at the highest level of remuneration. But compared to the life chances without the intervention which forms the basis of this thesis, this progress would not be possible.

This paper outlines one possible intervention towards addressing the development of a less privileged population. To this end, it supports the super ordinate goal of the Indian Nation, something all Nations of the free world should embrace; and that is Unity in Diversity.

## RESEARCH FINDINGS

The following table summaries the nodes and their relationships. A node represents objects such as people being studied, concepts, places, mental states. Nodes can be given values or attributes according to the features that they represent. They can be arranged in structures such as tree or sets. [Frazer 2000:196]

No	NODE	COMMENTS
1	Dignity of the individual	Intellectual capital subsumes social capital
2	Those that are capable of knowledge should be given the opportunity to learn.	Note the comment of Dewey with regard to training. What it can do and what it cannot do.
3	Parsimony	Use of abstraction both in hardware and software. Understand components, the significance is the way they are configured
4	Role of tacit knowledge	You know more than you can say [Polyani1966].
5	Social Learning	This developed incrementally. Many participants found this challenging at first. Other members realised this and accommodated newcomers.
6	Creativity	This was a significant issue. Many of the staff were artists and musicians before they had gained their technical knowledge. And their approach has become a driver attraction and helps retention of participants.
7	Momentum	Potential tension between cohorts or individual starters, has to be channelled in a positive way (see later comment on the development of social skills).
8	Avoid the educational Tournament	They do not want to be perceived as ranking one person over another.  Each person is valued for themselves.
9	Diversity	The staff never appear upset or disconcerted by unusual behaviour.
10	How it works, not how to work it	Technology makes you stupid at the level of the user. What is required is an understanding of the underlying technology
11	Each group is different; we are sensitive to this.	This is why people return. They belong to the group. It provides them with a status, a future and a caring community they cannot find anywhere else.
12	Being an instructor is demanding technically and emotionally	Participants translate their feelings of inadequacy to the work in the facility. Staff, by managing

		the learning effectively can allow the participant to perceive their progress. This success therefore increases their self worth.
13	Staff have to instil 'responsible behaviour	This is difficult and demanding. Whilst developing the individual, standards have to be set. Timekeeping is a particular challenge particularly when a participant is new and starts to engage in group activity.

#### ZERO DOLLAR LAP TOP

1	Participants were almost destitute	Quite different from individuals who were not affluent, but who had a fixed abode.
2	Participants exhibited more than one index of social exclusion	The course was in some cases the only positive aspect in their life.
3	Participants had drive	After many negative experiences, this was a chance to change life styles.
4	The staff had a creative background not a computer science focus, However they had extensive practical skills by hands on engagement themselves	Although the programme started with a strict technical agenda, the horizon of the participants was widened as possibilities were explored.
5	The carrot was the laptop itself	The participants did not realise until later the deep learning that had taken place. The laptop provided a tangible evidence of their progress and development.
7	The team had to recognise the difference between appearance and reality	The Lap Top was the centre of attention, the learning included problem solving and social skills.
8	The approach of the staff was highly tacit	It was difficult if not impossible to write down they 'coped' with the demands of the day.
9	The super ordinate goal was always behind decisions made.	The coherence theory of truth is a central value that cannot be compromised.

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