

AN INTERNATIONAL MODEL FOR INDUSTRY-ACADEMIC PARTNERSHIP IN ENGINEERING MANAGEMENT EDUCATION

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ABSTRACT

The University of Warwick has recently been declared to be the leading University in Europe in terms of its links with industry, an accolade due in no small measure to the contribution of its Manufacturing Group, and in particular the Group's Engineering Business Management Training programmes and the work of its Advanced Technology Centre.

This paper will outline the experience of the Group in the development of a wide range of post-graduate and post-experience training programmes both in the UK and overseas (particularly in South and South-East Asia).

The Group now has over 300 partner companies world-wide including such world famous names as Rolls-Royce, British Airways, Rover Group, ICI, Jaguar, Computervision, British Aerospace, Digital, Lucas Industries, Sun Microsystems, Raychem, Motorola, Dow Chemical... etc.

1.0 INTRODUCTION :

Some 15 to 20 years ago, engineering and particularly manufacturing engineering in the UK had become synonymous with inefficiency, obsolescence, decline, complacency, and poor industrial relations : so much so that a new generic term was coined, namely "The British Disease". As a result, it became almost impossible to recruit well-qualified graduates in manufacturing engineering or even to persuade school leavers that engineering of any type represented a worthwhile, interest-

ing and challenging career.

Added to that was the divide between the elite University establishments and industry which was more of deep gulf with two seldom talking to each other, let alone working together. Manufacturers considered universities to be out of touch with reality, university-based research to be commercially irrelevant and graduates to have no real understanding of real world and few if any, practical competences. On the other hand academics were seen to be only interested in adding to their collection of

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pure research paper-the criteria upon which promotion was judged-and seeing little benefit in becoming associated with the often short term, practical and high pressure requirement of industry.

Fortunately, in the late 1970' s it was recognised that the only way to achieve long term success of the UK economy was to create a successful and stable wealth creating (manufacturing) capability underpinned by a higher education system with close working relationship and common aims. Accordingly, a number of initiatives were introduced to improve education and training standards, encourage recruitment to engineering courses and the engineering profession generally and to stimulate industry academic links. Perhaps the most notable of the latter was the introduction of the UK Teaching Company Scheme which encourages company based research and development programmes supervised jointly by industry and University staff. It is regarded by many as the most successful government funded industrially related, initiative ever introduced and remains both well supported and effective today.

The University of Warwick as one of the newer Universities at that time, with perhaps less in built prejudice or bureaucracy and set up specifically to forge close relationship with local industry, was well-placed to react positively to the new initiatives and to embrace the collaborative concept in all aspects of its work.

The Manufacturing Group was therefore formed in 1980 under the leadership of professor S. K. Bhattacharyya and with the close support of three ma-

yor UK companies; Rolls-Royce, Lucas Industries and the Rover Group (then British Leyland). From that small nucleus of partner organisations the Group has now expanded with over 300 partner companies world-wide and with approximately 4000 participants on its postgraduate and post-experience training programmes annually.

Partnership and collaboration remain the hallmark of the Group's activities be they training initiatives or research and development programmes. Particular care is exercised that it is not just a case of convenient lip service to the word "partnership". Partnership at Warwick are full and effective collaborations from which both sides, i.e. industry and the University, benefit as do the participants on the training programmes.

The effectiveness of the programme is demonstrated by the numbers of partners generated world-wide, the size of the training programmes (with over 1000 M.Sc. students enrolled annually) and the demand to transport the programmes overseas particularly to the Asia Pacific region. The Group now has major centres in Hong Kong, Malaysia, Thailand, India and China as well as in six cities in Europe.

2.0 PARTNERSHIP

At this point it is appropriate to dwell and consider what is meant by partnership in the Warwick context. How does it operate? How does it provide of benefit to collaborating companies? How are the partnerships forged and how they sustained over time, i.e. what is the secret of success?

It may be that the answer to the latter is an indefinable magic ingredient that exists in Warwick; possibly linked to the spark that comes from a Head of Group who is an "entrepreneur par excellence", a charismatic figure of unbounded energy and enthusiasm. Add to that a handpicked group of staff of high quality all with long industrial experience and all working harmoniously together without the constraints of a bureaucratic hierarchy and you may be coming close to a solution. Top that with a group of industrialists keen to become leading global players in their sectors, placing people and skill development as a high priority, ready to undertake radical change where necessary and challenge their own systems, procedures and management and you have the principal ingredients for success.

Of course there are structures and policies and practices which are important once the environment and the will to succeed have been established. The starting point, however, is full Board-level commitment on the part of companies and the (often unwritten) equal commitment by the University to fulfill its obligations within what has to be a commercial approach.

The Warwick Manufacturing Group now operates as a business and sees no shame in declaring so. Of course, as one of the leading research Universities in the UK, care has to be taken to protect academic integrity and values and continual attention is paid to quality control with both internal and external audits run on a regular basis.

"Partnership" to Warwick means the full involvement of industry in the

design, development, delivery and monitoring of its programmes. In training terms that means jointly the setting of strategic directions, (i.e. which programmes to run) the content of the courses and the specific content of each module; the style of delivery and mode of attendance, the review of modules on a bi-annual basis, and shared delivery. It is normal, for example, for no more than 50% of any module to be delivered by Warwick staff; the remainder will be lectures or case studies presented by senior industrialists from partner companies.

Joint steering committees oversee the operation of each programme and industrialists play a key role in supervision of company - based projects in all the programmes and in post - module review mechanisms which judge the relevance and effectiveness of every module, be it in plant or at the University.

Practically all the programmes are part-time, modular in nature with generally one week or half-week residential attendance at the Group's own residential facility - the Arden House Executive Post-Experience Centre. Selection of modules is then undertaken by participants in consultation with both University staff and their senior managers from industry to ensure that both individual and company staff development objectives are satisfied.

The intensive study mode associated with residential attendance is a key factor in the success of the programmes with substantial benefit gained from the formal and informal interchange between participants from different companies and different sectors fully "immersed" in their topic for the duration of their module.

If the role of the warwick manufacturing Group were to be constrained to one short sentence then it would probably be "to contribute to the business improvement of its partner companies", i. e. to benefits its "bottom line".

This is achieved by, for example, supporting companies to:

- become globally competitive and to asses that capability by appropriate benchmarking.
- align management to unified aims.

- differentiate accurately their products, processes and capabilities.
- elininat or reduce departmental and barriers and move from functional to business focused operations.
- adopt a continuous improvement philosophy.
- incorporate international best practice.
- better meet the challenges of the business, environmental, social and technical change.

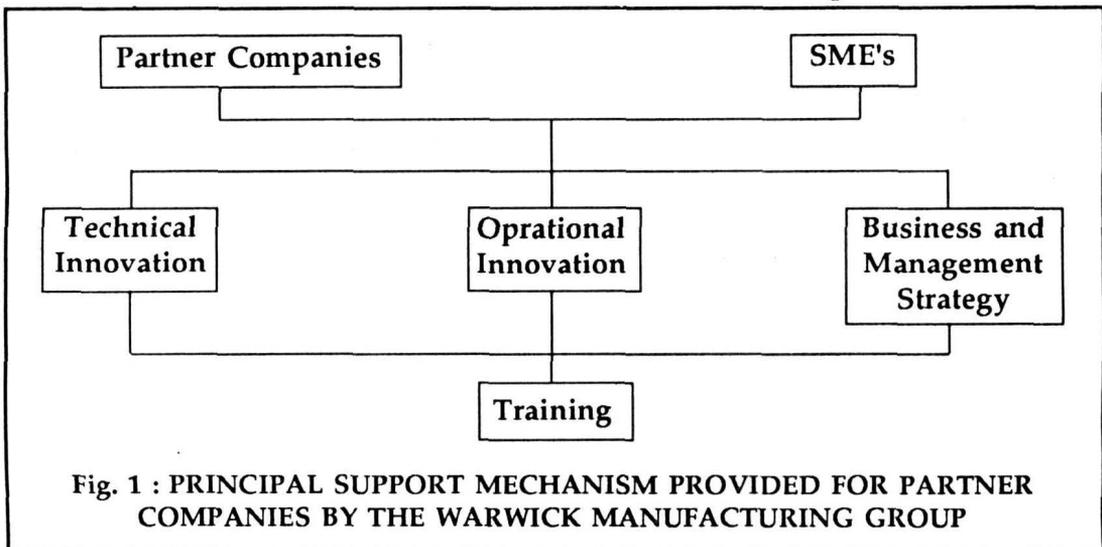


Fig. 1 : PRINCIPAL SUPPORT MECHANISM PROVIDED FOR PARTNER COMPANIES BY THE WARWICK MANUFACTURING GROUP

The methods of achievements are :

- Working in true partnership with companies.
- being flexible and responsive to partner company needs.
- establishing joint objectives.
- working with , not for industry.
- provision of total package of support mechanisms including:
 - training
 - networking
 - advisory service

- transfer of best practice
- awareness programmes
- executive action programmes
- technology transfer
- collaborative R and D

The support mechanisms are best conveyed by Fig. 1 which shows the four key strands of support to both major (large) partner companies and wide group of small and medium size enterprises who also utilise the Group's services.

R and D support divides itself into technological and operational innovation with strategic management issues closely related to latter. These three are then supported by the massive training programme which will be outlined below.

The benefits of the partnership approach to partner companies are :

- a sense of ownership
- cost-effective, quality oriented, customer focussed programmes
- direct relevance, particularly of post-module assignment and project work, to company activities and requirements
- high quality staff development programme for managers and professionals with minimum disruption to work schedules.
- continually reviewed and up-dated, industrially focussed programme.
- access to international best practice.
- cross- company fertilisation of ideas and experiences.

To the participants of the programmes the benefits are :

- flexible delivery mode with minimal work interference and high degree of participant choice.
- high academic quality but industrially focussed programme.
- directly supportive of present and future work activity.
- integrated, personal and vocational development programme with high degree of interdisciplinarity.
- substantial exposure to current trends and international best practice.

- cross- company fertilisation via both fellow participants and guest lectures.
- close relationship and access to massive University R and D and technology transfer programme.
- a post- graduate award from one of the country's leading Universities.

3.0 THE PROGRAMMES:

The principal programmes offered by the Warwick Manufacturing Group both in the UK and overseas are as follows :

3.1 Post Experience and Post Graduate Programmes

Principle areas :

- Engineering Business Management
- Process Business Management

Embracing Awards in :

- Engineering Business Management
- Manufacturing Systems Engineering
- I. T. for Manufacture
- Process Business Management
- Strategic Manufacturing Management
- Design Strategy and Management etc.

3.2 Award Bearing Post-experience Programmes

Engineering Doctorate (Eng.D)
'Masters Programme-'IGDS' (M.Sc)
'Masters' Programme by research (M.Sc)
Diploma Programme-'IMDS' (Pe.D)
Certificate Programme-'IMDS' (Pe.C)
Partnership Degree (B.Sc/B.Eng)

3.3 Other Non-Award Bearing Post-experience Programmes

- Chief Executive Action and Awareness Programmes
- Business Strategy Brainstorming
- Senior Management Programmes
- World Class Manufacturing
- Business Process Re-engineering
- Total Quality - Countinous Improvement, etc.

3.4 Tailored Programmes

- Engineering for Non-Engineers
- Advanced Quality Systems
- Supply Chain Logistics
- Advanced Business Improvement

3.5 Chief Executive/Senior Mangement Programmes

- World Class Manufacturing
- Business Process Re-Engineering
- Executive Action Programme
- Business Strategy Brainstorming

3.6 Strategic Educational Alliances

Providing total "turn key" solution to the complete HRD requirements of particular companies.

3.7 Overseas Programmes

3.7.1 Full Award- Bearing Engineering Business Management Programmes.

<u>Country</u>	<u>Partner Organisation</u>
Hongkong	Hong -Kong Polytechnic University
Malaysia	University of Technology
Malaysia	(Kuala Lumpur & Bahru)
Johor	
Thailand	Chulalongkorn University Bangkok
India	Confederation of Indian Industry, Calcutta.

3.7.2 Overseas Programmes-Other Training Initiatives.

<u>Country</u>	<u>Partner Organisation</u>
China	South-East University, Nanjing (+ODA)
China/ Hong Kong/ Taiwan/	Chiang Foundation, Hong Kong(+ CAIEP)
India	Indian Polytechnics (+ British Council)
Europe	Computervision Ltd. (Milan, Paris, Munich)
Asia	Computervision Ltd.

South Africa Pretoria University

3.8 Post-experience Education Programmes Special Overseas support

- Strategic Manufacturing Management
- Design Strategy & Management
- Computer Integrated Design and Manufacture

3.9 SME Support

Support mechanisms for SME's are indicated in Fig. 3, the two principle elements being

- a manufacturing Excellence Initiative- covering a range of training, advisory, consultancy and other support services.
- Breakthrough technologies-providing access through "Industrial Club" to new technological innovations which give a ramp change in capability to companies (e.g. rapid prototyping).

Up to 50% funding support is available through European Commission sources for any service provided and over the last 18 months over 100 compa-

nies have participated in this initiative.

The whole training provision is embraced in a generic title of Integrated Engineering Business Management Programme with 'integrated' referring to the integration in an interdisciplinary way of career development and relevant vocational education. Fig. 2 shows the key elements covered by approx. 100 modules which are now available and various modes of attendance and study methods which are used.

4.0 PROGRAMME CONTENT AND PHILOSOPHIES THE BASIC INGREDIENTS

The content of the various courses and programmes outlined above can be relatively easily identified from their title or from the associated list of modules contained therein. But what are the basic fundamental issues which are addressed and which must be faced by any company seeking to change its competitive position?

The following are some of the key questions which need to be answered by companies in what is referred to by the Warwick Manufacturing Group as an "Alignment Process".

(a) Mission

- What is the company's vision of what it wants to be?
- What external factors influence that vision and the company direction.
- What strategic objectives and milestones should be set?

(b) Goals

- What is the economic model that must be achieved?

(c) Segmentation

- Which customer groups should be targeted?
- What are their needs?
- What will be their needs in 5 years time?

(d) Positioning

- What position should be adopted to develop competitive advantage in the total offering to be provided to the customer?

(e) Market mix

- What specific products, services, distribution channels, pricing and promotion strategies will be pursued?

(f) Resource Development

- What are the critical success factors?
- Are existing manufacturing systems appropriate?
- What competencies does the company have?
- What competencies does the company need to develop?
- What additional other resources are required?

(g) Operations

- Are present logistics and operations management systems effective?
- How is the product supply monitored and controlled?

A study of the above will take a company through the various stages of knowledge acquisition, business planning, people development, product creation and product supply, and will identify those areas of deficiency which

may be addressed by the type of programmes offered by Warwick or other providers.

It has been practice of many of Warwick's partner companies to involve the Manufacturing Group in alignment process discussions from the onset thus facilitating the development of a deep and frank partnership embracing not only training but R and D, operational and technological innovation, technology transfer and the many other less well-defined benefits of a full collaboration.

Other key areas which can be addressed in a similar way to assist the business assessment and development of strategy are :

(h) Product differentiation- the key elements

Super value goods - "fitness for purpose"

Consumer goods - Value for money

Fashion goods - timeliness

Commodities - price

(j) Critical business processes

Super value goods - product creation and knowledge acquisition

Consumer goods - product supply and flexibility

Fashion goods - product creation and market scanning

Commodities - product supply and cost.

(j) Critical competencies

Super value goods - product design and development and IT

Consumer goods - time to market and flexible manufacturing

Fashion goods - market vision and time to market

commodities - productivity and logistics

(I) Focus Shift

Are substantial advantages to be gained by shifting focus from high to low product complexity or from high to low market uncertainty or the reverse ? There are spectacular examples of companies who have achieved success with such a shift (in either direction) e.g.

- watches moving to low complexity
- light bulbs moving to higher quality / price products
- metal windows replaced by mass produced p.v.c.

(m) Agile manufacturing

What are the fundamental capabilities for an organisation to be termed an agile manufacturer able to respond rapidly and flexibility to market demand ? Some suggestions would be :

- a well understood mission backed by strong leadership
- a well understood and enunciated values
- an innovative culture
- a well educated work force
- exploitation of all the intelligence of all the people for all of the time
- continuous Improvement Philosophy
- working as a team
- a strong network
- successful technology management
- development of multi-technology solutions.

- exploitation of information technology
- rapid response

Programmes offered by Warwick seek to address question such as these as well as many other issues through its flexible, modular approach using modules of varying depth, breadth, duration and level all developed in close partnership with industry. A business approach with a mutual interest in "the bottom line" is the key driver.

Typical trends for world class operation today are :

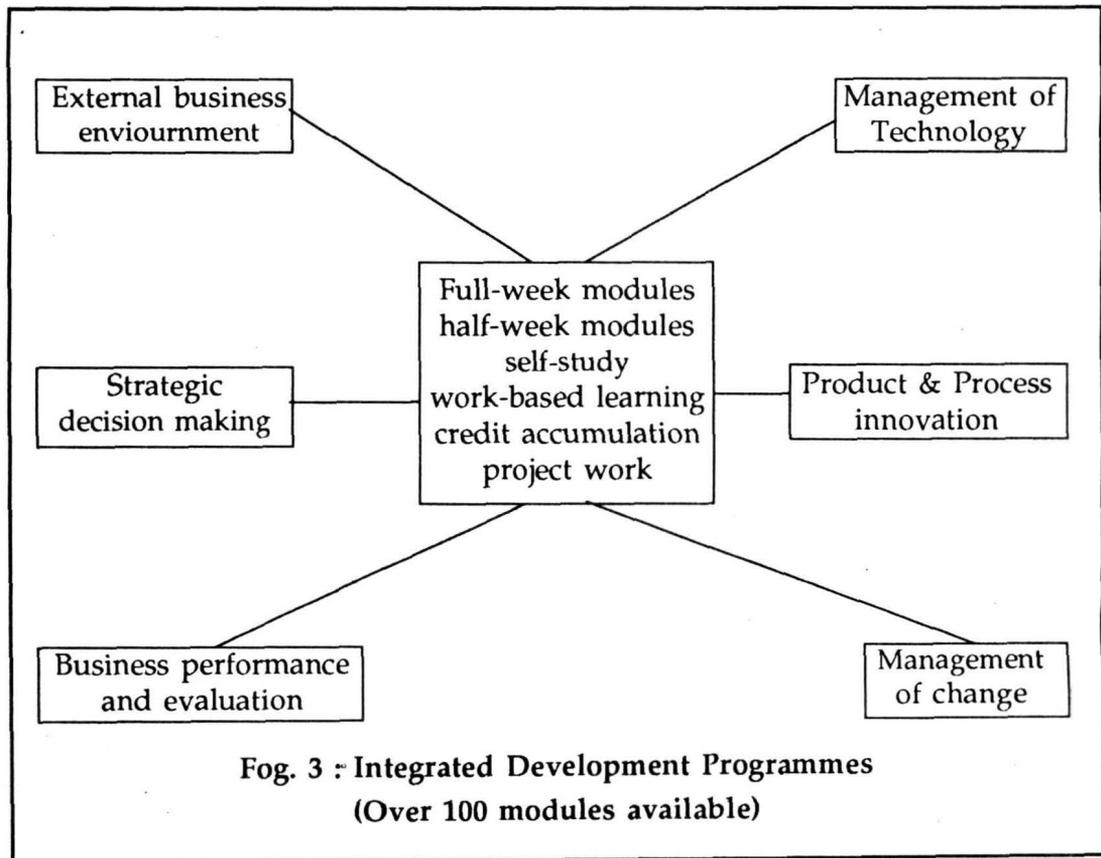
- Total quality and continuous

improvement

- Strategic business units
- Cost reduction and waste minimisation
- Time compression
- Agile enterprises

These trends require, and cannot be achieved without :

- reduced layers of delegation
- empowerment
- teamwork
- process focus
- flexibility and responsiveness
- integration of people and technology



**Fig. 3 : Integrated Development Programmes
(Over 100 modules available)**

At the heart of all these is the inherent need for a well - structured and well resourced staff development programme covering all levels of company personnel from top management to shop floor Programmes need to be well-defined, flexible, challenging, and, above all, relevant to present and future needs of the organisation. Close partnership between supplier and customer ensures that these requirements are satisfied not only at inception but on a continuously renewed basis.

5.0 INTERNATIONAL PROGRAMMES

The title of this paper claims that the work described represents a useful model for international training in Engineering Business Management. This claim is supported by the extent of the training activities of the Warwick Manufacturing Group listed in para 3 above and by the requests for further expansion of that programme world-wide. Discussions are already in hand for the development of collaborative ventures in Canada, South Africa, Holland, Indonesia, Singapore, China and Taiwan and the Group has just opened 6 new centres in Europe, in Paris, Munich, Milan, Wiesbaden, Madrid and Stockholm. Although the latter initially are concerned with computer software training on behalf of one of the Group's principal partners, Computervision, the newly introduced "Computervision European University" partnership with Warwick will give access to the full range of the Group's training programmes.

The question naturally arises as to why should a University such as Warwick extend its activities in such a

way overseas. Should it not concentrate in its home base and support of its local partners ? As with all things there are "pro's" and "con's" but we believe the balance of the following benefits far outweigh any concerns.

- Increased international dimension for the Group and the University
- Increase visibility for the University in recruitment terms
- Enhanced staff development opportunities in dynamic and rapidly growing new economies
- Creation of a network for staff, student and technology exchange
- Facilitation of transfer (in and out) of best practice
- Enhanced links for UK business and industry
- Provision of local UK based training for UK companies operating overseas
- Injection of British influence on industrial strategy development overseas

Partner companies clearly see the benefits of the enhanced international dimension of Warwick and the associated access to international best practice and are fully supportive of the activities.

There should be little doubt that there are problems associated with such an extensive overseas operation and the weak should consider very carefully before venturing forth. The logistics, complexities of staffing and other resource support are immense and substantial efforts are required to 'localise' all material delivered so that it is relevant to the environment within which the programmes are offered. It would be futile to simply seek to transfer existing

modules, without change, to other countries with different business and social environments, laws, cultures and practices, A principal feature of Warwick's work overseas is the care which is taken to ensure the relevance of its programmes to local industry in the region served.

Once again the principle of partnership is applied to its fullest possible extent. Collaborations are set up - usually but not exclusively - with key local Universities who play a full partner role in setting up and delivering the localisation of all modules, with local "module coordinators" (pretrained at Warwick) appointed for each module offered. They also assist in general administration and in the supervision of project activity in partner companies.

An expansion in Hong-Kong from 60 M.Sc. industrial participants in 1990 to over 550 in 1995 surely speaks for itself in terms of the success of such a partnership in this case in the Hong-Kong Polytechnic University. A similar rate of growth is expected in the programmes commenced this year in Malaysia, Thailand and India.

6.0 THE INDIA PROGRAMME

October 1995 saw the start of novel, exciting and challenging new overseas initiative for the Group when the model described above was launched in Calcutta. For the first time the Group's selected partners were not a key University but the prestigious Confederation of Indian Industry. As part of its celebration of its Centenary Year, the CII has decided to build a new Centre of Excellence in each of its four regions, North,

South, East and West. The Centre in the Eastern Region at Calcutta, will be focussed on Human Resource Development and the University of Warwick has been honoured to be invited to be the key partner in provision of manufacturing, engineering and engineering - related business management training within the new centre.

As a result, the M.Sc. level Integrated Graduate Development Scheme (IGDS) has been launched with an initial intake of 60 participant following an initial programme of 7 modules, namely

1. Manufacturing Strategy
2. Logistics and Operations Management
3. Human Factors in Industry
4. Applied Statistical Methods
5. Financial Analysis and Control Systems
6. Information Systems Strategy
7. Quality Management and Techniques

A Steering Committee has been set up for the Centre and for the programme consisting of senior executives from CII member companies, other leading industrialists and representatives from Warwick and from Indian academic. The committee will decide on the programme to be followed in future years as the scheme expands and will identify those areas in which particular "localisation" is required including the development of new India specific modules.

Whilst the programme is centred in Calcutta it is nevertheless intended as a national provision for industry throughout India. Accordingly, the new Centre will include residential facilities similar

to those at Warwick to enable the intensive full-week module delivery mode to be effected.

Initially the programme offered will have multi-company participation but consideration will be given to specially tailored programmes to meet individual company's needs if demand warrants it.

It is anticipated that the demand for the programme will be very high and that registration levels will soon reach those experienced in Hong-Kong and quoted above. Experience there has shown that initiatives of this type give a **substantial** impetus to industrial development and to the enhancement of global competitiveness of participating companies.

However, participation in such programmes will not in itself be sufficient without the full commitment of top management to a radical assessment of its business strategy, its manufacturing and operational systems and its human, physical and financial resource management methods. If that is done with flexibility and realism the future for manufacturing industry in India looks extremely bright.

No one can doubt the extent of the • sometimes latent, intellectual, and entrepreneurial capability of the Indian nation. With the right technical and managerial education, appropriate government support and a will to compete. The sleeping giant will surely arise.

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