HUMAN RESOURCE DEVELOPMENT IN WELDING TECHNOLOGY ISSUES AND STRATEGIES FOR THE NEXT DECADE

by
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INTRODUCTION

It is a great honour and a privilege to be invited to deliver the Sir L. P. Misra Memorial Lecture in this international gathering of fellow welding technologists. In the past, distinguished welding experts had delivered this prestigious lecture which has been dedicated to the memory of Sir L. P. Misra, an eminent welding engineer and a visionary of our country. He was deeply interested in the development of welding technology. He had realised the need for a specialised professional society in the area of welding for dissemination of knowledge and furthering the cause of national and international brotherhood among the welding fraternity. He was the Chairman of the Indian branch of the Welding Institute, U. K. He had also sown the seeds of to-day's Indian Institute of Welding (IIW) with a membership of over 3600. I pay my regards to this great soul but for whose untiring efforts and foresightedness, the IIW would not have possibly seen the light of the day.

We are on the verge of entering with great hopes into the twenty-first century, a new millennium. Welding is a very versatile and almost an indispensable method of fabrication and repair of structures and components. It is an interconnection technology known to the civilization since time immemorial. Forge welding, brazing and soldering found applications several thousands of years ago for fabrication of swords, cannons, cross bows, ornaments, etc. However, majority of material joining processes is comparatively new and developed during the present century. During the last 3 to 4 decades, the pace of developments in the fields of science and technology has been very fast. This has had its effect on welding as well. MIG welding of forties and fifties reappeared during the eighties as synergic pulsed current MIG welding having remarkable capabilities. During the last decade, sensor-based welding systems were commercialised. Some newer processes such as friction stir or electroslag strip welding, for example, are found to possess great potential. In short, knowledge of the characteristics of the welding processes and their interaction with those of the material and the welded structure are being fully exploited to ensure high speed, defect-free weld, utmost reliability, user friendliness and ease of repeatability.

Welding has grown to be a highly interdisciplinary subject. Persons with knowledge in engineering disciplines such as mechanical, electrical, electronics and computer have contributed in the development of various processes and equipment, whereas physicists, metallurgists, chemists, chemical engineers have helped in the development of welding consumables and in the understanding of the welding metallurgy.

Selection of welding consumable, welding process and process parameters can now be appropriately done in many cases which was not possible a decade or two ago.

The latest trend in this area is: (a) simulation of weld thermal history to enable prediction of weldment properties, and (b) assessment of residual life of welded structures. However, exploitation of the vast capa-

bilities of the latest developments calls for adequate training of the human resources manning such systems.

Welding is a manufacturing process having a large dependence on the interactions between man, machine and material. In the present age, both machine and material have become highly sophisticated. To cope up with this sophistication, the human manpower needs to be appropriately greared up.

Human resource development (HRD) plays a key role in the economic development of an organisation (Fig. 1). Irrespective of the character of the organisation, HRD can provide an edge for its growth. It is easy to recognise that human beings are an integral part of complex systems, and it is easy to overlook that humans themselves are complex systems. There are many things they can do, and there are also many things they cannot do. An efficiently operating human-machine combination implies an efficient human, who has undergone the right type of technical education, operating an efficient machine.

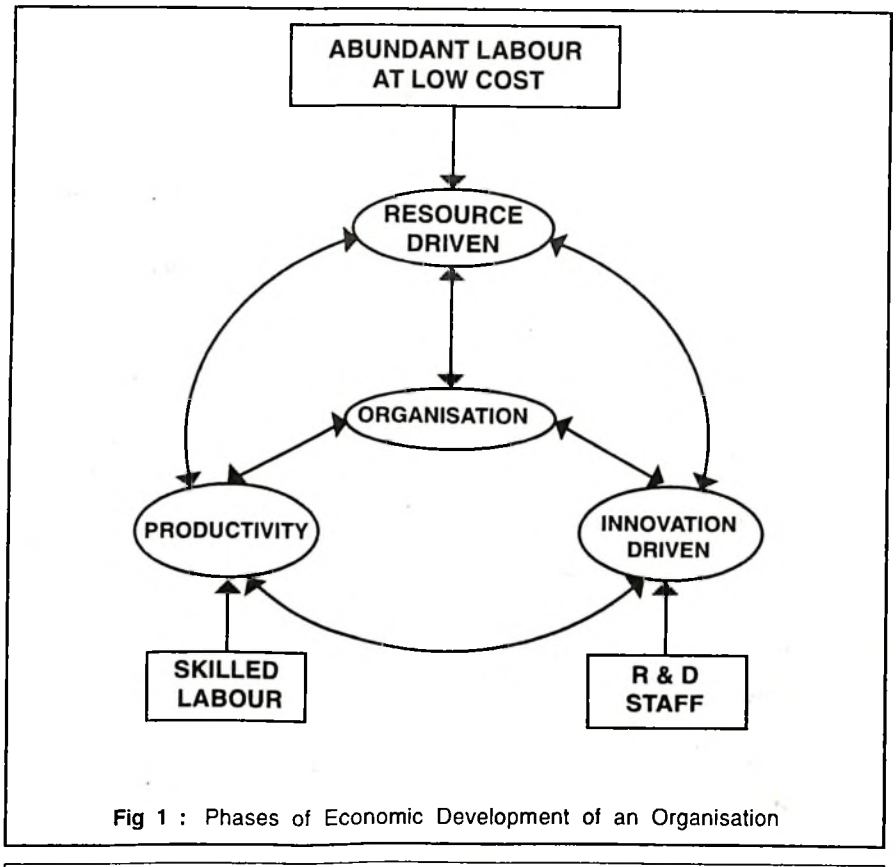

Fig 1 : Phases of Economic Development of an Organisation

STATUS OF TECHNICAL EDUCATION

India has a vast reservoir of technical personnel as is depicted in Tables-1 (a) & 1(b). The technical education system and the routes to higher technical education prevailing in our country are shown in Fig. 2. Our technical education system has

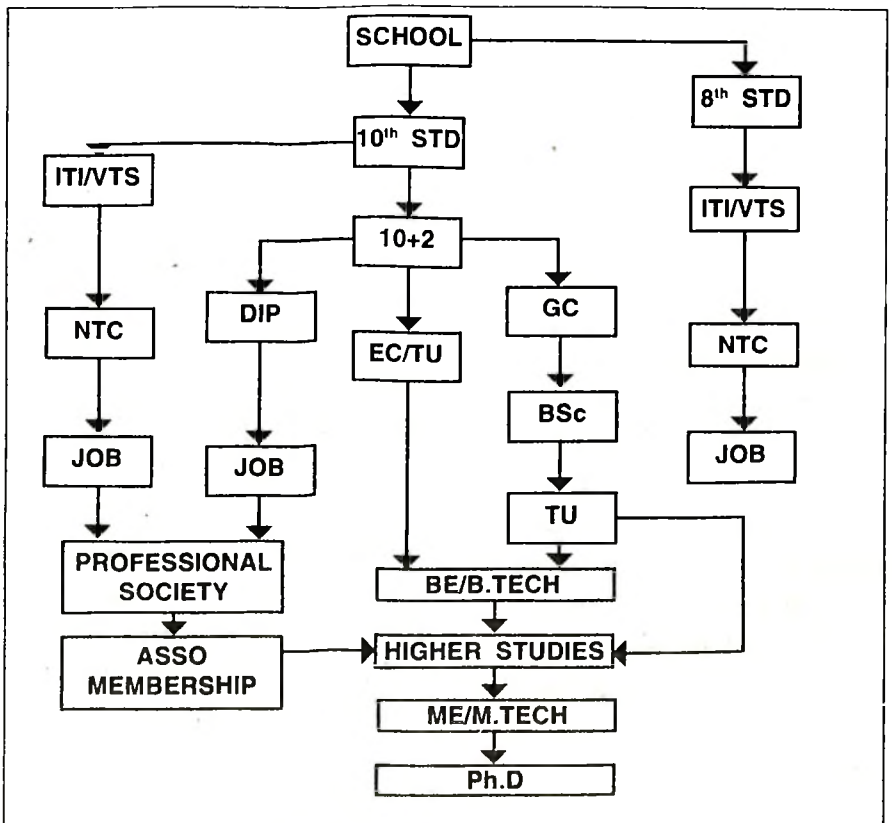

Fig 2 : Routes to Higher Technical Education

Table 1a : Technical Education Scenario in India

Industrial Training Institutes	1580
Diploma level Technical Institutions	976
Degree level Technical Institutions	604
Post graduate level Technical Institutions	140
Graduate Engineers per year	80,000
Diploma Technicians per year	1,25,000
Skilled workers per year	2,60,000
Masters degree holders in Engg per year	7,000
Doctorate degree holders in Engg per year	400

Table 1b. Stock of Technical Personnel **in '000**

Nature of Study	Year 1991	Year 1996	Annual Growth rate %
Engg. Graduate	546.7	726.9	5.9
Engg. Diploma Holders	873.9	1196.4	6.5

both strengths (Table-2) and weaknesses (Table-3) which need due consideration.

Craftsman (ITI certificate) and technician (diploma level) education programmes in the welding trade are being offered in a number of technical institutions. There are also a few institutions which offer post-diploma level courses in welding technology. The syllabus followed in many such institutions is old and obsolete, and is delivered in an environment of somewhat poor infrastructure facilities. The result is a misfit between the requirement of the industry and the manpower available.

At engineering degree level, students of some disciplines such as mechanical, metallurgical, ocean engineering courses, have exposure to a very limited extent, in welding technology. Some of the premier institutions in technical education offer programmes at Masters' and Doctoral levels in the field of welding technology. But the turnout per year in this field from all such institutions put together is meager.

The result is a vast gap between the supply and the demand. This gap needs to be bridged through innovative educational programmes to suit the working professionals at different levels.

EDUCATIONAL PROGRAMMES FOR WORKING PROFESSIONALS

A key to success in a competitive environment is harnessing human potential. It is based on the philosophy of recharging the skill and knowledge of the employee through in-house and external education and training on a continuing basis to last for the life-long. It has been globally recognised that continuing education provides the answer to all issues related to HRD (Table-4) and it is applicable to all categories of employees of an organisation.

Table 2 : Strength in Technical Education System

1. A large number of technical institutions.
2. AICTE – a nodal agency to control quality of education.
3. Apprenticeship training schemes.
4. Community polytechnics to interact with the community by training rural youth for productive employment, helping in transfer of technology and providing technical and support services to the people.
5. Post graduate level institutions to promote post graduate education and research
6. Modernisation and Removal of Obsolescent schemes operated by MHRD/AICTE to modernise and update technical education institutions at all levels.
7. National Science and Technology Management Information Systems (NSTIMS) to update a meaningful manpower projection on a continuing basis.
8. Advanced technician courses for technicians possessing diploma qualification.
9. Continuing education programmes for updating skill and technology of working professionals.
10. R&D in selected technical institutions for promoting research culture in technical education institutions.
11. AICTE-approved technical programmes promoted and managed by professional societies.

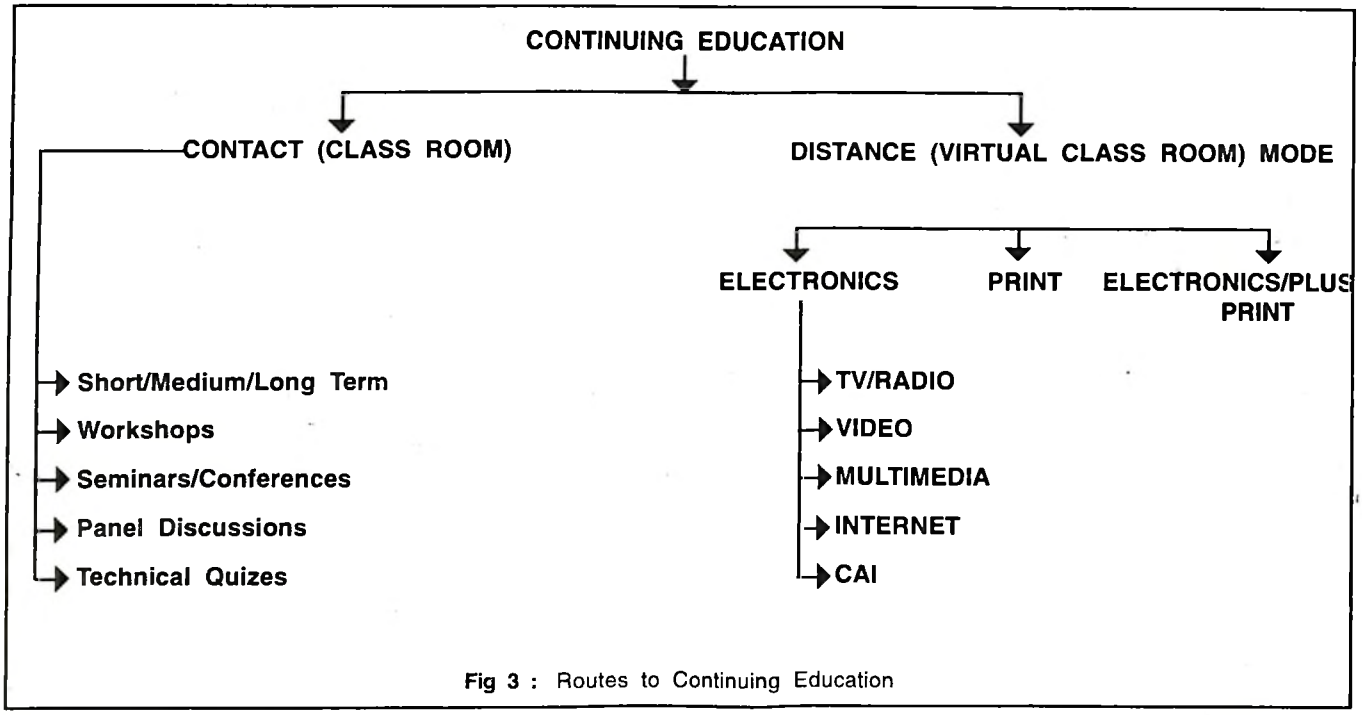

Fig 3 : Routes to Continuing Education

Continuing Education through Information Technology

A revolution in Information Technology (IT) has occurred in this present decade. It will become louder and clearer in the years to come. The coming decades are bound to witness greater strides in the application and development of IT. With the help of IT innovations, data bank in different subjects can be built and conveniently disseminated.

Such innovations have ushered in great opportunities in continuing education in a distance mode (Fig. 3). Today it is no longer necessary to depend on the conventional classroom mode of learning. The concept of virtual classroom for spreading education has become a reality.

Several institutions and organisations are fruitfully engaged in producing educational aids that are based on IT. This has given rise to the development of Educational Technology (ET) in the sphere of teaching and learning (Fig. 4). Mention must also be made about the Multimedia Technology, which has become a very convenient user-friendly tool in ET.

These technologies have great scopes and potentials. What is needed is an appropriate agency to plan and execute the training programmes.

ROLE OF INDIAN INSTITUTE OF WELDING

In a scenario where the technical educational institutions have limitations with respect to meeting the trained man-power in the field of welding technology and where there is vast scope of exploiting the medium of continuing education to meet the requirements of the industry, the Indian Institute of Welding (IIW) can and should play a pivotal role in filling the vacuuam.

Continuing education hinges on the principle of informal education proceeded at self-pace. The design of the curriculum is as important as the mode of delivery. The curriculum should have multiple exit points. It is observed that there are a large number of dropouts among the professionals registered for educational courses offered by professional societies and this acts as a deterrent to new entrants. On the other hand, if there are a number of exit points with specific goals, such programmes would become more popular, fruitful and effective (Table-5). IIW can operate such educational courses in conjunction with its existing single exit-point programme on AM-IIW examination.

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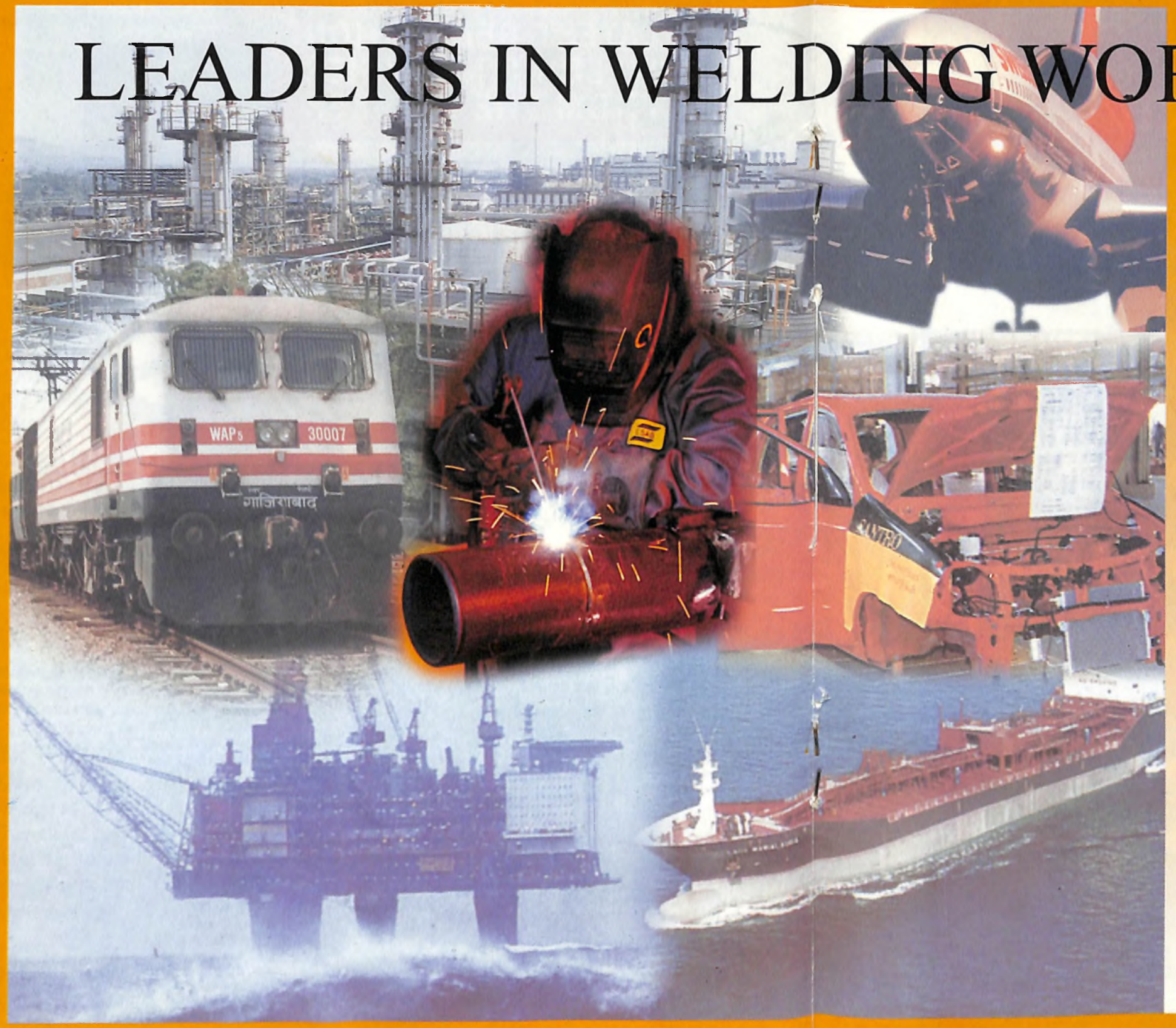

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