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This paper has been slightly amended since the seminar.

THE SOCIAL IMPLICATIONS OF EARTHQUAKE PREDICTIONS AND WARNINGS ON AND FOR ORGANISATIONS

N. R. Britton*

The underlying assumption is that society will be able to employ earthquake prediction as it develops in the future to save lives and possibly reduce property damage. In other words, earthquake prediction will allow society to take actions that will provide some measure of protection from this natural disaster.

It is my contention that earthquake predictions will be of little value to society unless that society is prepared to act in a positive way on the basis of the information produced about predictions and warnings. In earthquake prediction, we are dealing with a technology that, by its very nature, demands a unique relationship to society if it is to develop. Earthquake prediction will provide society with information. If it is to benefit from that information, society must learn how to use it.

Earthquake prediction is not an activity that can be isolated for one sector of society, viewed in terms of isolated parts of the system, or as regarded as an activity isolated from the rest of society. The organisation of possible future impacts must reflect these interdependencies.

For an overall assessment of the social implications, a dual approach to the study is desirable. The first part of this approach should determine how different sectors as well as the overall society regards earthquake predictions and warnings. The other part of this approach should determine how earthquake predictions and warnings will affect society. In other words, how will society react in a positive manner to such predictions and warnings? This involves research into such structural changes as earthquake insurance, earthquake prediction legislation, the dissemination of predictions and warnings, and whether existing organisational resources are adequate to handle an earthquake situation, or, whether new organisations will have to be created to integrate earthquake prediction and warning into society.

A pilot-study that has recently been completed in Christchurch looked at what structural changes an earthquake prediction will have, as well as how organisations regard earthquake predictions and warnings.

Twenty-three organisations were studied, covering government departments, emergency-services, plus private industrial and commercial companies. Organisations were the focal point of the study, rather than individuals or the society-at-large.

A three-fold typology was developed to separate the various organisations in the Christchurch region. These three categories were:-

1. Organisations economically affected by an earthquake prediction and warning;

2. Organisations whose main function could be considered as consultive and co-ordinative in response to an earthquake prediction and warning, and

3. Organisations whose main function would be that of relief.

A member from each of the 23 organisations was interviewed, and each respondent was asked a series of 66 open-ended questions. The findings of the pilot-study are based on the results of the interviews with these 23 respondents.

This paper will deal with three general areas of interest in the social implications of predictions and warnings, namely:-

1. disaster planning within organisations,
2. how earthquake predictions and warnings are perceived by organisational members, and
3. how organisations viewed the actual techniques of earthquake prediction.

I. DISASTER PLANNING IN ORGANISATIONS

The disaster planning of the organisations in general is quite limited, and in the case of earthquake emergencies, their planning is extremely limited, if planning exists at all. With the exception of three cases who had specific plans that featured actions to be performed in an earthquake, fifteen of the organisations had some form of emergency planning, but this was limited to fire-evacuation procedures. Emergencies, therefore, on the organisational level, were seen in terms of fires.

The majority of respondents also stated that their general plans could readily be adapted from a fire-hazard situation to an earthquake-occurrence situation. But this attitude of a fire-plan being sufficient to cover an earthquake situation is extremely short-sighted.

When respondents were asked how their organisations would react to an earthquake prediction, eight of them said their initial reaction would be according to a prepared plan that would cater for such circumstances. But this research reveals that adequate plans just do not exist.

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* Department of Sociology, University of Canterbury.

There is also a lack of awareness by respondents of the emergency plans of other organisations and the roles that other organisations perform during an emergency period. Individual organisational respondents are not aware of the functions, capabilities and resources of other organisations. This is especially so with members of industrial and commercial companies and their awareness of the roles performed by emergency-services. For example, only ten of the 23 organisational respondents were aware of the Civil Defence plans, and were more or less familiar with these plans.

Looking briefly at hazard-reducing measures that have been practiced by Christchurch organisations, only one respondent of the 23 could cite a specific example of such an operation that has been performed. This is significant if one remembers that earthquakes are a danger to society because of the effect they have on man-made structures. These deficiencies in earthquake mitigation result from the absence of prior experience with earthquakes on a devastating scale. This absence of prior experience with earthquakes will significantly influence how earthquake predictions and warnings will be both perceived and received. Lack of experience may well mean that warnings will not receive much attention. It should be remembered by such respondents and society as a whole that there is no written guarantee that an earthquake will not occur within the near future, thus the complacency that this research has uncovered is completely unwarranted.

This research reveals that organisational planning and preparation for earthquakes is most unsatisfactory. Very few organisations have plans which deal specifically with earthquakes. And, furthermore, the disaster-plans of many organisations are merely 'paper-plans' that remain largely unrehearsed and unpracticed. This lack of practicing and 'dry-run' simulations should be regarded as a serious deficiency in the functioning of organisations.

The main arguement put forward by respondents that did not consider themselves to be prepared was the unknown nature of the earthquake. This quotation from one of the respondents helps illustrate this position:

> *"The thing that makes planning difficult in any earthquake is the scope of danger. It can be anything from utter destruction to a chimney-pot falling off; thus no-one can be particularly well prepared."*

Most respondents, however, stated that they would seek advice from experts outside their own organisations before they finalised emergency planning on earthquakes.

II. RESPONDENTS PERCEPTION OF EARTHQUAKE PREDICTION/WARNING

People have expectations that must be recognised and that must be partially fulfilled (or, alternatively, the society must be re-educated into accepting different expectations) by members of the scientific community if favourable interaction is to develop between scientists and the population at large. That is, if earthquake prediction is to become effective and aid society, scientists must be aware of what the population expects and how they will react to earthquake predictons (and warnings). This is just as essential as societies awareness of the technology of earthquake prediction.

Both favourable and critical views of earthquake prediction emerge from the research. Nineteen of the 23 respondents had positive views about earthquake prediction. This was particularly so in the case of the 'economically-affected' organisations. Ten of the 11 in this category gave examples of beneficial consequences. The main advantage of having a prediction and warning is that organisations will have time to prepare for the emergency. Earthquake predictions and warnings will save lives - the advantage of reducing loss of life far outweighed loss of profits and production output.

Sixteen of the respondents agreed they would probably alter task assignments for personnel within their organisations in the event of a warning. Shutting down machinery, closing down vulnerable plant, restricting entry to dangerous areas, and deploying personnel to safer sites and jobs were some of the alterations mentioned by respondents. A further eighteen respondents stated that the physical structure of their organisations would be examined to determine the vulnerability of their buildings to the impending earthquake. We may note here that the Ministry of Works and Development undertakes a similar survey on a regular basis for government owned and leased buildings, but the results of such surveys could not be obtained for our research purposes.

Respondents acknowledged the possibility that although there would be loss of profit and output in an earthquake prediction situation, this loss would be smaller and more tolerable compared to what might be expected if a warning was not issued and acted upon.

Earthquake prediction also drew some negative comments. From an economic point of view, one respondent stated; and I quote:

> *"Responding to an earthquake prediction might not be a sound proposition - what do you do with a work-force of 700? If we sent them home and an earthquake did not occur, thousands of dollars would be lost in a very short time."*

Some respondents also felt that they would suffer disproportionate losses if they acted on an earthquake warning. This was particularly the case if responding to the warning was not an obligatory action by all organisations. Quite a few respondents inferred they would act on such a warning, yet at the same time, would not be initiators in doing so.

There is also the problem of false-alarms and earthquakes that are not predicted. For example, one respondent said:

> *"No prediction has proved reliable in the past - we tend to treat a lot of these things as a 'cry-wolf' situation, especially with storm-warnings. Staff and public become*

> *complacent and treat warnings lightly. I think this situation could be extrapolated to earthquake predictions and warnings."*

Turning now to the matter of legislation and the dissemination of earthquake predictions and warnings, nine of the respondents thought that legislation would be needed in this area. I will quote two respondents' statements to illustrate this point:

> *"I think certain l-ws have got to be laid down to protect people. It should be mandatory that companies and individuals should do 'x' number of things, but (these laws) should not be overly restrictive."*

Another respondent said:

> *"In anything as major as this, we cannot have everybody doing what they think they ought to, therefore regulations telling people what to do should be produced."*

Large industrial companies considered that laws governing behaviour in an earthquake warning period should be produced, not for the larger companies themselves, which have a multiple role in society that at times makes them more responsive to adopting patterns of behaviour that are socially beneficial, but more for the smaller companies that are considered to be more profit-oriented and would thus ignore such discretionary measures.

Issuing statements on earthquake predictions and warnings to the public needs to be considered seriously. Such statements that are released to the public will have to be succinct and unambiguous so that misinterpretation is kept to a minimum. This quote from a media representative illustrates the problem:

> *"People have a tendency to hear only half of what is transmitted. They so easily leap to the wrong conclusions and alarm can so easily be spread. Thus considerable caution is required."*

Two respondents said they would question the issuing body's/bodies statements on the prediction and would seek verification of that prediction. One respondent went so far as to suggest that his organisation would try to obtain a court-order to prevent such a warning from being publicly announced on the grounds that earthquakes cannot be predicted to such a level of certainty, and also, that the economic consequences of such a warning may be worse than an unexpected earthquake.

Fifteen respondents stated that they would not question the credibility of the earthquake prediction.

The pilot-study also revealed that seven respondents thought the best organisation for issuing an earthquake prediction and warning to the public would be the Civil Defence Organisation. Fourteen of the 23 respondents considered a combined public release by the Civil Defence and the Police Department would be a better approach. (Respondents considered that the Police Department was much better equipped and more experienced to cope with a disaster on such a scale that was perceived in an earthquake catastrophe).

No respondent thought the Department of Scientific and Industrial Research should have the prime responsibility of making predictions public, but this organisation was considered to be the one from which the issuing body/bodies should receive the information of the earthquake prediction. Respondents also suggested that a direct government involvement was not the best method of making the prediction public.

One more matter which I want to deal with in this section is the question of earthquake-related studies and information on such matters. Quite a few respondents said that research should be undertaken on earthquake-risk zones and earthquake-risk structures. More information should be made public on these matters, and what material there is at present about risk-zones, risk-structures and other related areas should receive more publicity. But one of the problems of the effectiveness of such studies and information is that people do not accept that an earthquake will affect them. This quotation supports this view:

> *"Information and studies would be an extremely good idea. But it would not make much difference to organisations or the public. People in their own minds know only too well that nothing is going to happen to them or Christchurch. An earthquake can happen at Napier, Inangahua, or Milford, but not in Christchurch."*

III. PREDICTION TECHNIQUES

Before reacting to an earthquake prediction, respondents would have to know the degree of accuracy of that prediction. One method that respondents would aid them in ascertaining the potential threat would be the inclusion of a statement giving the probability that the earthquake would occur. A probability of 75% of the earthquake occurring and complying with the specific information released was quoted frequently as being a reliable indicator of the prediction being acted upon. The prediction as it is released to the public should also contain such information as the location, timing, and intensity of the earthquake. There is also an emerging view in the American literature, that estimates of the severity of ground-shaking which will occur should accompany the prediction. Such estimates are important for discerning the distribution of damage from the predicted earthquake.

And, most importantly, the publicly released statements should also contain prescriptions, or at least strong suggestions for public action.

Respondents were asked what they thought would be more important in earthquake prediction - whether it would be more beneficial to attempt to narrow the time-window, or alternatively, whether identifying the precursory signs of an impending earthquake was more important.

These two terms were defined in the following manner in our research: narrowing the time-window places emphasis on determining the exact timing of the impending earthquake, and identification of precursory signs emphasizes establishing magnitude and