Preferred citation: A. Mawson. Organisation requirements for innovation and economic growth. In **The role of fundamental research in paper-making**, *Trans. of the VIIth Fund. Res. Symp. Cambridge, 1981*, (Fundamental Research Committee, ed.), pp 1079–1087, FRC, Manchester, 2018. DOI: 10.15376/frc.1981.2.1079.

ORGANISATION REQUIREMENTS FOR INNOVATION AND ECONOMIC GROWTH

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Abstract

Innovation, revolutionary change, is a major element of economic growth and brings about changes in productivity, employment and competitiveness, nationally and internationally. The prime requirement for innovation is existing or latent market need. R & D is not a sufficient component in itself to bring about innovation. Fundamental research work is probably most cost-effective if directed towards solving the problems of evolutionary change.

Revolutionary innovation challenges the established order, changes patterns of work, makes capital plant redundant and sometimes eliminates the whole market for certain products. Generally it involves risks and time-scales far beyond those normally handled in a company. Increasingly it requires large amounts of revenue and capital.

To overcome these obstacles to innovation requires a strong sense of purpose in an organisation and strong direction of research activity. Given our own industry's pitiful profit record Government support may be necessary. However, stronger funding of a smaller number of projects should be the aim.

Introduction

A good level of support for science and technology is necessary to our industry, and to our nations, as a means of ensuring economic growth, employment and the ability to sustain a rising standard of living. The generation of knowledge and its

commercial application, innovation, is required to bring about the changes in labour, materials and capital productivity which are all necessary to maintain competitiveness both nationally and internationally.

Whilst the basic necessary requirement for innovation is an existing or latent need in the market-place for new goods or services, application of technology is often an enabling step in satisfying this need.

There can be little doubt that our industry exists in an increasingly competitive market-place. Increasing international trade and increasing competition from substitute products have led to higher demands on most companies to be more cost effective, and have increased the impact, for good or bad, of technological change.

The problem with all innovations is that they challenge the established order within both the company and the market-place. Major innovations change patterns of work, make capital plant redundant, and may eliminate the whole market for certain products. By their very nature these major changes often have an impact across a whole company. Because the changes are major, many companies fight shy of recognising the need for, or have difficulty in implementing, innovation.

Further problems arise because innovation usually has a long time-scale, often far beyond the tenure of any one Chief Executive, and there can be temptation to concentrate on the issues which have more immediate impact on the company. An additional very real problem in today's climate of extremely low industrial profitability concerns the high cost of introducing innovation: companies often have insufficient money to support it. Co-operation between companies and government support are increasingly being considered for fundamental research, for development and for investment in production equipment.

The fundamental issues all companies are struggling with are, firstly the problem of getting more science for less money and, secondly, of ensuring its effective application.

The Wiggins Teape Group is immune neither from competitive pressures nor from organisational and other problems of introducing change. The group operates in many countries in totally unrelated business areas. Central management and direction is given by a Group Board, with three subsidiary boards being responsible for operations in the United Kingdom, Continental Europe, and other overseas territories. Many businesses and operating units maintain their own technical functions co-ordinated to the Group Technical Centre located in the UK.

Because of the organisational and business complexity of the Wiggins Teape group, we have attacked the problems of more cost effective development and more rapid implementation, by working to integrate technology into the strategic and business thinking and not just into the thinking of the technical personnel. Instead of merely addressing questions such as "How much should Wiggins Teape be spending on Research and Development (R & D)?" and "What emphasis should be placed on Research rather than Development?" we have, in addition, been trying to assess the role technological development has to play in the overall business strategy. The questions we have been asking ourselves are:

What is the role of R & D in a multi-product company?

How should we organise R & D activities for maximum effectiveness?

How should we bring together the R & D programme and priorities to reflect both business or strategic thinking as well as development of technology know-how?

I would like to expand these three points in the rest of this paper.

The Role of R & D

There are many ways of characterising R & D activities. In the Group Technical Centre we classify R & D efforts into four areas of work:

provision of on-going support for the existing business;

provision of fundamental research support behind existing business;

development of major new products and processes for existing business;

provision of support for new business diversification.

Where appropriate, R & D activity is characterised in each business area under these headings.

The distinction being on-going support and development of existing business is one mainly of time-scale and importance. On-going support is mainly orientated to solving specific and well-perceived business problems with a short-term focus. Business development involves developing new products and processes for existing business which could have a major impact on its growth and profitability. These projects have a longer time-scale, greater investment and greater risk than those product and process development projects listed under on-going support.

I emphasise that this way of characterising R & D effort is only one of many. It does, however, enable us to debate issues at business level, and then across whole operations, on the appropriateness of resource allocation.

The role of R & D is defined, however, not by classification of activity but by the proportion of effort that is consciously or otherwise allocated to each activity. Decisions on the degree of emphasis on each of the four areas of work are influenced by the rate of change we see in our industry's technology, by

competitive efforts and by technological threats from other industries. There is also the question of whether we wish to be seen as a "leader" or a "follower" in the business areas we are engaged in.

Over the past two years, in response to a redefinition of the basic direction and strategy of the Wiggins Teape Group, central R & D effort has been re-allocated. During this time, the aim has been to eliminate technical work aimed at diversification, and to shed short-term support for existing business to the technical staff at the manufacturing units. The manpower released by these moves, and additional staff, have then been allocated to major product and process development work, and to additional basic research work, to enable assessment to be undertaken of the importance of newer technologies to Wiggins Teape business.

Organisation of R & D

The issue debated recently has concerned the extent to which R & D efforts should be de-centralised to business units as opposed to centralised at the Group level. The factors we considered in reaching a decision included:

the role that had been defined for R & D;

the extent to which Wiggins Teape operates in the single basic technology of paper-making;

the size of our individual business units, many of which are not large enough to afford a reasonable R & D effort of their own.

We were very conscious that the closer R & D activity is to a business, the better perception R & D personnel have of business problems and the less likelihood there is for technical solutions to be found to problems and opportunities that do not exist.

Equally, we were aware that a central R & D organisation, as has existed at Wiggins Teape for the past twenty-five years, is the most efficient way of providing basic technological support in the situation where the common technology of paper-making cuts across most Wiggins Teape business. We also believe that concentration on major product and process development are best carried out centrally, since a number of our individual business units are too small to afford an R & D organisation of a sufficient size to be effective. Additionally it was apparent that technical personnel in the business faced so many short-term pressures that attention was being diverted from long-term development issues. Finally, we believed that there would be a significant number of developments which fell outside the total scope of any of our businesses and that these were best handled in a central organisation.

Not surprisingly, therefore, we concluded with a re-affirmation of the need for central R & D resources but noted that special attention had to be paid to integrating the central project work into the business and technical programmes of the individual business units, and into the Group strategic thinking.

Setting priorites

The fundamental problem every company, Wiggins Teape included, has to face is the need to make R & D responsive to the short and long term needs of the Group and the market place. This statement reflects the view that in the majority of actions R & D must provide, and be seen to provide, a service to the rest of the Company. The statement does not imply that R & D can abdicate the responsibility of ensuring that the relevance to the company of emerging technologies is understood, brought to the attention of business managers and acted upon.

The establishment of priorities and the development of the R & D programme depends on a high level of dialogue, discussion and mutual understanding within the whole company. We believe success in developing the R & D programme and priorites requires:

clearly defined responsibility for inception and monitoring of projects;

planning procedures which involve operating management and R & D personnel and which are based on analysis of both market and technological opportunities;

co-ordination of "bridging" mechanisms to provide a link between operating management and R & D personnel.

Defining responsibilities for projects

We believe it is important that specific individuals or groups of people, for example, the Group or a Territorial Board, are held responsible for authorising the start and continuance of individual research programmes or projects. Obviously the responsibility will be different for different parts of the R & D programme.

1. **Provision of On-Going Support of Existing Business.** Whether this type of work is carried out within the individual businesses themselves or within a central R & D organisation, the decisions on priorities, programme composition and effort allocation clearly belongs to the business management. Within this area of work however, there is a requirement that top management retain sufficient knowledge, influence and control to ensure that major but longer term technical issues are not neglected through pressure of day-to-day problem solving

2. **Provision of Fundamental Research Support.** Where this work is carried out centrally, decisions become slightly more difficult. It is a responsibility of central R & D to suggest to business management areas of fundamental work it believes would be most useful; hence the need for a central research organisation to have a clear perception of business technologies and an accurate, unbiased assessment of its own capabilities.

Equally, technical management in the business must have the opportunity to suggest other areas of work. The final decision on the programme however and the resource allocation to it, must lie with central R & D management.

3. **Development of Major New Products and Processes.** The decision making on this type of work is again a business management responsibility whether the programme is carried out by a technical function within the business or by a central research group. The only deviation from this occurs where technical and commercial success would change the business radically either in asset base, product lines or market position. In this case a more senior authority, e.g. Territorial or Group Board, is required to sanction, and then to monitor the project.

4. **New Business Projects.** Decisions on these programmes can only be at the top corporate level.

Planning and control procedures

As competition between companies and between whole industries becomes more intense, and as profitability and 'available cash' become more scarce, we are increasing the sophistication of the planning and control system used in determining the annual and longer-term R & D programme and priorities. We are seeking to ensure that expenditures are well invested and that these expenditures pay out as planned. Within Wiggins Teape we are asking that:

business management systematically and thoroughly scrutinise the economics of their business and the trends in their industry to identify where R & D efforts could make a major impact on profitability;

research management be more rigorous in identifying the technological problems inherent in R & D projects and in

assessing the impact on the projects' costs, timings and probabilities of success;

major decision points and key parameters in each project be clearly identified and the project monitored to ensure the need to re-evaluate the outlook for the project, or to revise the priority is not ignored.

Bridging Mechanisms

In order to ensure the central R & D organisation understands the technologies, competitive pressures, commercial priorities and customer needs of the individual business, we believe it is essential to have one or at the most two people for each business area to link the R & D efforts more closely with the operating business management. These link personnel also have the responsibility for 'selling' back to central R & D the need to undertake work for individual businesses.

We are currently experimenting organisationally in this area with success ranging from minor (but positive) to very major.

Conclusions

In summary, we do believe that our industry and the Wiggins Teape Group will continue to rely heavily on science and technology for its future survival and profitable growth. Following from this conclusion we have increased resources behind more fundamental work, i.e. knowledge generation, both at the Group Technical Centre and in collaboration with other organisations. Finally, we have taken steps to ensure that the work carried out is not wasted by dissipation over a range of projects, and to ensure that it is essential and required by the businesses, and that it will be implemented.

Discussion

Discussion following prepared discussion contribution from Dr. J. Mardon.

Mr. D. Attwood, PIRA, UK

Dr. Asaoka, in your preprint you discuss Japanese government subsidies to your institute. Can you tell us please a little more about this, in particular, what ratio of funding you expect from industry and from government?

Dr. H. Asaoka, JPRI, Japan

The Japanese government gives no subsidy to any industry. If the government wants work done in a particular field, it discusses this with the appropriate companies, who put up the necessary money. Thus, in general, the government doesn't subsidise any industry.

Mr. A. Ibrahim, AccuRay Corporation, USA.

Mr. Justus, references to the concept of the extended nip press can be found as long ago as 1967-68, where Wahlström and others showed that the applied pressure and its duration could be varied to achieve optimum pressing of a specific grade. This work was supported in publications of Beloit's own research. I see Beloit's development of the extended nip press as the first stage in the practical application of these results. Does your Corporation have any plans to go to a second stage, in which the applied pressure and the drainage flow are under operator control, and variable to suit the product?

Mr. E. Justus, Beloit Corporation, USA.

The extended nip press is a project on which Beloit have been working for over ten years. On a three dimensional plot, showing sheet moisture as a function of both nip residence time and nip pressure, the area of practical interest can be enlarged with the extended nip press to include nip residence times of up to 30 ms, at pressures up to about 600 psi, leading to increases in sheet dryness of some 25% over conventional presses.

Physically, the heart of the extended nip press is a curved shoe fitting beneath the press roll. It is about ten inches long in the machine direction, and loaded hydraulically to about 600 psi, equivalent to about 6000 pli in a conventional nip. There is a belt adjacent to the shoe, and the two felts and the paper sheet run between the belt and the Venta-nip press roll.

Lubrication is by oil applied between the belt and the shoe, whose mechanics are the same as those of a crown-controlled roll. The first commercial unit was assembled and run in the shop, and has been running on a paper machine some nine months. A full report will be given on it at the Tappi meeting shortly.

It is imagined that an extended nip press could be used in a liner-board machine as second after a double felted first press. This combination should give drynesses into the dryer section of above 45% dry. The advantages of the extended nip press seem to include a reduction of about 25% in the amount of water to be evaporated, and an approximately 15% increase in sheet density.

Mr. S.F. Brailsford, Reed International Consultants Ltd., UK

Mr. Justus, you implied that it was best for machinery development to be left to the manufacturers. However, surely the interests of the paper and board machinery suppliers are diametrically opposed to those of the paper manufacturers? We, the paper producers, prefer to use the least quantities of chemicals and the cheapest machines possible, which must surely be against the interests of the chemical suppliers and machinery builders. Thus I put it to the panel that the paper manufacturers find it hard to believe that it is in their own best interests to leave all R & D to the suppliers.

Mr. E. Justus

I don't want to travel with an airline that designs its own aircraft and I don't believe that in the long run it would be economical for airlines to do so. Machine building is a specialised trade, and the builders are to be commended for eliminating expensive and difficult to maintain, but very profitable, items from machinery (e.g. suction rolls).

Machine speeds have doubled on almost every grade of paper over the past twenty five years, and the cost of machinery per unit of production has increased less in the paper industry than in almost any other.

Dr. A. Mawson, Wiggins Teape, UK

Many people in paper-making argue as Mr. Brailsford, but I believe that competition forces suppliers to continue improving the performance and productivity of machinery. While I believe that discontinuous innovation is most likely to arise outside the industry, I am sure that incremental technical improvements will always come from within.

Mr. B.W. Burgess, PAPRICAN, Canada

The position isn't at all clearly defined. No organisation has a monopoly of expertise, so I don't agree with Mr. Justus that all machinery development should be left to the manufacturer.

Dr. D.A.I. Goring, PAPRICAN, Canada

Mr. Justus, is your Corporation working on air-forming for high speed machines?

Mr. E. Justus

No, and there is a reason. It seems to us that what gives paper its particular characteristics, is the hydrogen bond. Dry-forming is for speciality products, while my Corporation is in the business of supplying machinery for making commodity grades. We intend leaving dry-forming to the speciality machine builders.

Dr. A.H. Nissan, Chairman

This issue doesn't need to be polarised, and while I would hate to suppress inventiveness amongst users, I think that I am in favour of most of this development being done by machinery builders. The cost of research by suppliers can, except for royalties, be distributed over a large number of units if it is successful, whereas this is not the case of research by users.

Mr. B.W. Attwood, Consultant, UK

Mr. Justus must realise from his own experience that machinery innovation can be a two way process. His corporation has made use of ideas developed by paper-makers and developed them to levels unattainable by their originators.

On the subject of air-forming, it is important to bear in mind that it is a speciality process, not for general application. I am concerned that, unless it is being done in secret, none of the major machinery manufacturers is investigating either this or any other of several new ideas, which may be the precursors of technology discontinuities. It looks very much to me as though the main research effort at this time is into evolutionary modification.

Dr. N.K. Bridge, PIRA, UK

A report on innovation and the factors influencing it has been prepared by the Science Policy Research Unit at the University of Sussex. One of the conclusions presented there was that innovation is often initiated by users, then further developed by the suppliers. This seems very natural, and I am sure that Mr. Justus recognises the approach.

Mr. F. El-Hosseiny, Weyerhaeuser, USA

I think that the development of machinery should be left to anyone who wants to do it, though I agree that the manufacturers are likely to make a better and cheaper job of it. But paper-makers have to be careful not be inveigled into buying extremely expensive equipment that they neither understand nor need.

Dr. J. Colley, APPM Ltd., Australia

Development and innovation doesn't stop as soon as equipment is delivered to the paper mill machinery house. Most installations have an element of speciality about them, and no manufacturer can expect his machines to suit every application straight away. The last stage of development, in the paper mill, is usually conducted by the paper-maker, though with the manufacturer usually present too.

Dr. J. Mardon, Omni-Continental, USA

Dr. Justus has a valid point, from one particular viewpoint. The key to managing R & D lies not in knowing what to do, but in knowing what not to do. By tying up a lot of limited resources of expertise and equipment in machinery research you are not equipped for, your research operation will be very ineffective and you would have done better leaving it to the manufacturers. I am sure that is what Mr. Justus was referring to, as both he and I have seen many examples of it. If a paper-maker has an innovative idea, then his most effective way to exploiting it, is to develop it himself as far as he reasonably can, before taking it to the machine builder for further improvement. But to try to produce large scale pilot plant is a mistake.

Dr. A.H. Nissan

Without wishing to take sides, I will just mention that Tsai Lun, M. Robert, and the Fourdrinier brothers were all users. The twin-wire was a user development, and I think George Tomlinson was a user. But machinery builders have produced revolutionary changes also. Dr. Mardon's point about when to take a developing idea to a machine builder is important, because, whatever else, the builder does have experience of how to design and make pieces of machinery that work, and the outcome of the idea will be much influenced by whether or not it works. There isn't however a god-given law about this.

Mr. G. Place, Proctor and Gamble, USA

I believe there is a god-given law on this subject, which is that the R & D management and the general management of a company must have a very clear view of what business they are in. What I hear from Mr. Justus is a very clear view of his business, and therefore a very clear view of the research his company will undertake. If a revolutionary change does come about then Beloit either will have to have made arrangements with their research group to switch to the new technology, or go out of business. Thus the primary strategic question for a company is to resolve what business they are in, and for both R & D and general

management to see it the same way. This view of the business can be as narrow and specialised as you like, provided there isn't some discontinuous change of technology. As soon as one occurs, the view will have to be widened if the company is to remain in business.

Mr. E. Justus

A lesson I saw illustrated very well the other day during a visit to the Imperial War Museum is that the simplest way of doing a thing is the best. The example I saw was of World War II aero engines, amongst which the successful ones stood out by virtue of their simplicity and cleanliness of design. I thought this example one of the best of the artistry and rightness of design that I have ever seen.

Dr. A Mawson

The similarity between two of the engines you looked at, the Rolls and the Daimler Benz, probably illustrates a point we are overlooking, namely that we learn much from our competitors.

Dr. A.H. Nissan

Before bringing the discussion back to paper-making, I must just say that the most successful aero-engine design has been the turbine, developed by an RAF engineer, a user.

Mr. B.W. Attwood

What happens to an innovator from a paper mill who has a idea, but who can't interest anyone, either machinery builders or other paper-makers, in it? He must have something material to show them, because innovation is concerned with doing things differently.

Mr. P.E. Wrist, Mead Corporation, USA

I see a difference between invention and innovation. The innovation mentioned by the previous speaker was not in widespread, successful, commercial use and therefore was not, as I understand it, an innovation. It was only at the stage of

invention. To qualify as an innovation, as I see it, an invention has to be in commercial use.

Mr. J. Gough, Wiggins Teape, UK

Mr. Wrist, in the last diagram you showed in your presentation, demonstrating the relationship between the research resources required and the rate of growth sought, what was the scale of the x axis, the research resources? If it was percentage annual sales, then it implies that for a major breakthrough, it is necessary to spend around 6% of annual sales revenue on R & D. This is an unheard-of figure in our industry.

Mr. P.E. Wrist

Those figures were drawn from the examples firstly of a number of companies undertaking minor product development, who seemed to be spending, on average, rather less than 1% of annual sales: secondly, those who, while doing good development work, were remaining within their industries, spending 1-3%: thirdly, some examples of companies breaking into new markets. I would be the first to agree that present annual sales is a poor way of quantifying expenditure. For a conglomerate, with enormous sales, the amount required to penetrate a new market is a rather small percentage. My main point in that diagram was, to make a major breakthrough a company must spend on R & D at far higher rate than it need just to maintain market position.

Dr. A.H. Nissan

If, in a business with annual sales of $1 m, a product improvement is introduced that increases sales to $2 m, then it doesn't follow that R & D spending should double. So, this annual sales percentage issue is very misleading. I have seen only one article, many years ago, where an attempt was made to calculate, accurately, recommended levels for R & D expenditure. The calculations were involved, and required taking account of product life and profitability, amongst other things.

Mr. D.G. Croxon, Kimberly-Clark

Mr. Wrist, would you think it advisable to involve research workers in discussions of profitability, or do you believe they should be left totally in isolation, not even allowed telephones?

Mr. P.E. Wrist

I don't think taking their telephones away will much improve profits. There is an advantage in having at least the research managers know something about business and the factors that influence profit. However, that isn't their primary concern, which must be the identification of new technical opportunities to be brought to the main management's attention. They must point out the advantages, while recognising that the company is a team effort in which there are others more skilled in making financial judgements. This way lies the course to a true corporate decision on the viability of new projects. Profitability is very difficult to relate to R & D, and by loading such matters onto R & D personnel, the risk is of giving them too much to worry over, such that their performance is impaired. Still, they should be aware that making a profit is one of their company's objectives.

Dr. J.L. Brander, Wiggins Teape, UK

Expenditure on R & D is sometimes believed to be a function of what industry you are in. In other branches of machinery building 6% of annual sales is considered adequate to keep market position, without expecting any breakthroughs. I would like to ask Mr.Justus if the same is true in paper machine building?

Mr. E. Justus

6% is a lot and we would like to have a budget like that, but we don't.

Dr. M. Hussain, Abitibi-Price, Canada

From one of the charts in Dr. Asaoka's paper, I see that Japan consistently spends less as a sales percentage on R & D than we do in USA, in every industry except iron and steel.

Since we all recognise that the Japanese economy is doing better than that of the US, is there something significant in that? Also, I would like to ask Mr.Justus if he would care to comment on the suggestion I have heard, that Beloit deliberately held the extended nip press back in order to protect their foundry business?

Mr. E. Justus

The reason for the extended nip press' long development period, was arriving at a suitable mechanical arrangement that would survive in a paper mill. The belt was the most difficult part of the assembly. Our first design made use of hydrostatic rather than hydrodynamic bearings. The development has been hard work, and if you were to see our annual expenditure figures you would see that we weren't trying to hold back on it. We are in competition with the world in machinery production and if we have a development that will make more paper at lower cost, we won't hold back on it.

Dr. A.H. Nissan

The development time of the extended nip press was not unusually long.

Mr. A.G. Marriott, BPBIF, UK

There has been very little discussion about the financial justification for R & D, though it has been suggested, especially by Mr. Wrist, that it is essential for a company's survival. Would anyone of the panel like to comment on the quite widely held belief that it doesn't pay to be market leaders in an innovation, and that the second group in, the copiers, stand to do much better? The Japanese at one stage of their post-war development seemed to illustrate the truth of this.

Dr. A. Okagawa, JPRI, Japan

Japanese industry spends roughly 0.3 to 0.4% of sales on R and D, which is comparable with what is found in other countries, not less as has been suggested.

Dr. W. Adams, AccuRay, USA

We have discussed to some extent how inventions come about, before being developed into innovations. I think they usually come into being wherever a problem is well identified, and where there is stress. The greatest inventiveness is shown in time of war, or when companies are in trouble. So if people of inventive minds are subjected to stress, then inventions result. To develop further, to the innovation stage, using Mr. Wrist's definition, involves people with marketing skills. So, bearing in mind what I've said, I would like to ask anyone on the panel if they have ever tried taking their problems to their suppliers in a stressful way?

Dr. A.H. Nissan

Can anyone on the panel define "a stressful way"?

Mr. P.E. Wrist

The big thing that helps change an invention into an innovation is an identifiable market need. The chance of rapid adoption of an invention when there is a need for it are great. This shows in statistics too, such that some 80% of innovations can be shown to be in response to previously identified market needs, whereas only 20% arise without a market need. That doesn't mean that the latter group is unimportant, because when such inventions finally gain acceptance they often provoke change, revolutionary rather than evolutionary.

Lasers are a good example. For years after their development they were virtually unexploited, yet now we see that they will probably be at the heart of the next revolution in communications technology. We need both kinds of inventions, but in an industry where it is important to make a profit every year, it is probably better to look for inventions that meet market needs, rather than the other sort.

Mr. E. Justus

If a customer with an invention wants to provoke a response from us, then his best chance is to spell stressful "M-O-N-E-Y".

Dr. A.H. Nissan

On that, which defines the essence of all our involvement in the industry, I think we should call a halt.

Today we have had fourteen panelists give their views on various aspects of R & D, and I think that the fact that I have had to cut short the discussions must testify to the high standard of their various presentations. Thank you for putting such efforts into the preparations.

Concluding Remarks

Mr. M.I. MacLaurin

Firstly, I want very much to thank Dr. Nissan for so ably chairing today's proceedings. It required much preparation and hard work, but the results have well justified the effort. So, on behalf of us all, Alfred, thank you.

Thank you, also, the Engineering Dept. Staff who have been working behind the scenes, handling the audio equipment and projectors, as well as the very efficient people, Sandra and all the UMIST students, who have been doing all the microphone work, and the two girls, Katherine and Dawn, who have been manning the front desk.

I will be brief in closing this symposium because many people have a lot of travelling to do this evening, and I want to sustain our reputation for being on time. But I shall speak for a few minutes about the next, the eighth, to be held in 1985.

Firstly, a large number of delegates has in fact responded to my request for opinions yesterday, and it is quite clear that we shall be at Oxford unless some compelling difficulty arises. We shall start investigating right away, to see how things can best be arranged to overcome some of the problems we have had here. But is does seem that a majority would prefer being at Oxford.

Secondly, this particular meeting in its first morning and its last day, has departed somewhat from the tradition of these symposia, and I think that format has been timely for 1981, especially as regards todays discussions. However, I think it is not something we shall repeat too soon, and the 1985 meeting will

be essentially scientific throughout, with a return to the format of previous symposia in the series.

Thirdly, you may recall that, in my opening remarks on Monday, I suggested we didn't need a theme for 1985. Well, even before the first working session Dr. Rance had put his disagreement on record, and it has become clear during the week that most people here disagree with me on that. So I am now persuaded of my folly and publicly repent.

What really convinced me was the emergence during the week, based upon a lot of help from everyone, of an idea for a theme, endorsed by the committee. We shall have to sort out the wording of it, but, as we all know, the paper-making processes and the properties of paper products depend very much on the properties of the pulps we use and the processes by which we prepare them. In 1985 we intend to bring those relationships together as the theme for the symposium. If anyone has ideas about this, even if you think it is utterly wrong, I would like you to write to one or other of the committee.

Now, all that remains to be said is thank you to everyone for taking part in the week's events. Travel home safely, and let's all meet again in 1985.