



Institute of Malaysian  
& International Studies  
Universiti Kebangsaan Malaysia

**IKMAS  
WORKING PAPER  
SERIES**

**NO.1**

**SOCIAL ENGINEERING IN RURAL DEVELOPMENT:  
BOTTOM-UP AND TOP-DOWN APPROACHES**

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**JULY 2016**

## Abstract

This paper addresses ways in which outside interveners can best achieve effective technology transfer to small farmers. Securing adoption and utilization of new technologies is vital in rural development, but hard to achieve. Farm households are often locked in to familiar ways of operation, which although primitive at least ensure basic minimal outputs in situations fraught with climatic and other uncertainties. Getting to higher outputs frequently entails use of ‘social engineering’. Here new methods are contained within special systems of operation, which may themselves involve departures from socially conventional approaches. Outside interveners may introduce such systems in a ‘bottom up’ manner, where new approaches are worked out and agreed in community discussions, or in a ‘top-down’ down manner with little consultation. This interesting topic is explored by the author in relation to rural development in eastern Indonesia, where circumstances are backward and new technologies promise large advances in productivity and incomes. There recent approaches have generally been bottom-up, following adverse results from earlier top-down initiatives. It is hoped that readers can then discuss the more top-down approaches taken in Felda and MADA schemes, enabling useful comparisons to be made.

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## **Introduction**

What I want to do today is to consider a major human development problem as it applies to agriculture. How best should we approach the crucial task of introducing new technologies and methods enabling us to get higher outputs and higher qualities of output, enabling people to reach higher standards of living? This is a huge challenge to those of us involved in rural development. Successfully introducing new technologies entails what I am choosing to call ‘social engineering’, which comprises making appropriate arrangements to enrol society in its improvement. This is a highly difficult task, and a key aspect is deciding whether to use bottom-up or top-down approaches.

Basically, a bottom-up approach comprises placing main reliance on the initiatives of communities concerned, with minimal and carefully targeted help from outside. A top-down approach entails the enrolment of far more outside intervention, with comprehensive supervision and much less reliance on local support. There is in practice no one best approach, however, and what is most appropriate depends greatly on the circumstances.

I am quoting two case studies to illustrate my theme. One bottom-up case with which I am extremely familiar is that of small scale partly subsistence farmers in the remote province of Nusa Tenggara Timur (NTT) in eastern Indonesia. This location features the lowest per capita incomes in Indonesia, about one fifth of the Indonesian average. Dr. Ria Gondowarsito (my wife), and I have for 25 years been leading an Australian-Indonesian improvement project there under the auspices of an NGO, the Nusatenggara Association (NTA), spending three months a year in the area. The goal of the project is to raise family incomes, and it caters at any one time for some 2,000 families, or 10,000 people, on the islands of Timor and Flores, most of whom operate tiny 0.5-1.0 ha farms.

The top-down case with which I am less familiar, although I’ve had periodic close contacts with it, is that of Felda settlement schemes in Malaysia. Here 112,635 mainly landless settler families were provided with new oil palm and rubber holdings between 1956 and 1990, with most families being allocated 4.0 hectares. There are today 317 settler schemes, averaging just under 1,500 hectares per scheme. I was quite heavily involved with Felda schemes during their early years in the 1960s when I worked for the Malaysian Rubber Board, and in the last two years Ria and I have visited several schemes and interacted with staff and settlers.

Both cases entailed substantial social engineering in securing their improvements, and I'll be quoting experiences from each to illustrate my theme and underlying analysis. My thoughts on social engineering are still in progress, and I'll much appreciate any comments. I'll be especially grateful for insights on Felda schemes, where many people present today have far more knowledge and experience than I do.

I am conscious of course that social engineering extends to all forms of human activity, and I know many of you will have experience from non-agricultural spheres. I am also not a sociologist or anthropologist but an agriculturist, and hence have limited knowledge of the theories underlying those disciplines and applying amongst other things to social improvement.

### **Conceptual framework**

I want first to establish a conceptual framework for my analysis, and will go on to consider my two case studies. In checking the conceptual framework I look firstly at what I term 'original situations', the conditions before interveners wanting to introduce new technologies seriously commence their work. I look secondly at 'interventions' by these interveners, and their utilization of social engineering.

#### *Original situations*

The original situations before substantial interventions are commonly those of a primarily subsistence agriculture. Here farm families on the remote peripheries of developed regions rely mainly on subsistence agriculture for their livelihoods, albeit with some previous infiltrations of improved crop and animal varieties and relatively small cash components through sales on local markets. Basically, though, the subsistence systems in these original situations are those developed over hundreds of years to more or less reliably supply reasonable quality foods and other needs for families concerned.

Crop and animal yields in original situations are very low by modern standards, but except in times of unusual drought or other calamity don't fluctuate much. The prevalent foods are nutritious and have good keeping quality, enabling families to survive until the next annual harvest. The underlying farming systems have over long time spans become geared to local cultures, in terms of both production and harvesting methods. This is a situation of relatively low risk, and one where most families reduce risks further through efficient applications of the underlying primitive technologies.

But we need to look more closely at ‘original situation’s, and if we do observe they are by no means uniform. There are big differences between farming families concerned in levels of primitive livelihood, to some extent related to size of holdings but also to levels of expertise. It is also very significant that some farmers are what Indonesians term *petani maju* (successful farmers) – they do things better than their neighbours, and with higher yields and incomes get ahead even further. Often such farmers have previous experiences in developed places far from traditional locations, and these experiences let them to see things in new ways. Such *petani maju* can be vital in facilitating social engineering, as we will see.

We should further recognize in these original situations ‘embedded structural aspects’, meaning that certain families are reinforced in superior positions by inheritance traditions or laws. These give them considerable power over neighbours, who in what we might term the ‘worst’ scenario are landless labourers having to work for richer counterparts to survive. Such structural aspects can be major negatives in making changes, complicating social engineering and making it far more difficult.

Finally, in considering original situations, we must consider the special circumstances of agricultural settlements. Here people who are usually landless and come from various backgrounds, sometimes with little or no experience of agriculture, are brought in from outside to settle new lands. Such schemes include the Felde enterprises in Malaysia and Transmigration schemes in Indonesia. While there are no embedded structural aspects in such situations, the lack of agricultural knowledge and existence of diverse backgrounds may make social engineering even more difficult.

### *Interventions*

I now come in my framework to considering interventions through social engineering. The ‘outside interveners’ undertaking interventions come in many forms, but in our situation of overcoming rural poverty are normally government agencies or NGOs.

The goals I am focussing on are those of securing higher yields and qualities of crops and livestock, including adoption of new crop varieties and better animals which can be processed and sold on the cash market. These goals involve social engineering to facilitate moves from the subsistence circumstances just outlined to fresh higher income positions. There are of course many kinds of improvements needed in most situations, including those to water and

sanitation, other infrastructures, education and health. The basic problems of engineering such improvements are similar, however, and will not be considered today.

The key ingredients of crop and livestock improvement are well known, involving packages of new seeds, more productive animals, and associated inputs, with subsequent implementation of better processing. But the social engineering underlying successful introduction of these packages and processing methods can differ greatly in nature. I'll briefly consider typical bottom-up and top-down approaches, so as to highlight main features of the wide range of social engineering possibilities involved.

A typical bottom-up approach in engineering involves a relatively small role for the external intervener, with emphasis on community participation and feedback at all stages. The intervener supplies seeds, animals and other key inputs such as fertilizers, cement, and help in processing, maximizing use of local materials and getting participants in a self-help mode to manage the new undertakings and provide necessary labour. Most inputs are supplied on credit, repayable when enhanced incomes become available. The only further input of the intervener is technical advice and training, provided at appropriate intervals. Full use is made of key aspects of the social situation, including the *petani maju*, whose farms are often utilized as demonstration plots from which good ideas can spread to others and make new innovations seem less risky. Customary local modes of operation, such as working together in *kelompok* (group) and engaging in traditional forms of community consultation, are also fully utilized.

A typical top-down approach in social engineering involves the external intervener much more intensively, with far more comprehensive operations being undertaken without much community consultation. Input packages are managed intensively by the intervener, and frequently entail only part repayment of the costs of intervention. Customary systems are largely bypassed, and substituted by new command arrangements directly pursuing the goals of technical improvement.

It should be noted that bottom-up approaches are particularly applied in smaller scale improvements often featuring NGOs as the outside intervener, while more top-down approaches tend to feature large-scale initiatives undertaken by government agencies. Bottom-up approaches are usually cheaper, demanding much more contribution from local communities. Top-down initiatives, on the other hand, are more expensive but at the same

time probably more suitable where large-scale intensive improvements impacting large populations are involved.

## **Case Studies**

### *Nusa Tenggara Timur*

Let me now address the case of the small scale partly subsistence farmers in Nusa Tenggara Timur (NTT), Indonesia. There has indeed been considerable infiltration of new agricultural technologies into NTT over the centuries, greatly improving the far earlier ‘original’ combination, 500 years ago, of subsistence roots, dry rice and unimproved pigs. Thus maize came to NTT from North America through China 450 years ago in the 16<sup>th</sup> century, cattle came from Bali in the 19<sup>th</sup> century, and cocoa and vegetables arrived in the mid 20<sup>th</sup> century. The maize and vegetables much bolstered subsistence, while cattle, cocoa and vegetables enabled small cash incomes to be earned. More background on eastern Indonesia and NTT is given by Hardjono and Barlow (2000), and by Resosudarmo and Jotzo (2009).

All yields in NTT in 2016 remain very low, with paddy and maize, for example, yielding averages of 600-700 kg per hectare compared to modern yields of 2-3 tons, root crops yielding 1-2 tons compared to 10-20 tons, and cocoa 0.4-0.5 tons compared to 2-3 tons. But the subsistence side is nonetheless ‘reliable’ in the terms of my ‘original’ situation, with cultivation in most years leading to at least the quoted low yields. The combination of several subsistence items including maize, paddy and roots also helps, in that depressed yields of one crop are usually balanced out by better yields of others. The current array of low yields, given sufficient land, is enough for a family’s yearlong subsistence, while small cash incomes are also earned.

There is, as I posited for our ‘original’ situation, a wide distribution of income levels in the NTT part-subsistence rural economy, and there are also 2-3 per cent of *petani maju* (successful farmers) who stand out from the others. There are too in some areas, and relating to embedded structural aspects, *tuan tanah* (landlords) firmly controlling land distribution and particularly constraining certain landless people dependent on them in earning livelihoods.

What the Nusa Tenggara Association (NTA) and other local interveners have tried to do is to socially engineer the introduction of new maize, cattle, small animal, cocoa and vegetable technologies. They have also tackled provision of social infrastructures, although these won’t

be considered today. The approach has been quintessentially bottom-up, with close community interaction, much self-help, and the supply by the NTA of credit for crucial purchased inputs along with technical advice.

There has in the NTA's social engineering been much reliance on selected socially responsible *petani maju*, where these have been initial focuses of activity. Thus the holdings of these people have been converted to 'demonstration farms', which have been brought to modern yield levels with advanced management practices. These holdings serve to demonstrate that perceived risks in adopting new techniques are less than might otherwise be thought, encouraging surrounding people to make their own changes. All development work has been through the traditional community vehicle of *kelompok* (social groups) each containing 10-15 families with an elected leader and treasurer, and never through individuals. This in itself broadens the impact of what is being done, and stimulates further participation.

Usually *Petani maju* are the heads of initially cooperating *kelompok*, but over time other leaders are brought in. The NTA has also, in conjunction with communities, held periodic *musyawarah* (meeting/consultation) at which feedbacks and interactions and further suggestions are secured. The fact that the NTA has cooperated with local communities for decades means it is far beyond an initial phase of polite and misleading responses, that might have existed for a year or so. Interactions are genuine, sometimes mutually critical, and embody a very collegiate atmosphere. The costs of this approach have been low, and with improving cocoa, for example, are RM600-700 per hectare compared to expenditures in Malaysia some 15 times as much.

There have of course been numerous and continuing difficulties, and as always with the highly variable attitudes and performances of small farm households it has been crucial in seeking advances to enlist not only *petani maju* but other serious people honestly prepared to try improvements. All selected persons help in demonstrating what can be done to less dynamic people, frequently encouraging them to participate in turn. Sometimes, however, inactive individuals, or those solely concerned with their own welfare, have been chosen for participation, and results have been poor. Again, securing technical efficiency at all levels has been hard, and occasionally NTA-paid extension officers have given sloppy advice or reacted too slowly to emerging problems. To remedy this the NTA has organized Training of Trainers or TOT, not only for NTA staff but also for keener farmers. Here close cooperation with a government research agency with high technical expertise and dedicated to improving



agricultural technologies, the *Balai Pengkajian Teknologi Pertanian* (Research Centre for Agricultural Technology), has been absolutely crucial. An MOU between the NGO and the agency allows this agency's staff to be utilized not only as trainers but also as technical supervisors of local NTA units.

Accounting control in what is known as the most corrupt province in Indonesia has been another special pre-occupation (and important cost) in efforts to avoid the persisting danger of funds leakages. But here community monitoring has played a key role, and been an important element of consultations. Handling 'embedded structural aspects', which in this case especially involve *tuan tanah* reluctant to benefit landless tenants, has been tricky and not always secured desired results. In general, however, the efforts of the NTA in Nusa Tenggara Timur have borne good fruit, with higher and sustainable crop yields and better incomes being secured by growing numbers of rural households.

Good relations with government have been a further key aspect, and very necessary in an atmosphere where NGOs seen as non-cooperative and threatening the official structure are not permitted to survive. The NTA as a partly foreign NGO has strenuously avoided political matters, or at least dressed them up as purely technical issues. It has been fortunate to operate in Indonesia, a country whose officialdom possesses a dominant pragmatism and flexibility in regard to development. Indeed, it originally established itself in the early 1990s within the outwardly inflexible but actually quite adaptable rural development regime of the New Order.

An at least apparent adjustment to government thinking is nonetheless required, although given the ruling pragmatism and circumstances where NTA's clients form significant local voting blocks in the new Indonesian democracy and can influence the success of Bupati, the regional political leaders, there has been little difficulty in pursuing the goals outlined. The NTA has always seen government as an important part of the community, inviting local officials and politicians to local *musyawarah* and field days, getting them to participate in those events, benefitting from their advice, and liaising with them in its work.

### *Felda*

I now turn to Felda, where as I've said my knowledge is more limited and I am hoping Malaysian colleagues can help with further analysis. Here the 'original situation' is one where previously landless people arrived at what had been untouched jungle, albeit cleared at the start of intervention by contractors, planted with rubber or oil palm at good technical

standards, and about to commence production. The settlers were allocated 4.0 hectare plots, and provided with basic housing and other social facilities in a highly engineered and integrated operation.

The settlers were guided closely by Felda management, which supplied all key inputs along with continuing technical advice and supervision of their harvesting and other activities. Management also, after various trials over the initial decade, organized settlers in 24-person blocks, giving these small groups considerable independence under an elected leader who could be compared to *petani maju* in NTT. This proved effective in reducing costs, passing feedbacks to scheme administrations, and getting persons from different backgrounds to cooperate positively.

Central processing was also set up, with harvested rubber and oil palm fruits being purchased from settlers and transported to nearby large factories sustaining economies of scale. Social facilities including schools, mosques and shopping facilities were progressively established and brought to standards generally above those in other rural areas. The levels of management after early difficulties were usually good, with staff being well-trained in both technical and social aspects of their work. What progressively became a huge Felda apparatus, controlled from Kuala Lumpur and devolved through *wilayah* (regions), proved in most instances to be highly effective. Felda was lucky in effective leadership, especially in its long-running Chairman, Raja Alias, whose work has been analysed by Rokiah Talib (2009). The settler side of its organization still persists at a largely competent level today.

Felda management also set up *Jawatan Kuasa Kemajuan Rancangan* (JKKR, or Scheme Development Committees) of elected settler representatives, who passed on settler views to the Felda authorities. Later when the time came to replant, this work was again undertaken by contractors, while subsistence allowances were provided to settler families during immaturity. This was a far more coordinated and expensive endeavour than that described in NTT, with crop establishment costs in present terms being over RM10,000 per hectare, with repayments by settlers only amounting to part of these costs, and with additional large overheads. But the outcome from the management-intensive and expensive process was generally most satisfactory. Good incomes were earned and distributed to settlers, and technical performances matched well with averages on commercial estates. In the outcome, large numbers of previously landless people and their children were provided with far higher

living standards than they would otherwise have secured. Felda settler developments have been comprehensively and interestingly analysed by Lee and Shamsul Bahrin (2006).

Inevitably, however, there were many difficulties in such a massive social engineering endeavour. Thus the proposal in the 1980s to change to a 'share' system whereby settlers who repaid loans would be given shares rather than individual land titles was bitterly resented by most settlers, with thousands leaving the United Malays National Organization, the dominant party in government, to join other political groups. The government was eventually forced to give way on this issue, and in October 1988 agreed that individual land titles should be given to settlers repaying debts. Numerous more minor problems occurred, as for example with the decision in the 1980s to plant parts of holdings with cocoa on Felda schemes in Johore. This proved a serious mistake, with heavy pest attacks forcing replacement of these areas by oil palm after only three years.

There were also frequent disputes over crop sale prices and other social issues, which in some schemes became extremely serious and justified high-level intervention. These often persisting socio-economic problems have been examined by several authors, mostly focussing on particular schemes or clusters and chiefly attributing the difficulties to inadequate communication. These authors include Halim Salleh (1973), Alladin Hashim (1979), McAndrews (1979), and Mohd Zufri et al (2016). It is indeed interesting that certain schemes experienced far more social and technical problems than others, in a possible reflection of standards of management. Yet Felda managers appear over time to have become cleverer in social management, and better at anticipating and avoiding such problems.

More latterly, and dating from the 2000s, Felda schemes have had to adjust to the ageing of original settlers, under circumstances where most second generation people have left schemes to get jobs in urban areas. Felda consequently made the big social engineering change in the early 2000s of setting up Technoplant to take over management of settler areas owned by those unable to continue operating them. This Felda subsidiary, which works mainly through contractors employing foreign and largely Indonesian labour, is responsible for operating over 80 per cent of the settler area, and for replanting an even bigger proportion of the total hectareage.

Felda settler managers in this new situation still control budgets and social relations, working closely with Technoplant managers and staff in a way which involves creative tension and which I've observed to work well. In the meantime, the older generation lives in good houses

improved with help from generous Felda interest-free loans, while the younger generation remaining behind engages in ancillary enterprises contributing in some cases to thriving social centres. This latter is a sphere undoubtedly needing more attention, with excellent potentials for setting up more centres of active rural growth and facilitating Malaysia's adjustment towards a more diversified rural economy.

## **Conclusions**

What can I say in answer to my initial question as to how we should approach the crucial task of introducing new technologies, enabling us to raise yields and qualities and improve peoples' incomes in a variety of rural situations? Both cases reviewed - the NTA in Nusa Tenggara Timur and Felda in Malaysia - appear to have successfully engaged in social engineering in very different circumstances. Clearly a bottom-up approach was sensible for the NTA in its situation of limited resources with small individual households in Nusa Tenggara Timur, while the more top-down approach of Felda was appropriate in its case with major funding from government and the need to operate successfully over large areas with huge numbers of people. There is really no conflict between bottom-up and top-down, only a pragmatic decision as to which it is best to apply in particular situations of technical and social improvement.

But apart from the rather trite conclusion that we should adapt our approach to our goals, resources, and the conditions of our target population, are there other insights to be drawn from this NGO-Felda comparison?

One insight that comes out strongly, and which Ria and I have struggled hard to achieve over the years, is the need to efficiently apply high technical expertise to the problems at hand. The fact that this has been achieved in both the NTA and Felda cases has been crucial to their successes and a vital ingredient in social engineering. Another key insight is the importance of effective and honest management, enabling high performance to be secured with resources available and avoiding the disabling and insidiously spreading effects of corruption. A final insight is the crucial significance of building good community relations and socially engineering situations to achieve this. Such building is a particularly tricky task, but again vital to long term sustainability and success.

All these are useful insights to develop and discuss further in relation to our social engineering of future developments in rural areas.

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*Colin Barlow*