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COMPLEX SYSTEMS IN CRISIS: THE DEVELOPMENT PROCESS
UNDER CONDITIONS OF URGENT STRESS*

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I. THE CONTEXT OF TRANSITION

1. In its fiftieth anniversary year, the United Nations is redefining and reaffirming its mission in a world undergoing a remarkable rate of change. The number of member countries has more than tripled, from 50 at its inception in 1945 to 184 in 1995. The world population has more than doubled, from approximately 2.2 billion in 1945 to 5.6 billion in 1995. The major threat to world peace has shifted from potential nuclear conflict between super-Powers to internal strife within countries. The primary mission of the United Nations as it enters the twenty-first century is increasingly linked to development - that is, to reducing the social and economic inequalities that have fostered religious and ethnic strife within countries as well as regional conflicts between neighbouring States. Some of these conflicts have historic roots, such as the current conflict among the nations of the former Republic of Yugoslavia, which were long suppressed by the larger threat of nuclear war. These conflicts are now being played out in costly warfare over causes kept alive through bitter memories and an inability to generate a vision of peaceful cooperation among factions. Further, the needs of an expanding world population have placed a heavier burden upon available resources, and the United Nations is confronting insistent demands from its donor countries for improved performance and management of scarce resources.

2. In this context of social, economic, and political change, the United Nations is re-examining the relationship between public administration and development in order to fashion more effective and efficient means of delivering technical assistance to developing countries in the service of world peace.

3. The present paper will examine the specific problem of providing technical assistance to countries in transition - that is, it examines the particular set of problems that occur when the Government of the country seeking assistance is itself in crisis. Such crises may have various sources, continue for varying periods of time, and disrupt governmental performance to varying degrees, but their primary characteristic is that the existing national Government is unable to meet the immediate daily requirements of its population or to build a viable basis for sustainable development without external assistance.

4. Countries may experience disruption of their governmental systems from at least three major sources: massive natural disasters, such as earthquakes, cyclones, or volcanic eruptions; internal civil strife; or external conflict/war with neighbouring States. During such periods of disruption, the stages of transition are not clearly demarcated one from the other; failure in one part of

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the system may, and often does, precipitate failure in others. Consequently, technical assistance to the country needs to consider the problem on at least two levels: the macrolevel of the whole system's operation, and the micro-level of the specific area of damage or strife.

5. The experience of disaster - natural, civil, or externally imposed - has a substantial impact upon development in the affected countries. The immediacy of human needs requires expenditure of scarce resources which, in recurring or prolonged disasters, creates a cumulative deficit that limits future development. The particular challenge in designing technical assistance for countries that have experienced disaster is to do so in a way that promotes transition to a responsible governmental and social system, capable not only of meeting immediate needs but also of sustaining the development process over the long term.

6. The present paper will undertake four tasks:

(a) To present briefly the conceptual model of complex, adaptive systems in the context of disaster;

(b) To examine transition as a learning process for the system undergoing change;

(c) To apply this model to a range of actual systems located at different points along the continuum from chaos to order;

(d) To review the potential of information technology as a mechanism to facilitate collective learning in systems undergoing development.

In the brief comparison of actual cases, it will consider four issues that are central to United Nations involvement in technical assistance for development:

building institutions and governance for development; assessing absorptive capacity; timing and modalities of intervention; and coordination of donor assistance.

II. TRANSITION IN COMPLEX SYSTEMS

7. The task of transforming disaster into constructive development requires a conceptual model different from the traditional, linear model of economic development which assumes a stable administrative system. Instead, in the countries that have experienced disaster, governmental systems are often

vulnerable to internal failure, fragile from the drain on limited resources or, in extreme cases, non-existent. In most cases, the existing systems are decidedly non-linear, subject to unpredictable changes in the exercise of authority and allocation of resources for public welfare. Development processes found in this set of cases also differ from the ecological model that assumes an equilibrium between the system and its environment.

8. The conceptual model of complex, adaptive systems is appropriate to explain the development process in countries that have experienced severe disruption in their governmental systems. It focuses on the process of transition between different states of function in continuously evolving social, economic, and political systems. It combines elements of both the economic and ecological perspectives but accepts the fundamental premise of non-linearity in social, economic, and political systems. It recognizes that those systems, to varying degrees, engage in continuous learning and self-organization in reciprocal interactions with the environments in which they are embedded.

9. The model of complex, adaptive systems is drawn from a substantial literature (Prigogine and Stengers, 1984; Ruelle, 1991; Nicolis and Prigogine, 1989; Kauffman, 1993; Gell-Mann, 1994; Kiel, 1994; Ditto and Pecora, 1994; Comfort, 1994a and 1994b). Such systems have, in general, four central characteristics:

(a) Sensitive dependence upon initial conditions;

(b) Different rates of absorption of information and skills among different segments of the society, leading to different levels of autonomy and dependency within the system;

(c) Vulnerability to random events that substantially alter the performance of different components of the system;

(d) A capacity for self-organization - for example, to reallocate energy and action in order to achieve a larger goal.

10. Each of these characteristics is important for the process of providing technical assistance to countries in transition. The first condition, sensitive dependence upon initial conditions, means that each system is governed by local conditions that shape and limit the alternatives for action at later stages of development. That is, small changes in initial conditions, iterated over time, can lead to large differences in outcomes. Development plans that are externally designed often do not take fully into account the local conditions,

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which include beliefs, needs, resources, previous alliances and leadership (or lack of same), among people in the target communities. These local conditions create differences in implementation of the proposed plans, which may make them vulnerable to disruption or corruption from unanticipated sources over time.

11. Secondly, each system is composed of subunits and sub-subunits that have different rates of absorption of new information, skills and resources over time. Consequently, these different units perform their functions at different levels of autonomy and dependence, which may generate dysfunctional dynamics within the system. The task of transition involves orienting the subunits of the system towards the same system-wide goal and encouraging maximum performance of each unit towards that goal, albeit at different rates. Reorientation may, and often does, entail a re-examination of the basic values and priorities of the subunit in order to place its functions within the context of the larger, long-term system-wide goal. This process of collective learning may be supported by design.

12. Successful transition requires continual circulation of information and feedback to allow the subunits to adjust their performance not only to the new goal but also to their near-neighbours whose performance affects theirs. This task can be facilitated by interjecting a timing mechanism for monitoring performance and feedback of those results into the respective decision processes within the system. Such a mechanism focuses attention of the component units on the system-wide goal and provides opportunity for review, reflection and revision, all requirements for learning among the system's participants.

13. Thirdly, complex, adaptive systems are subject to chance as well as choice. Random events occur which may alter the performance of the system, disrupting previous plans and requiring reallocation of resources and attention. Systems in transition need to be able to adapt to unexpected situations, yet keep their focus on the system-wide goal.

14. Fourthly, the capacity for self-organization is the spontaneous effort to reallocate energy and action to achieve a system-wide goal. This characteristic is based upon the assumption that all systems operate on a continuum that ranges from order to chaos (Kauffman, 1993). Further, systems at either end of the continuum continually seek to move towards the centre. At the centre of the continuum exists a narrow region called the "edge of chaos" (Kauffman, 1993) where there is sufficient structure to hold and exchange information but sufficient flexibility to adapt to changing conditions in the environment. Consequently, according to Kauffman, systems that have experienced disaster or chaos will seek to move towards order, and systems that function under extreme

order will seek to move towards chaos. The middle region of the continuum, or the "edge of chaos", provides the greatest opportunity for creative change.

15. If one accepts these characteristics as valid for systems undergoing transition, one can then delineate a model of development that builds on the capacity of populations for spontaneous self-organization. Such systems depend upon communication and information networks and rely upon the capacity of individuals and organizations to learn new values, beliefs and skills in responsible interaction with more experienced actors.

III. TRANSITION AS A LEARNING PROCESS

16. If we accept the model of complex, adaptive systems for countries in transition, then the actual existence of chaos need not be wholly negative. Disaster, by shattering the existing habits of thought and action, also creates opportunity for rebuilding governmental systems in a healthier, stronger way. While the tragic losses incurred under chaotic conditions cannot be undone, the challenge to the United Nations lies in facilitating the transition from chaos towards the centre region of creative change. The requirements are clear. First, sufficient structure to hold and exchange information must be established. In governmental systems, this is the basic infrastructure for the exercise of legitimate authority: a legal system, a judicial system, a police system, a prison system for those who act outside the law, and the design of governmental institutions that ensure informed, voluntary choice by the citizens. Those systems take time to establish, but recognizing the need and providing technical assistance to the process is a valid, and valuable, service by the United Nations.

17. Secondly, sufficient flexibility in the exercise of this authority in order to adapt to changing conditions must be ensured through a professional administrative system: the establishment and training of a professional civil service, the establishment of financial management systems, macroeconomic monitoring and policy development capacity, information management, central/local relations, resource management, and planning and analysis capability. Again, United Nations technical assistance can be instrumental in facilitating this process.

18. Once the basic balance between structure and flexibility is established within a country in crisis, local communities can create new ways of meeting their own needs. The system is then in healthy transition, and self-organizing processes will likely evolve.

19. However, it is important not to underestimate the forces of resistance and obstruction to this process of transition, as long-established interests fear that they will lose control of previous sources of privilege and power. The process of facilitating healthy change in a system under stress includes identifying the subunits, or sub-subunits, that are still functioning with some degree of autonomy and competence and supporting their performance in ways that, in turn, influence the performance of their near-neighbours in the system. As the influence and example of competent performance spreads throughout the system, the dynamics of the system change. Resistance collapses, and the system moves towards the creative centre of the continuum.

20. For countries in transition, chaotic conditions, while destructive and damaging, also provide the opportunity for different segments of the population to learn new skills and develop local capacities that shift the components of the system to a different level of interaction. Whether that dynamic is constructive and moves the system towards order or whether it deepens the destructive drive towards chaos and total collapse may depend upon external support.

IV. COMPLEX SYSTEMS IN CRISIS

21. Four cases of actual United Nations involvement or intervention in countries undergoing crisis illustrate the concept of complex, adaptive systems. They each represent different points on the continuum from chaos to order and demonstrate the potential for growth or failure from outside intervention. They illustrate that the basic challenge to public administration systems for rebuilding their societies after crisis is the same, whether the source of disruption is natural or violent.

22. The four cases, ranging from least to most chaotic, are:

(a) Maharashtra, India, which experienced a severe natural disaster, an earthquake of magnitude 6.5 Richter, on 30 September 1993;

(b) Haiti, which reached a peaceful resolution of internal conflict;

(c) Rwanda, which represents a violent resolution of internal conflict;

(d) Bosnia, which represents continuing violent internal conflict or war, supported by neighbouring States.

Each of these cases represents a state of transition, dependent upon external assistance for constructive development. The form of assistance offered is likely to generate dynamic change that could either lead to constructive development or slide further towards chaos.

23. Each case will be examined from the perspective of the United Nations mission and to support development and in terms of the generation of self-organizing processes and the impact of the disaster upon its development. Then an assessment will be made of the four issues involving United Nations intervention: building institutions and governance for development; assessing absorptive capacity; timing and modalities of intervention; and coordination of donor assistance.

A. Maharashtra, India

24. Although the earthquake disaster in Maharashtra, India, on 30 September 1993 represents the case closest to the centre on the continuum from chaos to order, the first minutes and hours after the earthquake struck, at 3.56 a.m., constituted unmitigated chaos in the rural villages of Latur and Osmanabad districts. The epicentre of the earthquake was near the village of Killari in Latur District, with a population of 12,264 and 2,847 homes. Fortunately, many people were still awake, celebrating a religious holiday. Yet the earthquake caused extensive damage and loss of life. Official reports listed a total of 7,582 dead, 21,849 injured, and 30,000 families, or 175,000 people, rendered homeless by the earthquake. The disaster wholly disrupted life at the village and regional level.

25. The United Nations role in providing assistance to India following the Maharashtra earthquake was limited to contributions of disaster relief through UNICEF, but the case represents an interesting example of the spontaneous emergence of self-organizing processes following disaster. The evidence clearly documents a dynamic, coherent disaster response system that evolved from the local conditions in the region. While strong elements of governmental authority took action to mobilize the system, there was the high degree of voluntary action which represents important processes of self-organization. From the first radio call by the voluntary police, who in turn activated the national satellite communications system, to the voluntary response of neighbours who searched through the rubble for injured victims, reports document that individuals and groups initiated collective action based upon the information immediately available.

26. Three conditions had a powerful influence upon the emergence of self-organizing processes and their transition into a disaster response system in this poor, rural region. First, in 1988, the Government of India had invested in a national satellite communications system and located downlinks to the national satellite in the offices of the district administrators, or tax collectors. This communications system allowed multiway communications between the state of Maharashtra offices in Bombay and other district and state offices in India. Using the satellite system as the base communications network, computer links operated between the cities of Solapur, Omerga, Latur and Osmanabad. Within the cities, microwave links established two-way communication among city offices involved in disaster response. Within the villages, volunteers manned wireless stations to connect them with the larger network. Using this communications network, the Chief Secretary of the state government of Maharashtra established a hot line that connected him to all villages in quake-affected areas.

27. Secondly, the Indian Administrative Service (IAS) has established a professional corps of educated public administrators who share a common background of professional training, accept a common set of responsibilities towards developing the capacities of the citizenry in their jurisdictions, and represent a strong presence of the national Government in state and local jurisdictions. Most officers have had some experience with disaster response as part of their training. Thus, within two days of the earthquake, 32 civil servants of IAS rank were reassigned to disaster response. Four district administrators were assigned to the two most heavily affected districts. All of the local subdistrict administrators from neighbouring districts were summoned to work on disaster response.

28. Thirdly, the strong Hindu tradition of humanitarian values provided a core set of widely shared beliefs that reinforced actions to help others. This philosophical approach underlay many of the actions taken by individuals and voluntary groups to assist the victims of the disaster. It contributed substantively to the high degree of participation by individuals in voluntary organizations and the high proportion of voluntary organizations represented in the disaster response system. These three conditions created a structure of communication processes through which information could flow rapidly among participating decision makers. Communication was facilitated by the high degree of shared values, and flexibility was enhanced by the recognition on the part of Indian administrative officials that they needed to work in collaboration with the community quickly to alleviate the severe degree of suffering in the stricken region.

29. While none of these three conditions was new to India, each facilitated self-organizing processes. The Indian Administrative Service provided sufficient structure to hold and exchange information. The satellite system provided the technical capacity to facilitate communication and the exchange of information across jurisdictional levels within the governmental system. The Hindu tradition of humanitarian values supported flexibility and adaptation among public, private, and non-profit organizations to reallocate energy and resources to the disaster-affected villages. Together, the three conditions enabled informed, responsible managers to make innovative use of existing resources to serve the common goal of humanitarian aid to the affected communities. This goal also engaged the participation of a wider group of citizens in voluntary response activities. There were gaps in performance, but the emergence of a basic disaster response system through self-organizing processes is evident.

30. In this case, the major source of longer-term international assistance for recovery was not the United Nations, but the World Bank, which made a sizeable loan to India for the reconstruction of housing for the damaged villages. The World Bank was very much aware of its role in the long-term process of development for the area. It first authorized a very careful needs assessment of the villages. Indian officials were involved at every stage and the construction process was monitored, with prompt feedback to both villagers and donors.

31. This case illustrates the potential of transforming the destruction caused by disaster into an opportunity for constructive development, at least with regard to the reconstruction of housing. The question is whether this dynamic process of self-organization can be sustained and extended to the longer-term problems of development in the region.

B. Haiti

32. Haiti represents a different type of case for United Nations intervention. After nearly three years of civil strife, marked by increasing violence, corruption, and near-total devastation of the country's social and economic infrastructure, the military general, Raoul Cedras, under strong threat of outside military intervention sanctioned by the United Nations, returned the legitimate authority of the Government of Haiti peacefully to its democratically elected president, Jean-Bertrand Aristide. On 15 October 1994, Haiti was bankrupt, but free.

33. The threat of chaos continued, however, since years of calculated violence and repression had left a bitter legacy of distrust towards agents of order, the police and the military. Returning to this cauldron of hatred, fear, and abject poverty, President Aristide faced a massive task of national reconciliation, rebuilding and renewal. For six months, United States troops were deployed to maintain order or to provide sufficient stability so the nascent structure of democratic government could function. On 15 March, the task of maintaining order was turned over by the United States to the United Nations, which deployed troops under its command from more than 30 countries. On 25 June 1995, the people of Haiti held their second democratic elections and reaffirmed their commitment to democratic government and development.

34. It is still too early to assess the outcome of the United Nations role as peace-keeper in Haiti. Yet, the presence of the United Nations force provided the structure essential for the elections to be held peaceably. The issues of development are paramount in Haiti, but its democratically elected President will have a legitimate basis on which to build economic and social policy.

35. In terms of building institutions and governance for development, Haiti faces a very long and arduous task. Retraining the police from the instruments of fear and oppression they had become under the Duvalier and Cedras regimes into a professional corps that can provide legitimate security to the mass of citizens has proved a major and still unfinished undertaking. Rebuilding and retraining the judiciary, whose members had been decimated through killings and exile, is a second major step towards creating responsible governmental structure.

36. These tasks were further complicated by the fact that Haiti had almost no civil institutions left that could manage development assistance even if it were made available. Its "absorptive capacity" is very low. The banks had no credit; businesses were non-operational. Roads and infrastructure were either in total disrepair or destroyed. Schools were non-functional, due to lack of funds to pay teachers or buy supplies. More than 53 per cent of the adult population is illiterate and, therefore, unable to follow written instructions. The country is in desperate need of rebuilding its capacity to function and to maintain a civil society.

37. The United Nations coordinated peace-keeping assistance for Haiti effectively, although it did not come easily. The strong interest of the United States in ensuring stability in the Caribbean region and in stemming the outflow of refugees seeking political asylum reinforced its substantial commitment of military forces to maintain order during the first six months and its continued

contribution to the United Nations peace-keeping forces. The timing of the United Nations peace-keeping intervention in Haiti was well chosen in terms of establishing the structure of governance for development, but whether cooperation among countries established during peace-keeping actions can be translated into cooperation on providing needed development assistance is another matter.

38. Haiti cannot move forward in economic and social development without substantial infusions of external capital and technical assistance. The next major task facing Haiti - and the United Nations community - is the coordination of donor assistance in ways that genuinely support the development of self-organizing processes for the Haitian people. Accomplishing this task will require the articulation of a goal that is shared, at least to some degree, by all participants. While Haiti's President Aristide has effectively articulated a goal that is substantially shared by the Haitian populace, it is less clear that this goal is accepted by the Haitian élites and the wider international community. Forging a shared goal - or "bias for choice" - regarding Haiti's long-term future will be critical in facilitating the voluntary cooperation of a wider community of countries with Haiti's development programme. The United Nations, with its mission of technical assistance for development, is in a favourable position to facilitate the articulation and dissemination of a catalysing goal for cooperative action among member countries towards development in Haiti. This is a more difficult and challenging task than peace-keeping; it requires more interaction with the Haitian people and the ability to translate a global goal into local terms.

C. Rwanda

39. In Rwanda the United Nations intervened to protect millions of refugees from a violent, destructive civil war that has, for the moment, ended in a fragile truce between the warring Tutsi and Hutu tribes. With the minority Tutsi victorious in their effort to end genocide and repression by the majority Hutu, the task of rebuilding a country in which the civil and physical infrastructure has largely been destroyed is enormous. Although the current governing coalition includes members of both Hutu and Tutsi tribes, the stability of this Government is by no means certain. The history of violence between the two tribes goes back nearly 500 years.

40. The initial conditions of near-total destruction of both the physical and administrative structure of government and other commercial, educational, and social institutions create in Rwanda a situation of much more severe chaos than

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in Haiti. The United Nations role is clear. It must first establish sufficient structure for not only government but also legitimate commercial, educational, and social institutions to function. Without a legitimate Government, there is no structure for reporting accurate, valid information to the people. For example, rumours of Tutsi attacks upon returning Hutu tribesmen kept refugees in camps in neighbouring Zaire despite the offers of reconciliation from the coalition Tutsi/Hutu Government. Routed Hutu military extremists apparently engaged in spreading the rumours, in order to discredit the efforts at reconciliation by the new coalition Government. Without valid information, the refugees, fearful for their safety, remained in the camps, unable to act and vulnerable to infectious diseases and starvation.

41. Yet, in the midst of this chaos, small segments of the society are beginning to function again. The Tutsi-led Government has reached out to Hutu tribesmen by including in their coalition a moderate Hutu who is also committed to ending the violence and rebuilding the country. There is a beginning vision of a peaceful society that respects the rights and traditions of both tribes. Women in Rwanda, returning to abandoned villages, planted crops again, beginning a cycle of food production that would reduce dependence upon external sources. Religious leaders have returned to their churches, many of which were sacked and burned during the war, seeking to pick up the remaining pieces of their ministries and cementing them together with a bond of faith. While these actions represent small indications of a movement towards order, external assistance can take two important steps to assist. First, it can nurture the efforts of the still separate groups towards a common goal of shared peace between Hutu and Tutsi. Secondly, it can reinforce the structure of government and commerce which will allow the free circulation of information and enable informed citizens to make viable choices in allocating their attention and actions towards a shared goal of a peaceful Rwanda that respects the rights and dignity of both Tutsi and Hutu tribes.

42. The timing of United Nations intervention is crucial. After the violent excesses of the genocide, leaders of both tribes and the majority of their members are horrified by the costs and losses of war. They are open to new alternatives that would end the violence and allow a return to a more civil and ordered society. The actions that are being taken by the United Nations at this time - the re-establishment of a legitimate judicial system and a professional police system - will help to create the essential structure for orderly government. The next step - of creating a professional civil administration that can accept and administer international assistance effectively - is essential to providing the flexibility needed to adjust the nascent institutions to the needs of a Rwandan society that includes both Hutu and Tutsi as rightful

participants. Unless these two steps are taken, Rwanda is not likely to develop the capacity to accept external assistance or absorb it into its society effectively. The issue of coordination of donor assistance thus becomes moot. If the United Nations can facilitate the creation of sufficient structure and flexibility in Rwandan governmental functions, the Rwandan people are likely to initiate self-organizing processes towards development that, in turn, can be supported with external assistance to reach a shared goal of sustainable development.

D. Bosnia

43. Bosnia represents the most difficult and most chaotic of the four cases considered in this study. For three years, a civil war between Bosnian Serbs, Muslims and Croats has been waged, with sporadic moves towards order interspersed with deeper lapses into chaos. The United Nations involvement in this peace-keeping effort has endured the humiliation of stolen equipment used against them, repeated broken truces and captured hostages. The country continues to be ravaged by war, with both Serbs and Muslims flaunting insults at United Nations peace-keeping forces. In this apparently impossible and increasingly desperate situation, one question is whether there is any evidence of self-organizing processes moving towards a creative resolution of the tangled problems of religion, nationalism, and territory.

44. A broad assessment of conditions in the Bosnian conflict clarifies the United Nations task in this case and illustrates why its peace-keeping efforts have not been successful. A central element for creative resolution of this conflict does not yet exist. There is no Bosnian government that includes both Serbs and Muslims and recognizes and respects the equal status of both. Without such a structure, information circulates only within enemy camps, which still have strong incentives to maintain their hostilities. Further, the Bosnian Serbs have been supplied and supported in their position by neighbouring Serbia, which has taken an active role in continuing the conflict. The Bosnian Muslims until recently were publicly attempting to honour the United Nations-imposed arms embargo placed upon Bosnia but have increasingly rejected it to the point where they are now capturing United Nations military equipment and supplies for their own use. The wholesale rejection of the arms embargo by the Bosnian Serbs and indirectly by neighbouring Serbia in continuing to supply their brothers across the border gave the Bosnian Muslims little recourse but to reject the embargo also or wait for slaughter.

45. The painful irony of this case is that all of the steps taken towards peace are irrelevant without a Bosnian governmental structure that includes both Muslims and Serbs. Such a structure is not likely unless there is a goal that articulates a country of Bosnia that includes both Muslims and Christians and respects the rights and beliefs of each, equally. The Bosnian Serbs have fought this war with a ferocity and tenacity that echoes the hatred nursed from their loss to the Ottoman Empire at the Battle of Kosovo in 1389. Dreams of Serbian glory, nurtured in bitter silence for 800 years, rather than a goal to create a unified Bosnia, have fuelled this intensely hostile conflict.

46. Without a common goal, the Bosnian Serbs and the Bosnian Muslims have no

basis for building a governmental structure to support political and economic development. The United Nations task in this conflict is to search for some common beliefs that will bridge the gap between the two warring parties. It will be most likely to do so if it can identify small groups or subgroups within each of the hostile parties that are open to cooperation and resolution of the conflict and support their efforts. This requires an intensive level of inquiry and communication at the local level, which has not been the United Nations usual method of operation or service delivery. But unusual situations require the creative development of appropriate strategies to reduce chaos, which, in the Bosnian case, means continuing bloodshed and war. The challenge to the United Nations in this painful case is to devise new means of initiating movement towards the creative centre among subgroups of both Bosnian Serbs and Muslims.

V. LESSONS FROM CRISIS

47. What has been learned from these four cases of nations in crisis that can inform one's understanding of the United Nations role in this changing world? The critical issue in each case is the creation of sufficient governmental structure to hold and exchange valid information that will support citizens' actions towards a common goal. The need for governmental structure is the same, whether the crisis stems from a natural disaster, internal civil strife, or warring parties supported and supplied by external allies. Without this structure, the other issues of flexibility, timing and modality of interventions, capacity to absorb assistance, and coordination of donor assistance become moot. The critical task, in each case, is to support local processes of self-organization and to orient them towards a larger, shared goal of sustainable development and cooperative peace, as responsible members of the community of countries.

48. Effective administrative machinery is an inseparable part of all sectors of government, including the political, social, economic, and legislative elements that shape the State's essential work. In any post-conflict restoration process, it is fundamental that the earliest possible formulation and preparation of a post-conflict reconstruction strategy should be ready for implementation once a peace agreement is signed. The basis of any such strategy is a needs assessment of the direct implications and consequences of the conflict and the major changes emerging as a result of the conflict. Such plans should also provide actions for the second and third phases of reconstruction - the transitional and reconstructive phases - and a long-term strategy that should reinforce administrative capacity-building and sustainable development.

49. The necessity of the earliest possible restoration of local and central governmental structures is essential to ensure the coordination of the delivery of relief operations and humanitarian aid. The importance of re-establishment of basic communications and transport facilities and the utilization of available information technology to link local governments with the central government is essential; and so is the imperative of restoring and recruiting vital human resources. Recommendations for a long-term strategy of institutional capacity-building propose that the elements of good governance, sustainability and environmental conditions be acceptable and realistically implementable within the national context. A detailed exploration of current United Nations considerations of post-conflict reconstruction strategy is the subject of a companion paper, "Restoration and restructuring development of government administration in post-conflict peace building" (ST/SG/AC.6/1995/L.10/Add.1).

VI. INVESTMENT IN INFORMATION TECHNOLOGY TO SUPPORT TRANSITION

50. The changing world environment places new demands on the United Nations, demands that were not foreseen at its inception in 1945 but that have become evident as the number of countries, the number of peoples resident in those countries, the number of interactions and types of conflicts within and among those countries have increased. In order to develop and extend its mission of peace in this rapidly changing world, the United Nations needs not only to facilitate transition among its member nations but also to update its own technical capacity to function as a complex, adaptive system of 184 countries.

51. Given the increasing complexity of its role in facilitating development among countries with widely varying economic, social and political systems, innovative means of fostering communication, coordination, and organizational learning within and among its member countries are essential if the United Nations is to play a successful role in this dynamic environment. If transition is redefined as organizational learning and if learning is fostered by creating an information-rich environment, a major vehicle for guiding this collective learning process is the appropriate design and implementation of information technology.

52. Recent advances in information technology offer innovative means for addressing the difficult, non-linear problems of complex systems in response to and recovery from, crisis (Comfort and Chang, 1995; Comfort, 1993; Comfort, 1991; Comfort, Woods, and Nesbitt, 1990). Geographical information systems support spatial analysis of dynamic problems and enable graphic representation of complex information to multiple managers in different locations. Active indexing techniques allow managers to update this information and transmit it to multiple managers simultaneously. Interactive communication networks allow the near-instantaneous exchange of information around the globe. Advanced techniques of logical inferencing, including fuzzy logic for uncertain problems, can be used to extend human reasoning capacity in complex, dynamic environments. Advanced software programs permit the modelling and measurement of non-linear systems to assist managers in understanding and guiding the dynamic processes of social and economic change.

53. In what ways can information technology support transition to more constructive, productive states of development for countries in crisis? First, information technology can be used to support the design and implementation of an administrative infrastructure that makes available to the citizens current information on the basic institutions of society. This could include information on newly restructured institutions, such as the judicial system in

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Rwanda or the police system in Haiti, or information on what types of assistance are available at which locations, such as in the reconstruction process in Maharashtra. This information infrastructure can be designed to function at two levels of operation - the micro-level of daily operations for local agencies, and the macrolevel of interactive communication and problem-solving for major issues or crises affecting the national system. A third level, a meta level for international communication, coordination, and problem-solving, can be designed to support decision processes between the United Nations, working in collaboration with donor countries, and the recipient country in reference to the design and implementation of appropriate technical assistance.

54. Secondly, information technology can facilitate the flexibility needed for societies undergoing transition. As conditions in the troubled country change, the basis for decision needs to reflect those changes immediately, if it is to be effective. By facilitating the storage, retrieval, updating, representation, and transmission of information to multiple managers simultaneously, information technology supports an interactive decision process that can incorporate new information and solicit feedback from multiple participants easily and inexpensively. Extending the transmission of this information to the citizenry increases their knowledge and understanding of the problems of transition and can be used to actively solicit their participation and support, as in the state government's request for voluntary assistance to the earthquake-affected villages in Maharashtra.

55. Thirdly, information technology can be used to facilitate the very important process of envisioning future alternatives to existing states of crisis. In cases of recurrent or prolonged hostilities, as in Haiti, Rwanda and Bosnia, a primary task of moving to constructive action is finding a shared basis for reconciliation of the parties in conflict. While information technology is only a mechanism - and must be understood and recognized as such - it can provide ready and inexpensive access to impartial accounts of events, their costs, consequences and future implications. Making these accounts available equally to all parties in the conflict can support the individual and group processes of review, revision and redesign which are essential for collective learning. Out of this process of collective learning will, it is hoped, evolve shared goals for action to resolve the conflicts and rebuild the troubled country.

56. Finally, information technology can also be used to form and support the operation of "virtual think tanks" or groups of knowledgeable professionals with skills and experience in crisis management and development issues. Such groups may serve as a resource to the target country in its transition process or as support to the United Nations in designing modes of intervention and

coordinating donor assistance. Using interactive electronic communication, file transfer protocols, and the information resources of the World Wide Web, the groups of experts can be both international and interdisciplinary in their composition and global in the scope of problems they address.

57. Carefully designed investment in information technology, coupled with appropriate organizational development, offers the possibility of not only restoring collapsed systems but of renewing faltering ones and generating viable systems in new areas of economic and social practice. Information technology also provides a means of measuring changes in performance and efficiency resulting from this investment. In the twenty-first century, these systems need to be capable of supporting the interdisciplinary, interorganizational and international decision processes involved in global risk management and development.

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