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Costs and Benefits of the Chemical Weapons Disarmament

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List of Contents

Headnotes: Concept of peace dividend and disarmament: *Myth v. Reality* – Recognition of the need for thorough analysis through examining the implementation of a arms control or disarmament instrument, felt in the governmental as well as research institutions – This paper, a response to such a need - 1993 Chemical Weapons Convention, a multilateral, non-discriminatory disarmament instrumented, ratified by 174 states – Implementation of the Convention in the seventh year – Identification of areas to conceptualise the meaning of the Peace Dividend, creation of a framework – Analysis of the concept of Peace Dividend through the examination of economic, security, political, technological advancement, research and development and human security aspects of the implementation of the CW disarmament – prospects and challenges – Emerging Principles of *Peace Dividend* as observed in the practical implementation of the CW disarmament process

1.0. Introduction[1]

The Chemical Weapons Convention entered into force on 29 April 1997 and has at the time of 174 States Parties. It is the first global undertaking in the area of weapons of mass destruction that aims at eliminating an entire category of such weapons in a defined space of time, under international verification and with guarantees to prevent the recurrence of these weapons in the future. An analysis of the Convention is, of course, predominantly an issue of global (and sometimes regional) security and confidence building. There are, however, some underlying economic considerations which, amongst other factors, influence the way the value of the Convention is being perceived by the States Parties (and also by States not yet party). Cost-benefit or, more accurately, cost effectiveness assessments are particularly important for those States Parties that have major expenses to meet as a consequence of implementing the provisions of the Convention. But such considerations also drive to some extent the decision making of countries with little or no chemical activities but considerable expectations in relation to the (real or perceived) benefits associated with treaty adherence. Many of the benefits that persuade such countries to join the regime are economic in nature, as are considerations of penalties for not joining the regime.

The more-than-a-decade-old debate about the impact of disarmament on development and the so-called 'peace dividend', however, seems today to have been overtaken by assertions that the costs of arms control have risen disproportionately to the benefits that disarmament can accrue. The traditional argument that disarmament would create a peace dividend had two complementary aspects: firstly, it was assumed that the moneys freed from the weapons programmes could be allocated to other, peaceful government expenditures. Secondly, there was an assumption that global disarmament would ease co-operation and trade between countries, thus leading to a tangible effect on economic and technological development. The arguments presented today, on the other hand, that global arms control and disarmament combined with international institution building and verification may not be the most cost-effective way to approach global security rests, in turn, on a number of assertions: that such measures lead to considerable spending on the verification of States and facilities that are of no particular proliferation concern while being ineffective in dealing with those that are; and that

[1] The author gratefully acknowledges the comments of Mr Ralf Trapp, OPCW.

treaty obligations create funding obligations that vastly exceed the capabilities of some States. Disarmament expenditure is then approached as part of an overall trade-off in the context of overall budget constraints (and often against a somewhat narrow definition of the underlying national interests that need to be served).

As the Convention has entered its seventh year of life, it may be appropriate to take a look at how the economics of CW disarmament have played out in practice. Such an analysis is of significance for two reasons: firstly, economic considerations (whether well-founded or based on perception) influence decisions about accession to the Convention, even in countries with genuine security concerns in relation to chemical weapons. If universal adherence to the Convention is accepted as worthwhile pursuing, an understanding of the economic factors that influence decision making on CWC adherence is important. Secondly, cost effectiveness is a key aspect of the viability and credibility of the treaty regime for the States parties, in particular but not only the major contributors (which also happen to be those States Parties that have significant national expenses for treaty implementation), and will thus influence their attitudes towards the Organisation. In a world of competition for limited resources, this is an important factor.

But there is also a broader significance of such an analysis. The debate about a peace dividend has largely been conducted in the abstract. The debate about the cost of global arms control, on the other hand, has been conducted in isolation from other factors. Empirical studies, for example in relation to the impact of restructuring of military expenses on a regional basis (e.g., the closure of bases) or conversion of certain military-industrial structures, have been looking at situations which may only to a certain extent be relevant to the issue of global disarmament. At the same time, the CWC, as the first global and comprehensive disarmament treaty, affects not only military structures and entities, but also the private sector in the form of the chemical (and some other) industries.

As Willet (2002) observed, the methodological challenges of analysing the costs and benefits associated with arms control are formidable. This paper does not attempt to undertake a comprehensive analysis of the subject. Instead, it attempts to make a contribution to the development of a methodological framework that could be used to analyse the issue at hand.

2.0. Overview

CW disarmament has a number of economic dimensions related directly to the basic undertakings of the States Parties. These basic undertakings can be summarised as follows:

- Cessation of all CW development and production activities and, at a later stage, of the maintenance of stockpiles
- Destruction of the entire stockpile of chemical weapons and of chemical weapons production facilities within prescribed time frames
- Verification of the stockpiles and CW production facilities and of their destruction by the OPCW
- Prohibition of the development, production, stockpiling, and use of chemical weapons
- Prohibition on transfers of chemical weapons and CW production equipment
- Implementation of non-proliferation measures, including declarations and on-site inspection by the OPCW in the chemical industries of the States Parties and transfer regulations related to scheduled chemicals
- Establishment of an OPCW system for the co-ordination and delivery of assistance to States Parties in cases of use of chemical weapons, use of riot control agents as a method of warfare, and threats posed by other States caused by actions prohibited
- Facilitation of international co-operation in the peaceful uses of chemistry, including in relation to international trade in chemicals, equipment and technology.

During the current phase of treaty implementation, the emphasis is obviously on the implementation of the provisions related to the destruction of chemical weapons. This is partly the result of the time lines established by the Convention, partly a reflection of the character of the Convention as a global disarmament treaty. Over time, the relative weight of the non-proliferation measures and, simultaneously, the benefits to be expected from co-operation in the chemical field would be expected to increase. Measures related to assistance against the use of chemical weapons should be of a temporary nature, reflecting on the one hand the degree of confidence reached by the participating States in the regime stability, and on the other hand the perceived capabilities associated with those States that have not (yet) joined the Convention.

An economic analysis of CW disarmament will thus have to address a range of factors within a framework that changes over time. Such an analysis would need to take account of processes within States Parties, the structural and institutional aspects of treaty implementation, and influences from outside the treaty realm (actions and perceptions related to non-parties).

Before discussing some aspects of the analytical framework for analysing the economics of CW disarmament, it may be useful to recall some of the factual background of CW disarmament.

3.0. CW disarmament: Facts and Figures

Six States Parties—Albania, India, Libya, the Russian Federation, the United States of America, and one other State Party—have declared a total of (originally) approximately 71,365 agent tonnes of chemical weapons. These weapons were located at 36 storage facilities. Since EIF, twelve States Parties—Bosnia and Herzegovina, China, Yugoslavia (now Serbia and Montenegro), France, India, the Islamic Republic of Iran, Japan, Libya, the Russian Federation, the United Kingdom of Great Britain and Northern Ireland, the United States of America, and one other State Party—submitted declarations of present or past capabilities to produce chemical weapons. As of 31 December 2003, the total number of CWPFs declared stood at 61. Thirty-one of them, had been certified by the Technical Secretariat (one of the principal organs envisioned by the Convention with a mandate to oversee the day-to-day implementation of the Convention) as completely destroyed, while nine CWPFs had been certified as converted, i.e. as no longer capable of being used as CWPFs. Of the remaining 20, ten facilities were to be converted and ten were to be destroyed. The number of States Parties, which declared old chemical weapons (OCW) since EIF remained at ten—Australia, Belgium, Canada, France, Germany, Italy, Japan, Slovenia, the United Kingdom of Great Britain and Northern Ireland, and the United States of America. While three States Parties China, Italy and Panama—have declared abandoned chemical weapons (ACW) on declared facilities that had been designed, constructed or used since 1 January 1946 primarily for the development of chemical weapons. Some of these facilities were proving/testing grounds, research/defence establishments and laboratories.

4.0. Primary economic factors

The economic impact of CW disarmament will differ for States Parties depending on, inter alia: whether they possess CW capabilities when the Convention enters into force for them, and what these are; their state of development in relation to chemical research and production; and to what extend they depend on chemicals for other economically relevant activities. Here follows a discussion of economic factors that are relevant to countries with declarable CW capabilities.

4.1. CW possessors and States Parties that have declared CW production capabilities

The obligations undertaken under the Convention will have an economic impact on CW possessor States in a variety of areas, both in relation to the immediate time span after EIF and in the longer run. These economic considerations will have to relate to the "negative undertakings" under the Convention (i.e., the requirements to cease production activities and, over time, storage of chemical weapons) as well as the "positive undertakings" (i.e., to destroy the weapons and related production capabilities and bear the cost of OPCW verification). The following discussion looks at expenditure factors in relation to: personnel, capital investment, costs associated with changes in activities, costs related to implementation of CWC provisions related to the declarable facilities/activities (declaration, inactivation, security, destruction), verification costs, conversion costs (facilities, personnel, material), and some issues related to structural impact on military spending (R&D spending in particular). It should be noted that the discussion does not attempt to provide a cost-benefit analysis in any proper way. For example, while aspects related to CW destruction costs are included here, the paper does not address alternatives and would essentially concur with the view that weapons disposal costs should be considered as part of the lifecycle cost of weapons procurement, not as expenditures specific to the disarmament obligations.

4.1.1 Human resources

Chemical warfare is a specialist occupation quite different from normal (conventional) military operations and planning. It is science-intensive. Chemical warfare requires a good understanding of the dissemination of chemical agents from, weapons systems, their behaviour in the environment, and the

way the human body absorbs them and is affected by them. Chemical troops are specialised formation in all armies that possess these weapons. The same applies to troops trained in chemical defence. Furthermore, the production of chemical weapons requires specialised chemical and technological knowledge and, in addition, a good appreciation of safety as well as medical and other emergency measures. In other words, when compared to other branches of the military, an offensive CW programme will inevitably involve a proportionally high number of staff with higher education and specialised training. While other types of personnel are also required in an offensive CW programme (such as administrative or security staff), it is this highly specialised workforce that needs to be addressed when an offensive CW programme is to be shut down.

This is, incidentally, not only a question of economy, re-employment (possibly unemployment), re-training cost and the like. There is also a genuine concern that, if these issues are not resolved adequately, there is a danger that some of these highly specialised experts become targets of proliferation attempts. There are a number of countries, not party to the CWC, that have publicly been associated with proliferation ambitions. It would cause serious concerns if experts formerly involved in offensive CW programmes would be hired by countries suspected of having clandestine offensive CW programmes. This is particularly true in the early phases of such clandestine programmes, when indigenous expertise will be limited.

There are short-term and long-term considerations in regard to personnel formerly involved in CW development, manufacture and employment. In the short run, shutting down an offensive CW programme and starting up a CW destruction program may actually *create* jobs. The specialised knowledge that was required for development and manufacturing of chemical agents, or the employment of chemical weapons, is highly relevant to CW destruction operations. It was no surprise that the personnel that was previously involved in maintaining the offensive CW programmes got involved, in all five declared CW possessor States Parties, in the development and operation of destruction operations. As these operations progress from laboratory scale and pilot plant operations into industrial-scale destruction facilities, the number of scientific and technical staff that will be required in all phases of the destruction operations may in fact increase over the numbers needed in the past to maintain the stockpile.

Re-training cost will be modest, in fact it will be probably less than if personnel not previously experienced in handling and

dealing with chemical agents were to be hired for the job. The destruction programmes would thus provide, in accordance with the Convention, an "employment buffer" for this highly specialised staff for some 10 or so years, possibly longer if destruction operations get delayed.

In addition to the destruction operations, the verification requirements under the Convention create additional albeit temporary employment options. Verification of CW destruction requires an appreciation of chemical weapons design, CW safety, destruction technologies and other specialised knowledge. It is thus hardly a surprise that a considerable number of experts formerly involved in the offensive CW programs of the possessor States Parties got involved at either national or international levels with activities prescribed under the Convention for the verification of the destruction of CW and CW production facilities.

It can thus be argued that the Convention does not initially (during the active destruction phase) require excessive re-training and re-employment of the highly specialised workforce formerly involved in the offensive CW programs, for the initial 10 or so years of implementation. For the time period to follow, a number of factors become important in assessing any future requirements. One is the age distribution in the workforce. Another one is whether this highly specialised workforce would be competitive on the job market if released from service. A third is whether there would be other suitable employment opportunities for these personnel within the military forces or elsewhere in government.

4.1.2 Destruction of chemical weapons capabilities

It is generally assumed that any defence spending, including CW, provides jobs directly and indirectly in supplier networks and also through the multiplier effects of local spending resulting from the defence jobs. The towns and regions in which military bases and defence industries are located bear substantial costs, particularly where communities depend upon defence spending as the major source of employment. Contrary to this general assumption, cuts in the CW defence do not have heavy adverse effects on regional economies because CW programs are generally integrated and less labour and capital intensive. Hence, regional economies, in overall, are not highly dependent on CW defence spending and hence less vulnerable to cuts in CW military expenditure Although, it should be kept in mind that once CW destruction operations will be completed localities dependent on defence spending will bear the costs of adjustment.

In this regard, one can say that, although particular regions could be affected due to CW disarmament, if the economic base of the concerned regions is diverse and range of alternative employment prospects is higher, then adverse impacts may decrease further. A direct impact could be that towns dependent on defence companies or on military bases and interests groups likely to suffer from the defence cuts will lobby for the policy to be changed and will also demand compensation from the regional governments.

CW disarmament is bound to bring some structural changes in the regional economies. CW destruction operations in various regions will begin and complete at different times. There will be a significant shift in the regional distribution of military contracts (for CW destruction contractors) from one region to another. This applies to the case of the United States of America as well as the Russian Federation, the two largest possessors of CW stockpiles. This will have two possible impacts: capital growth in existing firms and the addition of new kinds of industry that had not previously been represented in the regional economy (for example when destruction operations will begin, industry producing CW gasmasks and boots will either initiate new operations or shift their operations from previous locations if it will also get contracts at the new facilities).

4.2. Economies of conversion of CWPF:

The CWC provides three options for the future of ex-CWPFs: conversion for purposes not prohibited under the Convention, temporary conversion into CWDF or destruction of the ex-CWPF.

Before discussing specific details on CWPF conversion challenges and prospectus, few general remarks and perceptions on military conversion process would be useful. Conversion of military (including research and development) has to be undertaken as a part of the overall transformation of the war economy and military institutions to peaceful purposes (Southwood and Andreev, 1998). In this light, it should be noted that a successful and efficient conversion or destruction of the CWPF require co-ordination at all three levels: macro, micro and regional level. Manpower and capital involved at all three levels are likely to be affected by this process, therefore, policy tailoring the needs and concerns of the three levels ought to dominate any policy discussion.

When we talk of conversion, it is useful to be aware of conversion experience in other fields. In fact, a number of

researchers express their cynicism. For example, Adelman and Augustine show a concern in their paper that conversion in the United States has a "… discouraging history of failure." They observe that "… successful examples of such conversion [of military production in the United States] are difficult to find. Detailed research has not identified a successful product in our economy today which was developed through a military-to-civilian approach … as of 1990 there are very few concrete examples of actual conversion" (Southwood, 1997).

Then, what are the general motivations for conversion of the CWPFs? Several factors could be cited, however, the most important them are by undertaking the conversion the governments may (a) avoid unemployment of former staff (b) prevent wastage of technical knowledge capabilities and social unrest (c) attract bring young people to useful careers in science and technology (d) reduce military expenditures including research and development and diversion to non-military purposes and (e) building of confidence.

4.2.1. Option 1: Conversion for purposes not prohibited under the Convention

The most important economic feature of CWPF conversion is that CWPF facilities, unlike stealth, armour and nuclear weapons facilities, are easy to convert from the viewpoint of human and technical skills. The Convention requires destruction of specialised equipment and the elimination of specialised feature of specialised buildings, thus, standard buildings and standard equipment can be used for conversion which could save around 40% costs of the total cost. The converted facilities will become a useful source of income. However, it is imperative that the market-suitable type of chemical products and technology are selected.

It is equally important to be aware of a number of technical, political, economic and verification considerations. CWPF conversion is neither instantaneous nor cost-less. First, the question whether the converted industry will survive and remain profitable. Undoubtedly, in the short run, their adjustments will be constrained by several factors and contractual commitments. For example, the converted facilities have to operate with the existing plants, labours and their locations, and with the existing markets and distribution systems. Since much depends upon civil market opportunities, governments may be the only customers until the time the industry reorients a firm's strategy and identifies new profitable markets, which might utilise the firm's competitive

advantages. In the longer term, say over three to five years (which is normally a gestation period in case of the CWC), a firm can invest in the costs needed to enter new civil markets and it can decide whether to enter such markets by internal expansion or by merger or take-over. However, early preparations for conversion are useful in order to design and develop competitive products for the civilian markets (Thorsson, 1984–85). Another challenge is to develop suitable civilian production without radical reconstruction of the enterprises.

Against these challenges, what are the prospects for successful conversion of CWPFs?

- CW armament has low level of dependency on defence contracts;
- Converted CWPF would have multiple clients such as national or regional governments, multi-national corporations;
- Compatibility between defence and civilian technology exists;
- Because of civilian market, future profits are likely to justify new investments in form of conversion to produce civilian chemicals;
- CWPF conversion involves low risks in diversification;
- Opportunities for entering new civilian (especially public sector) markets are available;
- Resources (managerial, technical, capital) for diversification are available;
- Since the Convention does not require conversion in short time, the CWPF industry may be able to diversify in long-term say 5-10 years;
- Governments may get personnel of firms with civil production or marketing skills. Thus, if CWPF conversion requires higher personnel than available then it can get from the civilian labour market.

In fact chances of CWPF conversion success increase if government searches for alternative products not limited to those made with existing means of production.

Challenges:
What are the chances of successful conversion of CWPFs in the Russian Federation and the United States? The records show that the Russian Federation has given a preference to the conversion option, while the United States has preferred CWPF destruction option. Although, the conversion option appears to be a necessity and desirable in the Russian Federation, it has to take place in the context of the large scale economic and political restructuring and thus faces many obstacles. By contrast, the obstacles appear to be fewer and less forbidding in the United States and the sense of urgency is also less, hence the conversion in the sense of redeployment of military resources to civilian projects is also rare.

The table on the conversion requests lead us to conclude that the Russian conversion requests are made on the basis of the individual merits of each CWPF. The new productions from ex-CWPFs in the Russian Federation are directed towards the consumer goods industry. This option appears to be attractive, because of the apparent high demand in the consumer market: in 1992 alone more than 1000 samples of new civilian products and consumer goods have been designed and manufactured by the Russian industry. It is safe to assume that these figures have increased since then. Former CWPFs of the Russian Federation have been equipped with automated production system and modern technologies. This helps to facilitate an easy conversion and offers better infrastructure than local chemical civilian industries within the Russian economy and thus arguably has an advantage to succeed in the domestic market.

Since ex-CWPF with large infrastructure and less commercial market experience have to enter into competition, they face a number of additional challenges such as competition with existing large companies, threat from small-scale industries if governments, without affording appropriate protection, change to new managerial culture of commercialism. Competitions can force CWPF converted facilities to provide civilian consumers with scientific products of higher quality at the same cost and without increasing their prices. It is natural that state assistance in form of technical assistance for strategic planning and financing for feasibility studies, marketing and actual projects would be required for CWPF conversion as well as once CW destruction operations are completed. Governments may wish to subsidise CWPF conversion programs but there is a risk that it can only be worthwhile if there is also a strong demand for what it can produce. Thus, governments must find potentially successful

products that can survive in the market.[2] Moreover, there has to be a strong will to examine the extent to which the chemical technology capability can be redirected and restructured to serve the public sector in areas other than defence and also the extent to which it can bolster the health and productivity of country's commercial industry. The chances of joint ventures between domestic and international partners with former CWPF do not offer bright prospects. The fact that there are very limited joint ventures between the United States and the Russian Federation and that also limited to nuclear and air-defence industry allows us to reach such a conclusion (Marlin, 1998).

Who can finance the CWPF conversion and destruction programmes? It is quite logical that in some economies federal structure do not play that important role in converting military potential (for example USA), however, in some cases, this may not be the case (for example India, Russian Federation), since the chain of command and decision-centre is at the federal level. In such circumstances, the role of non-federal actors in stimulating conversion assistance should be explored. The basis of conversion becomes the programs and projects fixed by the state for the converted establishments, based in turn on their business plans. These programs and projects are to be financed from various sources, depending on the interest shown by investors in the commercial or other outcome of particular projects. The source might be a state, a commercial undertaking, bank for innovations, a foreign investor, the establishment itself, credits received, and so on. Another important source of funds for conversion projects might be the municipal authorities interested in solving regional aspects of development (Nikitin, 1998).

4.2.2 Temporary conversion into a CWDF

Another option under the Convention is temporary conversion of a CWPF into CWDF. Here, the main saving comes from the use of specialised and standard equipment, which could be around 40%. Nevertheless, a new building must be built for the purposes of carrying out CW destruction since CWPF buildings can provide only partial infrastructure for the CW destruction operations. Manpower from previous CWPF can be utilised to support CW destruction operations, which is another source of saving.

[2] For example, when during the World War II, there was an extraordinary demand for military equipment, the government subsidised conversion for commercial to military work and was prepared to buy all that was produced.

4.2.3 Destruction of CWPF

The third and final option is destruction of CWPFs. This option entails one-time expenditure in destroying the specialised buildings and equipment as well as standard buildings and equipment. In such case, the land available could be utilised for civilian industry purposes. Destruction of CWPF means inactivation, closure and finally physical destruction. Each phase involves cost implications in several respects.

4.2.4. CWPF conversion programmes in the Russian Federation:

The example of conversion of CWPFs into purposes not prohibited under the Convention is illustrative in certain respects. The Russian Federation has declared 24 CWPFs out of which it plans to convert 16 CWPFs for the purposes not prohibited under the Convention. An analysis of its conversion requests submitted to the OPCW suggests that "economic costs and benefits" remain the main driving force in making this decision. The Russian government has argued that it would loose approximately US$ 19 million if it has to destroy these16 CWPFs. Additionally, the potential economic loss would be around US$ 20 million per year. Last but not the least, by converting these facilities for non-prohibited purposes, it would save at least 875 highly-skilled personnel. The Russian Federation plans to produce a wide range of commercial products at these facilities.[3]

[3] These products include among others, sulphur oligomer as a component for the production of hydraulic brake fluids as well as foundry work, purified diethylamine as a raw material in the production of diethylhydroxylamine, polyethylene drum, tosol coolant, chemical weed and pest killers, polymer film and polymer packaging, polyethylene bottles, burefen herbicide, exterior and water-based paints, pesticides, vegetation production (rex and strobi fungicides, facet herbicides, basagran M herbicide, pivot herbicides) and packaging of these herbicides, polyetheresulphone (a polymer used as an electroinsulating material for protection against high tension at high temperatures in automobile and aircraft manufacture and space techniques, polymer packaging from polythene to polypropylene and a unit for filling small-sized bottles with permetrin, plans to produce aerosol packaging for household chemicals using a propane-butane mixture as a propellant (which is in line with the aims of the Montreal Protocol on Substances that Deplete the Ozone Layer of 1987) which makes it possible to avoid using certain coolants as propellants, filling of sodium hypochlorite into one-litre polyethylene bottles, which is commonly used as bleaching and disinfecting substance "Belizna, trichlorethylphosphate (TCEP), which is used as a plasticiser in the production of cast materials based on cellulose acetate, and also as a fireproofing compound in the production of varnishes, plastics, and polyurethane foam; Polyol mixtures, which are used as raw material for the

5.0. Secondary economic factors

5.1. Introduction

Although CW disarmament will heavily impact on the economy in the short-term, it will pay off in the long-term. Disarmament involves major adjustment problems and costs for the real resources of human, management and capital, and their associated inputs of raw materials, energy and supporting services. Human resources (see above) and capital face similar adjustment and conversion problems in terms of whether the resources can be transferred easily and quickly from military to civilian markets. Some resources are highly specific to the military sector and are non-transferable. It is natural that different type of economies will face different magnitude of problems. The adjustment costs will be higher if large-scale disarmament occurs during a recession or difficult economic situation in the economy such as the Russian Federation.

5.2. Other Economic Challenges and Prospects

Unlike other weapons, CW are not deployed in any other territory/country, thus, the problem of manpower and capital supporting the maintenance operations in distant regions of the world does not arise. At national level, the storage and maintenance cost will be phased out in proportion to the destruction of CW stockpile. Thus, upon the completion of destruction of entire CW stockpile, the maintenance cost bill will not be a burden to the state treasuries. CW destruction regime has a transition process of at least 10 years and even longer. The

manufacture of rigid polyurethanes; Polyethers (former name – Laprols) Polyur A-01, Polyur A-03, and Polyur A-04, which are used as a hydroxyl-containing component in the production of polyol mixtures. It should be noted that the Russian Federation initiated commercial production at some of these facilities and also had to discontinue production of certain commercial items. For example, at one facility it started production in 1989 of permetrin but in 1994 it was stopped due to commercial reasons. Since 1994, the commercial equipment from permetrin production line has been used for production of dichlorphos. Similarly, at another facility at one facility it set up a unit for the production of cypermethrin peretroid but due to change in market demand for cypermethrin, another project has been developed. Another example is that from 1958 until 1994 the left wing of building 9 housed the manufacturing of high pressure rubber technological hoses (wire reinforced) for hydraulic systems used in agricultural machinery. Due to the lack of demand this production at present is mothballed. For more details see official requests submitted by the Russian Federation to the OPCW by consulting OPCW official documents.

longer the transition processes the greater economic burden on states. Thus, the states by accelerating their destruction programs can significantly reduce costs related to the transition.

CW disarmament is burdensome for CW industries because verification imposes a substantial economic and reporting (administrative) burden on civilian firms, as they have to deal with the requirements of reporting and on-site visits conducted by the OPCW inspection teams.

CW destruction does not directly cause development in all economic sectors but may encourage development in some fields such as infrastructure (housing, schooling, medical facilities surrounding CWDFs), research and development institutions for developing destruction technologies, and can serve as source of employment to a limited extent for the destruction operations.

One important consideration is release of land that had been used previously by governments for the purpose of production, development, testing, maintenance, and storage and currently for the destruction purposes. Once the destruction operations are completed, this land will become free for use either for another military purposes or civilian purposes. Although land used in CW related operations are relatively less, it is not insignificant in terms of civilian economic purposes. The government can return these lands to civilian market for civilian purposes, which would not only generate immediate revenue but also provide a long-term source of income for other civilian enterprises.[4]

The increasing globalisation of the world economy has increased the importance of individual countries of not neglecting the development of their civilian technology base while focusing on the military side. Thus, states need to redirect their resources to the civilian base in order to survive in the world economy. Although CW research and development are minuscule, this fragment is equally important to be redirected to civilian purposes, which could contribute to the country's niche in the world market.

The globalisation of the world economy means that trade barriers can no longer be relied upon to protect from foreign competition those domestic industries that use substandard production technologies and/or make substandard products. This means, in turn, that all countries are inescapably locked in a

[4] Governments often occupy huge chunk of land fertile/non-fertile alike for defence purposes which could be well utilised for civilian purposes. For example, the South African Department of Defence is the largest land user of all government departments within South Africa. It currently utilises approximately 0.4 per cent of the country's land surface for its defence-related needs (UK – 1.2%, US – 1.1%, France 0.4%).

civilian technological competition in which those countries that spend less on military research and development (R&D), in order to spend more on civilian R&D, all else being equal, to gain the advantage.

5.3. Military R&D for defensive purposes

5.3.1 Defence Industry

There are not big defence firms, which are likely to encounter the significant adjustment problems, and which are wholly or largely dependent on CW offensive programs defence sales. Lack of a strong industry means less pressure on governments not to pursue CW disarmament.

In view of the CW defence cuts, the armed forces would like to react to perceived threats which will increase the requests of the armed forces for appropriate equipment and capabilities and the concentration on the development of next generation of equipment needed to ensure their capability to fulfil a new and changing role. For example, military may demand a share of the peace dividend to ensure that their smaller forces are better equipped for their new and changed roles, so that they are more capable of protecting the national interest. Although CW disarmament should not be substituted to encourage other arms race, policy-makers will be forced to appease such lobbies by meeting some of their demands.

The pressure from the military-industry complex comprising of defence ministries, including the armed forces, the political-institutional structure and defence contractors, including the linkage between these interest groups and their common concern with maintaining defence expenditure is perhaps the biggest obstacle against a speedier CW disarmament. Economic agents in the military-industry complex are always seeking alternative ways of ensuring national security, of making money and protecting their incomes and budgets. In my view, military-industry complex is not a big problem in the case of the CW disarmament. In normal arms race, indirect resources such as companies and their workforces associated with the military-industry complex acquire a culture of dependency on government defence contracts, rather than a culture of enterprise in which firms have to survive in competitive markets, and a culture of dependency could adversely affect international competitiveness.

It can be argued that the CW disarmament is taking place in an environment where military planners see qualitative improvements of weapons systems as a key element to

compensate for the quantitative arms reductions that are expected in the coming years. Consequently, for some planners R&D forms the basis for new and improved defence products, for the automated battlefields in particular, as well out of area conflicts requiring mobility and flexibility. Thus, on one hand, they can say that disarmament is taking place but on the other hand we loose sight of qualitative improvement taking place in other areas of weapons.[5]

5.4. Chemical trade

5.4.1. CW import and exports

Production and development of CW may require import of technology, if not readily available in the domestic market. However, unlike nuclear weapons, such technology is cheaper and could be produced domestically with relatively less know-how. With the onset of CW disarmament, funds and revenue allocated to import such technology will be saved. This further means that if a country experiences balance-of-payment or hard currency problem, funds saved from the prohibition of CW related imports can help the government. In relation to exports, CW exports are minuscule compared to other armouries therefore it is expected that export industry is not significantly affected by the CW disarmament. CW exports are neither a major source of employment, therefore, effects of CW disarmament is likely to be less. International mobility of scientists in CW area is not found or proven to be a founded concern, therefore, it is less likely that transfer of CW technology will spread further.

The case studies of the UK, France, the USA, Germany and the Russian Federation show that their export earnings are from non-CW related fields of military exports. For example, the UK's

[5] For example European co-operation for the long term in defence (EUCLID) is taking place which consists of 11 so-called common European Priority Areas or CEPAS (e.g. new radar technologies, artificial intelligence, stealth, etc.). Since then the number of CEPAs has further increased. In light of this, one can hardly believe that CW disarmament will not substitute development in other areas. In fact, one can be disillusioned by the fact that states are pursuing CW disarmament for sheer economic reasons and nothing to do with true disarmament intentions. Thus, one's view on political economy is very restricted in the sense that how far the CW disarmament process fits in within the political economy of a state party. Similarly, in the UK, there is a shift away from research on major defence platform towards 'smart' weaponry and C3I equipment to be incorporated into more mobile and flexible armed forces. The new MoD philosophy is that its research program does have a role to play in promoting national prosperity.

arms industry produces almost ten per cent of manufacturing gross domestic product, generates huge earnings from exports and employs about 400,000 people (Milne, 1998). Furthermore, because of less demand abroad and less revenue-generating capacity, states can withstand economic pressures to export. In other words, CW exports are not an attractive option to states.

6.0. Peace, Security and Political considerations

One of the most important considerations in analysing the political economy of the CW disarmament is that the CWC has been embraced universally by many states, in some cases, even without their neighbours joining the Convention. States from high-tension area of the world have been attracted by the CWC. The security regime offered by the CWC is perhaps the most important incentive. For example, the Republic of Korea has joined the CWC without its neighbour with whom it reportedly share far-from friendly relations. Although India who is a possessor CW country, its neighbour Pakistan has opted to join the CWC discarding the fallacy of security value of retaining the military option of chemical warfare (Zanders and Hart, 1998). Several states from the Arab League have joined the CWC, despite their earlier position not to ratify the CWC unless Israel joins the 1968 Non-Proliferation Treaty (NPT). Against this positive assessment, a sombre reality remains that several countries in the Middle East and neighbouring region of Africa remain outside the OPCW community.

The first dividend[6] is that the CWC aims to reduce the risks of regional or global conflicts by reducing and ending the CW arms race. Thus, in addition to properly calculated and carved economic beneficial options available, the CW disarmament indeed brings first benefit, namely, reduction of risk of war.

Has the CWC contributed positively to the improvement in the perception of security in the world? The primary goal of CW negotiators was to get rid of CW so that the perceptions on improved security are enhanced. Peace dividend consists of two main components: improved security and economic and development effects. Thus, in case of the CWC, when we speak

[6] Jörn Brömmelhörster (1997) shows a comparative analysis of various definition of peace dividend. Peace dividend is the "return of confidence and the consequent rise in investment following the establishment of peace after an armed conflict has ended" (Billenness 1995 citation from Dommen and Loukakos 1995, p.4); The peace dividend [is seen] in terms of the conversion of talent, expertise, and technologies from the production of weaponry to commercial products and processes, which will have positive effect on the …economy (Ettinger, 1993, p.107).

of peace dividend, improved perception of security should be given more weight than economic and development effects. Alternatively, had the fundamental goal was to increase economic development, we would have obviously given the later component more weight.

How the perceived security threat is removed? World knows the countries, declared stockpile and efforts as well as problems faced by the States Parties in CW destruction programs. The world also knows that none of the possessor States Parties intend to keep stockpile and has no malice intention. This fact is reinforced by various reports produced by the OPCW on the basis of its inspections. The data on stockpile, destruction is provided to all requesting States Parties. This is a big confidence-building measure, which is one step in the peace dividend.

In case of conventional weapons, it is possible that these stockpiles may be stolen and exported to other regions or ended up in black markets. But this is not the case with the CWC because States Parties are obliged not to transfer or retain chemical weapons.

The fact that CW disarmament is voluntary process serves a big purpose. For example, if a state has been required to destroy its arsenals after defeat in a war, then it would have been inclined to hide such stockpiles. But this is not the case since states have voluntarily joined the Convention (Kingma, 1997).

Another important influence the implementation of the CWC contributes is the curtailing CW expenditures not only releases scarce resources for more productive socio-economic development (neo-classical economy model) but also reduces the aggressive behaviour of some regimes (possessing as well as threatened regime) and enhances regional security by reducing tensions founded on uncertainty between states (George, 1997). Earlier, these States Parties maintained strategic force levels, compositions and operations but these are no longer required in CW area, thus, a change primarily from independent competitive decisions on part of the States Parties to co-operation. The allocation and operations game has changed from being essentially non-co-operative to co-operative—a game of co-ordination.

Another indirect impact of CW disarmament is its positive influence on the process of regional co-operation and integration. Normally, arms race is seen as an obstacle to bilateral and regional co-operation. Thus, CW disarmament is naturally poised to contribute positively in this respect.

7.0. Relations between CW disarmament and the realisation of the concept of Human Security

CW destruction aims to impact positively on traditional military concept as well as human security too. According to Renner (1997), "unlike traditional military security, human security is much less about procuring arms and deploying troops than it is about strengthening the social and environmental fabric of societies and improving their governance. To avoid the instability and breakdown now witnessed in countless areas around the globe, a human security policy must take into account a complex web of social, economic, environmental and other factors." We can make certain observations in the context of CW destruction. First, CW destruction does not contribute heavily to the construction of social fabric but it definitely contributes to a better environment in the long run. CW storage and leaking pose a greater threat than their destruction. To a certain extent, we can argue that CW areas are inhabitable in so long as CW and CWPF are existing but once the threat of CW is gone, rehabilitation is possible. Another way of looking is, due to CW programs, existing communities may tend to relocate themselves somewhere else which has negative impacts on remaining social community. With the commencement of the CW disarmament, the process of relocation may reverse.

Renner further argues that "national security is a meaningless concept if it does not encompass the preservation of liveable conditions on earth. A reasonable definition of security needs to encompass breathable air and portable water, safe from radioactive and toxic hazards, an intact climatic system, and protection against the loss of topsoil that assures us our daily bread. The well being of nations and their individual citizens depends as well on economic vitality, social justice, and ecological stability as it does [on] safety from foreign attack. Pursuing military security at the cost of these other factors is akin to dismantling a house to salvage materials to erect a fence around it." (Renner, 1997). Since continuous presence of CW and associated hazards carry a potential to adversely affect this broad concept of security, it can be argued that CW destruction will facilitates realisation of this concept in the long run.

By accepting the CW disarmament, States Parties and states have given away, particularly States Parties, an important tool of leverage in disarmament and arms control negotiations. One can positively argue that these States Parties would be able to exert more moral as well as political pressure in negotiating other disarmament and arms control instruments.

8.0. Technological Advancement

Does large-scale R&D spending and technological progress in the military sector occur at the expense of R&D and technological development in the civilian sector? It is logical and well expected that one would like to know how the CW disarmament process is affecting technological advancement of any country.

8.1. Challenges

8.1.1 Adverse impacts on country's competitiveness due to lack of CW offensive R&D

One can ask whether a country's commitment to CW R&D enhance or impair its growth and international competitiveness. An answer to this is CW R&D has neutral or insignificant effects on country's competitiveness in international markets. If countries were interested in buying CW technologies and could not produce them domestically, then country with CW R&D know-how can exercise monopoly and when demand for it goes down may experience shortfalls in its earning. However, CW technologies can be easily produced in domestically, therefore, the question of country loosing international competitiveness does not arise.

8.1.2 Fallacy of an automatic transfer of potentially-diversifiable funds to civilian purposes

While one may express a lot of optimism that savings of CW R&D could now be diverted into civilian industry, one must keep in mind that this shift would not be possible until the CW stockpile are destroyed. The main reason is that CW destruction programs requires huge funds, therefore, the government may continue to allocate what otherwise called civilian chemical R&D funds to CW disarmament. Thus, in initial phase, civilian chemical industry may not receive potentially diversifiable funds. However, in the long run, upon completion of the destruction process, the fund for civilian chemical R&D can be re-stabilised and perhaps increased. Another point is reduction from CW R&D will not necessarily free funds for allocation to civil R&D, thus aiding the conversion process by creating new demand for displaced scientists and engineers. In practice, however, government budgetary processes rarely work like that. Military R&D funding is usually perceived as part of the overall military budget, not as part of an overall science and technology budget. Hence reductions in it would be more likely to result in alternative use of

defence funds (or even budget reductions) than to increased civil R&D spending. Any attempt to reserve those funds for conversion would have to be fought for politically (Gummet and Stein, 1998). It is equally possible that governments may decide to divert CW R&D funds to other areas of armaments instead to civilian industry as mentioned above.

8.1.3 Blurred line between military and civilian R&D programs

In the context of CWC, we can safely assume that no military or offensive R&D is being carried out, however, R&D for non-prohibited purposes can and will continue. One immediate question or argument arises, that is, the boundary between military and civilian technology has blurred, and the direction of technology flow is more difficult to determine and thus one can not identify the trend with an absolute preciseness also in the context of the CWC. But because of strict verification and monitoring regime, identification of development of technology for prohibited purposes is easy because of extensive reporting requirements and follow-up inspections.

8.2. Prospects

8.2.1 Civilian application of CW research and development

Military will continue to carry out research on CW defence which has peaceful or civilian application since offensive/warfare related R&D is prohibited under the Convention. Thus, although military will consume resources which otherwise could be dedicated to economic development related purposes, this research is beneficial to civilian population at large. In particular, when military will carry out research with a view to establish whether new chemicals fall under the category of CW, it will be helpful to the OPCW community at large. Thus, military research programs have positive contribution to civilian products and technology: finding and determination of new chemicals falling under definition of CW, CW defence equipment etc. One can say in this regard that such military R&D has a positive contribution to economic growth, productivity and living standards (safety and security) of people at large.

8.2.2 In-built advantages of CW R&D programs for the facilitation of the CW destruction

CW research and development is a key determinant of the CW arms race.[7] CWC allows non-prohibited R&D which is less expensive, less alarming, and less provocative and less destabilising which means it builds a sense of confidence and security, while at the same time it serves the purpose of disarmament. CW R&D is a less time consuming process compared to other weapon systems. The cost of development and the length of CW development stages are lesser than air-defence or conventional-weapons.

8.2.3 Significant adverse impacts on industries pursuing CW R&D discarded

CW production and development require significant purchases from the defence industries, but the destruction process does not require the same purchases. Even during the production and development phases, it does not require greater purchases from industry like aeroplanes, radar, torpedoes, tanks and submarines. In the destruction operations, governments may give contracts to CW R&D establishments themselves to come up with the destruction technologies. Thus, very small number of industries could be affected.

In this regard, one may wish to apply the crowding-out hypothesis. According to this, necessary investments in CW R&D may crowd out valuable investment in the civil sector. While CW R&D may contribute (*albeit* insignificantly) to the advance of a technology, a nation's resources of qualified scientists and engineers, and the skilled manpower supporting them, are not inexhaustible. Defence and civil work are in competition for the same skills, and it would be regrettable if defence works become such an irresistible magnet for the manpower available that industry's ability to compete in the international market for civilian high technology products becomes seriously impaired.

In this regard, the case study of the United States is worth analysing. During 2001, total federal support for R&D was up 9% or 7.6 billion to 90.9 billion in fiscal 2001. Support for non-defence R&D was up 11% or 45.3 billion while funding for the defence R&D activities of both Department of Defence and

[7] Generally, it is assumed that high spending on military R&D leads to disadvantage in exports of civilian high technology products but Reppy (1998, p. 54) disagrees with such hypothesis.

Department of Energy was up 7% to 45.2 billion, bringing the two roughly into balance for the first time since 1981. Federal support for basic research, most of which finds its way to colleges and universities was up 12% to 21.2 billion. There was 6% rise to 223 million in funding for work in chemical sciences. Funding for the Department for Defence's research, development, test and evaluations programs rose 7% to 40.2 billion. Funding for basic research, which had been on the back burner for the past several years was up 16%, with funding for applied research up 15% and funding for development up 14% (*Chemical and Engineering News*, 2001).

8.2.4 Alternative employment of knowledge and skills of CW R&D personnel

We can argue that CW disarmament is bound to impact on CW R&D, which means releasing of personnel and continuing cuts in CW R&D will appear less attractive for new entrants into the labour market. Furthermore, we can say that valuable civil investment is the alternative which is being crowded out by CW R&D. Of course, if resources are unemployed, there is no crowding-out. But we all know too well that significant resources have to be allocated to CW R&D. The qualified scientists and engineers released due to the CW disarmament will be (are) searching for new jobs. Whether they are successful or not depends on their access to labour market information, the minimum wage at which they are willing to work, and the transferability or specificity of their skills. It is logical that CW scientists and engineers may not perhaps have exclusive access to non-governmental labour market because of their employment conditions with the government. However, it is against this dismal picture, one positive aspect should be noted, that is, most of the skills are transferable and can be well utilised in the civilian chemical industry sector. In fact, if military and other required personnel skills are converted to gainful use for the civilian purposes, then this would contribute substantially to a reduction in the levels of uncertainty and insecurity amongst this work force.

8.2.5 Elimination of the sense of insecurity and military spending

With the beginning of the CW destruction, CW R&D is prohibited. As we know, military R&D spending in one country translates into new weapons that can feed insecurity and military spending in rival states. With the prohibition of CW R&D, the

Convention helps to eliminate such a sense of insecurity and military spending.

8.2.6 Use of funds saved from military CW R&D for destruction technologies

Some military R&D resources will have to be assigned to developing and modernising the technology and equipment used to eliminate discarded weapons by safe and ecological methods. The idea is to make the military R&D institutions work at reverse technologies (Maslennikov, 1998). In the areas of R&D, CW military design and research centres have to diversify if they are to remain competitive. One greater area of work in which money could be more spent is development of verification technology and methods and their further refinement. This would not only enhance credibility of the CWC but will also help other arms control/disarmament instruments that due to want of stringent verification methodology is condemned non-ratification world-wide.

8.2.7 Transparency in permitted CW R&D programs

Transparency in military-related R&D is an important prerequisite for a comprehensive program on efficient conversion which exists in the CWC, although civilian chemical R&D reporting does not require States Parties to produce budget figures, i.e. how much they are spending in such R&D. To overcome the blurring of the lines between civilian and military paths of the scientific development, new tools of science and technology assessment have to be introduced and used by decision-makers in the national and international arms control communities. The Scientific Advisory Board of the OPCW performs this role in the context of the CWC. The role of the Scientific Advisory Board is to establish a kind of science assessment with the aim to detect, describe and reduce the use of new chemicals (science) for military relevant purposes. Scarce resources, technological dynamics, and political pressures, combined with the converging demand profiles of civilian and military technologies, all support the recourse to a dual-use strategy, whereby a technology is developed first for the civilian sector and then used for military purposes. This holds true for chemical R&D. R&D establishments would like to research which new and existing chemicals pose threat to the object of the Convention. They will carry out research and determine whether they fall under the scope of definition of CW. If so, such chemicals, under the

general-purpose criterion will fall under the CWC regime. Thus, peaceful research on chemicals is intended to identify new chemicals, which may have military applications. Since the Scientific Advisory Board will continuously monitor developments in the field, it is unlikely that any State Party will use such chemicals for non-prohibited purposes.

We can argue that the CW disarmament directly and indirectly stimulate co-operation between States Parties in the areas of non-prohibited activities. A very good example of this is several training and seminars organised by various States Parties. For example, a course on medical aspects of defence against CW regularly held in Iran on annual basis serves valuable purpose for medical professionals who are new to the field of chemical defence, and who do not have an extensive background in the medical aspects of defence against chemical weapons. This also provides a unique opportunity for them to gain insights from Iranian physicians who have personally treated chemical weapons victims in field situations.[8] One can argue that such courses are held because the CW disarmament has started and several states remain outside the ambit of the OPCW and the later situation may create potential reason for the threat of CW. Without the CW disarmament, such valuable programs would not have initiated at international level with a multilateral participation. These courses generate awareness and education among medical professionals for providing assistance to CW victims, thus, national-capability of a state is strengthened in this area which provides confidence to state that it will be able to assist CW victims in such cases.

9.0. Peace Dividend Principles of the CW Disarmament

Based on the above analysis we can draw following major principles of the CW disarmament.

9.1 Principles

- CW disarmament has major economic consequences involving costs as well as benefits. On the cost side, it requires a fundamental reallocation of resources for destruction of CW and CWPFs as well as from military to civilian production. This is likely to result in major problem of allocation of funding for CW and CWPF destruction or conversion process as well as unemployment or underemployment of labour, capital and other resources in the process of

[8] OPCW document: S/266/01

disarmament. As a result, the economic dividends of CW disarmament are rather negligible and costly. Ultimately, however, in the long term, CW disarmament can lead to significant and worthwhile benefits through the production of civil goods and services as resources are allocated to the civilian sector. Thus, in its economic aspects CW disarmament is like an investment process involving short-run costs and long-run benefits.

- Elimination of CW expenses and disarmament leads to make feel member States that their national security and economies are not threatened by their process. In fact, the threat of use of CW is eliminated from the OPCW community of states.
- CW disarmament involves general problems of disarmament. Overcoming the economic, technological and environmental constraints on destruction and conversion requires financial commitments, managerial innovations, manpower training, capital retooling and other initiatives so as to minimise the costs and maximise the benefits of disarmament. In addition, the physical conversion of defence plants and equipment can be difficult and costly. As a result, sometimes it is better simply to destroy specialist defence plants.
- CW disarmament contains unprecedented economic problems for certain countries, particularly, when it is occurring simultaneously with a shift from a centrally planned to a market economy.
- Since governments provide defence expenditures they need to be involved in the adjustment process. Public policies which assist change and resource allocation can help to minimise the costs of disarmament. Examples include manpower policies which provide information on alternative employment opportunities and assistance for retraining and mobility and incentives for creating new civil industries and for undertaking civil scientific and technological projects in areas such as energy, environment and space exploration.
- Military research and development promotes a growth in the cost of defence equipment and creates pressures for increased defence spending. It generates technological expectations that promote large-scale investments which in turn create rigidities resisting reductions in military expenditure. Thus, disarmament requires control of military technology, especially military research and development. Real disarmament preventing future rearmament requires control of military development work.

10.0. Concluding Remarks

One can assume that redirection of resources may create transition as well corresponding instability in the national economy as well as regional economy but such instability is not that big. Instability is brought through transfer of funding, readjustment of labour forces (creation and redirection), military-industry complex, local/regional microeconomic sectors dependent on CW installation etc.

One should keep in mind in case of the CWC that CW military expenditures are highly concentrated by firm (government in most cases) and by geographical area, while the benefits to taxpayers and to the sectors to whom the reduced expenditures will flow are widely spread (alternatively losses may occur to smaller economies, national economy at large may benefit, however, in longer term).

We can also say that in long term disarmament will create pressures and expectations that some of the peace dividend available to industrialised countries will be used to aid development in the poorer nations. We can say that CW destruction in developed countries also consumes some funds which otherwise could have been made available to needy countries. This means, CW disarmament affects this aid-transfer in a short-run, too. Of course, it can not be taken for granted that upon CW disarmament the fund will automatically go to development in developing countries but the prospects are perhaps better. Because currently states must carry out the destruction due to legal obligations, thus, possessor States Parties must find resources domestically to carry out destruction obligations.

Our methodological and factual analysis proves a hypothesis that the CW disarmament is definitely a better option than keeping the CW stockpile, for the world as well as national peace, security and economy. The author believes that further research on this vital link between peace and disarmament, encouraged by policy-makers, would continue to reinforce this assessment.

Annex:

Prospects and challenges in the Chemical Weapons Disarmament: An Overview

Factors	Prospects	Challenges
Human Resources	• Transferability of skills and knowledge • Less unemployment problems because of possibility of retention of knowledge and skills • Use of skills and knowledge in devising destruction technologies • Recruitment for personnel with skills and knowledge on destruction rise • No illicit activities due to universality of the Convention and lack of lucrative markets abroad • Gradual process of diversion of culture from military to peaceful purposes of chemistry	• Possibility of unemployment, however, after 10 years of EIF • Under-utilisation of skills and knowledge • No new recruitment for CW military programs • Reintegration with non-military culture and society etc. • Retraining personnel • Maintenance of interest and availability of scientific-personnel at the government disposal • Brain drain • Competition of ex-CW personnel in the civilian market • Civilian market preference for the younger, lower-salaried scientists over ex-CW experienced scientists and engineers
Economic	• Long-term economic benefits • No strong economic pressure groups like N-weapons, conventional weapons • No export-import market for CW technologies • Regional economies are not highly dependent on CW defence spending	• Short-term investment in destruction/conversion process • No unified solution for different economies facing different challenges (innovation required) • More economic hardships in the period of recession • Difficulties in selling ex-CWPF products, mainly due to contamination fears

	• CW destruction/conversion offer employment prospects • Infrastructure industries likely to benefit (communication, housing, hospitals etc.) in the CW destruction process • Possible diversion of CW defence program fund to civilian purposes • Saving of skilled and scientific personnel • Saving from discontinuance of storage and maintenance operations upon completion of CW stockpile • Reclamation of land for peaceful purposes • Help from international donors to CW destruction programs	• Fierce competition for survival for ex-CWPF (now converted) in the advanced civilian chemical industry • Development of suitable civilian production without radical reconstruction of ex-CWPFs • Lack of joint ventures (either with local or international partners) • Severe financial and other burdens on state governments and industry due to verification regime • Feasibility and market studies for survival of ex-CWPF in civilian market require funding from states
Defence Industry	• No significant losses to CW defence industry, • Demand for CW defence equipment may remain stable or increase • Compatibility between defence and civilian technologies • Gradual destruction process allowing defence industry to reallocate its resources for other defence fields/civilian purposes	• Possibility of diversion of funds saved from CW disarmament to qualitative improvement of other armouries
Peace, Security and Politics	• Destruction of existing CW stockpile and continued absence of CW from the OPCW community • Reduced risk of regional or global conflicts • Enhanced possibility on development and co-operation in the peaceful use of chemistry	• Continued threat from non-member States

	• Reduced aggressive behaviour of some governmental regimes • Positive impact on bilateral and regional co-operation and development • Enhanced military security perception • Direct contribution to the concept of human security • Chances for disarmament/arms control in other areas increased	
Technological Advancement	• CW research (with military application or prohibited purposes) ought to die • Diversion of scarce R&D resources to civilian purposes • Increased chances of countries' competitiveness due to availability of funds for civilian chemical R&D • Role of OPCW (through SAB) in detecting, describing and reducing the use of new chemicals for military relevant purposes • Diversion of military CWR&D for development of verification technology and methods and their further refinement	• Diversion of scarce R&D resources to civilian purposes not guaranteed • R&D on CW destruction technology require financial and other resources, thus, peaceful chemistry R&D may not get immediate funding • Boundary between military and civilian R&D getting more and more blurred • Difficulties in monitoring programs which use peaceful R&D for military diversion
International Co-operation and Develop-ment	• Positive attitude by international financial institutions in granting aid to SPs involved in CW disarmament • Global programs (training, seminars etc.) on CW defence • Use of CW related fund for aid to developing countries in longer term	

References

Brömmelhörster, Jörn. 1997. "Peace Dividends Resulting from Defence Budget Cuts." In *Converting Defence Resources to Human Development, Proceedings of an International Conference*. Report 12. Bonn: BICC, November, pp. 67–68.

Chemical and Engineering News. 2001. Federal R&D Budgets Congress sets final figures for fiscal 2001; scientific agencies fare well. 8 January, p. 22.

George, Paul. 1997. "Defence Expenditures in the 1990s: Budget and Fiscal Policy Issues for Developing Countries: An Overview." In *Converting Defence Resources to Human Development, Proceedings of an International Conference*. Report 12. Bonn: BICC, November, p. 62.

Gummett, Philip and Josephine Anne Stein. 1998. "Benefits and Costs of Military R&D." In *Reppy* (ed.), p. 55.

Kingma, Kees. 1997. "Demobilization and Reintegration: An Overview." In *Converting Defence Resources to Human Development, Proceedings of an International Conference*. Bonn: BICC, November, p. 17.

Marlin, John Teeper. 1998. "The Dashed Hopes for Conversion of U.S. Military R&D". In *Reppy* (ed.), p. 127.

Maslennikov, Ivan. 1998. "Transforming the Russian Economy." In *Reppy* (ed.), p. 100.

Milne, Tom. 1998. "Conversion of R&D: The UK Case." In *Reppy* (ed.), p. 183.

Nikitin, Mikhail. 1998. "The Conversion of Military R&D in the Russian Arms Industry." In *Reppy* (ed.), p. 135.

Renner, Michael. 1997. "Small Arms, Big Impact: The Next Challenge of Disarmament." In *Worldwatch Paper #137.*

Reppy, Judith. 1998. "Conversion of Military R&D"

Southwood, Peter and Yuri Andreev. 1998. "Conversion of Military R&D: Concepts and Complications." In *Reppy* (ed.), p. 65.

Thorsson, Inga. 1984–85. "In pursuit of Disarmament: Conversion from Military to Civil Production in Sweden." 2 vols. Stockholm: Liber, p. 301.

Willett, Susan. 2002. "Costs of Disarmament–Rethinking the Price Tag: A Methodological Inquiry into the Cost and

Benefits of Arms Control." United Nations Publication. UNIDIR/2002/4.

Zanders, Jean Pascal and John Hart. 1998. "Chemical and biological weapon developments and arms control." In *SIPRI Yearbook 1998*, p. 459.

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Bimal N. Patel (BSc, MA, LLM, PhD candidate), staff member of the OPCW, The Hague, the Netherlands. The views expressed in this article are those of the author and do not reflect in any way those of the OPCW. The effort was undertaken with the original idea that the success story of the CWC will have positive spill-over effects on the negotiations pursued in other areas of armament, particularly, the Biological Weapons Convention. The author sincerely appeals to international policy-makers to encourage concerted research approach at global and national level on the costs and benefits aspects of all fields of arms control and disarmament, conventional as well as non-conventional weapons.