Scientific Programme Indonesia-Netherlands

Koninklijke Nederlandse Akademie van Wetenschappen

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# Preface

On February 11, 2002, renewed Memoranda of Understanding were signed between the Indonesian and Dutch ministers responsible for education, science and technology. The memoranda express the mutual intention to continue and further expand the scientific cooperation between Indonesia and The Netherlands. At this occasion, the two countries could already look back at a successful cooperative programme, established in 1992. It was a pleasure for the Dutch partner in this so-called SPIN programme, the Royal Netherlands Academy of Arts and Sciences, to use the occasion and organize in Bandung an Open Science Meeting, in close cooperation with the Institute of Technology. The meeting was held one day after the signing ceremony. At this meeting a cross section was presented of joint studies realized within SPIN. It demonstrated the breadth of cooperation that had been established. The topics ranged from social science studies to medical, ecological, agricultural and mathematical research projects. In addition papers were presented on the history of Dutch-Indonesian scientific cooperation and on the organization of the present SPIN programme.

The present volume is an edited collection of the papers presented at this Open Science Meeting. Although the reader will regrettably not fully experience the wonderful cooperative atmosphere that characterized this symposium, he or she will encounter a range of fascinating outcomes of scientific interaction across the globe. May it be a challenge indeed for the further expansion of our joint Indonesian-Dutch research.

Willem J.M. Levelt
President, Royal Netherlands Academy of Arts and Sciences

# The Scientific Programme Indonesia-Netherlands (SPIN)

Johan Stapel

Ladies and Gentlemen, dear scientists,

It gives me great pleasure to address you at this Open Science Meeting of the Scientific Programme Indonesia-Netherlands, in short: SPIN.

The Royal Netherlands Academy of Arts and Sciences holds responsibility for the administration and co-ordination of the Programme. I am very happy to see that so many of you are gathered here today to talk about science in general and about the scientific cooperation between Indonesia and the Netherlands in particular. Your interest and participation in this meeting strengthens us in our belief that scientists from both our countries attach great value to the bilateral cooperation.

Dutch scientists have a long history of scientific research activities in the Indonesian region and have, over the years, built up extensive networks and experience. And not without reason. Indonesia is a country with a large cultural, (marine) biological and geological diversity and enormous natural resources. There is still so much that we have not discovered yet! We could, for example, learn from Indonesia's internal religious patterns in which Islam plays an important role; important in the light of the increased tension between the West and the Islamic world. In view of the process of unification of Europe we could learn from Indonesia's discussions on centralisation versus decentralisation. For the Netherlands, Indonesia could be a stepping-stone to other ASEAN-nations. It is the combination of all these aspects, which is matched nowhere in the world, the size of the country, its geographical position in the world, which makes Indonesia of invaluable scientific interest.

Indonesian scientists, on the other hand, are also interested in the Netherlands. One reason for this interest is because of the availability of the historical and scientific databases on Indonesia that have been built-up in the Netherlands during the past two centuries. Indonesia profits from exactly the same extensive Dutch-Indonesian scientific network. For Indonesia, the Netherlands provide a gateway to western science and society, a stepping-stone to other European countries. Learning from each other (and I do not mean copying each other) is a precondition for mutual, East-West, understanding, understanding which forms the basis for sustainable cooperation. The enhancement of scientific capacity and infrastructure contributes enormously to economic progress and strengthens the position of Indonesia in the world, especially in the long-term.

The Programme we are talking about today has its origins in 1992, when a long tradition of cooperation between Indonesia and the Netherlands was re-specified by means of two Memoranda of Understanding, signed by the Dutch minister of Education and Science and his Indonesian colleagues from the ministry of Research and Technology and the ministry of National Education.

The programme effectively started off in 1995 with a first phase of approximately 50 individual research projects, more or less equally distributed over the so-called Cultural and Social Sciences (and Humanities) and the Natural and Life Sciences. The main objective was to encourage scientific cooperation on the basis of reciprocity and mutual benefit, within the constraints of the priority areas mentioned in the MoU's. Most of the projects from this so-called project-phase have come to an end. The results on average are good; some projects were excellent and of course a few projects had poor results. The overall achievements, however, are very satisfying. About 50 PhD-students from the Netherlands and Indonesia and another 30 S3-students were trained or are still being trained at the cost of about M€ 15.

In 1997, the Academy and the ministry of Education, Culture and Science, in consultation with the Indonesian Steering Committee, decided that the Programme should change its scope and focus by shifting from individual research projects to larger-scale research programmes on a selected number of priority areas. The main purpose remained the same (to encourage scientific cooperation on the basis of reciprocity and mutual benefit), but in contrast to the project-phase, research programmes should consist of a coherent set of research and supporting activities. They should also aim to stimulate the establishment of sustainable scientific cooperation. It did not seem likely that this result could be reached by stand-alone projects; the project-phase showed a highly 'scattered' composition.

The following 6 priority areas were selected:
- Applied Mathematics.
- Infectious diseases.
- Biotechnology.
- Islam in Indonesia.
- Indonesia in Transition.
- Legal Research Cooperation.

For each of these priority areas a coordinator was invited to draft a work plan for the selection of research topics within the priority field on which the cooperation should concentrate. Based on the endorsed work plans research groups were then invited to submit research proposals. A selection procedure, based on the assessment of the scientific quality of the proposals, resulted in an implementation plan for each priority area. A programme coordinator, appointed as such by the Academy, supervises and should even stimulate the coherence and interaction within a priority programme.

The programme-phase of the scientific cooperation has been given the acronym SPIN, which stands for Scientific Programme Indonesia-Netherlands, and which, by the English meaning of the word 'spin', should express dynamic science. An Internet-site has been opened as a forum through which the participating scientists can communicate their plans and preliminary results to the outside world: www.knaw.nl/indonesia.

The first 5 of the listed priority programmes have started and have been running now for over 1 year. The priority programme on Legal Research Cooperation is at present in preparation. Research proposals for this programme are currently in the process of peer review. We anticipate a start of this programme in the second half of this year.

Furthermore our Academy, together with the Netherlands Foundation for the Advancement of Tropical Research (WOTRO) agreed to initiate a new priority programme on Coastal Zone Research, a follow up of the Banten Bay programme, which finished last year. Discussions between WOTRO and the Academy on the one side, and LIPI and BPPT on the other side have recently started.

The first year of SPIN has shown great enthusiasm from both sides. Post docs and PhD-students have been selected and appointed, workshops, seminars and summer schools have been organised and research has actually started.

At this moment about 100 scientists from the Netherlands and 100 scientists from Indonesia are involved in SPIN. And their number is likely to increase with the coming Legal Research Cooperation and later probably with the start of Coastal Zone Research. Among those involved now are 30 Indonesian PhD-students, 3 S3-students, 8 Dutch PhD-students and 7 post-doctoral fellows from Indonesia and the Netherlands, as well as two experts from Australia and Egypt. The remaining approximately 150 participants are tenured senior scientists from Indonesia and the Netherlands (promoters, project leaders, supervisors). The large number of senior scientists involved indicates the enormous interest in the programme from the established scientific communities, which is a prerequisite for sustainable cooperation, and hopefully is a guarantee for successful scientific research. So far, this new phase in the scientific cooperation, besides workshop proceedings, has already resulted in 13 scientific papers and 1 book.

But we are not here today only to hear about the scientific achievements and how well everything is going. We are also here to discuss Indonesian-Netherlands scientific cooperation in general. I am sure that many of you think that the cooperation could (and should) be improved on some points. Your fellow scientists and I would like to hear your opinions on the strengths and weaknesses of the cooperation. What is the additional value gained from working together, what is the benefit for Indonesia, and what for the Netherlands? What aspects in the cooperations make your research successful, and what aspects cause setbacks? Formal arrangements. Practical arrangements. The interaction between counterparts. Is there a real two-way cooperation? Use your own research experience as an example. Your comments will be invaluable to us in fine-tuning and improving the programme where necessary.

The Academy understands that the current social and economic situation in Indonesia may easily lead to prioritising research areas for short-term problem solving. Without denying or trivializing the importance of short-term problem solving, the Academy is of the opinion that SPIN should focus primarily on the building and maintenance of a highly educated scientific elite in Indonesia, which have an important function as an interface between international scientific developments and the national needs for research and knowledge, also in the long term.

Sustainable scientific cooperation and the building of a scientific elite in Indonesia is not something that can be achieved in a short period of time. It requires long-term genuine commitment from the scientific community and from the science policy makers in both our countries.

I am very happy, therefore, that in Jakarta yesterday the willingness to continue the cooperation was expressed again at the highest level: the Dutch minister of Education, Culture and Science and the Indonesian ministers of Research and Technology and of National Education renewed their Memoranda of Understanding. The signing of these Memoranda, yesterday, is partly a result of your efforts too, of your scientific commitment to the cooperation programme. In the light of the long-term objective of SPIN, I sincerely hope that the signing of these new Memoranda will be a reason for both the Indonesian and the Netherlands governments to show their commitment as well, by making available new funds for the scientific cooperation between our two countries. Tomorrow, during a Round Table Conference at the Bosscha Observatory in Lembang, in the presence of the responsible Dutch and Indonesian ministers, we will present the achievements of todays Open Science Meeting. I therefore appeal to all of you for a lively and fruitful discussion today.

Dear scientists, I hope this meeting will give you an opportunity to learn from each other's experience. I hope the meeting will contribute to network building, that new ideas will emerge, that you'll find new pathways and new partners for scientific cooperation.

I wish you all a very fruitful meeting.

# Scientific cooperation and the building of endogenic research capability

Bambang Hidayat

**Introduction**

The presentation will be categorically divided into 4 broad outlines, namely: Changing the guard and guarding the past: A Historical Sketch From 'Bataviaasch Genootschap voor Kunsten en Wetenschappen', to the 'Koninklijk Natuurkundige Vereeniging'.The period covered a span of time of about 200 years, from 1778 through 1950. On April 24, 1778 with the motto: 'Ten nutte van't gemeen' was born the 'Bataviaasch Genootschap voor Kunsten en Wetenschappen' which flourished rapidly. One hundred years later the President of the organization comfortably and confidently declared in his laudatio that: .... 'zal ons Genootschap in the wetenschappelijke wereld schitteren als een ster van de eerste grootte' (e.g. Brandt, 1992). Most of the results during that period were in the field of ethno botany.

**The aspect of 'Colonial Science'**

Colonialization was an important historical facet with wide-ranging result. Even a scientific exploration or scientific endeavour had occasionally to choose between the utilitarian principle against pure scientific pursuits. Like colonialism itself, colonial science is more than a set of institutions or structures. Embedded in them are economic as well as cultural construct. In many instances, they had their own discourse. This is to be compared with the Indian case (Kumar 1995). For example the study of pure, tropical, biology had to overcome resistances which was caused by the desire for practical needs (Schoor, 1994) Geology was another science which ushered the motive to find prospective mineral deposits (e.g. Honig and Verdoorn, 1945; Hidayat, 1996).

**From 'Koninklijk Natuurkundige Vereniging' to MIPI**

The publication of 'Een eeuw Natuurwetenschap in Indonesia' (1850-1950) by Macdonald, Braber and Derx (1950) documented and testified the solid contribution of Dutch scientists in their efforts to develop science in the colony. As a matter of fact, Lewis Pyenson (1989) viewed that the A... early part of the 20$^{th}$ century witnessed the birth of world science in Nederlandsch Indië A, including the Noble price to the Dutch scientist (Eijckman) in Indie who developed a new concept of vitamin.

In the period covered here Nederlandsch Indië had also witnessed the growth of higher education, which started with the founding of the (Javanese)

Medical School then followed by 'Technische Hogeschool' Bandung (Pyenson, 1999). The tertiary level of education proved to be not only the place for seedling future scientists but also, due to the liberal outlook, formed a fertile ground for brewing nationalism. The founding of the universities in Nederlandsch Indië have helped to prepare the future as it accommodated (Hidayat, 1995):

- the practical transfer of science;
- scientific knowledge and information;
- the scientific attitude and approach to phenomena.

The founding of Majelis Ilmu Pengetahuan Indonesia (MIPI) in 1950 marked the changing of guard for scientific endeavour as well as its infra-structure. Indonesians are now responsible for their own destiny in cultivating scientific infrastructure and, accordingly, higher education to fulfil their need for modern life. The future of that institute has gone through several stages and changes but the main aspect remain in the field of developing an indigenous capability. The number of tertiary-level of education increases from 4 in 1950 to several hundred in 2002. This alone has created several academic problems.

**Concept of cooperation and collaboration**

From its cradle in the western civilization science as such has been following the wave of western domination to spread all over the world. On its ways, as in other cases of cultural propagation, science is not exempted from the general rule. Filtering processes must then have been operating at many countless cultural borders B whether it is called adaptation or adoption, reluctance or enthusiasm B manifesting itself in the different ways science progresses in the science-receiving nation.

A closer look at the growth of science at its origin indicates that there must have been a prerequisite for developing science. In the first place in order to be able to accept change there must have been preparedness for 'ethical' mutation. Some expounded the view of the cause of scientific revolution in the west was the realization of the hedonist-libertarian ethics B an ethic which provided the thinkers and philosophers of that time with the possibility to pursue their own interest and pleasure for the sake of uncovering the secret of nature. It then became more apparent, in later years, when science stroke many interfaces with other human interest and social structures and language system, that other factors were necessary in order to make science as it is now. One of the most demanding is the public and societal need that have been entered to in the equation of science and external force. What cannot be ignored is the science-technological atmosphere. The atmosphere should be conducive for any future academic research and for innovation.

Cooperation implies that genuine benefits should be obtained and distributed among the concerned parties. 'Just-return' may be the right term in economy or trade. In science this term should not be confined to sole material benefit, but should accommodate a wider sense of understanding that cooperation or collaboration would serve as an endowment of manpower capability for a longer time scale. Endowment in science can best be secured by exposing scientists and institutions from the 'developing countries' to new trends and techniques in science.

In recent times there have been new efforts to develop science for the benefit of both parties. To cite a few for example in Mathematics (Van Groesen and Sembering, 2001), in optics (Handoyo, 2002; Tjia, 2002), in Biology (Sudarwati, 2002), in Astronomy, (Hidayat, 2000; Hidayat and Van der Hucht, 1998), Aeronautics (Hari Muhammad, 2002). The guidelines of the cooperation had actually been delineated in a Report by KNAW (1997). It is gratifying to record here the new paradigm in science cooperation '...Terwijl effectieve samenwerking in de wetenschap beoefening op zichzelf reeds een egalitaire relatie vereist tussen de participerende partijen, is gelijkwaardigheid zeker sinds 1992 het credo van samenwerking geworden'. Many of today's exposé testify the ideals of cooperation as stated in that document.

**The scientific ecology of the 21st century**

The plane of ecology is certainly not painted by the Netherlands and Indonesia alone but by the global forces, which are at work, and by the powerful trend toward democratisation. Best can be cited in this process is the powerlessness of the Third World to face the 'market' trend of genetically modified organism, transgenic foods and against many and modern genetically-related medicine. The question whether science and technology serve as a liberating or accommodating power in the Developing World is still reverberating. Is biotechnology, for example, and unalloyed good certain to improve health and nutrition among people who badly need both, or is this new science inextricably tied to old politics of domination and exploitation? (Gieryn and Johnson, 1992).

Whatever the stance is we should move forward. Science is too important to be ignored in the process of nation development. The recent past of Abanjir phenomena (in Jakarta 2002) has given us the lesson how we, as a nation, have neglected the one important aspect of scientific quality that is its predictive power. Science not only play an essential role in the contemporary world but, more importantly, it is the pillar of any civilization. It is as essential for any community as a language. It is the currency that is used everywhere in the society of civilized nations.

We should pave the way in order to elevate our scientific capability. Scientific functions create their own organs best in certain concentration of flow of information. Therefore we should improve within the framework of our future cooperations with any other nation the following (Hidayat, 1997);
The indigenous capability:

- program of build and transfer of knowledge (please note that knowledge is not Akebatinan);
- the comprehension of power of interdisciplinary research;
- concerted effort in graduate training, as well as mastering of 'international' and national languages;
- finding talents at mass level;
- to build an awareness that any transfer of technology also means the transfer of science as well as culture.

The human society of the 21st Century faces a daunting yet an inspiring task of forging a relationship with nature as well as with other nations. We also learned that new concepts have emerged about global trends in population, in development and environment. It is therefore essential to encourage the integration of academic research into market demands with price in the role and credibility of scientists and academics.

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# Social security research in a time of crisis

Irwan Abdullah and Frans Hüsken

By mid-1996, three research centres (the Population Studies Centre at Gadjah Mada University in Yogyakarta, the Centre for Asian Studies at the University of Amsterdam, and the Department of Anthropology at the University of Nijmegen) launched a research project on 'Social Security and Social Policy in Indonesia'. The project was sponsored by the Royal Netherlands Academy of Arts and Sciences (KNAW), and data collection has formally ended by mid-2001. Research was carried out by a team consisting of eight senior staff members from the three academic centres, two post-doctoral research fellows, and ten PhD candidates.[1] For practical reasons, fieldwork concentrated on Indonesia's most populous island: Java, with a few additional studies in Madura and Bali, and focused on the ways in which people cope with social, economic and ecological insecurities in times of rapid change.

**Social security in Indonesia: outline of the research theme**

With the wisdom of hindsight, a project on Indonesian social security could not have been planned in a more appropriate timeframe than that of present-day Indonesia. When in 1994 we started to think of formulating a general framework, the 'Asian Crisis' was still something unheard of and to many it seemed even unthinkable. Indonesia was among the worlds fastest growing economies, joining the Asian tigers in their claim for sustained growth and economic prominence on the global scene. Annual growth figures of 6 to 8 per cent were no exception in the 1980s and early 1990s, and in the eyes of most observers it looked as if this rapid development would last – if not forever, then still for a considerable number of years to come.

The country, which economy some three decades ago still ranked among the world's weakest, with a per capita income of US $ 50 (amounting to just half of the GNP per capita in countries like India, Nigeria and Bangladesh) had managed in the late 1980s to raise per capita income to US $ 500. Which was 30 percent higher than that of India, 50 percent higher than that of Nigeria and 150 percent higher than that of Bangladesh (World Bank figures for 1990).

Sure, these growth figures (to which foreign aid and booming oil prizes have made a major contribution) concern the economy as a whole, but part of

1 Funding for these researchers comes partly from the KNAW grant, while additional funding was obtained from the Indonesian Ministry of Education and Culture (Depdikbud), the Netherlands Foundation for the Advancement of Tropical Research (WOTRO) and from the participating research centres.

this growth in the long run did trickle down to the poorer sections of the population. In 1970, an estimated 60 percent of the Indonesian population were living below the poverty line.

By the early 1990s, the general conclusion seems to have been that widespread poverty was rapidly disappearing as by then less than 15% of the total population was considered as 'being poor or destitute': a percentage comparable to present-day conditions in the usa and Western European countries – although absolute levels of poverty are, of course, of a different order of magnitude.[2] Of course, the figures given for the Indonesian economy have been strongly, and rightly, criticized by many Indonesia specialists. Poverty statistics can never assess in great detail and precision who are the poor, and according to what criteria they are considered poor. The World Bank figures should therefore be taken with a grain of salt, particularly as they were meant to express the Bank's support for the Indonesian model for economic growth. Nevertheless, also the most critical observers of this Indonesian model, agree that by the early 1990s the extent of mass poverty both in urban and rural areas had markedly declined, even though poverty was still widespread in specific areas and among vulnerable groups.[3]

Like elsewhere in Asia, economic growth has been achieved mainly through processes like commercialisation of agriculture (the Green Revolution and its concomitant introduction of new technologies being the major vehicle), industrialization (mainly in its labour-intensive, low-wage variety of textile, garment and confectionary production) and a rapidly increasing tertiary sector of trade, banking and transport. These processes had affected the lives of millions of men and women basically by pushing them out of agriculture into the urban world of industrial production and construction. Ever since the late 1970s a constant flow of temporary and permanent migrants was moving to Indonesia's major cities, looking for work. Many found employment, and notwithstanding the low wages they often earned more than they would have done in their villages of origin – although they had to work longer hours and although they had to live in marginal housing compounds.

Those who had stayed behind in the villages shared in the gradually improving living conditions: agriculture and small-scale rural industries provided employment, and overall economic growth brought its trickle-down affects which many experienced in a direct way by receiving remittances from their migrant family members.

The project in its original shape intended to focus upon the ways people in local communities and urban settlements are coping with these changing living conditions (which brought new forms of insecurities) by creating and recreating social arrangements and networks to provide both short- and long-term social security.

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2 The 1998 *Human Development Report* calculates that in the United Kingdom, Ireland and the usa 15 till 16 percent of the population lives below the poverty line.

3 See e.g. J.P. Dirkse, F. Hüsken and M. Rutten (eds), *Development and Social Welfare. Indonesia's Experiences* under the New Order. Leiden: kitlv Press, 1993.

Before the great transformation of the Indonesian economy started in the mid-1970s, the most common forms of social security arrangements in Indonesia involved kin and family groups, neighbourhood associations, patron-client bonds and local-level organizations. Taking care of the sick and elderly was supposed to be the main responsibility of close relatives, while mutual help in agricultural work or in preparing the often elaborate and costly life cycle ceremonies was thought to be a traditional obligation of neighbours and co-villagers. Local elites, whether they were village administrators, wealthy farmers or religious leaders, ideally had to act as patrons providing the families of their tenant-farmers or workers not only with a form of steady employment but also helping them out in times of need. Of course, all this was more often than not part of the idyllic myth of a corporate village in which people support each other by sharing at least part of their resources. In actual fact, the Javanese *desa* has rarely been such a place of harmony and cooperation. Nevertheless, the relatively localized nature of the rural economy before the New Order came to power, had created a degree of interdependency which provided at least some basic forms of social security for most villagers. As a consequence of increased commercialisation in agriculture and in rural industries, and of a geographic and functional expansion of local and regional economies we hypothesized that local types of social security arrangements had gradually come under pressure which may have caused them to being eroded or reshaped. We supposed that new types of security strategies and informal arrangements had been created at the local level. The project aimed at checking which 'traditional' security arrangements were still viable, and which new ones had come to the fore, as well as assessing which social classes and categories were included in these arrangements and which were not. The focus of the project was first of all at the local level as we supposed most changes in social security was of a local nature. We did, however, not exclude supra-local arrangements and policies even if we recognized their limited importance: in the past two decades, the national Indonesian government had initiated a number of programmes and institutions which were specifically designed for increasing social welfare. For a number of reasons, these government initiatives have not been very successful in compensating for disappearing or weakening local institutions of social security. In some areas, private projects had been set up, either by religious organizations or by NGOs, but due to limited budgets and political restrictions, they had exemplary value at the most.

In sum, we intended to study the social conditions and actions for safeguarding individual or group security in order to explore processes of long-term social change and its consequences in particular for the poor. By focusing upon social security from a perspective of arrangements, strategies and networks, we wanted to approach these poor not primarily as victims (either of progress, or of exploitation) but as creative and imaginative actors in a constantly changing socio-economic environment.

Four major questions were taken as the guidelines for the research project:

1. What impact do processes of socio-economic change (commercialisation, economic diversification, migration, education) have on existing local mechanisms of social security?
2. Which (new) strategies do people pursue in order to maximize social security on (a) an individual level; (b) within the social organization of the household or kin groups; (c) in group formation based upon solidarity along horizontal (neighbourhood) and vertical (patronage) lines?
3. Which at role is played by the state (and, where relevant, by non-governmental organizations) in working towards a system of social security, and what are its explicit and implicit aims and achievements?
4. What is the role of the informal sector, particularly as an interface between the rural and urban worlds, in providing care arrangements?

**Organisational set-up**

The project being a combined effort of three research centres at Indonesian and Dutch universities, its management, planning and implementation are shared by a project committee. Research projects were broadly defined at the beginning, but their elaboration was the primary responsibility of the researchers. During the preparations for fieldwork, a number of other researchers with related themes joined in. As some of them had been involved in research in Java in the 1970s and as they intended to carry out a restudy of the communities they studied in the early years of Indonesia's booming economy, their participation added a fruitful longitudinal dimension to the project.

Fieldwork locations and topics can be embedded in an overall grid which covers the rural as well as the urban world; agricultural, industrial and tertiary sector labour; the different regions of Java, as well as part of the neighbouring eastern islands; gender and ethnic dimensions of social insecurities; institutional as well as 'informal' types of security arrangements[4]. An analysis of Indonesian governmental and non-governmental policies complemented these local studies.

**Fieldwork in times of crisis**

Nearly all fieldwork projects started by mid-1997 when there were hardly any signs of a coming major economic crisis, let alone of a major political change. Soon afterwards, in September 1997 however, the Asian miracle started to show its weaknesses: the tigers turned out to be giants with feet of clay. Within a few months the Indonesian currency lost 80 percent of its value vis-à-vis the dollar, and the government proved unable to turn the tide. By January 1998, things changed for the worse and prices of imported goods started to rise quickly. The IMF-induced policy of abandoning government subsidies on basic necessities made things worse. Within a few months, the major growth sectors of the economy: construction, industrial production (including the export-oriented ones) and transportation experienced heavy setbacks, and many of them were forced

4 See the annex for a list of the participants and for details of their individual research projects.

to close down their activities. Finally, after 30 years of the authoritarian rule of Indonesia's New Order government, it transpired that its major economic strength had been based upon a closely connected network of the president, his family and his cronies and that corruption, collusion and nepotism had been its major instruments. Rapidly, social unrest and criticism turned toward the Suharto circle and the main pillars of the New Order regime. Finally, after months of student demonstrations, in May 1998 the 'reformasi' was achieved, that is: the president was forced to abdicate, and in his fall he drew with him a remarkable number of people who had jumped on his bandwagon. With 60 percent of its population living below the poverty line by mid-1998, Indonesia was back to the situation of the early 1970s.[5]

Even after this break with the political past (some might be inclined to say that in fact not much has changed as Suharto's friends and protégés are still powerful – but this is the time nor the place to go into a political analysis), the economic future of Indonesia remains gloomy. Three presidents later, the currency crisis has still not been overcome; economic restructuring is still in the waiting, and foreign aid through the IMF and the International Consortium still play a waiting game. After a period of high hopes that with Suharto's departure from the stage, the economic crisis would also subside, Indonesians are facing increasing prices of basic commodities, a declining purchasing power, and uncertainties about their economic future.

**Summary of results**

Studying social security under conditions of a major breakdown of the national economy proved to be a rare kind of laboratory research in the social sciences. While we originally intended to analyse security arrangements providing support in times of setbacks in individual living conditions, most researchers now could study the functioning or non-functioning of the security arrangements *in vivo*: under our own eyes, people – after a time of 'wait-and-see', hoping for a miraculous turn for the better – had to face the facts of losing relatively well-paid jobs, the dwindling of their savings, the rapidly rising prices, and – worst of all – a gloomy future, the depth and length of which nobody could fathom. In such situations they had to mobilize their networks of social security, if indeed they had one.

It is still too early to comprehensively assess the results of all field studies, as a number of publications and dissertations are still in progress, but we will try to summarize a few conclusions, taken from interim reports by the individual researchers.

Even though the crisis has brought a series of insecurities, in the short run one cannot see an overall feeling of despair. In the villages, the impact was less direct, mainly because villagers could cut expenditures on commercial

5 These figures were given in the Indonesian newspapers of August 1998. Of course, the same reservations which apply to earlier government data on the reduction of mass poverty, should be made with regard to these figures, the more so as these figures are presented in dollar terms. With an exchange rate of 12,000 rupiah to the dollar in August 1998, as against 2,000 rupiah in August 1997, while price increases for basic commodities had not yet reached that 600 percent level, the newspaper figures on the number of poor are at least partially artificial.

consumer goods by resorting to local resources. In the cities the situation was different, although in the beginning there were no clear signs of panic either. Apparently, many people were able to either deny the severity of the crisis in their own lives or to hang on by using their own material and immaterial resources. Some of the urban unemployed would sell part of their assets (particularly the luxury items), and wait for a change of times. Others returned to their villages and were able – at least for the time being – to mobilize support from their relatives. Until mid-1998, panic was mainly absent among those who suffered the direct impact of the crisis. Later on, however, several regions became the scene of occasional food riots, and in the past few years, not much has improved.

During the world crisis of the 1930s, it was often said that the Indonesian village economy could easily absorb the strong influx of returning unemployed plantation workers. Most researchers always considered this conclusion to be part of the colonial myth of the resilience of the village community. However, immediately after 1998, at least part of this was true. In those areas from which only in recent years young people had moved to the cities, it turned out that after having lost their jobs, many of them could still find employment in village agriculture or the regional economy in general.

On the other hand, in villages that already since more than a decade had been involved in urban migration, returning migrants faced far greater problems. Having been the proud urbanites in appearance and attitude, they had become unfamiliar with village life and with working in the fields (and certainly unwilling to get back into the mud), while villagers who had stayed behind were not particularly inclined to help them.[6]

It seems that processes of individualisation and the 'loss of a community spirit' have not been as all pervasive as we assumed at the beginning of the project. That is, those migrants that have maintained contacts with relatives and friends by regularly sending remittances and by returning to the village on important occasions, could still count on the support system the village offered in the past. Those who have moved towards an urban lifestyle, and therefore neglected their networks in their villages of origin, face a far harder future. The question, of course, remains: for how long can these rural households afford to share their assets with the returnees?

But it was not only the villagers who provided support in times of crisis. Also some of the urban neighbourhoods had over the years grown into 'communities', or at least into a framework of local groups which in the form of savings clubs or rotating credit associations served important functions for coping with short-term shortages and debts. In the short run, i.e. during the first year of the crisis, they enabled urban *kampung* dwellers to hang on for a while.

6 This was clearly exemplified in one of the research villages, which consisted of a number of quite distinct hamlets. In the more 'urbanized' part of the village, return migrants remained unemployed while in the more remote corners of the village, they were able to re-enter the labour market far more easily.

Furthermore, and certainly not surprisingly, it turned out that government initiatives in the field of social security had been very limited in the past. The only substantial programmes involve civil servants and permanently employed industrial workers – who together make out only a minor percentage of the population. The sad part of the thing is that when the crisis hit Indonesia, these programmes were ill-suited to cope with its consequences or that their assets had dried up at the time they were most needed, as in 1998 it was found that the greater part of the government social security funds (*Jamsostek*) had 'disappeared'. The Social Safety Net (*Jaringan Pengaman Sosial*) which the go-vernment introduced in 1998 to cope with the worst effects of the crisis on the urban and rural poor, turned out to be not only far too limited in scope and funding but also badly managed and ill administered.

A general conclusion from the research is that social security provisions are still mainly within the family. However, families have become smaller and its members are often living quite far apart which implies that people in need do not have easy access to them anymore. Moreover, family members also experienced economic setbacks and therefore are often unable to support their parents or brothers and sisters.

From among the wider range of relatives, people occasionally receive support but this is more an exception than a rule, and for the same reason as given above, their support as limited. In the villages, help from wealthy employers is decreasing as the former patron-client bonds between landlords and tenants or farm workers are changing towards more business-like relationships.

In a number of cases, however, support from neighbours and friends tends to be more important than that from relatives. People who are in a day-to-day exchange relations with their neighbours and colleagues, are obviously more entitled to resort to mutual support systems. This points to the conclusion that social security networks based on strong bonds like those between relatives and patrons and clients, are being replaced by wider networks of people who have weaker but more ties with each other.

A remarkable observation is that people in dire circumstances, turn to 'irrational' methods of finding social security. In the years following the economic crisis, gambling had become more visible and prominent. When people don't see a 'normal way out of their problems, the lure of windfall gain becomes highly attractive, even though the risks are very high and losing means an even further setback.

The gambling phenomenon supports a general finding in our research, which is that individualization has grown and that people, more often then in the past, have to find their own solutions – which in many cases, they do only partially or not at all.

These findings lead to the conclusion that in the present situation, the Indonesian state has a greater responsibility than in the past to provide social support. This is not only a matter of charity, but also of good economic statesmanship. We only need to look at Thailand, which at the time of the crisis had a relatively well-developed social security system, to see that state support for its citizens is a crucial way to overcome a crisis like the Indonesian one.

## Annex 1: composition of the research team, 1996-2001

**Participating institutions:**
Population Studies Center, Gadjah Mada University, Yogyakarta (PSC)
Department of Anthropology, University of Nijmegen (KUN)
Centre for Asian Studies Amsterdam, University of Amsterdam (UVA)

**Individual research projects:**

*Urban studies:*
Agus Dwiyanto (senior PSC)
Social security, ageing and housing in Sidoarjo (East Java)
Faturochman (PhD-cand.PSC)
Social security and social justice (East Java)
Andreas Susanto (PhD-cand KUN)
Social security strategies among the Chinese of Yogyakarta
Ambar (PhD-cand PSC)
Women and social security strategies (East Java)
Erwan (PhD-cand PSC)
Housing and social security (Central and East Java)
Huub de Jonge (senior KUN)
Networking among Madurese street vendors in Bali
Hotze Lont (PhD-cand UVA)
Saving and credit in and urban kampung (Yogya)
Ruli Marianti (PhD-cand UVA)
Social security arrangements among urban widows (East Java)

*Rural Studies:*
Irwan Abdullah (senior PSC)
Changing security arrangements, Kali Loro 1972-1998 (Yogya)
Made Kutanegara (PhD-cand KUN)
Household organizations and social security, Sriharjo (Yogyakarta)
Pujo Semedi (PhD-cand UVA)
Survival strategies in a Central Javanese fishing village
Latief Wiyata (PhD-cand UGM)*
Honour and shame in Madurese society
Jan Breman (senior UVA)
Migrant labour and the crisis in Indonesia (West Java)

Frans Hüsken (senior KUN)
Rural households and return migration in Pati (Central Java)
Gerben Nooteboom (PhD cand KUN)
Labour and food security in Bondowoso (East Java)
Ratna Saptari (post-doc KUN)
Industrial workers and social security in Malang (East Java)
Abram de Swaan (senior UVA)
Mutual societies in Indonesia
Ben White (senior ISS)*
Changing households in Kali Loro, 1972-1998 (Yogya)
Willem Wolters (senior KUN)*
The household economy in rural Banjarnegara, 1978-1998 (Central Java)

* Denotes affiliated researcher

# Islam in Indonesia: dissemination of religious authority in the twentieth and early twenty-first centuries

Moch Nur Ichwan and Johan Hendrik Meuleman

## Introduction

Within the framework of Dutch-Indonesian scholarly cooperation, Islam is a theme of major interest. Firstly, Islam receives increasing attention worldwide, both in general or popular discourse and in the more limited discussions of the academic and political elite. Because of phenomena of large-scale Muslim immigration to Western countries, numerous military and political conflicts involving Muslim communities, and, last but not least, the dramatic events of 11 September 2001, most of these discussions have recently tended to become less balanced and less based on in-depth knowledge.

Research in conformity with the highest academic standards may help invert this regrettable trend. Another, obvious reason for which the study of Islam earns a primary position within this bilateral cooperation programme is the fact that Indonesia has the largest Muslim community in the world. The third reason is that Indonesia and the Netherlands have a long-standing and unique experience in this field.

Scholarly activities that originated in the colonial context may very well be continued in a post-colonial situation of common interests and shared management. Previous educational cooperation in the same field has shown so.[7]

Another reason for which the Islam in Indonesia programme occupies an important place within the Scientific Programme Indonesia-Netherlands (SPIN) is its contribution to a sound understanding of the relationship between the political and the scholarly interests of research activities. According to a rather simplistic standpoint, the existence of any political or social dimension of a research project automatically disqualifies it as a scholarly enterprise.

The Islam in Indonesia programme is evidence to a more balanced and realistic standpoint: scholarly research activities should not be meant to serve the immediate political interest of a particular government, party, or group. However, they may very well lead to a better understanding of social mechanisms leading to conflicts, which will help various political actors to look for solutions to situations and transformations that are considered as problematical according to broadly accepted standards.

7 The primary reference would be the Indonesian-Netherlands Cooperation in Islamic Studies (INIS), which has been implemented by the Universiteit Leiden and the Ministry of Religious Affairs of the Indonesian Republic and a number of the institutes for higher education in Islamic Sciences it administers.

A concrete example, mentioned during the February 2002 Bandung presentation of this programme, will clarify the purport of this principle: the researchers involved are no intelligence agents and their task is not to answer questions such as the one of whether or not al-Qaeda (al-Qa`idah) possesses a basis in Poso, Central Sulawesi – a hot question at that moment. On the other hand, the results of their labour are expected to contribute to a better understanding of the mechanisms underlying communal strife in the Moluccas. Competition for leadership and party adherence among the Indonesian Muslims, and similar questions; nevertheless, it is the task of others – Indonesian politicians and citizens at large in the first place – to solve the various political and social problems they are facing. Therefore, general political and scholarly interests of research programmes do not necessarily exclude each other. The opposite is often the case. The detailed analysis of the Islam in Indonesia programme, below, will show that it serves interests of both categories.

From yet another point of view, this research programme has gone beyond too rigid ideas about what excellent research should be like. It does not limit itself to research in the strict sense of the term, but rather includes a – top-level – educational component: in addition to a number of senior researchers, six Indonesian PhD candidates are involved, who will be trained as fully-fledged experts through their participation in this international project. In this way, the programme has adopted the integration of research and education that has become the hallmark of strong academic traditions in most parts of the world.

A final particularity of the Islam in Indonesia programme, testifying to its dynamic understanding of what a contemporary research project should be like, relates to its bilateral character. Although the programme is based on Indonesian and Dutch scholarly institutions and traditions, it has been consciously anchored in a global framework. From the viewpoint of the personnel involved, this is reflected in the participation of a number of senior researchers from third party countries – even representing three continents other than Europe and Asia. From the thematic and methodological perspective, this global framework is reflected in the adherence to scholarly debates in various countries.

Cases in point are the discussion on shifts in religious authority and the endeavour to combine text-based and social-scientific research in Islamic Studies. The initiative to invite Brinkley Messick from Columbia University, New York as the keynote speaker for the first annual seminar of this Dutch-Indonesian programme was precisely related to these two examples. Not only the Indonesian, Dutch, and other researchers of the programme showed much interest in this American scholar, who has done extensive research on the development of authority in Islamic justice in the Yemen; the opposite proved true too.

**One central theme, four sub-projects**

The Islam in Indonesia programme will involve at least ten researchers, not including part of the supervisors and coordinators. Their activities are centred around one common core theme. Within this general framework, four complementary sub-projects have been designed. The coherence of the programme is also enhanced by a series of meetings in which various researchers participate. During the first year of the implementation, all researchers present in Leiden attended a series of discussions on previous publications of special relevance to the programme. Examples include work by Dale F. Eickelman on the nature and transmission of the authority of Islamic judges and legal texts at successive stages of Moroccan history and a book on similar questions in the Yemen by Brinkley Messick.[8] These meetings aimed at strengthening and unifying the analytical and theoretical framework of the participating scholars and at helping them to situate their activities in a broader framework. Moreover, throughout the four-year period scheduled for its implementation, the programme will provide a series of common workshops and seminars. In addition, periodical meetings are held by the experts in charge with the supervision and coordination of the programme. On the other hand, sufficient freedom is left to the individual researchers in order that they may produce their articles, dissertations, and other monographs in conformity with the demands of scholarly creativity and dynamism.

The central concept of Muslim authority, as understood in the context of this research programme, is a complex one. On the one hand, it comprises the authority of persons among Muslim communities. These persons belong to one or more of the categories of *'ulamā'*[9], muftis, leaders of social and political organizations, intellectuals educated in the Western tradition, or yet other social and intellectual groups. On the other hand, the concept comprises the different types of written and unwritten materials to which Muslims refer, such as hadiths, classical works of religious sciences, fatwas, modern scholarly and popular lectures, printed works, and Internet documents, as well as cassettes. Research is done into the nature of these various types of authority, their foundations and origins, their reproduction, transmission, and distribution. Transformations in Muslim authority, such as shifts in the types of authoritative materials Muslims reference or in the categories of persons that possess religious authority receive particular attention. Processes as globalisation, localization, decentring, and/or recentring are taken into consideration, as is the changing relationship between state and society.

Within this common framework, the following four sub-projects have been designed:

- traditional religious authority: *'ulama'* and fatwas;
- mystical associations (*tarekat*) in urbān communities;
- *dakwah* (Muslim propagation) activities in urban communities;
- education and the dissemination of religious authority.

8 Eickelman, Dale F., *Knowledge and Power in Morocco. The Education of a Twentieth-century Notable*, Princeton: Princeton University Press, 1985; Messick, Brinkley, *The Calligraphic State. Textual Domination and History in a Muslim Society*, Berkeley etc.: University of California Press, 1993.

9 Islamic religious scholars; singular: *'alim*.

A few short clarifications may reveal their interdependence. Among the questions examined by the first sub-programme are those of whom Indonesian Muslims solicit fatwas, i.e. 'expert' opinions on questions of Islamic law. From: are they persons versed in the classical works of Islamic jurisprudence during year-long studies in traditional *pesantrens* or Islamic boarding schools, domestic or foreign graduates from Middle-Eastern universities, United States educated food processing engineers, or a combination of these different categories of experts. Which – classical, modern, Indonesian, Middle Eastern, and/or Western – texts do their fatwas refer to; who ask for their opinions: private persons, organizations, or public authorities?

Changes in these respects that occurred during the twentieth century are also being analysed. The second sub-programme is interested, among other developments, in the phenomenon that an increasing number of persons from urban business circles and the higher echelons of the bureaucracy and military are interested in various types of mystical organizations. One of the questions asked in this framework is to which extent these organizations are led by or follow traditions transmitted from traditional *'ulamā'* or rather are based on methods and views recently developed by figures with different intellectual and social backgrounds. The third sub-programme addresses similar questions relating to dakwah organizations and activities and the fourth does so regarding Islamic educational institutions.

**Scholarly and political interests**

This contribution started with a discussion of the importance of the Islam in Indonesia programme within the framework of the Indonesian-Netherlands scholarly cooperation. From a more general point of view, the programme serves various interests too. As explained above, these interests are both of a political and a scholarly nature and this combination should not be considered as an anomaly. Let us list these general interests in order of ascending political significance. Firstly, the programme contributes to the extension of Islamic studies beyond their focus on the Middle East, which continues to be dominant in most research institutions in the West as well in countries with Muslim majorities. Next, it uses both philological and social scientific approaches. In this way, it will be a step in the realization of a combination that, to the extent it has been mentioned by scholars, has often remained a slogan or a desire rather than a reality. Thirdly, this programme involves both Muslim and non-Muslim scholars and from this point of view again is a most welcome step beyond traditional divides. Finally, the programme is relevant to various contemporary political and scholarly questions and debates. Some of them have been briefly mentioned in the preceding paragraphs. A more detailed discussion of one of the sub-programmes will clarify this point even more. The programme being presented is in the middle of its implementation. It is natural, therefore, that the discussion focuses on research questions and hypotheses rather than final results.

# Research objectives exemplified by a sub-programme: dakwah activities in urban communities

## Introduction

The Malay/Indonesian word *dakwah*, from the Arabic *da`wah*, is the general term for Islamic religious propagation. Although it comprises efforts to convert non-Muslims, *dakwah* primarily concerns activities aiming at strengthening and deepening the faith of Muslims and developing their ways of life in conformity with its principles. *Dakwah* activities have been highly appreciated in Muslim societies all through their histories. Since the beginning of the twentieth century, many movements and organizations that have considered *dakwah*, in one form or another, as their chief objective have developed all over the Muslim world. They vary from small groups operating in limited circles of various social positions to large, well-established organizations. Some operate within the framework of international organizations such as the Muslim World League and the Tablighi Jama`at. From the doctrinal point of view, they are situated closer to or farther away from mainstream Islam. They may be totally private, sponsored by public authorities, or part of the state apparatus. All referring to the Koranic objective of 'enjoining what is right and prohibiting what is reprehensible', their activities range from preaching, passing by the distribution of literature, the organization of intellectual discussions, and artistic performances, to health care and projects of social and economic development.

The sub-programme on *dakwah* activities in urban communities will develop a systematic survey of the various types of *dakwah* organizations and it will examine aspects such as their composition, organization, linkages, networks, strategies and activities. The example of this sub-project will allow us to clarify in some detail two important points of the general introduction on the Islam in Indonesia programme. They are the core concept of religious authority and the relevance to general scholarly and political questions and debates. In addition, it will show us how the research programme may be enriched by adding a comparative perspective.

## Authority in the context of dakwah

Research relating to authority involves analyses of the leading personalities of the various activities, the spiritual, social, educational, or yet other bases of their authority, their organizations and their networks, locally, nationally, and, in some cases, internationally. On the other hand, it is interested in the written and non-written works the participants and adherents refer to and discuss about: are they

traditional books of Islamic religious sciences, produced in Indonesia or in the Middle East; are they contemporary intellectual products of Muslims or even non-Muslims living in the West? The production, distribution, and translation of books are among the phenomena analysed in this connection.[10] Special attention is being paid to shifts in the types of religious authority – including of persons – that are reflected in or enhanced by recent and contemporary dakwah activities.

The development of Islamic reformist organizations in Indonesia, since the beginning of the twentieth century, has undermined the monopoly of religious authority held by the '*ulamā*'. Various social and political activists not educated in the traditional religious sciences have obtained positions of authority within the Muslim community. Among them are quite a few graduates of technical colleges or of domestic and foreign social science faculties. During the New Order period, this tendency was radicalised. Part of the role and authority of the established socio-religious organizations has been taken over by more recent *dakwah* organizations. The Indonesian market has become flooded with translations of contemporary Middle Eastern booklets explaining how Muslims should distinguish themselves in behaviour and clothing. At the same time, translations of contemporary works of Muslim thought and social and political analysis in Western languages have also attracted increasing numbers of Indonesian readers. Therefore the trend is not towards one particular type of new references. Nor is the tendency simply to move away from old forms of authority to new ones. In 1999, the wave of democratisation resulted in the leader of the largest organization of '*ulamā*' being elected state president. One of the most prominent examples of recent *dakwah* organizations, the Forum Komunikasi Ahlu Sunnah wal-Jamaah (FKAWJ: Communication Forum of the Followers of the [Prophetic] Tradition and the Community), strongly implanted in university campuses, is led by a council of '*ulamā*'. The guerrilla activities of the ill-famed Laskar Jihad, which originated from the FKAWJ, are justified by fatwas obtained from Middle Eastern '*ulamā*'.[11] This militia, by the way, was one of the fiercest adversaries of that `*alim* who had become president. These few examples show the complexity and interest of the ongoing research on religious authority in connection with *dakwah*.

**General scholarly and political relevance**

The *dakwah* sub-programme will borrow from and contribute to various more general debates in contemporary social sciences and Islamic Studies. The themes of the most relevant of these discussions include the following: civil society and

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10 About which a first report has been presented as Johan Meuleman, *Modern Trends in Islamic Translations*, as a contribution to the workshop of the History of Translation in Indonesia and Malaya project, organized by the Association Archipel, in Sèvres, 2-5 April 2002 and to be published with the other contributions to this project, edited by Henri Chambert-Loir and Monique Zaini-Lajoubert.

11 Additional evidence to the interdependence of the various components of the Islam in Indonesia programme is the fact that in the framework of another sub-project Noorhaidi is preparing a dissertation on the Laskar Jihad (The Jihad Paramilitary Force: Islam and Identity in the Era of Transition). Cf. a first publication of this author: Noorhaidi Hasan, *Faith and Politics: The Rise of the Laskar Jihad in the Era of Transition*, Indonesia (Ithaca), 73 (April 2002), p. 145-169.

its role in social and political development, in which the Indonesianist, Robert W. Hefner has been interested. Transformations in the production, nature, and position of traditional holders of religious authority, as studied by Brinkley Messick, Dale F. Eickelman, and Fanny Colonna in Yemen, Morocco, and Algeria, respectively; the interaction of global and local aspects of Islam, as analysed in the case of Indonesia by Azyumardi Azra and Johan Meuleman; the way modern states give shape to Islam, as most recently elucidated for Egypt by Gregory Starrett; and the continuous recentring of Muslim authority as emphasized by Richard W. Bulliet.[12]

To illustrate this point, some details may be given on the theoretical framework proposed by the last-mentioned author and its relevance to the object of research. In his *Islam. The View from the Edge*, Richard W. Bulliet proposes to analyse the recent Islamic resurgence in terms of a contest among three parties: secular governments; '*ulamā'* and lay people striving to preserve and reinforce the established religious tradition Shi'ism in Iran, Sunnism in most other countries; and new Islamic organizations developing along the social edges created by massive urbanization and by the development of secular state education.

Bulliet's division into three types of actors is useful for the analysis of recent *dakwah* movements in Indonesia. However, it should be amended at two points. Firstly, Indonesia's government is only secular to a certain extent. The official principle that Indonesia is not a secular state, but one based on *Pancasila* or the 'Five Pillars', of which the first one is the belief in a unique God, has been taken seriously by all Indonesian regimes. It is within this framework that the state and government have been among the actors in *dakwah* activities. The exact nature of state involvement in activities related to religion and the extent to which it differs from or is similar to the policy of more outspokenly secular states with large Muslim populations is one of the main questions addressed in the individual PhD research presented at the end of this contribution. Secondly, although in Indonesia one can distinguish a group of '*ulamā*' and other persons who act as the defenders of the Sunnite tradition, they adhere to several sub-traditions, each with their own organizations. These distinctions within the second category of Bulliet's model will certainly have to be taken into account. The question of to what extent Bulliet's contention that the development of Islam may be understood as a contest between the state, the established religious tradition, and more recent groups at the 'edge' of Muslim society holds true for Indonesia, will receive much attention in the research programme. Preliminary research suggests

12 Cf. Hefner, Robert W., Civil Islam. Muslims and Democratisation in Indonesia, Princeton and Oxford: Princeton University Press, 2000; Messick, op. cit.; Eickelman, op. cit.; Colonna, Fanny, *Les versets de l'invincibilité: permanence et changements reliqieux dans l'Algérie contemporaine*, Paris: Presses de la Fondation nationale des sciences politiques, 1995; Starrett, Gregory, Putting Islam to Work. Education, Politics, and Religious Transformation in Egypt, Berkeley etc.: University of California Press, 1998; Azyumardi Azra, *The Transmission of Islamic Reformism to Indonesia: Networks of Middle Eastern and Malay-Indonesian 'Ulamâ' in the Seventeenth and Eighteenth Centuries*, diss., Columbia University, New York, 1992 (Indonesian translation: Jaringan Ulama. Timur Tengah dan Kepulauan Nusantara Abad XVII dan XVIII. Melacak Akar-Akar Pembaruan Pemikiran Islam di Indonesia, Bandung: Mizan, 1994); Meuleman, Johan Hendrik, *Indonesian Islam between Particularity and Universality*, Studia Islamika. Indonesian Journal for Islamic Studies (Jakarta), 4, 3 (July-Sept. 1997), p. 99-122; Bulliet, Richard W., *Islam. The View from the Edge*, New York and Chichester: Columbia University Press, 1994; among the most important publications.

that the relationship between the various Indonesian *dakwah* movements and organizations is generally of a complementary nature rather than one characterized by competition or even conflict. The multiplicity of *dakwah* movements is in conformity with the pluralistic tradition of Indonesian Islam. However, tensions have existed. They can mostly be attributed to a combination of difference in religious understanding and jealousy between organizations with adherents from different social classes.

Preliminary study leads to a similar conclusion concerning the relationship between private *dakwah* organizations and the state. The Soeharto-led New Order regime is an interesting case in point. Government officials and agencies basically coordinated, stimulated, and completed private initiatives. However, matters were complicated because the public authorities, besides their policy of stimulating private initiatives of spiritual development, considered the preservation of public order and stability one of their main objectives. This often led to intervention against religious activities that were considered a threat to public order or the harmonious relations between different communities.

The topic of the relationship between various categories of organizations involved in *dakwah* activities – including the state – is also relevant to general political questions and debates. It is related to the questions of the place of religion in general and Islam in particular in the Indonesian state, the nature of the New Order regime, the role of religious movements in its fall, and a number of fundamental debates and conflicts in contemporary Indonesia.

**The comparative dimension**

In order to illustrate how a comparative dimension may contribute to the value of this research, reference may be made to the analysis of recent dakwah movements in neighbouring Malaysia by Manning Nash.[13] This author, in his contribution to the well-known American Academy of Arts and Sciences programme on reli-gious fundamentalism, arrived at the conclusion that these Malaysian *dakwah* movements may generally be characterized as 'fundamentalist'. Preliminary study appears to indicate that no such general qualification applies to the Indonesian situation.

Indonesian *dakwah* movements are extremely diverse from the viewpoint of official status, organizational structure, social background, understanding of Islam, and type of activities. They also differ much in size and scale of operation. Some *dakwah* activities are undertaken by large, well-established social and religious organizations such as the Muhammadiyah and the Nahdlatul Ulama. Other ones are supported, directly or indirectly, by the state. Yet other activities related to *dakwah* are relatively new organizations, outside the sphere of the religious or bureaucratic establishment. Some are small, local groups with very few adherents. Others are active in larger areas or even on the national level. A number of *dakwah* movements that operate in Indonesia originate from abroad. Examples are the Tablīghī Jamā`at, also known as Jamā`ah al-Tablīgh

13 Nash, Manning, *Islamic Resurgence in Malaysia and Indonesia*, in Martin E. Marty and R. Scott Appleby (eds), Fundamentalism Observed, Chicago/London: University of Chicago Press, 1991 [The Fundamentalism Project. Vol. 1], p. 691-739.

wa-al-Da`wah, the Darul Arqam, and theeq Hizb al-Tahrīr. The first-mentioned organization originates from India and has developed into the largest dakwah movement in the world. It has been present in Indonesia since about 1952. The second originates from Malaysia and has spread in Indonesia since about 1990. The third one comes from the Middle East and was introduced into Indonesia in 1987.[14] Other Indonesian *dakwah* movements entertain strong links with international organizations. This is the case of the Dewan Dakwah Islamiyah Indonesia (DDII: Indonesian Council for Islamic Propagation).

Which from the beginning has had close links with the Rābitah al-'ālam al-islāmī or Muslim World League, which has its headquarters in Mecca, and in 1993 became a member of al-Majlis al-islāmī al-'alāmī li-al-da`wah wa-al-ighāthah or International Islamic Council for Da`wah and Relief, based in Cairo.[15]

Therefore, the broad spectrum of *dakwah* organizations that has been operating in New Order Indonesia and afterwards, appearing from a provisional survey, would suggest a much larger diversity than contemporary dakwah organizations in Malaysia, as observed by Nash. This comparative question will certainly receive more attention.

14 *Tempo* (weekly, Jakarta), 3 April 1993.

15 Van Bruinessen, Martin, *Ulamā dan Politik di Indonesia* ['Ulamā and Politics in Indonesia], in idem, *Rakyat Kecil, Islam dan Politik* [Ordinary People, Islam, and Politics], Yogyakarta: Bentang, 1998, p. 184 f.; *Pelita* (daily, Jakarta), 12 October, 9 December 1993; *Republika* (daily, Jakarta), 15 October, 10 December 1993.

# The programme illustrated by an individual research project: the making and unmaking of statist islam

## Introduction

To illustrate what individual research activities within the general framework of the Islam on Indonesia programme and in connection to the Dakwah in Urban Communities sub-programme theme amounts to. This contribution will close with a short and necessarily provisional survey of the study on The Making and Unmaking of Statist Islam: State Production of Islamic Discourse in New Order Indonesia and Afterwards, made by Moch Nur Ichwan in preparation of a dissertation.

Both from a political and from a scholarly perspective, the relationship between state and Islam is a most important theme. This particular case study focuses on 'statist Islam' in New Order and *Reformasi* Order Indonesia (1985-2003). The term 'statist Islam' is used for state-oriented Islamic discourse developed by the state to support its political agendas and interests. The main reference for the concept of discourse, in this framework, is Ernesto Laclau and Chantal Mouffe, Hegemony & Socialist Strategy: Towards a Radical Democratic Politics, which links this concept to those of state and hegonomy.[16] Although this individual project is basically part of the sub-project on dakwah within the 'Dissemination of Religious Authority' research programme, it is related to some of the other, interconnected sub-themes of the programme too.

Statist Islam may be constructed through three different processes:

1. the Islamization of the state, which makes Islam the basis of the state and statecraft;
2. the 'statization' of Islam, which makes the state a dominant and hegemonic force that reconstructs Islam to support its interests;
3. the secularization of the Muslim state, which separates the state from any religion, including Islam.

The study examines the hypothesis that these three processes are not mutually exclusive and that Indonesian statist Islam has in fact been constructed through the combined processes of Islamization, statization, and secularisation.

Although Indonesia has a Muslim majority, it is not an Islamic state, nor a secular state. Indonesia is not based on *sharī`ah* (Islamic law), but instead on *Pancasila*, an alternative ideology constructed to maintain pluralism and multiculturalism, and to overcome sectarianism. However, the establishment

16 Laclau, Ernesto and Chantal Mouffe, *Hegemony & Socialist Strategy: Towards a Radical Democratic Politics*, Londen: Verso, 1985.

of the Ministry of Religious Affairs, dealing mostly, but not exclusively, with Islamic affairs, and the adoption of some aspects of *shari`ah* into its legal system, such as the Law on Religious Courts (1988), the Compilation of Islamic [family] Law (1991), and the Zakat Law (1999) might be considered as partial Islamization of the state. These same developments, however, might also be viewed as perfect examples of the statization of Islam, absorbing Islam into the state. In other words, the Islamization of the state proceeded within the framework of the statization of Islam.

The entire New Order period was characterized by the statization of Islam. Three stages may be distinguished: the forceful statization of Islam, from the establishment of the New Order regime to the establishment of Pancasila as the sole basis of all political and mass organizations. Including the Islamic party and Muslim organizations (1967-1985); the milder statization of Islam, ending with the establishment of the All-Indonesian Association of Muslim Intellectuals (ICMI, 1990); and the peaceful statization of Islam, from the foundation of the ICMI to the collapse of the New Order regime (1991-1998).[17] To a certain extent, the last-mentioned form of statization of Islam continued into the post-New Order era. On the other hand, a process of 'destatization' of Islam has started. It was partly caused by the weakness of the state, but primarily by the democratisation process and the increasing strength of Muslim civil society. As a result, the statist Islamic discourse has become less effective in society.

In order to develop and examine these provisional ideas, this individual research project will pay special attention to three key aspects of statist Islam, namely the state discourses of Islamic *dakwah*, education, and law. As an illustration, some details about recent fieldwork relating to *dakwah* are presented below.

*Fieldwork notes: state policy concerning Islam and state production of dakwah discourse*

It is widely known that most dakwah discourses are produced by Muslim organizations, such as the Nahdlatul Ulama, the Muhammadiyah, the Dewan Dakwah Islamiyah Indonesia (DDII: Indonesian Council for Islamic Propagation), and yet other organizations. The state production of Islamic dakwah discourse has been generally neglected both by Muslims themselves and by researchers. Such neglect is caused by the following reasons: 1) the dominance of 'societal' *dakwah* discourse, i.e. *dakwah* discourse within the ('civil') society rather than within the state; 2) the general idea that statist dakwah discourse is more political than religious; and 3) the ongoing democratisation process, which focuses on civil society rather than the state.

The state has influenced *dakwah* discourse in two ways. Firstly, it has controlled *dakwah* discourse. This control has been established by a policy of compulsory authorizations for *dakwah* activities, delivered by local authorities,

17 Cf. Abdul Aziz Thaba, who classifies the Indonesian New Order period into the 'antagonistic period' (1967-1982); the 'reciprocal-critical period' (1982-1985); and the 'accommodative period' (1985-1994) (Abdul Aziz Thaba, I*slam dan Negara dalam Politik Orde Baru* [Islam and State in New Order Policy]. Jakarta: Gema Insani Press, 1996, p. 29).

by surveillance, physical and psychological threats, and by prohibitions. In this particular context, the police and military forces played a fundamental role, especially during the New Order era. Their violence against Muslim *dais* or *muballighs* (Islamic preachers) and *dakwah* institutions was frequently reported in many parts of the country. Secondly, the state has produced its own *dakwah* discourse. The state production of *dakwah* discourse has been part of the state policy in the matter of Islam in general. When the state was quite oppressive to Islam during the period of 'forceful statization of Islam', and even during the period of 'milder statization of Islam', 'societal' *dakwah* discourse and activities were rather limited, marginalized, and suppressed. When the state attitude towards Islam became more positive since about 1990, societal dakwah discourses have been liberated and since the collapse of the New Order in 1998, they have acquired yet more freedom.

The state production of dakwah discourse has been implemented primarily through the Ministry of Religious Affairs. A complementary role has been played by state-supported institutions such as the Indonesian Council of Ulama (MUI), the Yayasan Amal Bakti Muslim Pancasila (Pancasila Muslim Foundation for Philanthropic Deeds), and the Majelis Dakwah Islamiyah (MDI: Council for Islamic Propagation), especially during the New Order. In general, the New Order state produced the so-called 'pro-state, pro-*Pancasila*, pro-development' *dakwah* discourse. Consequently, the so-called 'anti-state, anti-*Pancasila*, anti-development' *dakwah* discourses were severely attacked, even by the use of police and military forces. The production of the 'pro-state, pro-*Pancasila*, pro-development' *dakwah* discourse has been continued by the post-New Order regime, but in a more 'civilized' way. However, the roles of the various state-supported institutions have generally weakened.

This transformation from the New Order to the *Reformasi* Order is one of the topics elaborated with the help of field research. As an illustration, two comments collected in Yogyakarta may be mentioned. First, an 55-years-old leading official of the Provincial Office of the Ministry of Religious Affairs in Yogyakarta, a *dai* himself, said that there have been no significant changes in the state production of *dakwah* discourses, in terms of their being 'pro-state, pro-*Pancasila*, and pro-development'. The difference is that the state is no oppresses the societal dakwah discourses, even those produced by the so-called fundamentalist movements, at least until the time of the interview.[18] In addition to this comment, one might mention the fact that most *dakwah* discourse expresses a pro-*Reformasi* attitude. This seems also to be the position of the ministry in general as regards *dakwah* discourses. In the second place, interestingly a young independent, 30-years-old *dai*, an activist of the Foundation of Islamic Dakwah and Education Centre 'Silaturrahim Pecinta Anak-Anak (YPDP-SPA)', Yogyakarta argued that state policy concerning *dakwah* during the New Order was better than in the era of *Reformasi*. In the former period, societal *dakwah* discourses were well controlled. The *dais* also controlled themselves in order not to say everything they wished to say. The liberalization

18 Interview in Yogyakarta, December 30, 2001.

of *dakwah* in post-New Order Indonesia, he said, has given rise to the steady development of radical Islamic movements.[19]

The WTC tragedy (September 11, 2001) and the subsequent global reactions against terrorism made the Megawati regime reconsider its policy towards Islam, and indeed its policy in the field of *dakwah*. The first reaction of the Megawati government was an attitude of cautiousness. The government played a 'double-faced' strategy: for internal politics, to satisfy Muslim citizens, it condemned the US war against Afghanistan, which protected Osama bin Laden and his organization, al-Qaeda;[20] for external politics, to convince the USA and the international communities of its positive attitude, it signed the UN agreement against terrorism. This strategy seems to have worked so far. The government faced a very delicate situation, in which it had to consider three dimensions:

1) the possible strong reactions of Muslim parties and civil society;
2) the growing forces of democratisation, reform, and law enforcement; and
3) the international forces against terrorism, in which Indonesia should also take part.

State policy concerning Islam after the WTC-tragedy has been uncertain. The civil and military authorities basically faced three options: would the state use the oppressive way in dealing especially with Muslim fundamentalist movements, and with their *dakwah* discourse; would it support it; or, would it adopt an intermediate attitude? The first possibility, the oppressive way, has often been considered as the right attitude towards 'those who commit terror'. However, the third, more moderate, attitude seems to have been followed by the state in dealing with Muslim fundamentalists insofar as they do not 'com-mit terror'. The Ministries of Defence and Security and of Social Affairs, Politics, and Security as well as the police and the military have always used the corresponding rhetoric since 11 September 2001.

*Reformasi* has been the leading idea of the democratisation process. Democratisation implies respect for the freedom of expression of opinions and the freedom of religion, including the freedom of *dakwah*. However, in the transitional era from New order to more democracy these freedoms were easily manipulated and politicised. In this respect, *Reformasi* has produced counter-productive side effects, which are economic and political crises, as well as instability and insecurity in the country. The government seems to have opted for a partial return to 'stability and security approach', as shown the policy it has followed since the end of 2001 in the matter of Aceh and the Moluccas. If this change of policy would go as far as implying the come back of military forces in the political arena, the spirit of *Reformasi*, i.e. the aspiration at democratisation, law enforcement, and 'civilization' would be threatened.

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19 Interview in Yogyakarta, January 9, 2002.

20 An important instance of this attitude was Megawati's speech at the Isra-Mi'raj commemoration in the Istiqlal mosque, Jakarta, October 14, 2001.

## Conclusion

The Islam in Indonesia: Dissemination of Religious Authority in the Twentieth and Early Twenty-First Centuries programme promises to be one of the most fascinating components of the Scientific Programme Indonesia-Netherlands. Its interest lies in its subject matter itself, its relevance to important scholarly and political questions, and its combination of various, interdependent research projects. It implementation will deepen our understanding of what bilateral scholarly cooperation should be like in our contemporary, globalizing world.

# Lessons from tuberculosis research in Indonesia

Bachti Alisjahbana and Reinout van Crevel

Within the framework of the *Scientific Programme Indonesia-Netherlands* (SPIN), the Priority Programme on Medical Sciences focuses on infectious diseases. Five research groups each address a single topic: dengue hemorrhagic fever, typhoid fever, tuberculosis, antibiotic treatment and leprosy. This presentation will describe in more detail the tuberculosis-project. Apart from a description of the project itself, we will explain how this research relates to the tuberculosis-problem in Indonesia and discuss the Indonesian-Dutch collaboration within this project. As such, this project serves as an example for the other project of the Programme on Medical Sciences.

Tuberculosis (TB) is an infectious disease caused by *Mycobacterium (M.) tuberculosis,* a slow-growing bacterium, which is transmitted by coughing. It usually presents as a chronic pneumonia, but may affect any organ in the human body. The cornerstone to diagnosis of TB is microscopic examination of sputum. Treatment consists of a 6-months course of different antibiotics.

One third of the world-population is infected with *M. tuberculosis*, but only 5-10% will develop active TB; either following infection or years (sometimes decades) afterwards. The other 90% will never fall ill. The question is: what determines if an individual will develop TB after infection or not? More specifically: what determines whether the human host defence system will be able to control the infection or not?

The host defence against TB mainly depends on 'cellular immunity' with a vital role for two cell-types: macrophages and T-lymphocytes. These cells communicate through the production of messenger-proteins (so-called: type-1 cytokines), which bind to specific receptors. Genetic mutations, which lead to a reduced capability to produce or react to these type-1 cytokines, have been found in rare patients suffering from recurrent infections caused by atypical (nontuberculous) mycobacteria in western countries. Within the framework of the SPIN, the hypothesis is being tested that TB-patients also suffer from such defects. To this purpose TB-patients and healthy control subjects are examined for the capability to produce or react to these cytokines, and for the presence of genetic polymorphisms of relevant genes. In addition, among patients, the presentation (severity) and outcome of disease is related to these same parameters. Over 300 patients and some 150 healthy controls have now been included. The immunological and genetic analysis is underway.

This project cannot be separated from the TB-problem in Indonesia. First, the project very much depends on the quality of clinical and bacteriological data. Proof of disease is essential for this type of research: we need bacteriological evidence of TB in every patient. Second, risk of developing active TB, as well as the severity and outcome of TB are dependent on many factors including malnutrition, HIV-infection, the quality of treatment, drug resistance of the mycobacterium etc. Knowledge of such 'confounding' factors in the Indonesian setting is necessary for interpretation of the results of the cytokine assays or genetic analysis. The quality of the SPIN-project thus very much depends on the performance of the service system in the Indonesian health clinics participating in this project. For this reason, we have combined the immunological and genetic research of the SPIN-project with clinical-bacteriological projects. We will provide three examples of the value of such connected projects.

The first is related to the yield of sputum microscopy for diagnosis of TB. In general, the quality of management of TB-patients in Indonesia is unsatisfactory: according to the World Health Organization < 20% of patients with active TB are detected. Also in the TB-clinic participating in our project, the yield of sputum microscopy was disappointingly low. Careful evaluation of the diagnostic process led to introduction of larger sputum containers and renewed instruction of patients and health staff. This intervention improved the quality of sputum samples: (fig. 1) shows that the percentage of patients visiting this clinic who were diagnosed with TB almost doubled. Since then we have been able to reproduce the effect of patient education in a randomised controlled clinical trial in another health clinic.

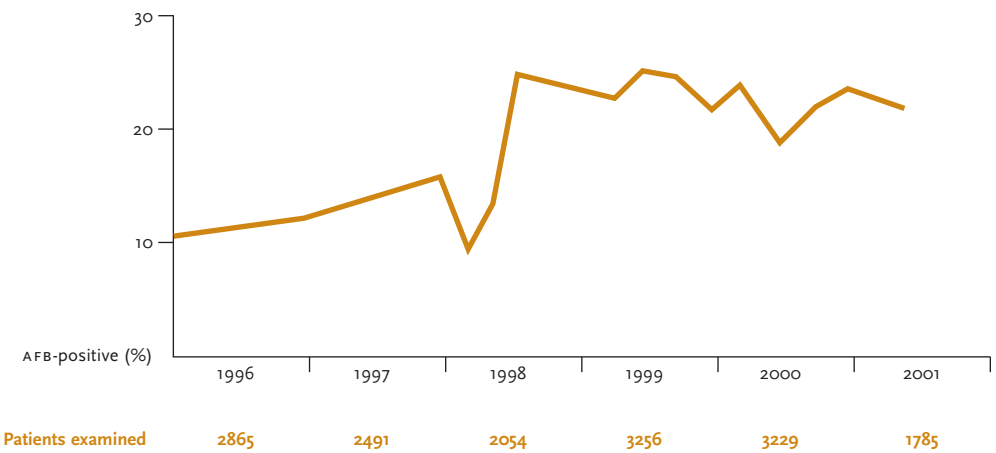



Fig. 1: AFB (acid-fast bacilli)-positive patients as % of the total number of patients examined in an urban TB-clinic in Jakarta, Indonesia (January 1996-July 2001). Since September 1998, larger sputum containers are used, and patients are instructed to provide good-quality sputum. Since this time, 1792 out of 8858 patients have been found AFB-positive (20.23%), compared with 706 out of 6822 patients (10.34%) in the previous 3-year period ($P < 0.001$).

The second example of the successful cross-fertilization of the SPIN-project with related research projects is related to the quality of treatment. In general, a very significant proportion (< 50% according to some sources) of TB-patients in Indonesia will not finish their six-month course of treatment: they will 'drop-out'. We have carefully followed patients during and after treatment. These data can now for the first time prove that those who do not fully comply have a poorer outcome: their cure rate was 35% compared with 83% for patients who show good compliance.

The interaction of the pathophysiological research within the SPIN-project with such applied research thus leads to improved patient management and better clinical data which in turn benefit the SPIN-project. In addition, it leads to generation of new research questions. For example, culture of mycobacteria, which was not done prior to this project, allows for additional bacteriological investigations. These have led to the identification of 'Beijing'-genotype TB-strains (see fig. 2), which are most probably more virulent than other strains.

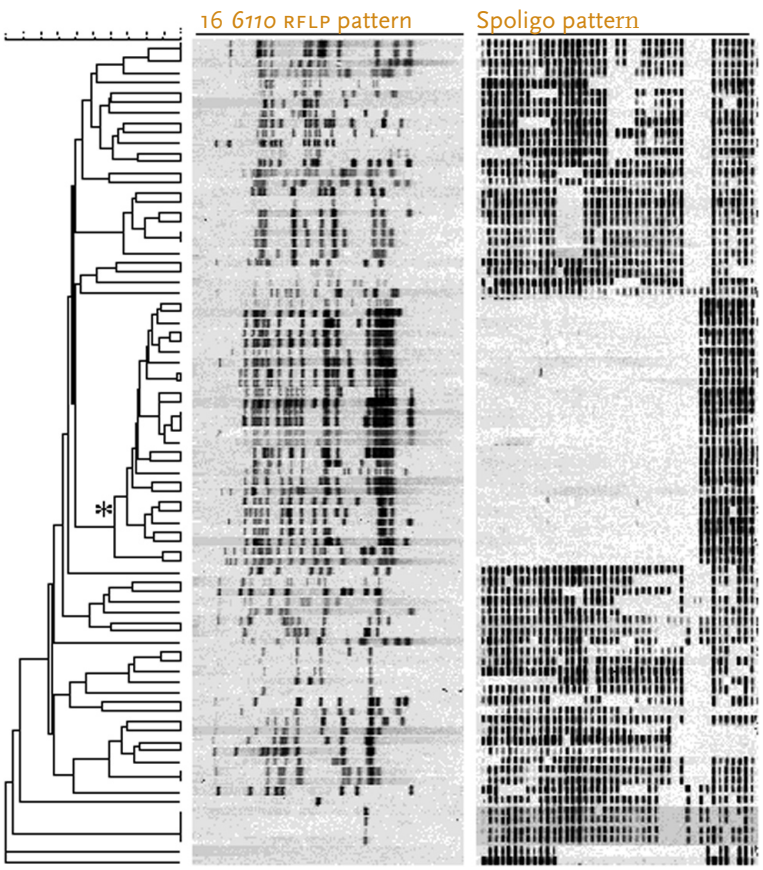



Fig. 2: Dendrogram showing similarity of the 84 IS*6110* RFLP and spoligo patterns of *M. tuberculosis* strains. The Beijing genotype strains are indicated with an asterix (*).

Many individuals (clinicians, scientists, bacteriologists) from different institutes in Indonesia as well as the Netherlands participate in the TB-research. These activities are now coordinated in the 'Indonesian-Dutch TB-Working Group' which has three objectives: (1) improvement of patient care, (2) increased understanding of the pathogenesis of TB, and (3) scientific collaboration. The strong point of this collaboration is the common interest, mutual dependence and benefit, and the input from both sides. A regular newsletter is written and there is an ongoing exchange of members from the working group between the two countries.

Although this is all very positive, we also face difficulties. Inter-institutional collaboration in TB is new in Indonesia, finance is limited to the main study, and some of the logistics in this type of patient-oriented research are very difficult. In addition, sometimes it is hard to work on an equal footing. For example, scientific writing is much easier for Dutch than for Indonesian researchers, who may also have a different scientific attitude. The other projects in the Medical Sciences Programme face similar difficulties. However, also in these projects the collaboration proves to be fruitful. Together with the strong infrastructure, which is being built, this may help to decrease the suffering of patients in Indonesia, and may help to increase our understanding of infectious diseases such as TB. Many opportunities and challenges still lie ahead!

# Biotechnology in agriculture: prospects for the future

Huub Löffler and Iwan Khaswar Syamsu

## Introduction: agriculture in the future

Agriculture is a main activity for all mankind. It not only concerns the basic need of men, but also accounts for major economic activities in many countries. This applies for both the developed and the developing areas of our world. Yet agriculture faces many challenges in the years to come. The agriculture must be improved to meet the demands of the modern society. These needs surpass the need for enough food only. High quality of food and high quality of production processes are equally important. These demands challenge scientists to enable these new agriculture systems and the only way to achieve these goals is a large-scale cooperation.

More specifically, the challenges for the agriculture are as follows. First, enough food must be produced. The world population is still increasing, and still a large part of mankind lacks sufficient food. This demands a substantial increase in food production. One of the obvious ways to reach this, is safeguarding a high yield. As for now, high losses are caused each year by especially pests and diseases. Chemical control is not always effective and not always within reach of farmers. Less vulnerable crops would reduce these losses. Yet sufficient food production on a global scale, is not enough. The pro-duction must be spread widely to serve local populations. Therefore food must be produced under various, sometimes adverse conditions and crops that are adapted to these conditions are needed.

However, we demand more from our crops. They should contain no harmful compounds like mycotoxins or pesticide residues. Mycotoxins are frequently produced in food crops that are invaded by fungi. Especially *Fusarium* species in cereals and rice and *Alternaria* species, attacking various crops, are known toxin producers. The toxins vary in their toxic activity, but generally are considered to affect human health to such an extend that restricting legislation is applied or considered. Populations relying on a limited number of crops for their daily nutrition, such as especially may occur in developing countries, are more vulnerable to these toxins. They will accumulate toxins in larger amounts than people with a more varied diet. They also lack protecting or counteracting compounds that may be present in additional food. Besides the absence of mycotoxins, food must not contain indogenous toxic compounds like deleterious alkaloids or allergenic compounds. Safe food therefore is a major challenge.

Safe food not directly implies healthy food. The latter contains enough micronutrients like vitamins to meet the daily necessary intake. Furthermore, a number of crops are known that contain health-stimulating compounds, protecting against diseases or even curing them. Therefore healthy food, sometimes also referred to as functional food, is an important feature of future crops.

All these crops must be produced in a sustainable way. They must not charge the environment to such an extend that it will effect the generations to come. These generations on their turn must be able to produce food for their needs. It signifies that the plants must use nutrients and energy effectively and that the crops must be protected against pests and diseases in a durable way. Therefore high quality production standards must be applied and plants are needed that are adapted to these standards.

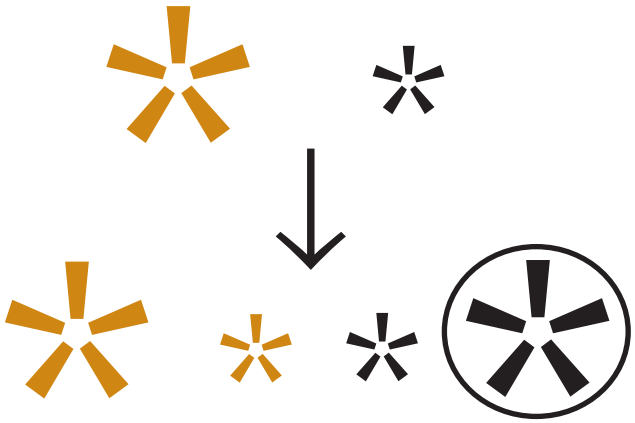
Besides for food, mankind demands the cultivation of crops for agribusiness. Many agriculture crops are used for processing. Plants yielding fibres for clothing, oils for painting and medicinal compounds are only a few examples of those. Particularly important is the production of wood. Since wood is slow growing, agricultural production of wood must be anticipated on a long time before the actual need. Crops may also be used as energy carriers. Biodiesel may become important in the future to serve public need.

Finally, when standards of living increase, the desire for ornamentals will increase. These crops already account for a significant economic activity that is likely to increase in the future.

Many traits that are desired in modern crop concern plant resistance. A durable resistance against a number of pests and pathogens will enhance yield and yield security. In this way plant resistance contributes to a sufficient global food supply. However, the resistance also makes chemical disease control superfluous. Less or no pesticides are needed to fight the pathogens and to protect the plant. This reduces the changes of pesticides residues present on food crops and enhances the quality of the crops. Furthermore, especially fungal pathogens may contaminate crops with mycotoxins. Aflatoxin contamination of various crops is one of the most known examples of this. Resistant varieties will prevent the infection with these fungi and in this way the mycotoxin contamination. Also the environment will profit from resistant varieties. Some pesticides will pollute the environment considerably, having a deleterious effect on natural life. Durable production system must prevent this pollution and resistance plant varieties will contribute to that. So generally, plant resistance is a specifically desirable trait for many crops.

**Biotechnology in Plant Breeding**

The future challenges for agriculture requires plant varieties that are adapted to our specific wishes. Plant varieties combing all desired traits may be present and ready for use. More likely, however, no varieties are present that meet all our wishes. In that case the varieties must be developed and plant breeding comes into focus. This technology has helped us over the years to adapt our crops and the technology will serve us further in the future.



Plant breeding is in fact nothing more than combining genetic variation and selecting plants with new desired combinations. For example: given a large brown flower and a small black one, we can create new combinations when both plants are crossed. The progeny will contain both parental types, but also small brown flowers and large black ones. When we are interested in the latter we can select for them and simply reach our goal. Long years of this type of crosses created the large variety of plants currently available for agriculture. Yet new tools, indicated as biotechnology, now enables us to increase the possibilities of plant breeding enormously. Biotechnology offers us powerful techniques that can be used to breed new varieties with greater focus and greater efficiency. The full implementation of this, in an economically and socially acceptable context, is the real challenge of the pant breeder to date. Biotechnology covers many different techniques. In the current BIORIN program, mainly three techniques are used: genetic modification, marker assisted selection and microspore culture. These techniques will be described generally, while the summaried BIORIN projects will give some more details.

**Genetic modification**

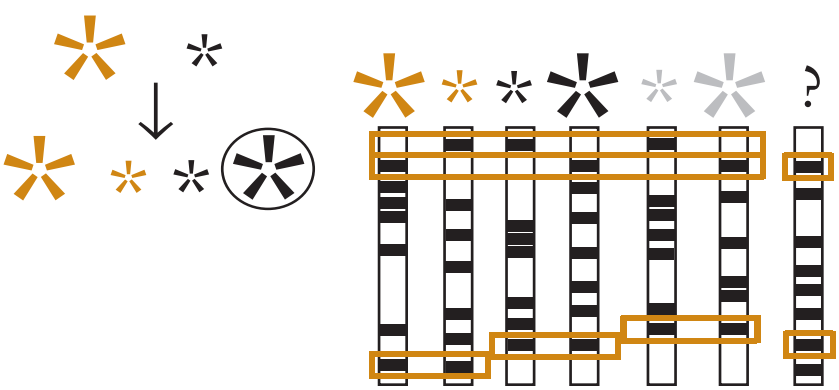
Genetic modification or plant transformation is perhaps the most known biotechnological technique. It makes use of basic knowledge about genes and gene structures collected over the last decades. Genes are the loci on chromosomes that are responsible for specific traits. Going back to our flower breeding, there will be one or more genes regulating flower colour and one or more genes responsible for flower size. Combining these genes in different ways will giver different flowers. The underlying chemical compound of chromosomes and thus also of genes is DNA. So genes exists of DNA, and modern techniques enable us to locate specific pieces of DNA (genes) on chromosomes that are involved in specific traits. Even more, it is possible to isolates these genes and multiply them in artificial carriers like bacteria. Lastly, the genes can be introduced once again in a plant cell in such a way that the gene once more is integrated in the

chromosomes of that cell and becomes functional. Plan cells are totipotent and – when treated correctly – can grow to full plants. When complete plants evolve from one cell with an extra gene – a genetically modified cell –, all cells of the regenerated new plant will contain the new gene. It will be clear that in this way the combinations of genes in the new plant and therefore the characteristics of the plant are changed. This method is used in three BIORIN projects.

**Marker assisted selection**

As indicated above, new varieties can be selected based on their appearance. When large, black flowers are needed you can simply select one from a cross. Yet there are other ways like marker assisted selection (MAS). Simplified, MAS is based on the following principle. DNA of any plant may be characterised by dissecting isolated DNA into fragments. These fragments can be separated by electrophoreses on gels: small fragments will run fastest and end up under in the gel, while the large fragments will stick on top. This will result in a pattern consisting of a number of distinct DNA-bands (the 'bar-code' of life). Since the different individuals contain different genes and thus different DNA, an unique DNA-pattern will be obtained for each individual. Now the DNA-patterns of many individuals can be compared with specific traits (like flower colour) of the individuals. Sometimes a DNA-fragment is found that is linked to that flower colour: it is always present in black plants, but always absent in brown ones. This indicates that you can select for the DNA-pattern of an individual: whenever the fragment is present we can predict that the colour of the flower will be black.

Although more complicated than a direct selection, the advantage of the method is that it already can be applied to young seedlings. The method will be stronger when different fragments are linked to more traits of interest: a combination of fragments will predict a specific phenotype of the plant. This technique is used in two BIORIN projects.



### Microspore culture

Most plants contain a double set of chromosomes, one inherited from each parent. Genes on both chromosomes may be the same (homozygous) or somewhat different (heterozygous): the combination determines the specific appearance of the plant. Sometimes it is preferred that all homologous genes on both chromosomes are the same: the plants should be completely homozygous. It limits the number of genes present in the plant cell and simplifies many scientific studies. Also for specific breeding methods like F1 hybrid breeding homozygous plants are needed. As mentioned, both parents contribute one set of chromosomes to a new individual. As a consequence, the sexual reproduction cells contain only one set of chromosomes. Pollen grains are the male reproduction cells of plants. Various tissue culture techniques enable the regeneration of whole plants from a single cell, and when a pollen grain cell is used for this, new plants will evolve with only one set of chromosomes. These plants are called haploid, in contrast to the normal diploid plants.

Haploid cells may be induced by chemical treatment to double their chromosome number once again. The only way to recover two sets is copying the first set, resulting in two identical sets. In this way, completely homozygous cells are obtained that can be regenerated to homozygous plants. This technique is used in one BIORIN project.

### BIORIN projects

#### *Breeding for blast resistance and drought tolerance in rice*

Rice production in Indonesia continuously faces the challenge to keep pace with an annual population increase, while the area of fertile wetland (lowland) available for rice farming is steadily decreasing due to urbanisation and industrialisation. In addition, rice production is subject to a variety of adverse environmental and biological constraints. To satisfy the demand for rice in the next decades, Indonesia will, among others, have to expand its rice cultivation to marginal dryland (upland) areas, where rice production is severely hampered by dehydration stress due to drought and the blast disease caused by the fungus *Pyricularia grisea* (also known as *Pyricularia oryzae* or *Magnaporthe grisea*). It has been estimated that the potential gain in rice production in such areas may amount up to 2-3 t/ha provided that rice varieties can be developed which are both drought tolerant and blast resistant.

The overall aim of this project is to contribute to the development of drought tolerant and blast resistant Indonesian rice varieties. Two molecular breeding approaches will be followed towards this goal: marker-assisted breeding for drought tolerance and genetic modification for drought tolerance and blast resistance.

The project will make use of a marker-assisted breeding strategy to try to discover drought tolerance genes in distantly related, drought tolerant rice cultivars and to incorporate these genes in locally adapted elite Indica cultivars that are widely cultivated in Indonesia. Furthermore, the feasibility of genetic modification will be explored for drought tolerance by using genes that

potentially are capable of conferring this trait. For one, genes involved in the biosynthesis of wax will be used. The wax-layer of leaves may affect the drought tolerance of plants. Furthermore, the drought tolerance potential of a class of regulatory genes which have been implicated in the adaptation of plants to environmental stress conditions will be studied.

The blast disease also affects all rice growing areas but, like drought, most severely threatens rice production in the upland rice cultivation areas. Conventional breeding of rice for blast resistance is difficult. Resistant cultivars can be obtained but their resistance usually only lasts for a limited period due to the occurrence of many race variants and the dynamic change in race composition of the blast pathogen population. The availability of genes coding for fungal cell wall degrading enzymes and other proteins with antifungal properties provides the opportunity to transgenically engineer fungal resistance into rice. We therefore will evaluate the usefulness of such genes for transgenic breeding of blast resistance.

### *Modification of cassava starch composition by genetic engineering*

Cassava is an important crop in many tropical Asian countries as a supplier of foodstuff for export to the USA, Japan and the EC. The starch from the tuberous roots of this crop is, furthermore, increasingly used as raw material for the local food, feed and industrial markets.

In Indonesia, especially the prospect for the industrial market is interesting. Recently, the Laboratory of Plant Breeding was successful in establishing a transformation system for cassava, which opens up the possibility for genetic modification and provides the information needed for handling and introduction of genetically modified cassava clones. The introduction of genetically modified cassava clones offers a way to increase the use of cassava starch in the food industry and for non-food industrial purposes.

*The project aims:*

- to isolate a number of genes involved in starch biosynthesis in cassava to alter the amylose content of the starch and to obtain information on the possibilities to alter the phosphate content too;
- to genetically modify cassava plants to contain high amylose starches with a high phosphorous content;
- to analyse the usefulness of the altered properties of the cassava clones, and
- to test the system of rules and regulations concerning the introduction of transgenic cassava plants into the environment.

In order to achieve the outlined aims of the project it is necessary to isolate a number of genes involved in starch biosynthesis. These genes will be isolated from a tuberous root CDNA library, which is available in the Laboratory for Plant Breeding at Wageningen University, using probes for the respective genes from potato or probes based on published sequences for these genes. When these genes are introduced in different combinations this may lead to increased levels of amylose and to low amylopectin starch.

Another important aspect of the work will be to set up the transformation work in Indonesian genotypes. For this it is necessary to set up friable embryogenic cultures (FEC) in elite Indonesian genotypes. Once transgenic plants have been produced they will be grown in the greenhouse and tuberous roots will be analysed for alterations in their starch level in the Laboratory for Polymer Carbohydrate Research which is located in the Laboratory for Plant Breeding. Transgenic cassava plants with altered starch characteristics will be pre-screened in Wageningen. The most promising transformants will be multiplied and sent to Indonesia to be tested in field experiments.

### *Indonesian cocoa with Bacillus thuringiensis toxin-mediated resistance to cocoa pod borer*

This collaborative research project is aimed at the production of transgenic cocoa trees expressing a *Bacillus thuringiensis cry* gene product, rendering them resistant to predation by the important Indonesian pest insect *Conopomorpha cramerella*, the cocoa pod borer (CPB). For this purpose purified toxins will be tested in bioassays against CPB and an identified active toxin-encoding gene will be modified for expression in plants. A pod-specific promoter will be isolated for controlling expression in cocoa, while a more general 35S-promoter will be used as well. Transformation and regeneration protocols for cocoa will be tested and optimised during this project. Both cocoa and tobacco, which can be analysed faster, will be used for transformation with the modified *cry* gene, as well as for study of the tissue-specific activity of the isolated cocoa promoter, using a reporter gene. Collaboration will be realised through the work of an Indonesian PhD student at Plant Research International, as well as through regular short-term exchange visits between the institutes.

### *Tomato molecular breeding for resistance to early blight*

Early blight, caused by the fungus *Alternaria solani*, is a major disease of tomato which occurs world-wide in (sub)tropical regions. The disease has gained importance in Indonesia because of the expanding tomato cultivation in lowland areas. The current project aims at developing resistant varieties adapted to Indonesian conditions. The objectives are to develop efficient screening assays for *Alternaria solani* resistance in tomato, to detect *Alternaria* resistance in tomato, to cross-resistant accessions with tomato varieties that are adapted to the Indonesian conditions, and to develop molecular markers linked to resistance.

To achieve the target of this research project, screening assays will be developed to various disease stages. These stages consist of a collar rot or damping off in seedlings, lesions on the stem, leaves and fruits, defoliation and sun scalding of the fruits. Resistance will be assessed in a tomato collection with local *Alternaria* isolates both in the laboratory, in the greenhouse and (in Indonesia) in the field. Interesting resistant accessions will be studied further.

The genetics of the resistance will be evaluated using molecular markers in a QTL (Quantitative Trait Loci) approach in segregating F2 populations. The resistance will be assessed in the corresponding F3 lines. Markers linked to the main QTL's will be developed. These markers can be used for efficient selection in commercial breeding programs. Selected material will be back-crossed for later use in breeding programs.

### *Use of haploid technology for genetic improvement of hot pepper*

When economic value is considered, hot pepper is the most important vegetable crop in Indonesia. However, hot pepper is still considered as a low input crop with a relatively low yield and a significant loss of product caused by pests and diseases. Application of haploid technology to the breeding of Indonesian hot pepper varieties will make the breeding programs faster and more efficient and will considerably support new, modern programs of genetic improvement. The overall aim of the project is to develop and exploit haploid technology for the genetic improvement of hot pepper varieties, adapted to cultivation in Indonesia, and to train Indonesian PhD students. The first specific objective is to establish an effective protocol for doubled haploid plant production. The second specific objective is the study of the molecular mechanism underlying initiation of embryogenesis from microspores.

Haploid technology includes the regeneration of haploid embryos from immature pollen grains and the production of haploid and doubled haploid (DH) plants from these grains. The technology allows one to attain complete homozygocity in a single generation and facilitates the direct selection for all (recessive) plant characteristics. It will considerably support new, modern programs of genetic improvement of hot pepper, such as molecular marker assisted breeding, unravelling of complex polygenic resistances against diseases, and producing F1 hybrid varieties.

### Cooperation: agriculture research

The BIORIN program is part of larger cooperation in the field of agriculture research between Indonesia and The Netherlands. BIORIN is the front-line research part focussing on fundamental research. Developing knowledge and educating scientists are the first target of the BIORIN projects. The ministries science and education are financing these projects and. BIORIN is closely linked to BIOBREES, a program with a more strategic impact. BIOBREES is supported financially by the Dutch and Indonesian Ministries of Agriculture. BIOBREES concerns mainly agribusiness, and makes use of knowledge generated within BIORIN. Agribusiness research attracts companies: they cooperate in a number of projects. Specific grants to support this cooperation are made available by the Dutch ministry of economic affairs. In this way the fundamental and strategic research contribute to the economic development. Finally, a training program (BIOTRAIN) is set up to disseminate all knowledge to Indonesian scientists involved into the various topics.

All together a broad range of research and cooperation is brought about. Much knowledge is generated and companies are using the knowledge in their agribusiness. Yet one link is still missing: the translation of all scientific knowledge to practically applicable knowledge for small-scale farmers. This vital aspect would emphasis the social aspects of the cooperation and ensure that the investments have their impact on all-day life. Specific attempts should be made to implement this part of the research.

### Advantage of cooperation

Good cooperation only works when it is to the benefit of all parties. Therefore synergistic activities must be defined. For the cooperation between Indonesia and The Netherlands this synergism is rather obvious. The financial and social situation in The Netherlands enables high-input technology. Much sophisticated, expensive equipment is available for use in research. Yet labour costs are very high, so labour-intensive experiments cannot be carried out. The latter is one of the strong aspects in Indonesian research. They excel in large-scale experiments focused on collecting data necessary for phenotyping material. The combination enables research that could not be carried out by both countries separately. Furthermore, Indonesia has access too much genetic diversity. The collaboration could take advantage of this by exploiting the diversity on Indonesian side and by opening new scientific possibilities with unknown genotypes on the Dutch side.

### Restraints in cooperation

Indonesia and The Netherlands are far apart. This demands specific attention of communication: it is highly necessary to share information efficiently. Sometimes this is difficult since not all communication methods are always fully operational. Therefore regular meetings are especially important. This aspect may have more emphasis in future cooperation: regular meetings and workshops help to focus the research, to disseminate knowledge, to strengthen the research network and to build capacity.

A major restraint encountered frequently is the financial balance. Most cooperation is based on matching funding from both countries. Normally, in The Netherlands additional finances are made available that are specifically allocated for the cooperation. They will cover – under specific conditions – the expenses for the project as long as the project last. In Indonesia, however, the matching finances often have to be found on a yearly base within existing programs. Regularly, new applications are necessary to get the matching financing. This obviously hampers the cooperation and makes it more difficult to get a full commitment for the projects. It also hampers the formation of a strong Indonesian-Dutch managing team fully dedicated to the cooperation. Therefore funding for the Indonesian side specifically allocated for the cooperation is highly recommended. This funding may originate from Dutch, Indonesian or International financiers.

### Conclusions

- The scientific agricultural cooperation between Indonesia and The Netherlands is of high value for generating new knowledge, for economic development in both countries, for building networks, for dissemination of knowledge and for training scientists.
- For sake of agribusiness, Dutch and Indonesian companies should be involved in projects.

- Small-scale farmers would largely benefit from the implementation of the knowledge for practical use. These activities should be started and might be financed from developing aid.
- Workshops and meetings are an excellent way to exchange knowledge and tuning research. They need specific attention in future cooperation.
- Cooperation benefits largely from a balanced financial situation on both sides. Funding should be made available specifically for the research targets for both sides.
- Cooperation also benefits from clear program management structures on both sides.

# KNAW research collaborations with the Netherlands in mathematics and physics

Tjia May On

**Abstract**

The KNAW collaboration projects, which were aimed at the promotion of quality researches in Indonesia, have succeeded over the years in the establishment of effective 'beach heads' of scientific research which are still relatively rare in this country. The resources assembled and experience accumulated in the processes have begun to show promising capabilities for its further development involving more extensive international scientific cooperations and better services to the Indonesian scientific, educational as well as the industrial communities. Special illustrations of those fruitful results will be given for collaborations in the field of mathematics and physics. While differing in specific background and route of evolution, projects launched in both fields share the same features of being a bottom-up development initiated by personal scientist–to-scientist contacts, and built on a comprehensive programme integrating the essential components needed for a long term cultivation of solid research bases and scientific infrastructure as well as sustained international collaborations. Results of these projects are vividly demonstrated by quality scientific publications in internationally reputable journals, the successful completions of a number of PhD and MSc programmes. The regularly held workshop and symposium activities have proved immensely effective in disseminating the state of the art knowledge and research results in the fields, keeping the Indonesian students and research scientists abreast with latest advances in the respective fields. No less important are the spin-off benefits resulted from the collaborations, as testified by the research grants awarded by the Indonesian government, post doctoral positions offered by research institutions abroad and embryonic cooperation with the industries. These results will be summarized in the talk along with a brief description of some of our ongoing works.

## Introduction

First of all allow me to thank the organizing committee, and in particular, Prof. van Groesen, for giving me the opportunity to share with you today our impression and over view on the KNAW collaboration research projects in mathematics and physics, as well as the benefits acquired and results achieved from these projects.

As we learn today, KNAW has been involved in a broad variety of collaborative research projects with Indonesian institutions over the last decade, and the EPAM projects in the particular field of mathematics and physics is relatively

small part of the whole scheme. Being relatively limited in the entire collaboration area, our impressions and experiences may nevertheless involve important aspects of common interest for the other areas of collaboration. We hope therefore that they are worthwhile to be shared and discussed with you here today.

Before proceeding with the presentation, let me just briefly describe my personal involvement with the KNAW projects as mentioned by Prof. van Groesen. I was first 'lured' so to say, into the scheme of a 4-year (1997-2000) research collaboration with the University of Amsterdam in the field of superconductivity supported by KNAW and the Indonesian RUT project. This was preceded by repeated and intensive discussions with scientists from the University of Amsterdam (UVA). Three years later, even before completing the ITB-UVA project, I was already 'courting' with scientists of University of Twente (UT), with some of them I was already well acquainted a few years back. More concrete discussion of the collaboration eventually led to one of the EPAM projects within the next couple of years, thanks to the tireless effort of our Dutch colleagues.

**General views on the collaborations**

It is obvious in our views, that the initial scientific contacts between the would-be collaborators played an instrumental role in the formulation of a workable program. Taking into account the mutual needs, identifying the complementing roles of both parties and sharing strong personal commitment are keys in providing the programs with a sound working ground.

Throughout the implementation of those projects, we have enjoyed and shared the great benefits of the collaborations. This is amply corroborated by the experiences of our colleagues from the Mathematics Department, who have also enjoyed similar cooperation with the University of Twente for even longer period. To be more specific, in addition to improvement in research quality, the teaching and research activities in the Mathematics Department have become more intimate with the new paradigm of using mathematics as a powerful tool in the formulation of workable physical and engineering models and the solutions by means of analytic as well as numerical methods. In the process, fruitful applications to practical and industrial problems have been realized in cooperation with external institutions in the scientific as well as the industrial sectors. In the Physics Department, the relatively neglected field of optics has been revitalized and modernized by a series of workshops and symposia on modern optics and its applications. Our research activities on non-linear optics, which were mostly confined to more basic material physics, have greatly benefited from the mathematical modelling approach in the development of simulation tools imminently needed for the explorations of new operational functions and the design of the related devices.

A very important feature incorporated in the KNAW collaboration scheme is the comprehensive and integrated nature of its multi component set up. Despite the formal emphasis on joint researches, these projects are typically composed

of subprograms aiming at research manpower development, the dissemination, transfer and exchange of important knowledge's, as well as the development of scientific networks involving other institutions. This integrated approach has proved immensely fruitful in bringing up the quality of education and research on both sides of the participating institutes. In order to allow effective scientific interaction and preparation of continuing collaboration in the future, the PhD programs launched in either institutes are designed with a "sandwich" arrangement.

Apart from the direct benefits obtained from the collaborations, we have also noticed the obvious research infrastructure and the growth of research culture during the process. Along with this is the growing scientific confidence built up among the young scientists by the resulted joint publications in respectable international journals, and the offers of post doctoral positions in well-known international institutions to some of the PhD's graduated under this collaboration scheme. No less important are the opportunity created in the process for extending the cooperation networks beyond the existing ones. Meanwhile, thanks to experiences and scientific competence gained through these projects, we have witnessed enhanced likelihood in winning research grants offered by the Government and even international funding organizations.

**Summary of activities and results**

To summarize the picture we shall present in the following the kinds of activity carried out during the project period as of now, and the results achieved so far. These are grouped into the mathematics and physics sectors respectively.

***Mathematics:***

- 1990: UTwente-math & ITB-math (Jurusan -> P4M)
- 1994-1997: EC-project 'Surface waves'
- 1995-2000: KNAW Appl. Math & Scientific Computing
  Research Workshops (10-12 weeks!)
  6 PhD's
- 1996-2001: KNAW 'Labmath'
  With 2 hydrodynamic laboratories, MARIN and IHL-Surabaya
  4 PhD's: 2 Ind, 1 Neth, 1 Estonia
- 1998, 2000-2005: KNAW EPAM
  6 projects

***Physics:***

- 1995-1996: UVA-Physics & ITB-Physics (discussion and exploration)
- 1997-2000: KNAW (non priority field) Superconductor Physics and applications
  Research workshop and Seminar (1 week)
  2 PhD + 2 S3 (2 completed in 2001)
  Installation of 10 K Cryogenic system
  Expansion of XRD equipment
  Joint publications : 21 international, 19 national

- 2000-2005: KNAW-EPAM Non-linear Optics
  Workshops and Symposia (Jan-Feb and Nov 2001, 2 weeks each)
  Publication of Symposium proceedings in international journal (JNOPM)
  1 PhD + 2 S3 +2 MSc

**Acknowledgement**
I would like to take the opportunity to thank the KNAW and the organizing committee for the presentation. I also take special pleasure in thanking Prof. van Groesen, Dr Andonowati, Dr A. Iskandar, and Dr A. Nugroho in many suggestions and assistances in the preparation of this material.

# Teluk Banten research programme:
## *an integrated coastal zone management study (1995-2001)*

Piet Hoekstra, Han Lindeboom, Rolf Bak, Gert van den Bergh, Dwi Abad Tiwi, Wim Douven, Jetse Heun, Tjeerd Hobma, Ton Hoitink, Wawan Kiswara, Erik Meesters, Yus Noor, Nyoman Sukmantalya, Siti Nuraini and Tjeerd van Weering

**Abstract**

The Teluk Banten project started in 1995 and continued until 2001. The programme was aiming at the sustainable use of tropical coastal ecosystems in Banten Bay (West Java), based on science-driven research on the interaction between abiotic, biotic and socio-economic coastal systems. An interdisciplinary research programme was created in which abiotic studies had to define boundary conditions for bio-indicators of the system, such as coral reefs and sea grasses. The present paper illustrates the way in which re-suspension of sediment affects the turbidity patterns in the bay and the way in which corals respond to variable degrees of turbidity. Coral reefs in Teluk Banten clearly demonstrate a process of acclimatization and adaptation to high turbidity levels and net deposition.

**Introduction: Coastal zone Indonesia**

The Indonesian archipelago consists of almost 18,000 islands and, with a total coastline of about 95,000 km and a great diversity in coastal ecosystems, the country belongs to the most significant coastal regions in the world. About 215 million Indonesian people (or 95 % of the population) live in the coastal zone and/or coastal plain. For natural resource-based economies and societies like Indonesia the coastal zone represents a considerable part of its natural resources and a sustainable use of these resources is a prerequisite for coastal zone development. These resources include fisheries, aquaculture, mineral resources like oil and gas and groundwater. The related socio-economic activities in the coastal zone are based on a range of user functions and these user functions are normally categorized as basic (food production, water and energy supply), social (housing, recreation, nature), economic (transport, mining, industrial development and tourism) and public (transport, coastal defence, sewage and waste water treatment/disposal). However, the combination of different user functions results in a coastal system that is facing a growing need to cope with conflicting interests. For sake of clarity this coastal system consists of three different subsystems:

- physical-marine system with river input, tides, waves, currents, sea surface temperature,turbidity, suspended load transport;
- ecological-biological system, including coral reefs, mangroves, fish populations and aspects like biodiversity;
- socio-economic system with planning, legislation, economics and trade and cultural elements.

Meanwhile, the Indonesian coastal zone is also subject to different effects of global change. Climate change and variability are responsible for (increased) sea level rise and the risk of coastal erosion and flooding, for monsoon shifts in climate (rainfall patterns, sediment load) and the El Niño and La Niña events. But also mankind is changing coastal systems in an unprecedented way. Coastal development results in the building of constructions, subsidence and the re-alignment of coasts. Meanwhile over fishing, dynamite fishing and large-scale mangrove conversion into fishponds lead to an overexploitation of coastal-marine resources. Therefore, proper coastal zone management in tropical regions heavily relies on science-based insights in the natural processes, values and resources of the coastal zone in relation to imminent stresses, in particular the development of large-scale aquaculture, harbour and industrial facilities and changes in coastal sediment budgets.

**Teluk Banten programme**

The Teluk Banten programme started in 1995 and the Teluk (Teluk = Bay) Banten area was chosen, based on existing plans to develop major harbour facilities in the bay as an overflow of Tanjung Priok, the main harbour of Jakarta. The programme has been divided into two phases: a pilot phase (1995-1996) for a general reconnaissance of the bay and a second phase (1997-2001) for in-depth research. At an aggregated level, the overall objectives of the programme were to:

- further develop understanding of tropical coastal zone ecosystems;
- contribute to the development of information and information systems relevant for coastal zone management in view of sustainable development;
- promote capacity building through research by PhD students.

In the pilot phase the main physical, biological and socio-economic aspects of the bay were identified based on short field surveys and desk studies. This pilot phase has lead to a number of important observations and conclusions. First of all, Banten Bay has important natural resources and about 70.000 people in the area are dependent on fisheries. Secondly, there are important ecological features in the bay, which include coral reefs, sea grass fields, fish and bird sanctuaries. Given the relative turbid water in different parts of the bay, the presence of coral reefs was somewhat of a surprise. Finally, the ecosystems are under heavy pressure due to a variety of local processes and developments such as high intensity of fishery all over the bay, natural coastal erosion in the eastern part, land reclamation for harbour development and industrial expansion in the western part and increased industrialisation and urbanisation in areas surrounding the bay.

The aims of the main programme were to establish the sustainability of the natural resources and their use in Banten Bay based on relationships between abiotic and biotic systems and in response to human influences, to incorporate this knowledge in conceptual models and a common data base and to provide a management information system to evaluate the impacts of human activities in the bay (Douven *et al.*, 2000; Schouten *et al.*, 2001). The latter element is crucial for the dissemination of the (scientific) results on a local, regional or even national level.

The issue of sustainability of natural resources was partly linked to the existence of (high) turbidity values in the bay and resulted in a number of related research themes:

- the role of coral reefs and of sea grass fields as nursery for fish populations and the fishery system;
- the (negative) influence of turbidity on these coral reefs and sea grass fields;
- the geological, hydro dynamical and sediment transport conditions responsible for both the temporal and spatial variability of turbidity within the bay;
- the relation between bird populations, habitat requirements and land use;
- the analysis of the planning and development system and procedures and the set-up of a management information system to present the quality of ecosystems by means of bio-indicators.

To address these issues a multi- and interdisciplinary research programme was developed for the second phase, build up of ten interrelated projects. These projects covered abiotic, biotic and coastal zone management aspects:

- Three dimensional flow patterns and sediment fluxes.
- Morphodynamics of wave-dominated coastal environments.
- Coastal marine sediments and sedimentation.
- The functioning of Enhalus acroides meadows (sea grasses).
- Interactions in the major demersal fisheries and the importance of vegetated.
- Habitats for groupers and snappers.
- Coral community dynamics of a coral reef under stress.
- Population dynamics of three Egret species (birds).
- An environmental monitoring and management information system.
- A dynamic geographical information system.
- Remote sensing applications.

In an early phase of the programme it was decided that the abiotic investigations (marine geology, hydrodynamics, sediment transport and sedimentation) should deliver information that could provide boundary conditions for four selected bio-indicators. The use of bio-indicators was proposed in an attempt to schematise the ecological functioning of the bay without having to develop a comprehensive ecological model for the region. Under the boundary conditions of the programme, the development of an ecological model was considered to be unrealistic. The four selected bio-indicators were corals, sea grasses, fishes (with emphasis on groupers) and bird life, in particular egrets. The chosen bio-indicators were thought to represent the more endangered habitats in the bay.

One of the most challenging aspects of the programme was the integration of all the knowledge on physical, biological and societal processes in a conceptual model of the bay, supported by means of a management information system (Douven *et al.*, 2000). This management information system includes a GIS-based database, as well as simple analytical and statistical models.

This paper gives an overview of the general abiotic characteristics of the bay, the way in which physical-marine processes and developments affect the turbidity patterns and deposition rates and how the effects of both turbidity and deposition are reflected by coral reef characteristics, as one of the main bio-indicators in the bay. It serves as an example to illustrate how abiotic boundary conditions affect the ecological system (and vice versa!) and how this may affect the basic, social, economic and public functions of the bay.

**Teluk Banten: general characteristics**

Teluk Banten, located about 80 km west of the Indonesian capital of Jakarta, is a shallow tidal embayment with a surface area of about 150 km² (fig. 1). The average depth of the bay is about 8 m and the bay is characterized by a series of islands. Pulau (= island) Panjang, the largest island, is a carbonate platform surrounded by fringing reefs. The smaller islands are mainly coral keys, in combination with

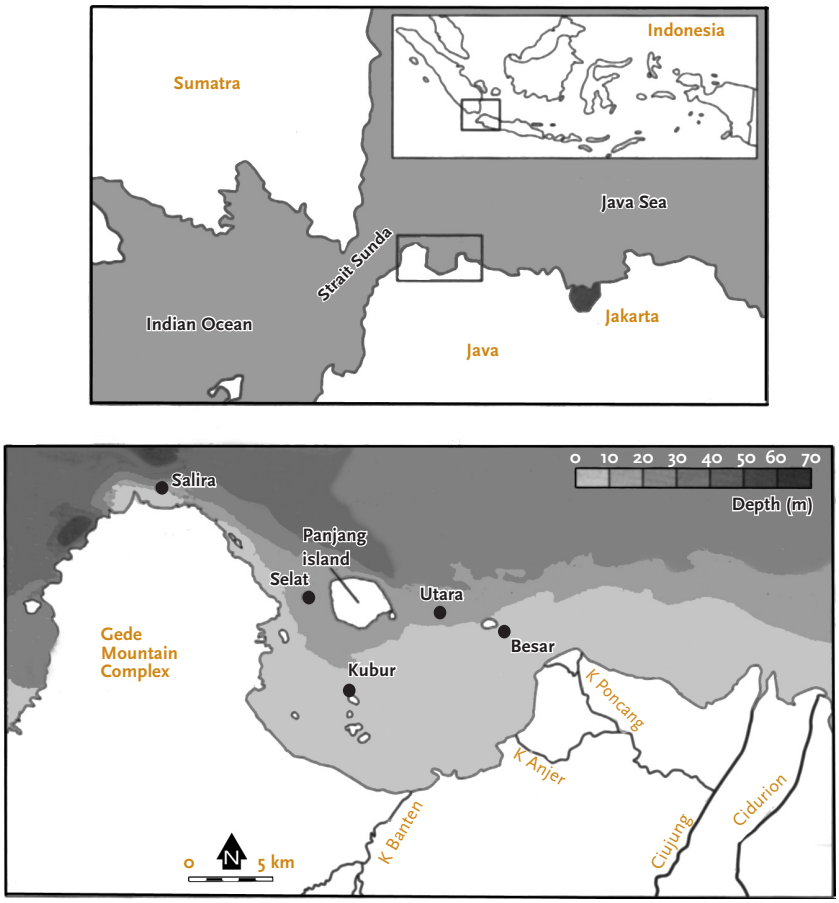



Fig. 1: Location map of Banten Bay showing the overall bathymetry, a number of coral islands and some of the sampling stations for long-term measurements.

reef platforms and a reef slope with living corals. The Gede mountain complex is a 600 m high inactive volcano that dominates the west coast of the bay. The former Ciujung delta forms the east coast of the bay whereas a low-lying marine coastal plain is located along the southern boundary of the bay.

In the beginning of the last century, the river mouth of the Ciujung river was diverted to the Java Sea and, consequently, the former river delta has been subject to reworking by marine processes (Van den Bergh *et al.*, a). So far, the maximum coastal retreat of the eastern shoreline has been up to 3 km.

The area is subject to a monsoonal climate with a monthly mean precipitation that varies from 100 mm in the dry season (July) to 400 mm in the wet season (February). Likewise, river discharge and sediment input into the coastal zone are commonly dominated by wet season conditions. Throughout the year, the winds in the western Java Sea are generally steady and of low intensity. Therefore, wave action in the Bay of Banten is also limited (Hoitink *et al*, subm.). The tidal regime is characterized by both diurnal and semi-diurnal tidal constituents since the Banten Bay region is influenced by the Strait Sunda (fig. 1) where the tide turns from diurnal at the side of the Java Sea into semidiurnal where it connects to the Indian Ocean.

**Marine geology and sedimentology**

Seismic and acoustic studies, in combination with coring and sampling has revealed that Teluk Banten is partly filled by a maximum 15 m thick, wedge-shaped body of Holocene sediments. These cover a gently seaward sloping Late Pleistocene topography with incised river valleys (Van den Bergh *et al.*, a). The various islands in the bay represent coral reefs that were built up during the Mid-Holocene high sea level stand on upwards protruding basement areas. $^{14}$C AMS dating of samples from these reef deposits indicate that after 5500 yrs. BP the sea level dropped several meters and these reefs fell dry (Van den Bergh *et al.*, a). Recent sedimentation in the bay is dominated by the accumulation of muddy sediments with variable amounts of organic remains and glauconitic pellets. Long-term deposition rates in the bay were determined based on the excess $^{210}$Pb analysis on 43 sediment cores. In addition, the bay-wide occurrence of a conspicuous layer of reworked shell material, proven to be formed by the tsunami associated with the 1883 Krakatau volcanic eruption (Van den Bergh *et al.*, b), acted as a perfect time-marker and control on the short-living isotope dating techniques. This layer is described as the Krakatau Event Layer (KEL). Results of the isotope analysis demonstrate that the eastern part of the bay is characterized by erosion or a non-depositional regime on a 100 yr. timescale. The most substantial accumulation is observed in deeper water (> 10 m) along the northern margin of a coastal mud wedge. Based on a comparison of the KEL layer and the isotope analysis, the accumulation rates (up to 2.59 g $cm^{-2}$ $yr^{-1}$) started to increase in the last two decades and are 3-40 times higher than before the increase. Throughout the shallower parts of the bay the deposition rates are rather small and stable; $^{210}$Pb accumulation rates are about 0.2 g $cm^{-2}$ $yr^{-1}$. However, estimates based on the KEL layer suggest that these values are too high, probably due to the fact that biological mixing was ignored in the $^{210}$Pb analysis (Van den Bergh *et al.*, a).

The depositional pattern suggests a redistribution of sediments in which sediment is eroded and re-suspended at the former Ciujung delta. Therefore, this Ciujung delta forms one of the major sources of sediment in Teluk Banten. The sediments are eroded by waves and (tidal) currents and this process is followed by a westward transport into the bay. Most probably, in the shallower parts of the bay, these sediments are frequently deposited and re-suspended again which explains the low deposition rates. Apparently, ultimately deposition takes place at the down slope of the coastal mud prism.

**Hydrodynamic conditions and turbidity patterns**

Tide-, monsoon- and density-driven flow processes in the Bay of Banten have been analysed from spatial and temporal observations on sea level, seawater salinity and temperature, current velocity and wind speed (Hoitink et al, subm.). The tidal regime was found to be mixed, predominantly diurnal, with a varying tidal range between 20 and 90 cm. The tidal motion is characterized by substantial differences between successive spring-neap cycles, which are due to the contributions of a large number of tidal constituents. The diurnal and semidiurnal tides induce bi-directional surface currents of about 0.15 m/s, with peaks up to 0.65 m/s, oriented along the bay's isobaths (Hoitink et al, subm.). The strongest currents are observed in the east part of the bay where the tidal flow is topographically controlled by the shallow sub tidal delta platform of the former Ciujung delta. Tidal currents inside the bay lag behind the tidal flow in the Java Sea, which generates horizontal velocity shears at the slope break north of the bay (fig. 2). This time lag is the result of the cross-isobath variation in tidal wave propagation which, in shallow water conditions, is defined by $C_g = (g.h)^{0.5}$ where $C_g$ = wave celerity, g = acceleration of gravity and h = water depth.

Drift currents are in the order of 0.08 m/s and related to the local, monsoon-dominated wind climate.

Typical rates of wind-driven circulation are likely higher since the present data set includes the 1998-1999 El Niño event, which involved anomalously low wind speeds.

The degree of stratification in the bay is determined by two competing mechanisms: (1) differential advection of salinity, which depends on the direction and magnitude of the sub tidal currents and enhances stratification, and (2) tidally-induced shears that reduce the water column stability. These two mechanisms generally result in weakly stratified conditions (Hoitink *et al.*, subm.).

Sediment suspensions (SPM, Suspended Particulate Matter) in Teluk Banten are derived from three major sources: the erosive eastern shorelines of the bay, small-scale river plumes and the flow-induced erosion and re-suspension of sediment in the bottom few meters of the bay. The most sediment rich suspensions originate from the shallow coastal waters surrounding the former Ciujung delta and are the result of high-energy wave events that mainly occur in the wet season. The discharges of small local rivers that debouch into the bay constitute a second source of suspended sediment. However, the most vigorous mixing of water masses takes place in the region were the river input is largest and the fine-grained sediments settle relatively rapidly and commonly do not

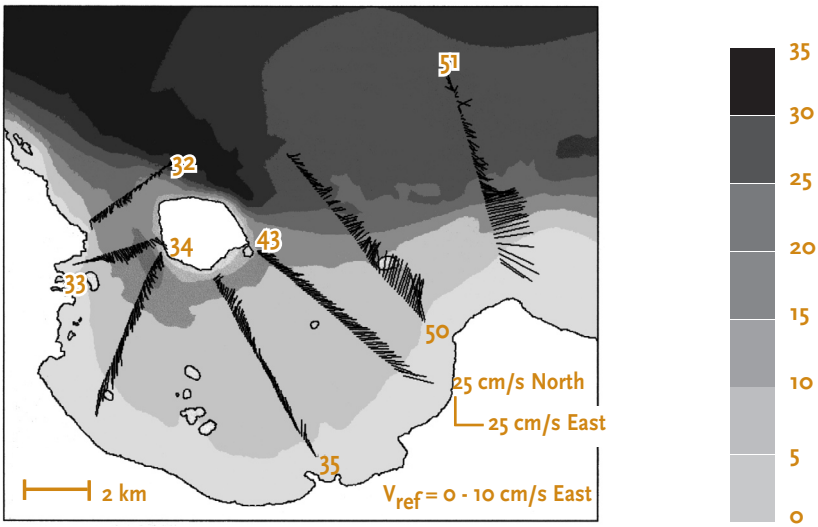



Fig. 2: Tidal flow patterns in the bay during eastward flow with flow maxima above the submarine Ciujung delta platform and with large velocity shears north of the delta. Water depth is indicated by grey colours (depth in m).

reach the central part of the bay. The third relevant source of SPM is the erosion and re-suspension of sediment by tide- and monsoon-driven flows. The critical shear stresses for both erosion and deposition are rather small and since the intensity of the tidal motion increases from southwest to northeast in the bay, sediment is easily eroded, e.g. in the sub tidal delta plain. During eastward flow conditions, the eroded sediments leave the bay whereas during westward flows sediments eroded at the sub tidal delta settle down in the central and southern part of the bay.

Consequently, regional differences in tidal currents and drift velocities contribute to the residual transport of sediment from the east to the central and southern part of the bay. In the past Pulau Dua, a bird sanctuary (Noor and Hasudungan, 2002) and former island, became attached to the mainland coast which has resulted in much more vulnerable conditions.

For coral reef systems in the bay, local erosion and re-suspension of sediment appears to be a dominant factor for the sedimentary and turbidity regime (Hoitink, 2000). In general, small-scale buoyant river plumes are not able to reach the coral islands and water masses, advected towards and along the reefs, are mostly less turbid than the environment that directly surrounds the corals. Time series of SPM clearly demonstrate that peak levels of turbidity at the reef slopes are directly linked to local wave- and current induced shear stresses (fig. 3). Wave action is largest at the reef crest, where coral growth is most abundant and little sediment is available for re-suspension. Tide- and monsoon-driven flow along a fringing reef, however, acts on the entire reef slope, from the toe of the reef to its crest. At the reef toe, large amounts of sediment are available for re-suspension and current-induced shear stresses generate clouds of SPM, which expand at the time of peak tidal currents and settle down afterwards (Hoitink, 2000; Hoitink and Hoekstra, subm.).

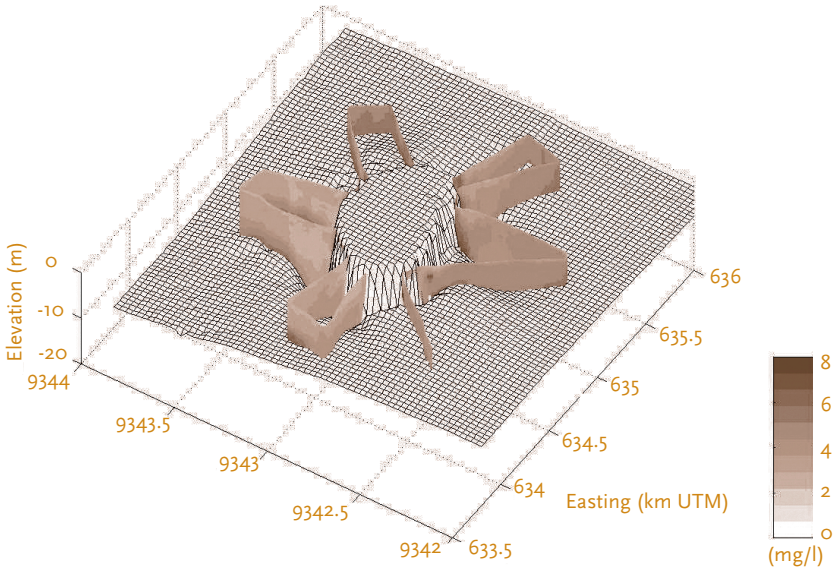



Fig. 3: Quasi-synoptic concentrations of SPM around a coral reef (Pulau P. Besar), based on acoustic backscatter signals of an Acoustic Doppler Current Profiler (ADCP)

**Bio-indicators: coral reefs**

Corals and coral reefs are known to typically flourish in clear oligotrophic waters but, contrary to this dogma, many reefs occur under marginal conditions such as due to high turbidity and/or high sedimentation rates (Bak and Meesters, 2002; Van Rouveroy van Nieuwaal *et al.*, 1999). Teluk Banten is such an environment and coral reef surveys and turbidity as well as sedimentation measurements were executed along a transect of islands in the bay. For some studies, Pulau Tunda, a coral island in the clear waters of the Java Sea about 20 km north of the bay, acted as a reference station. Results from sediment traps and turbidity measurements (again) indicate that high turbidity and sedimentation rates are not necessary (locally) correlated and should be studied as independent abiotic parameters.

The surveys have shown that coral communities have become adapted in reproduction and local recruitment of new colonies by recruiting heavily through asexual recruitment (almost 90 %), although sexual recruitment still occurred (10 %). In this study, recruits were defined as coral colonies of less than 4 cm diameter. Cover of living coral was high, ranging between 17 and 48%. Living coral cover appears to be correlated with turbidity (fig. 4). Net sedimentation and turbidity were highest at the island closest to the shore (Gosong Dadapan, south of Pulau Kubur; see fig. 1). These conditions were associated with an increase in partial mortality (death of areas of living coral colony surface) as well as a decrease in species richness (number of species), recruitment and topographic complexity (Bak and Meesters, 2002). Gross sedimentation and turbidity increased with depth from inshore to the outer parts of the bay, which was clearly linked to the process of resuspension. Simultaneously,

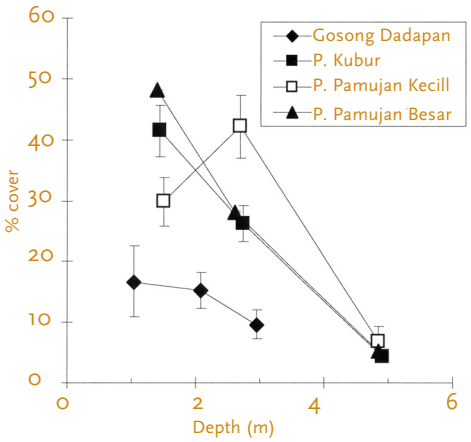



Fig. 4: Percentage coral cover as function of depth below water surface and for different coral islands inside and at the seaward boundary of the bay.

resuspension was a limiting factor for net sedimentation in and around coral reefs and net sedimentation was highest inside the bay and greatly reduced (60-90%) towards coral reefs at the seaward margin, for example near Pulau P. Besar (fig. 1). The spatially varying effect of re-suspension is also reflected by the partial mortality of scleractinian corals that is highest closest to shore and lowest for the more offshore located reefs.

At the level of the coral organism, the RNA/DNA ratios in coral tissue are supposed to represent the tissue growth characteristics. It appears that in turbid environments the RNA/DNA ratios of living corals are consistently higher, except for the most extreme turbid conditions close to the coast (Bak and Meesters, 2002; Meesters *et al.*, 2002). This is probably a genetically based variation and it suggests that these corals are adapted senso stricto to higher turbidity levels.

## Conclusions

The Bay of Banten is and probably always has been a turbid environment. In the past the main branch of the Ciujung River debouched into the bay and fresh river plumes with SPM were carried into the bay. Since the diversion of the Ciujung river the turbidity and depositional regime is mostly dominated by erosion and re-suspension and the former delta appears to be an important source of suspended matter. This sediment is partly transported to and deposited in the more central and shallow parts of the bay. The largest deposition rates, however, are observed near the slope break NE of Pulau Panjang where a mud wedge is present. Longterm observations around coral reefs in the bay demonstrate that transport and advection of SPM to coral reefs is less important for the local turbidity regime than the local re-suspension of sediment. Water masses advected towards the reefs are generally less turbid than the water masses directly surrounding the reefs. Waves, and in particular tidal and drift currents are very efficient in re-suspending sediment along the fringing reefs which causes a certain level of turbidity. For the most turbid environments and

in areas with net deposition, the coral reefs respond by showing an increase in partial mortality, a decrease in number of species, recruitment and topographic complexity. Coral communities have become adapted in reproduction and local recruitment of new colonies by recruiting heavily through asexual recruitment. The RNA/DNA analysis also indicates that there probably exists a genetically based variation in RNA/DNA ratios throughout the bay, which suggests that certain corals are adapted senso stricto to higher turbidity levels. As a result, coral reefs in Teluk Banten clearly show a process of acclimatization and adaptation to high turbidity levels and net deposition.

In the future, with an increase in human activities in areas inside and surrounding the bay a further increase in turbidly levels may be anticipated due to land reclamation, harbour development, dredging and shipping activities and the effects of industrial waste water. Our studies in the Bay of Banten indicate that in the present regime coral reefs and associated parts of the ecosystem can cope – to a certain degree – with increased levels of turbidity and net deposition. However, a further increase in turbidity may easily tip the scales and endanger the basic, social and economic functions of the bay.

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# General discussion open science meeting, February 12, ITB, Bandung

For Indonesia it is essential to built on a research infrastructure to become a player in the international scientific community. The national research development should be focussed on capacity building (increase of the number of S3/PhD-students). However, good science cannot be practised without proper access to research facilities, which are lacking in Indonesia, or are not well developed or organised. Most important is access to academic sources (scientific literature). Apart from access to research facilities an absolute requirement for good science is the strengthening of a scientific culture or mentality. Strengthening of a scientific culture should be a duty of senior scientists and goes deeper than just supervising of S3/PhD-students. (Bilateral) research cooperation is a strong instrument in strengthening a scientific culture. Sending Indonesian students to the Netherlands helps, but more important to help establishing a scientific culture is to bring Dutch (senior) scientists over to work in Indonesia for a longer period of time (2 years).

Young Indonesian scientists often face problems in the so-called 'writing phase'. The reason most often can be reduced to the difficult access to academic sources and the absence of a scientific culture, which leads to a reserved, unsure scientific attitude.

The Indonesian scientists present memorise that the scientific culture was high during the Dutch time. The problem, therefore, does not lie in the potential Indonesian research capacity. The Indonesian government has the important task to create an incentive and reward system, including the possibilities for a scientific career in Indonesia, which is a prerequisite to keep (young) scientists dedicated to their work.

The strengthening of the scientific culture in Indonesia is a complicated task. It is very difficult to persuade (international) scientists to stay in Indonesia for a long period of time (up to 2 years). A prolonged stay in Indonesia may imply a slow down in the development of the scientific career of the researchers involved. They face the same difficulties as Indonesian researchers in accessing research facilities and may be confronted with the degradation of their scientific network. For Indonesian scientists, a simple raise in salary is not enough. Scientists returning to Indonesia after obtaining a PhD overseas are often not able to continue their work in Indonesia. They return to a situation without a scientific attitude, without research facilities and without a budget to set up a scientific programme, which makes the overseas endeavours less effective and less beneficial.

The KNAW and NWO/WOTRO were asked for creating possibilities and facilities for returning PhD's to continue their work in Indonesia or in the Netherlands ('return grants', or Post-doc appointments in Dutch research programmes). In this way the effort put in the training of PhD-students could, to some extend, pay back. NWO/WOTRO has some possibilities and the new KNAW mobility programme issued by the Dutch minister of Education, Culture and Science could contribute to mitigate the problem of returning Indonesian PhD's. The poor scientific infrastructure in Indonesia, however, remains the biggest obstacle. The international research cooperation should be focussed on writing, education and strengthening of the scientific culture simultaneously.

Essential for Indonesia in developing a scientific infrastructure is the (financial) benefit that is obtained from research. While talking about improving the scientific infrastructure and culture, it may be wise to simultaneously think about bridging the gap between scientific research and commercialising of the results in order to get real attention from the Indonesian government. However, the objective of the Scientific Programme Indonesia-Netherlands is and should remain to jointly execute fundamental and strategic research, with a long-term perspective. Commercialising of results is the next step and the role of KNAW herein cannot be more than to try to tune cooperation programmes of other departments, with commercial objectives, to SPIN. Scientific quality and originality remain the major selection criteria for projects in the framework of SPIN.

**Conclusion**

The setting of the SPIN Open Science Meting has been one of good academic culture. The discussion hopefully inspirers Dutch and Indonesian science policy makers to undertake action in addressing the real problems of scientific research in Indonesia.

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Scientific Programme Indonesia-The Netherlands
February 12, 2002

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| BPPT | Agency for Assessment and Application of Technology |
| IAIN/UIN | State Institute of Islamic Studies/University Islam Negeri |
| IIAS | International Institute of Asian Studies |
| INIS | Indonesian-Netherlands Cooperation in Islamic Studies |
| ITB | Institut Teknologi Bandung |
| IPB | Bogor Agricultural University |
| KNAW | Royal Netherlands Academy of Arts and Sciences |
| LAPAN | National Institute of Aeronautics and Space |
| LIPI | Indonesian Institute of Science |
| LPPM | Lembaga Penekitian dan Pemberdayaan Masyarakat |
| NIOZ | Netherlands Institute of Sea Research |
| NWO | Netherlands Organisation for Scientific Research |
| WOTRO | Foundation for the Advancement of Tropical Research |

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