

# Establishing and Implementing the Building Blocks of a Country's National Welding Capability (NWC)

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**Abstract:** Since its foundation in 1948, IIW has been involved in numerous activities with outcomes which are able to significantly improve the quality of life of people through the optimum use of welding technology. In 1996, as an outcome of a meeting with UNIDO in 1994, the IIW Board of Directors Working Group Regional Activities and Liaison with Developing Countries (WGRA), introduced the unique IIW WeldCare Programme to assist developing countries to improve their national welding capabilities particularly through the establishment and/or growth of a not-for-profit national welding organisation. Since then, IIW WGRA has assisted many countries freely through the holding of IIW technology innovation workshops, governance workshops and International Congresses as well as providing them with information, experiences and documentation on successful NWC activities particularly from experiences in South Africa, Australia and globally. In 2013, as part of the IIW WeldCare Programme, IIW WGRA created a project "Establishing a National Welding Capability (NWC)". Several very successful NWC workshops have been held since then and 10 IIW Guidance Notes (GNs) are now being produced to assist not only developing countries but also developed countries which could utilise them to improve their national welding capabilities. The paper focuses on explaining the reasons for, and huge significance of, this IIW project, its progress, expected outcomes and in particular the 10 IIW Guidance Notes as NWC Building Blocks. IIW members will be given the opportunity to become involved and contribute their experiences, successes, information and documentation freely to be used in the IIW Guidance Notes for the benefit of all.

**Key-words:** National Welding Capability (NWC); Guidance Note (GN).

## 1. Introduction

### 1.1. Linking people joining nations

Since its foundation in 1948, IIW has involved participation by the "who's who" of the welding related world in continually improving the global quality of life. Many 100s of experts from around the globe are currently involved in more than 40 key IIW Working Units across all aspects of welding and joining.

IIW has 56 Member Countries constituting more that 80% of global GNP. Each region of the world is involved in IIW and there are links to many other national and international organisations.

IIW has managed to record its history all the way back to 1947 and the links to the three books on IIW's history are shown below.

- a) Joining Nations by Philip Boyd 1947-1990 [1];
- b) IIW early history 1948-1958 [2];
- c) Linking People, Joining Nations by David Barnett 1990-2015 [3].

A key point is that after the devastation created through World War 2, Europe in particular, was in a terrible mess but countries got together in 1947 and formed ISO and IIW amongst others to somehow help to build up the quality of life again. 13 countries formed IIW (11 European countries, USA and South Africa).

IIW thus has a tremendous record of improving the global quality of life through the optimum use of welding and joining.

Through the IIW Board of Directors Working Group Regional Activities and Liaison with Developing Countries (WGRA), IIW is endeavouring to assist countries in many ways



via the IIW WeldCare Programme. Pages 78 and 79 in the IIW White Paper [4] give background on this programme which includes assistance in the establishment and sustainability of an organisation responsible for the promotion of welding technology and related disciplines in a country whether with a developed or emerging economy or an economy in transition.

In 1994, an IIW delegation consisting of the IIW President, Raul Timmerman (Argentina). John Hicks, Secretary General of IIW and Chris Smallbone, Chairman IIW WGRA visited UNIDO to discuss possible means of collaboration in the funding of developing countries, particularly on the basis of supporting bi-lateral schemes such as the IIW proposed personal qualification scheme. This visit was quite successful with UNIDO expressing interest in assisting IIW in developing proposals and also entering into a co-operative agreement in transferring welding technology to countries in Africa [5].

In doing so, the Director General of UNIDO, Mr Mauricio de Mario y Campos, said that

*[...] given the international importance of IIW in welding activities, not the least the establishment of the relevant ISO standards, and the certification of welders and welding inspectors, I am confident that the above arrangement could make a very important contribution to the progress of welding in the developing countries of Africa [6].*

A proposal aimed at uplifting welding technology in selected countries on the African continent was subsequently prepared and submitted for funding through sponsorship with UNIDO for implementation in 1994 [7]. Unfortunately this promising development did not go ahead but became the basis of the successful IIW WGRA WeldCare programme.

Based on this approach and the success of the South African Institute of Welding [8], in 1996, as part of its Goal “To lead and assist Australian industry in welding-related activities”, WTIA implemented a national plan with strategies to establish the “building blocks” to create an Australian NWC [9].

By 2013, this was being achieved very successfully and a proposal was made at a meeting of the IIW Board of Directors Working Group Regional Activities and Liaison with Developing Countries (WGRA) to build upon this success with the addition of other countries successes as a means of assisting any country through the IIW WeldCare Programme to improve or build up its own NWC.

The IIW WGRA project to assist countries in establishing their own “National Welding Capability (NWC)” was then started with the key objective “To assist countries to establish a sustainable national capability in welding-related activities to meet the needs and requirements of the Industry, Government and people of the country and improve the quality of life through the optimum use of welding”.

The project would also build upon the very successful IIW WGRA work which had already been conducted in IIW Member Countries such as Romania, Bulgaria, Serbia, Greece, Nigeria, India, South Africa and Egypt amongst others.

The first IIW WGRA workshop on establishing a NWC was held in New Delhi at the 3<sup>rd</sup> IIW International Institute of Welding International Congress organised by the Indian Institute of Welding from 10-12<sup>th</sup> April 2014.

The second IIW WGRA workshop on “Establishing a National Welding Capability” was held in Timisoara, Romania from 3<sup>rd</sup>-5<sup>th</sup> June 2015 at the 3<sup>rd</sup> IIW South East European International Congress, the third workshop was held as a joint two day event with IIW Commission XIV at the IIW Annual Assembly in July 2016 in Melbourne Australia and the fourth will be held in Belgrade at the 4<sup>th</sup> IIW South East European International Congress on 10-12<sup>th</sup> October 2018.

## **2. The Importance of Welding to a Nation’s Economy**

Welding technology is an enabling technology used across almost all industries and a wide range of applications, from micro-joining of medical devices, electronics and photonics, to larger scale applications such as bridges, buildings, ships, rail, road transport, pressure equipment and pipelines.

It encompasses the total life cycle of welded products/structures including design, manufacture, conformity assessment, inspection and testing, operation, maintenance, repair and decommissioning including recycling and other environmental conditions. It is critical to the infrastructure of any country.

The importance of welding to national economic performance can be shown in numerous ways. One comprehensive study in the USA surveyed the manufacturing, construction and mining industries in which welding was a critical enabling technology [10]. It found their combined revenue totaled some US\$ 3.1 trillion, or about one-third of that country's gross domestic product. Direct welding costs were \$ 34.1B, 70% of which was labour costs. The labour costs for welding activities was in fact about 4% of the total labour costs for those industries. The true value added by welding technology in this example is probably at least ten times the direct welding costs due to the added value to the economy after the implementation and use of the technology.

### **3. National Organisation for the Promotion of Welding Technology and Related Disciplines**

Successful countries where welding is a fundamental part of its economy tend to have an organisation which represents the technological interests of the welding industry in that country.

The welding industry [11] is taken as those organisations and persons involved with:

- i) Design, manufacture, testing, inspection, operation, maintenance/repair, de-commissioning of welded products /structures;
- ii) Engaging/hiring of any of the organisations or persons involved in i);
- iii) Supplying welding equipment or consumables or materials to be welded; and /or,
- iv) Education, training, qualification, certification, research & development, work, health and safety (WHS), standards and industrial relations aspects of welding.

Such a national organisation must be able to:

- 1) Be correctly established in terms of a country's legal, financial and other compliance requirements with correct governance and management systems in place;
- 2) Cooperate and collaborate with the relevant organisations in the country to ensure that the NWC is achieved and sustained;
- 3) Have adequate highly credible staff resources to succeed in the agreed plans;
- 4) Be open for as many of the other organisations and people in the industry to have membership and have ownership of the NWC where applicable;
- 5) Enable firms to access technologies and technical information to meet their needs;
- 6) Respond to demonstrated needs of companies and have relevant support for solutions within the organisations in the NWC;
- 7) Develop strong links with industry and agencies;
- 8) Provide ready access to facilities and services in the NWC;
- 9) Not unnecessarily duplicate facilities and services already existing in the country;
- 10) Seek to collaborate with national and international organisations/agencies to meet industry needs;
- 11) Provide the Forums/Boards/Committees etc necessary to have all relevant organisations collaborating in the various NWC "Building Blocks".

### **4. Detailed IIW NWC Project Objectives**

The IIW NWC project aims to assist a country's industry, government or IIW Responsible Member to achieve the following objectives:

- i) To identify the welding-related needs in a country and provide solutions to ensure the country's future sustainability in relation to these needs;
- ii) To consolidate the existing welding related "building blocks" in a country to create the basis for a National Welding Capability (NWC);
- iii) To analyse, and identify the improvements required in the existing welding related "building blocks" as well as what additional "building blocks" are required in a country; and
- iv) To create the mechanisms and processes, to establish and maintain a country's sustainable "National Welding Capability (NWC)" including the possible establishment or improvement of a national organisation responsible for the promotion of welding and related disciplines.

## 5. Building Blocks to a National Welding Capability (NWC) Project

As mentioned above, welding technology encompasses the total life cycle of a welded product/structure. To ensure that all related aspects of this total life cycle are at their optimum, requires a country to have a national plan to ensure that the necessary research and development, technology diffusion, education, training, qualification, certification, local and international networks accompanied by the correct cultures, image and levels of funding and resources are in place on an ongoing basis.

The IIW NWC project aims to do this by creating IIW Guidance Notes (GNs) based on the experiences and knowledge of IIW Member Countries which can then be used by industry, governments or the IIW Responsible Member in a country to create their own national plan and strategies to establish their own NWC.

Shown below are the titles of a series of IIW Guidance Notes (GNs) to assist an IIW Responsible Member, a government or industry organisation, to establish a NWC in its country. Each IIW Guidance Note (GN) covers one of the "Building Blocks" required to establish and sustain such an NWC and have been created as 'stand alone' documents with some common elements in each GN.

IIW GN 1:	NWC- Overview of a NWC
IIW GN 2:	NWC- Research and Development (R&D) Building Block
IIW GN 3:	NWC- Technology Diffusion (TD) Building Block
IIW GN 4:	NWC - National and International Networks Building Block
IIW GN 5:	NWC - Education, Training, Skills and Career Paths Building Block
IIW GN 6:	NWC - Qualification and Certification (Q&C) of Personnel (Q&C) of Personnel and Companies Building Block
IIW GN 7:	NWC- Importance of Welding Building Block
IIW GN 8:	NWC - Resourcing the Welding Related Activities Building Block
IIW GN 9:	NWC-Non -Destructive Testing Building Block
IIW GN 10:	NWC - Necessary Cultures Building Block

## 6. How to Use NWC IIW Guidance Notes (GNs)

The progress and success in establishing a NWC depends upon the structure and facilities already existing in a country. Some IIW Responsible Members are national welding institutes with many of the building blocks in place in one organisation in the country whilst other countries may have the NWC building blocks across a number of organisations not owned by the IIW Responsible Member. The role of the IIW Responsible Member may be to

facilitate the co-ordination of a national effort by working with the other organisations in a national team effort or if, for example, the IIW Responsible Member is solely a research organisation or University, it could assist in building up a national welding institute similar to successful ones in other countries.

In some IIW member countries, the IIW Responsible Member may have very few facilities and resources but by using the NWC IIW GNs may be able to implement longer term strategies with the support of government and industry to build up the NWC infrastructure.

The IIW GNs are structured where possible so that any IIW Responsible Member, government or industry organisation can use the information in the IIW GN as part of its business plan. Such a business plan would need to be devised and implemented with appropriate strategies, financial requirements, action plans, milestones and key performance indicators to meet the required outcomes.

The concept of each IIW GN is that by showing possible strategies (which may be necessary to implement a particular building block) on a "Plan-on-a-Page", the user can link through each strategy to a bank of information linked to that particular strategy. The information obtained through the link will have been gathered from the experiences of other organisations and individuals who are prepared to share their successes and lessons, including challenges and failures, with the global community.

The user will then decide which strategies (those shown in the GN or amended or new ones) and information to use to meet the outcomes required in their own business plan. Action plans would be implemented for each strategy in the "Plan-on-a-Page".

It is expected that the IIW GNs will become part of an IIW Knowledge Resource Bank as envisaged in Section 10.2 page 157 of the IIW White Paper [4]. They will become "living documents" continually updated with more and more people contributing documents based on their experiences in establishing their own NWCs.

## 7. Typical Existing NWC Situations in Different Countries

Out of 193 United Nations member countries in the world, only 56 are members of IIW. These 56 countries probably constitute over 80% of the total Gross National Product (GNP) of all countries. If one considers the makeup of these 56 countries in terms of their national welding capabilities, then they range from probably 50% believing that they have probably more than 90% of the necessary NWC "building blocks" in place and the other 50% believing that they only have probably 30-60% in place.

If one considers the other 137 countries which are not members of IIW, these would probably believe that they only have from 2% to 10% of the NWC "building blocks" in place. The challenges therefore to implement the necessary building blocks to achieve the optimum NWC for a particular country can range from immense and daunting to relatively straightforward.

If one considers the range of situations which may exist at present in various countries, then the introduction of the different NWC "building blocks", their sequence and the speed at which they are introduced and succeed may vary considerably.

A few examples are given below, based on personal experiences, as to what situations might exist in particular developing countries. The approach to be taken to build up its NWC obviously depends on the situation in the country and the opportunities which may arise.

**Situation A:** Individual groups of interested people working together on a voluntary basis to transfer technology in particular welding related fields. Historically, these have been typically representatives of welding equipment, welding consumables and steel suppliers whose interest is obviously to sell their products, assist the purchaser in applying the products correctly and increasing more sales of the products through the successes achieved. Technology transfer through mechanisms such as evening technical presentations, technical demonstrations, webinars, supply company literature, seminars particularly by individual companies become the norm. Most technology will be sourced internationally.

**Situation B:** Initiatives are made between groups from different industry, research and academic sectors to establish a legal entity to act as the organisation to administer and co-ordinate the voluntary efforts of the

various welding groups for the betterment of the country. This is normally the initiation of the entity which could later become the national peak industry organisation responsible for promoting welding in the country. Although staff numbers may be very small, mainly administrative, the range and number of technology mechanisms grow and expand with the support of volunteers to include conferences, welding orientated magazines, greater number of technical meetings and seminars, representation on Standards Committees, production of technical literature etc.

**Situation C:** In addition to Situation B, due to the realisation that there is a need to train welders to use the items mentioned in Situation A, the government of the country has schools and colleges in a national vocational education and training system where such welders are trained. The individual groups mentioned in Situations A and B would support such training in various ways including the training of a wider range of personnel including apprentices, technicians, technologists, supervisors, inspectors, NDT personnel, engineers and technologists of various types all related to welding in varying degrees.

**Situation D:** In addition to Situation C, a Government owned or supported national research and development organisation may exist which may or may not do welding related research. Furthermore, there may be universities which conduct research and development projects at masters and PhD levels which may or may not involve welding. These can be expanded to cover welding related R&D.

**Situation E:** If a national organisation is to grow to meet the needs of the industry, then expansion in the number of its technical staff becomes essential to grow the technical activities required to meet the needs of the industry. This then gives growth in all the various technology transfer mechanisms including training of technology receptors to receive and implement the technology supplied by an increased number of technology suppliers both locally and internationally.

The training of technology suppliers and receptors might be carried out by the national welding organisation via the IIW programmes using a range of training bodies existing in the country.

Two useful links showing how South Africa and Australia built up their NWCs from these situations are given in references [8] and [9].

## 8. Recommendations

IIW has been able to create a number of extraordinary and unique activities to take place under its wing. For example, the introduction of its very successful harmonised international education, training, qualification and certification programme has not been emulated by any other profession or discipline in the world.

It is also an extraordinary achievement to be able to bring the experiences, knowledge and information from a multitude of individuals and organisations to a single source including a 'knowledge resource bank' for the free use of anybody in the world, to show and enable them to build up a national capability in a subject.

The IIW NWC Guidance Notes which are being produced contain excellent recommendations on which a country can build to optimise its national welding capability.

A key recommendation, however, is to ensure that the integrity of the individuals and organisations involved at any stage in the NWC development is paramount. There are too many examples of countries, organisations and individuals where the ethics are not what they should be and the efforts on optimising the NWC could falter or fail.

To conclude, there are two personal attributes which will help people to ensure the NWC succeeds.

Henry Ford, the great American philanthropist and car maker said

*You can do anything if you have ENTHUSIASM. Enthusiasm is the yeast that makes your hopes rise to the stars. Enthusiasm is the sparkle in your eyes, the swing in your gait, the grip of your hand, the irresistible surge of will and energy to execute your ideas. Enthusiasts are fighters. They have fortitude. They have staying qualities. Enthusiasm is at the bottom of all progress. With it there is accomplishment. Without it there are only alibis.*

and

*Nothing in the world can take the place of persistence. Talent will not; nothing is more common than unsuccessful men of talent. Genius will not; the world is full of educated derelicts. Persistence and determination alone are omnipotent.*

*The slogan "press on" has solved and always will solve, the problems of the human race.*

*Calvin Coolidge - 30<sup>TH</sup> President of USA.*

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