Recalling a Genius

An Overview of Professor Salam's Achievements

by Dr Gazi Serajul Islam

THIS article is in memory of Professor Abdus Salam, the Nobel Laureate in Physics on the occasion of his third death anniversary. He breathed his last three years ago this month, on 21 November 1996 at the age of 70.

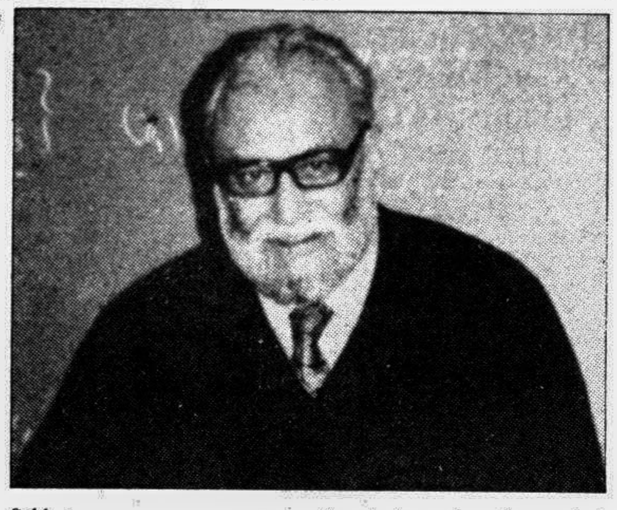
Professor Salam became a legend in his own lifetime and was greatly admired by the world scientific community. He was also an ardent advocate and relentless crusader for development of science in the developing world. It is quite impossible to describe his vast scientific achievements in a short article. As a great admirer of Professor Abdus Salam, I would try to give a bird's eye view of his work, focusing principally on unification of forces and discuss briefly its significance and relevance to cosmological theories of the origin and evolution of the Universe.

In 1946 Abdus Salam won a scholarship to Cambridge University, where he established a reputation as a brilliant physicist. Since then he has spent his life working mainly on two problems; first, to discover the basic building blocks of matter and secondly, to discover the basic forces among them. Since the material content of the Universe is divided into two parts, 'matter' particles such as quarks, electrons, muons etc., and 'interactions' such as gravity, electromagnetism etc., we can say that his work has been to devise a mathematical theory, that will describe the whole of creation.

The interactions among the two groups of matter particles — leptons and quarks — are divided phenomenologically into four categories. In order of strength they are: the strong nuclear force which binds protons and neutrons together to form nuclei; the electromagnetic force which binds electrons with nuclei to form atoms; the weak nuclear force which causes radioactivity; and, finally, the gravitational force which binds us to earth.

One of the central thrusts of Physics over the years has been the search for the unification of the natural forces — for their understanding as different aspects of one superforce governing the physical Universe. Newton recognised the fall of an apple, the tides and the orbits of the planets as aspects of a single phenomenon, gravity. But a real unification of forces was first achieved when electricity was liked to magnetism. At the beginning of the last century we had these two absolutely distinct forces — the electric force and the magnetic force. The electric force is produced by an electron, and in the space around it we have manifestation of the electric force. As soon as we begin to move the electron we get a manifestation of the magnetic force. The magnetic force is in fact not a fundamental entity; it is something connected with the electric force through the state of motion of the electron. James Maxwell in 1865 unified the electric and magnetic forces — the electromagnetic force, through his laws of electromagnetism. The great Albert Einstein who gave us the vision of an ultimate unification of all forces followed Maxwell.

Professor Salam was able to prove that the weak nuclear force and the electromagnetic force are nothing but two manifestations of a single force, the electroweak force. For his work he shared the Noble Prize for Physics in 1979 with Steven Weinberg and Sheldon Glashow who also arrived at the same conclusion independently. This discovery marked one of the leading conceptual advances of twentieth century physics.



Abdus Salam was one of those who have successfully made the first advance towards materializing Einstein's dream. In the 1960s the time was ripe for him to look for unification between the electromagnetic force and the weak nuclear force, which are apparently very, very different. On the one hand the electromagnetic force has an infinite range, while the weak nuclear force is a very short-range force. Furthermore, the weak interactions are parity violating while electromagnetism is not. Salam started working on unified gauge theories using Young-Mills theory as the basis, which is a generalization of quantum electrodynamics, a very accurate quantum version of Maxwell's theory of electromagnetism. But one major stumbling block on the road to this unification was that the carriers of the weak force, the W and Z particles appeared to be very massive, estimated to be about 100 times the mass of a proton. On the other hand the photon, the carrier of the electromagnetic force, was clearly massless. However, in the early 1960's, a mechanism, which generates the massive bosons by breaking the symmetry, was proposed by P Higgs and T. Kibble — known as the Higgs mechanism. According to this model, the whole of space is permeated by a scalar field, similar to some ways to the electromagnetic vector field. As particles move through space they travel through this field, and if they interact with it they acquire what appears to be mass. How massive a particle is depends on how strongly it interacts with the Higgs field. The photon has no mass because it does not interact with the Higgs field.

The Higgs mechanism proved to be exactly what Salam needed. It allowed the electroweak theory to retain its basic symmetry between electromagnetic and weak interaction, while giving the W and Z particles their masses and at the same time leaving the photon massless. At very high energies, the masses of the W and Z particles are relatively unimportant, and the theory reveals its true symmetry, the weak carriers being in effect massless, just like the photon. It is at lower energies, such as exists in the everyday world, that the symmetry is hidden, or appears to be broken, as the masses of the weak carriers become important, and the weak and the electromagnetic forces appear to have different strengths. In this way Abdus Salam was able to prove that the weak nuclear force and the electromagnetic force are nothing but two manifestations of a single force, the electroweak force. For his work he shared the Noble Prize for Physics in 1979 with Steven Weinberg and Sheldon Glashow who also arrived at the same conclusion independently. This discovery marked one of the leading conceptual advances of twentieth century physics. The theory of weak and electromagnetic interactions developed over the period 1961—1968 by Salam, Weinberg and Glashow have come to be known as the 'Standard Model'.

The electroweak theory has been convincingly verified, in particular by the discovery of the W and Z particles at CERN in 1983. In spite of tremendous success of this model, the hypothetical particle associated with the Higgs field — the Higgs Boson, whose existence the model predicts — has not yet been seen in the experiments. However, the latest find, the top quark has been discovered recently in confirmation with the Model's predictions.

The extraordinary success of the electroweak unification led Abdus Salam and Jogesh Pati to put forward the idea of grand unification of the strong and electroweak interactions now known as 'Grand Unified Theory'. They were the first to propose that the quarks and leptons in the same multiplet family would imply that the transition between states belonging to the multiplet is possible. In other words, a quark turns into a lepton, thereby causing the hitherto known stable proton to decay. The prediction of the theory is that the age of an average proton is 10^{31} years. This implies that a human would have to live some 2500 years before a single one of his or her body proton decays. Experiments have been carried out to find such events to no avail.

Abdus Salam has also worked on quantum gravity and super string, in an attempt to include gravity in the framework of a unified theory. Achieving such a super unification was Salam's ultimate goal.

The Standard Model of high-energy physics has a deep significance and relevance to the physics of the early Universe called Standard Cosmology. Abdus Salam firmly believed that the ultimate questions of where the Universe came from could only be answered by High Energy Particle Physics.

According to Big Bang theory some 15 billion years ago the Universe emerged from a hot, dense sea of matter and energy. As the cosmos expanded and cooled, it spawned galaxies, stars, planets and life. In the earliest moments of the Universe the particles which were dominant were unlike any that exist in today's Universe. In fact, theorists can only guess at what they were like. There is no reliable guide because physicists are unable to achieve comparable temperatures or energies on earth. Naturally, the question may arise, "How far back can physicists probe in their laboratories?"

The answer is to a time when the Universe was about one-hundredth of a second old. At that time, the Universe had grown to fill a volume roughly the size of the sun. By then, it had cooled down to about 10^{14} degrees. At this temperature the weak nuclear force would manifest the same long-range character as the electromagnetic force. And then we would see the unification of these two forces absolutely clearly. In fact physicists at CERN in Geneva managed to recreate these conditions in a giant particle accelerator in 1983. They created the W and Z bosons, particles that vanished from the Universe one-hundredth of a second after the Big Bang. These are the same particles predicted by Salam in his electroweak-unified theory.

Similarly, according to Grand Unified Theory of Salam, at approximately 10^{-35} second after the Big Bang, the thermal energy of the Universe was so fantastically high (=~ 10^{28} degrees) that three forces weak, electromagnetic and strong fused together and were indistinguishable. He believed that when the Universe was 10^{-43} second old gravity was indistinguishable from the electronuclear forces.

Abdus Salam's scientific achievements in this last four decades do not seem to have any limits. He has own innumerable academic awards from universities and national academies around the world. But his greatest scientific achievement was undoubtedly the establishment of the International Centre for Theoretical Physics in Trieste, Italy in 1964. He virtually created that Centre out of nothing. With the magic touch of Salam the Centre has now grown so much that it covers all the aspects of pure and applied Physics and Mathematics and related subjects. He has created the greatest scientific network ever seen in the world with Trieste as a basis. A small example is sufficient to depict the academic excellence of the Centre — more than 40 Nobel Laureates have visited and worked at the Centre since 1964. One year after his death the Centre had been renamed as The Abdus Salam International Centre for Theoretical Physics in order to bear the name of its late founder.

Professor Salam is the author of 285 scientific papers on Physics of elementary particles apart from papers on scientific and educational politics for developing countries. He has written and edited several books on science, technology and science education.

I think a great scientist like Professor Abdus Salam is not dead, his uncommon scientific achievements and rare accomplishments have immortalized him. He is among the latest to join the illustrious company of great scientists like Newton, Maxwell, Faraday, Fermi, Yukawa, Dirac and Einstein who have discovered the fundamental laws governing the physical Universe.

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What Separation Can Mean

by Edward W. Said

Whether it is Barak's dream of an imposed cage-like wire fence separating the two from each other, or the Palestinian desire to exist in a utopian land without an obtrusive Jewish-Israeli presence, both sides of the coin are unrealistic and destined for decades of future violence.

AN apparently deep and unquestioning desire on the part of most Israelis and Palestinians seems to be the need to exist in separate states. There has been a lull for some weeks now in the negotiations on all fronts in the peace process, much of it the result of Israeli unwillingness to venture anything very new or forthcoming. But Ehud Barak has in fact been quite explicit during this time, as well as since his election, regarding his political aim of separating Arabs and Jews from each other now and in the future.

Along with this has gone an extraordinary series of steps concerning "secure" (the phrase is always mistranslated as "safe") passage for Palestinians between Gaza and the West Bank, as if from the Israeli point of view Palestinians are a sort of infectious species whose presence across the land of Israel has to be contained, confined, detoxified. The opening of a new checkpoint at the northern end of Bethelehem is part of the same paranoia: one Palestinian has already been killed there and the continued likelihood of tension wherever the two peoples rub up against each other is very high indeed. What needs to be remembered, however, is that this is an unequal situation, in which Israel has all the power and holds all the land, whereas Palestinians are in the position of objects disposed hither and yon more or less at Israel's will.

Nor is this all, since the situation is complicated by the separatist logic of Palestinian nationalism. It is eminently deserving that a people stripped of its identity, dispossessed of its land, forced to undergo decades of oppression, exile, and military rule should wish to be restored to the community of nations as a fully-fledged member. The Palestinian case, however, is more complicated than any other in the history of liberation or independence struggles.

A dispersed people, the Palestinians today exist under several jurisdictions, including of course a Palestinian Authority that functions without real independence under Israeli tutelage. A million Palestinians are Israeli citizens, and about 2 million are Jordanians. Many more thousands live in various Arab countries with "undetermined" status.

All Palestinians rightly aspire to a condition of national coherence and sovereignty, even as their supposed representatives are negotiating to freeze the current undesirable status quo in such a way as to create a mini-state that will not, and can never enjoy full independence. Barak's logic of separation is therefore ironically matched by a Palestinian desire to exist separated from Israel, even though in all instances no such separation is truly possible.

Wherever one goes in Palestine/Israel the two populations are, in fact, mixed together, thanks in large measure to the horrifying efficiency of Israeli settlement policies since 1967. All over the land of historical Palestine (including 40% of Gaza and all around Jerusalem) Israelis are living in close, if tense and unwelcome, proximity to Palestinians. So whether it is Barak's dream of an imposed cage-like wire fence separating the two from each other, or the Palestinian desire to exist in a utopian land without an obtrusive Jewish-Israeli presence, both sides of the coin are unrealistic and destined for decades of future violence. Honesty enjoins me to reject both ideas as fundamentally, as well as philoscphically, unworkable, given the realities which are currently overlooked in the uncritical technicalities of the US sponsored peace process.

The facts — yes, they are facts and they cannot be denied at all except by outright lying or self-delusion — are that Israel today is simply not a purely Jewish state and that Palestine is simply not a purely Palestinian Arab state. Perhaps our dream twenty years ago for a Palestinian state was realizeable then, but today we have neither the military, nor the political, nor the moral will or capacity to create a real independent Palestinian state. I repeat: I can understand and in many ways support the idea of Palestinian independence, if it could be achieved. But how are we to uproot 350,000 Israelis, how are we to empty the recently built Jewish parts of East Jerusalem, how are we to remove the settlements, how are we to defeat the settlers and the army anytime in the present or near future? We have no way to do any of those things, and obviously negotiations will not do it. It has taken six years of concessions to Israel to achieve partial independence of about 13 per cent of the West Bank, minus security, water, air and border controls, which Israel still holds.

What possibility is there of a truly independent Palestinian entity under the present or even foreseeable circumstances? None at all. Israeli dreams are equally unimplementable, no matter how many roads, fences, checkpoints (including the most recent one in Bethelehem) and separations Barak and his advisers keep inventing. Neither Palestinians nor Israelis can be made distant from the other. In the area between Ramallah in the north and Bethlehem in the south 800,000 Israelis and Palestinians live on top of each other, and cannot be separated. That is the truth.

Therefore the only acceptable political logic for Palestinians is to move our struggle from the level of high-ranking negotiations to the level of the actual on-the-ground reality. The Authority simply does not have the popular backing for what it is doing in Oslo, first of all, and second, Arafat has no successor in the near future who can maintain control the way he does now. If we are to avoid horrible suffering and more violence in the future we have to transfer our efforts from the sky to the earth. We must adopt a strategy with like-minded Israelis — this is a crucial alliance — on matters where we have similar interests: secular rights, anti-settlement activities, education and equality before the law, whether it is Palestinian law which is anti-democratic or Israeli law which is equally anti-democratic when it comes to non-Jews as well as secular Jews.

This sort of project cannot be undertaken with officials who work either for the Israeli government or the Palestinian authority, both of whom have an interest in the status quo. I have no doubt that what I say here will have no effect on the ongoing peace process, nor on the thinking of the current leadership. I write in order to be heard by other Arabs and other Israelis, those whose vision can extend beyond the impoverishing perspectives of what partition and separation can offer.

We know that trying to draw lines between peoples whose cultures, histories and geographical proximity cannot be separated will not solve the basic problems of conflict between them. Political separation is at best a makeshift measure. Partition is a legacy of imperialism, as the unhappy cases of Pakistan and India, Ireland, Cyprus, and the Balkans amply testify, and as the disasters of 20th century Africa attest in the most tragic way. We must now begin to think in terms of coexistence, after separation, in spite of partition. And for this, as I said above, the only solution is a politics of the local people on the ground who tackle injustice and inequity on the ground, far away from the misleading summits with Clinton, and the treacherous secret channels of Oslo. Those leaders are far from the real long-term interest of their people, but they do what they have to do. They can do no more.

So let us see these new partitions as the desperate and last-ditch efforts of a dying ideology of separation, which has afflicted Zionism and Palestinian nationalism, both of whom have not surmounted the philosophical problem of the other, of learning how to live with, as opposed to despite, the other. When it comes to corruption, to racial or religious discrimination, to poverty and unemployment, to torture and censorship, the other is always one of us, not a remote alien. These abuses recognize only the victims of unjust power and these victims must resist all efforts made to cause their further suffering. That is the platform of the future.

Courtesy: 'The Dawn' of Pakistan.

Triangle or Tug-of-war?

by A M M Aabad

OUR politics today is symbolised by the tug-of-war between two powerful ladies. But they are using their power against each other, and the people are denied the benefit of the major component of this vast energy to motivate development.

Naturally frustration is creeping in the silent majority who see no way out to escape from the bilateral animosity of the two public leaders, who have demonstrated in a decade what they 'cannot' do for the people (we have heard too much about the respective glorious achievements). Since the people have the right to choose, a large section of the citizens may welcome the introduction of a third force in our politics, to break the duo monopoly.

It does not matter who would represent the third force, so long there is some CHANGE in the input and processing. What comes out cannot be predicted, but it will be clear after the teething period. It is better than this current stalemate of two plus one decades.

We have lost (not wasted) 28 years in groping for the national bearing and the right type of leadership which last for some time and deliver core institutions, not fringe benefits. Different types of leadership had been imposed upon us, and some we chose in good faith (not on gullibility). Certainly there had been serious lapses and failures, otherwise the country would have advanced far in one generation. We have to come out of the vicious circle, regardless of the differences in opinion.

Therefore the third force or the triangle concept (multi-party) may enable us to escape (for sometime at least) from the chronic burden of charismatic leadership and dynasty rule (more a vanity rather than a necessity). Across the border, the Congress is trying to bring back the dynasty rule. Longer reigns invite instability when the spell breaks, as noticed in Indonesia. West Bengal may be facing the same potential uncertainty after octogenarian Jyoti Basu retires in the near future.

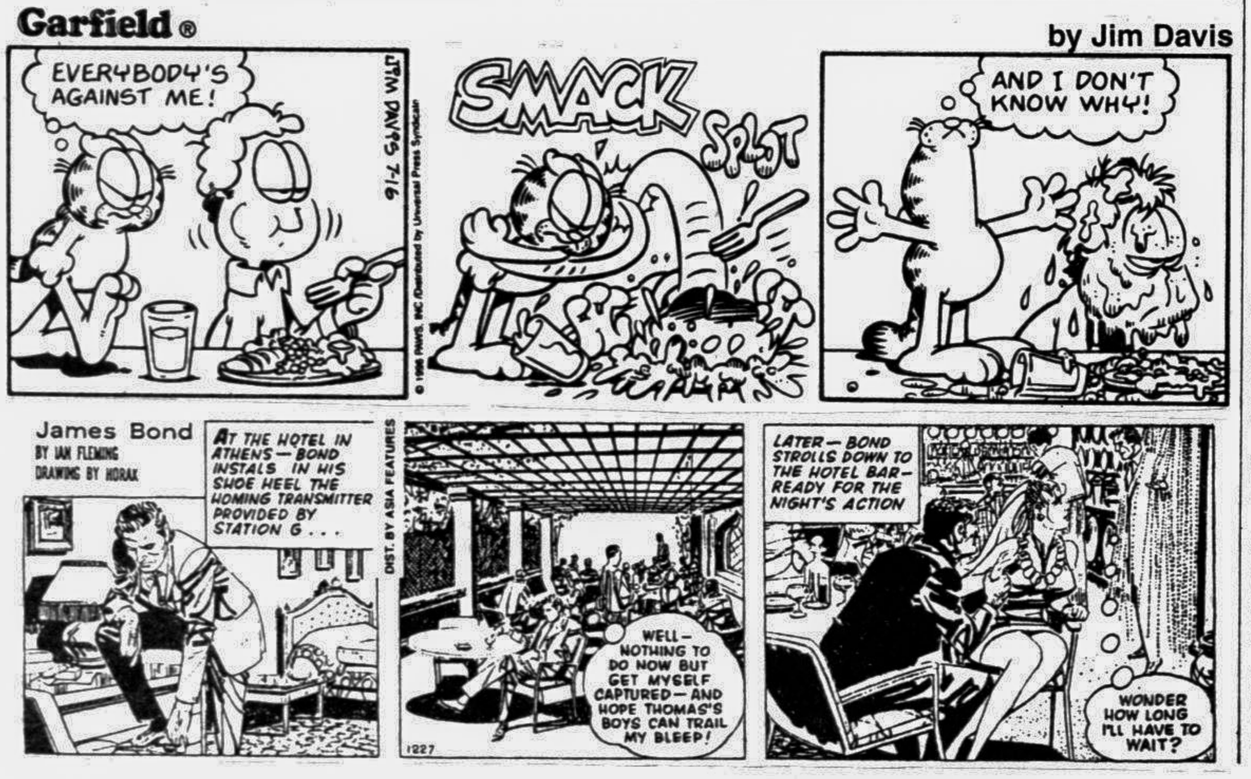
The millennium is a period of changes, hence our leaders must be prepared for the worst at the best of times — not that there are secret diabolical plots to oust them. Transfer of power to the future successors is cyclic and natural process, because without change there is no progress. Leaders at the top change what is below them (the mass); but when the mass uncoils, new leaders surface, as it should, as some output would be generated, and the energy thus generated has to be harnessed for the greatest good of the greatest number. Revolution is not being proposed in these paragraphs, but it is reassuring if future events could be forecast and analysed for better understanding.

The new leaders have to change the style of politics, and vow not to use the political platform as a business 'trip'. Political entrepreneurship is one thing, but doing business with political tools and assets means more temptation than service. Recently the Magsasay Award was won by a social worker in Bangladesh, for selfless service to the community, irrespective of political or financial clout. Mere public acceptance is enough reward. There is no substitute for inner satisfaction, morally speaking.

Let us face some stark truths. Developing leaders cannot develop others — the potential energy does not flow and enrich the environment and those lower down the scale. Developing systems eat away a significant portion of the available energy; leaving less for transfer of finished products and services to others in the community. Followers cannot follow from a distance — it must be hands-on approach. Power distances from the people. Thus there are several types of invisible force fields interacting in the society, which ultimately provide a national fulcrum of buoyancy and hope.

Intervention of third parties is sometimes necessary to untie the knots and clear the way for onward progress. We are not yet out of the experimental stage.

The goal can be simplified in a clear and clean statement: to lead a normal life. We are leading an abnormal life, and the leaders have failed to come to our rescue. This expectation cannot be belied.



Farmers' Firebrand Steps into the Corridors of Power

The government says that the appointment of an outspoken and troublesome farmers' leader as deputy minister shows its concern for the cause he espouses. Critics say the authorities are trying to silence him. Gemini News Service reports on a new twist in Namibia's presidential and parliamentary elections (30 November-1 December)

Christof Maletsky writes from Windhoek, Namibia

ONLY weeks before parliamentary and presidential elections in Namibia, President Sam Nujoma had been wooing an outspoken farmers' leader in an effort to defuse potentially damaging discontent over land issues.

The ruling South West Africa People's Organisation (SWAPO) clearly hopes Gabes Shihepo's appointment as Deputy Information and Broadcasting Minister would force him to damp down his confrontational approach.

His predecessor in the job resigned in early October, claiming lack of democracy in SWAPO.

In May, as president of the Namibia National Farmers' Union (NNFU), Shihepo joined forces with three other powerful groups to stage a "march for land." The protesters said that only a united force would make the government heed "the voice of reason."

Land is a burning issue. Critics claim that in the nine years since independence was wrested from white-ruled South Africa, the government has fallen far behind its targets for acquiring land for resettlement from large commercial farmers and absentee landowners.

Some object to land being purchased, arguing that it was stolen by the colonial authorities.

Critics also argue that allocation of purchased land has been slow or soiled by corruption, with preference being given to people who have connections to people in high office.

More than 20 purchased farms, covering 130,000 hectares, remain unoccupied, they say, even though some were purchased in 1991.

Lands Minister Pendukeni Ithana has acknowledged in the past that resettlement had been hindered by the "extremely cumbersome and time-consuming" procedures required by law, but it was important to adhere to the regulations for the sake of transparency and fairness.

In September, Shihepo — who was a headmaster for 20 years, a businessman and a community leader as well as a farmer — organised another protest march on State House by nearly 800 small farmers from across Namibia.

The government unsuccessfully tried to stop the demonstration, fearing it would harm SWAPO's campaign for the election, to be held on 30 November and 1 December. But Shihepo insisted that farmers had waited patiently for eight years and were tired of being ignored.

Though caught off guard, the farmers' union welcomed their leader's appointment.

"It will only benefit the cause of the farm workers and the union. It will help to raise our concerns," commented executive director Paul Vleermuis.

Vleermuis plays down claims that the appointment is intended to silence Shihepo: "Our union will never be silenced by any appointment. We are not affiliated to any political party, and we will use his appointment to advance our cause on land."

The union's new acting president, Pintile Davids, agrees: "This is expected to open another door to government."

But the newly launched Congress of Democrats is less sanguine.

"When people start to talk aggressively on issues affecting them, one way of silencing them is to give them some senior position," says Congress spokesperson Dr Elizabeth Amukugo.

"We view this appointment as a waste of taxpayers' money. What is the point of appointing someone at this late hour before the elections?" she asks, criticising Nujoma for appointing yet another deputy minister instead of cutting down the bloated public service.

Her party has promised to cut the Cabinet from 29 to a maximum of 15.

Congress is headed by a former high commissioner to Britain, Ben Ulenga, who quit SWAPO because of Namibia's direct involvement in the war in Congo (formerly Zaire) and because of opposition to a third term of office for Nujoma, a move which required a constitutional amendment.

SWAPO won 53 seats in the 72-seat National Assembly in the 1994 election and Nujoma, the country's "founding father" secured the presidency with 76 percent of the popular vote. SWAPO will almost certainly win again, but opposition parties are hoping to deprive it of the 75 percent majority needed to approve constitutional change.

The author is assistant news editor of 'The Namibian' newspaper.

Namibia prepares to vote

- Swapo won 73% of popular vote in 1994 parliamentary poll, 76% of presidential vote.
- In 1998 local elections, Swapo won 27 of 45 constituencies. The opposition Democratic Turnhalle Alliance took 9. Turnout was 40%, down from 82% in '92 local polls.

- In Nov.'98, Parliament passed constitutional amendment to allow a president to serve more than two terms - opening the way for Sam Nujoma (above) to stand again in 1999