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Management of the Industry/Research Organisation Interface

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ABSTRACT

The purpose of a consultancy undertaken to assess management processes in research projects to improve communication between research organisations and the mining industry through the development of an improved mode of operation and customer interface is discussed. The consultancy was conducted using the Nadler and Tushman Congruency Model of Organisational Behaviour to asses components of a project's inputs, transformation process and outputs for their degree of congruence or 'fit'. As an example the University of Queensland (UQ) managed ACARP Project 'Maximising Coal Production in the Presence of Hydrogen Sulphide (H_2S) Seam Gas' was used for illustration. An action research process was used to collect data on the project organisation and history, observations made of group project meetings and interviews undertaken with project staff and representatives of the mining industry and the UQ. The findings highlighted major differences in culture between the university and industry, inadequate planning and strategy development, ineffective intergroup communication, high and conflicting demands on time, and in some cases a poor fit between individuals and tasks. Recommendations proposed to address these issues are presented as two groups, those applicable to the current H_2S Project and those for future similar research projects. They involve improved strategies for intergroup and interpersonal communication, role clarification, project administration and organisational learning and assessment. The proposed interventions are relatively simple, easily implemented and inexpensive. They have the potential to improve the fit between the components of the organisation as well as between the organisation and its environment, enhance efficiency and effectiveness and improve the relationship between the university and industry to ensure future collaborative research projects and access to external funding.

KEYWORDS
Mining, mine ventilation, Hydrogen Sulphide, research management, strategies for university industry research interface

INTRODUCTION

This paper came about as the result of a post graduate student consultancy for Queensland University of Technology (QUT) into the management of processes of research projects between the University and Industry. The Consultancy was based on a specific project 'Maximising Coal Production in the Presence of H_2S Seam Gas'. This project was undertaken by a UQ project team. The project was directly funded by ACARP and two mines, which were mining in H_2S affected coal. The project was indirectly funded by the two mines through provision of information, samples and sample analysis and by UQ through provision of research facilities.

The H_2S project team leader was from the UQ Department of Mining, Minerals & Materials Engineering. The research group consisted of staff and students from this department, and from the Department of Chemistry, the Department of Earth Science (Geology) and two external consultants. Four ACARP Monitors, two representing the mining companies, one "independent" monitor from industry and an ACARP monitor, evaluate the research progress. In addition, the research group liaises directly with the two mining companies.

The Client for this consultancy was the H_2S research team with sponsoring and monitoring bodies forming the external environment. This is represented in Figure 1.

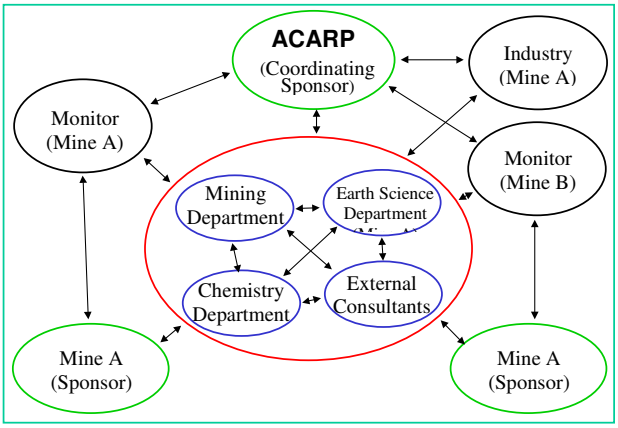

Figure 1. Model of H_2S research group organisation

The opportunity to conduct this consultancy came about through one of the industry monitors. The client had expressed concerns that some aspects of the management, organisation and communication within the H_2S project were not being carried out in the most effective way. The consulting team was approached to assess the internal and external environments and liaise with the client to develop a change program to improve the organisational effectiveness of the H_2S project

CONSULTATION PROCESS

The consulting approach used was the Schein Process Consultation Model. This model can be defined as: "*a set of activities on the part of the consultant that help the client to perceive, understand, and act upon the process events that occur in the client's environment in order to improve the situation as defined by the client" (Schein, 1988).*

An external consultancy was chosen because of the diversity and complexity of the project environment and limited internal resources to address process issues. This organisation had expert technical knowledge, skills and abilities but limited management process knowledge and experience. The consultative process method assumes that the while the client has constructive intent to improve the situation assistance is needed in:

- identifying the type of help available
- diagnosing what the problems actually are
- knowing what to improve and how to improve it (Schein, 1988)

This process also implies that for organisations to be more effective they should learn to diagnose and manage their own strengths and weaknesses. The consultants do not have the capacity to acquire enough information about the culture of the organisation into the diagnosis without actually participating in the client organisation. Such a situation could lead to interventions that are incorrect or resisted because they have been initiated by an external person. There are also time limitations regarding the amount of contact that the consultants will have with the project team. Therefore it is important for the client to learn to see the problem for him/herself and think through the interventions so that he/she is then able to implement the most appropriate solution.

Schein (1988) describes an essential component of the process consultation as the learning process that ensures that the client is able to continue to diagnose and fix problems by him/herself to improve the organisation. Implicit in this model is the notion that all organisational problems fundamentally involve human interactions and processes. While technical and financial matters may be involved there is always human involvement in the design and implementation of these processes (Schein, 1988).

This consulting approach can be justified as it can create a mindset change that assists in the development of the abilities of the people within the organisation. The university is an increasingly changing environment and one of the many challenges that are of concern is its ability to attract funding from industry for research projects (Turpin & Deville, 1995). At the core of this issue there are some communication failures and cultural misunderstandings that prevent parties from looking at this issue in a common way and therefore making it very difficult to deal with the situation in a constructive manner. Process consultation holds promise as a way of helping groups reach higher levels of consciousness that will promote organisational learning thereby increasing the creativity and effectiveness of the organisation.

Organisations learn within the set of assumptions that characterise their current culture and situation (Schein, 1993). When the circumstance changes and involves different cultural assumptions or learning across sub-cultural boundaries, communication must be viewed as a crucial element to learning. This applies to the H_2S project team due to its multidisciplinary nature and involvement with industry.

The consultancy group took the view that Schein's Process Consultation Model was an appropriate consulting approach for the H_2S Project Group because of the research group's need to be aware of their own environment and the external environment. The significance of this awareness relates to the interdependent relationship that exists between university researchers and industry and their need for healthy relationships for their future viability. The H_2S Project Group would have to develop the capability of continually learning from their experiences to reshape their future. This would involve developing skills to identify weaknesses and strengths and to seek and implement appropriate solutions to problems.

Kinlaw (1989) suggests that coaching can be a key strategy to building and diffusing learning capability within an organisation. Schein's process consultation model has similar supportive characteristics and has the potential to assist the H_2S Project Team to be more effective by helping them to learn to diagnose and manage the situation themselves (Schein, 1988).

PROJECT DEFINITION

The consultancy team was asked to assess the management processes of the research project, for the purpose of improving the communication between UQ and the mining industry, through the development of an improved mode of operation and customer interface for the research team. This is of significance as it has the potential to affect the future funding of other research projects. Discussions held at the commencement of the consultancy defined the issues to be addressed as follows:

- difficulties with managing the internal aspects of the project eg accounting, reporting, internal communication and meetings
- ways to improve the communication and cooperation between the diverse groups involved in this project
- researchers generally have fractional or part time appointments to the project - ie limited time to dedicate to the project
- perceived "unrealistic" expectations of external stakeholders as to the ability to provide research outcomes within time frames.

The confidentiality requirements of the client were adhered to, as agreed upon during initial discussions. Issues identified from individuals were noted in confidence and analysed in general terms only. Comments regarding the technical aspects of the research project were not included in the data collection or this report.

A process of ongoing liaison and feedback between the consulting team and the client was agreed upon and encouraged. Access to all members of the H_2S project group was possible, with some limitations due to distance. Before the consultancy commenced an agreement was obtained from all parties to the proposal.

CONCEPTUAL CONTEXT

The consultancy was conducted using the Nadler & Tushman Congruence Model of Organisational Behaviour. This model provides a road map for understanding challenges to the project team, collecting information, interpreting that information and the development of appropriate action plans. Nadler & Tushman (1980) have developed this model within the open systems framework.

French & Bell (1995) describe systems as a set of interrelated elements and this implies that a change in one element affects other elements. An open system is not only a set of inter-related elements but it also takes input from the environment, and transforms the input to produce output. In other words, an open system interacts with its environment. For the system to perform well each of these three system processes must be effective (French & Bell, 1995).

It is appropriate to consider the H_2S project team in terms of systems theory because it demonstrates a range of open systems characteristics. Those characteristics include the open nature of the H_2S Project and its active exchange with the surrounding environment. For the purposes of the analysis, the H_2S project has been considered as a virtual organisation, with a limited life and created for a specific purpose. The organisation includes the H_2S Project Team, as indicated in Figure 1, consisting of the Mining, Chemistry and Earth Sciences Departments and external consultants. The degree of congruence or fit between the organisation and the external environment and industry is examined closely as well, as it appears to significantly impact on the overall effectiveness of the non-technical aspects of the H_2S project. This is demonstrated by the high level of interdependency, interconnectedness and interrelatedness that exist between the elements of the H_2S Project Team.

The Nadler and Tushman model considers organisations in terms of inputs, the transformation process, and outputs, placing greatest emphasis on the transformation process and the interdependence between system elements. Inputs are considered in terms of the environmental context, resources required, the history of the organisation and its strategy. Outputs involve what the organisation produces, how it performs and how effective it is. The transformation process operating within the organisation includes the tasks required, the individuals involved, and the formal and informal organisational arrangements.

The Congruence Model allows the consultants to assess the degree of congruence or "fit" between these individual components. Nadler & Tushman (1980: 39), describe this "fit" as "the degree to which the needs, demands, goals, objectives and /or structures of one component are consistent with the needs, demands, goals, objectives, and / or structures of another component". The effectiveness of the organisation is based on the quality of these congruencies or "fits".

In addition to providing a conceptual framework for analysing organisations and organisational processes, Nadler and Tushman's model provides a process for organisational problem analysis. The basic problem analysis steps using the congruence model recommended by Nadler and Tushman were employed. The steps in this process conform well to the action research methodology, which was adopted for this consultancy.

Collected data from interviews, observation and surveys has been analysed according to the Nadler and Tushman model. "This model's major premise is that for organisations to be effective, their sub-parts or components must be consistently structured and managed - they must approach a state of congruence" (Nadler & Tushman, 1980:37). A number of sub-models have been adopted to more specifically define and explain the level of congruence in certain areas

One of the limitations of this model in analysing the H_2S Project is that it fails to consider the impact of the environment of associated organisations upon the team. The H_2S Project Team does not exist in a vacuum. It is embedded within the larger organisational context of industry and the university. Impacts that affect both of these organisations have the potential to be of great significance to the H_2S Project Team. Other university support organisations such as Research Services and the consulting arm, UniQuest do not have a direct association with the H_2S Project Team but, have a potential connection and therefore cannot be ignored in terms of congruence analysis. The consultancy group therefore has expanded the Nadler & Tushman Model to include a congruency analysis of associated external organisations and the H_2S Project Team. The importance of this inclusion can be supported by a statement from Stace & Dunphy (1994) that attributes the removal of organisational boundaries, that inhibit effective optimal group performance, to ensure growth and survival. For the H_2S Project Team, external organisations imposed considerable boundaries that impacted on the effectiveness of the team's performance.

METHODOLOGY

The methodology adopted for the consultancy is an action research process. This approach follows a process of:

1. systematically collecting research data about an ongoing system relative to needs of the system, that is, data gathering and diagnosis,
2. feeding the data back into the system,
3. taking actions by altering selected variables within the system based on the data and on hypotheses, and
4. evaluating the results of actions by collecting more data.

The advantages in using an action research process for this particular project stem from the following features:

- encourages a problem solving approach (scientists are used to utilising this mode of inquiry)
- the collaborative component of action research lends itself to a form of team building
- people tend to use the findings because of their involvement, thus creating behavioural changes that will be lasting
- this method of data collection and problem solving is usually economical.

Some difficulties, as described by Lippitt & Lippitt (1978) include the necessity of obtaining support from people within the organisation, the consultant losing some decision-making power and the possibility of bias for direct involvement. The consultancy group was able to deal proactively with some of these factors. Included in the consultancy group was one of the industry monitors, who was well known to both industry workers and university researchers in the formal role as project monitor (and informally as industry / university liaison). This enabled the consultancy team to very easily gain a rapport with and support from the client, researchers and mining industry personnel. The boundaries of the contract were also negotiated and upheld with a particular emphasis on maintaining the confidentially of all who participated in the data gathering exercise. This built up a measure of trust and openness between the H_2S project group and the consultants.

The interview process followed a variation of convergent interviewing, as described by Dick (1986). This process is an action research technique and was utilised to aid in verification of the findings. Interviews were structured using broad questions to initiate the interview process and to define the approximate topic without leading the interviewee in any particular direction. Probing questions were determined from the information given by the interviewee. In later interviews probe questions were used to verify data from previous interviews and to clarify uncertainties.

At the beginning of each interview the interview team was introduced and a short summary about the purpose of the consultancy and the purpose of the interview was given. It was also emphasised that all information obtained during the interview would be treated confidentially. Any references to findings from the interview would be referred to in generic terms so as not to identify any particular individuals.

Two people generally conducted each interview. The purpose of this allowed the person who was asking questions to maintain eye contact and attention. This aided in building up a rapport with the interviewee. Notes were recorded where and when it was appropriate to aid with recall of information. Interviews lasted for about one hour. At the end of the interview a verbal summary of the main findings was made and the interviewee invited to follow up on any ambiguous issues.

Each interviewer then independently documented the findings and interpreted the results. Notes were then compared and as common themes emerged more specific probing questions were asked in subsequent interviews.

The stages of the data collection were:

1. Interviews with sample of target population - key representatives
2. Interviews with sample of support researchers
3. Observation at project group meeting
4. Interviews with sample from mining industry
5. Interviews with University of Queensland sample
6. Interviews with University Research Services and UniQuest
7. Survey of remaining target population from research and mining groups
8. Review of project documentation and project group history.

The collected data was assessed according to the basic problem analysis steps recommended by Nadler & Tushman (1988). It included the additional component of associated organisations as recommended by the consultancy group.

The steps were:

1. Identify symptoms
2. Specify inputs
3. Identify outputs
4. Identify problems
5. Describe components of the organisation, (task, individuals, formal organisational arrangements, informal organisation, associated organisations)
6. Assess congruence (fits)
7. Generate and identify causes
8. Identify action steps (interventions).

Following data collection and analysis, a focus group consisting of key persons from each discipline responded to recommendations and tested the appropriateness of conclusions. This was a successful activity, providing some valuable feedback and comment which was then incorporated into the revised interventions presented to the client for review.

DATA COLLECTION AND ASSESSMENT

Data collected was analysed according to the Nadler & Tushman model of organisational fit. A preliminary set of findings were tested with the focus group, reviewed and presented to the client for comment and review.

Various pairs of components of the H_2S project were assessed for congruence based on the data and interpretations. Only Step 6. “Assess Congruence”, of the problem analysis model will be discussed here

The major findings of the data collection stage are summarised in Table 1 and form the basis of the congruence assessment.

Assessing Fit:

A. Individual/ Organisation

There are problems with the project in terms of project planning; detailed goals, objectives and strategies have not been clearly defined or communicated. Because this was not addressed at the beginning of the project, it has led to ambiguity and conflicts of interpretation between the research group and industry.

Table 1. Major findings

1. Intergroup communication needs improvement • Many commented that they did not know where others were at • Seemed to be little, if any, communication between departments • Meeting process not effective
2. Poor fit between individual and task in some cases • Technical skills generally fit well, however organisational skills and people skills need developing
3. High demands on time • Everyone has many demands on their time in different capacities and it is hard to balance all of these • Most research staff are fractional appointments
4. Inadequate planning/direction/strategy • eg financial accounting • Unclear directions, related to task • Planning not evident to industry and outside bodies
5. Differences in Cultures, Values and Norms • Expectations, culture and values of industry and research groups differ widely.

There is ambiguity in the project structure. This had led to role ambiguity and confusion about how roles should be performed as well as indeterminate and conflicting expectations. It is particularly apparent for newcomers to the project. Lavan, Welsch & Full (1981) explains that role ambiguity is linked to the complexity of the organisation as well as restricted channels of communication, both of which are evident in the H_2S project.

B. Individual/Task

Significant issues related to management/administration of the project are best explained as role conflict. Lavan et al (1981) identifies role conflict as being linked to the lack of compatibility with the role as well as the experiences of dual hierarchies of authority. Turpin and Deville (1995) point out that one of the increasingly difficult challenges for academic staff in universities, is to strike a balance between research activities and responsibilities to external funding bodies. The research staff, generally possess the technical expertise to fulfil research requirements. However because of the high level of task interdependence, more attention should be paid to detailed planning, coordination and communication as well as ensuring the project administrator has sufficient time and skill to fulfil that particular role, without conflict with other duties. Political forces are evident

C. Individual/ Informal Organisation

The complexity of the project, together with poorly defined roles and structure resulted in informal structures being adopted in some areas. Communication and coordination have been facilitated through the evolution of an informal industry/research group liaison role. While solving the immediate problem, it did however further exacerbate the already diffuse leadership of the project.

D. Task/Organisation

Many aspects of the project associated with the individual/ organisation fit contribute similar challenges in this area. This is primarily due to the conflicting demands of, and the lack of communication between the research group and industry. Ambiguity about scheduling and reporting has added to the stereotypical views each group holds of the other. It is important to note that while the research/technical task and organisation fit is good, the organisational arrangements do not meet the management/coaching and communication needs, both internally between groups and external between industry and research.

E. Task/Informal Organisation

As previously discussed, the development of an informal industry/research liaison role has facilitated task performance at the expense of clear role and structure definition elsewhere. The lack of alignment, in some cases, of the individual goals and project goals is having a detrimental effect on task accomplishment.

F. Organisation/Informal Organisation

The H_2S project can be considered as a formal, team based organisation, over which there is an informal imposition of the formal, hierarchical university organisation. Difficulties have thus been caused by the lack of congruence between the goals, rewards and structures of the two. The project has the goal of solving the hydrogen sulphide seam gas problem in mining, while seeking extrinsic commercial rewards and operating within a networked structure. The university by comparison, has the goals of generating and disseminating knowledge and acquiring external funding to do so. It seeks intrinsic peer recognition rewards and operates within a hierarchical, bureaucratic structure.

G. Extending the Nadler & Tushman Model

For the H_2S project, a great deal of the organisational effectiveness relates directly to the fit between the research group and its external environment, the industry. For this purpose, we have extended the congruence model to include an analysis of the fit between research and industry.

The data analysis identified a range of issues that are best explained as differences in culture, values and expectations of the research and industry groups. In many ways, these underpin other areas of incongruence. Turpin and Deville (1995) note that universities have undergone significant organisational change during the past decade, being pressed to attract an increasingly large proportion of their research budget from industry. As such, university staff, have needed to develop alliances with groups that were previously considered outsiders. In such an environment, university staff face changes

in the types of reward criteria, modes of communication, forms of capital and legitimising authority (Turpin & Deville, 1995) whilst industry struggles with finding solutions to commercial problems and competitive advantage.

Table 2. summarises the range of views expressed regarding industry versus research and demonstrates clearly the large gap between the culture needs and expectations of the two groups, which contributes to a lack of congruence.

Table 2. Culture, needs and expectations of research & industry

RESEARCH	INDUSTRY
Academic freedom of thought	Efficiency
Can't put research into time frames	Value for money
Generates & disseminates knowledge	Mines coal & generates profit
Need funding for survival of uni/dept/job	Need outcome to solve commercial problem
Autonomy in research discipline	Some hostility re levy
See industry as bureaucratic, demanding and not understanding of research	Expect accountability and business-like approach
Historically, reviewed by peers not outside bodies	Feel researchers are poorly organised, get off track and don't finish on time
Academia culture and university environment	Blue collar/heavy industry environment & culture

RECOMMENDED INTERVENTIONS

Improvement Strategies and Action Steps

These suggested interventions are divided into two groups: those applicable to the current H_2S Seam Gas Project and those for future research projects. This subdivision is based on the potential effectiveness of the intervention according to when applied in relation to the life cycle of the organisation (Randolph & Posner, 1982). When studied, the H_2S project was considered to be in the mature phase of its life cycle. As such, only those improvement strategies, which are most likely to impact positively on this project, have been selected, with the remainder to be implemented for future projects of a similar kind.

Overall, the purpose of the interventions is to improve the "fit" between the components of the organisation and the organisation and its environment, to enhance efficiency and effectiveness. With the H_2S "organisation", we believe that there is a second purpose which is to improve the relationship between the university and industry to ensure the future survival of collaborative research projects and access to funding.

A model of the improvement strategy process is demonstrated in Figure 2. This shows a desired shift in thought process and focus from what is known by theorists as a Political Management Framework, characterised by issues relating to the allocation of scarce resources, territory and conflict, to a more Human Resource Framework, emphasising the interdependence between organisations and people and the fit between the goals, values, skills and roles needed to achieve organisational goals. This would better support the teamwork required in the networked structure of the H_2S organisation, which appears typical of multidisciplinary activity based projects.

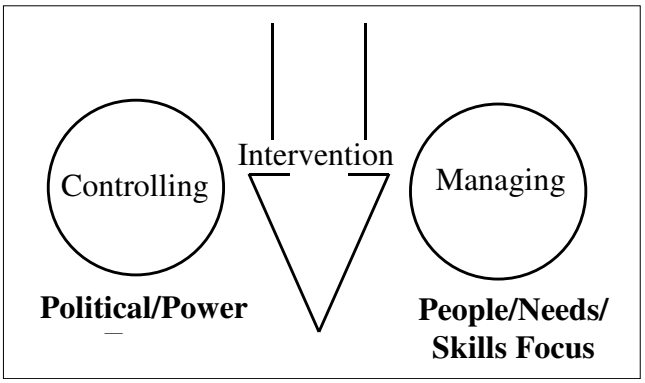

Figure 2. Model of purpose of intervention strategies

Secondly the aim is to reduce the "distance" between industry and research cultures, values and expectations. The differences cannot be eliminated, however effective implementation of improvement strategies should bring the two groups closer together, and enhance the understanding of each others' unique needs and characteristics and raise the level of trust and cooperation.

It should be stressed at this stage, that there are many similarities between the areas for improvement in the H_2S project and for industry-funded, university-based research projects in general. The hierarchical and bureaucratic university structure and the general scarcity of both time and financial resources, promotes a political management framework in which power and control are the primary focus. For the H_2S Project however, where networked interdisciplinary research imposes a high level of interdependency, a human resource framework is more appropriate. This framework focuses more on the needs and skills of people, with an emphasis on managing rather than controlling, and addresses some of the incongruencies identified in the data analysis.

Despite the major differences between the two frameworks, intervention strategies to facilitate the transition from one to the other can be readily applied. Through a series of relatively simple, easily implemented and inexpensive interventions, most of the issues can be addressed.

Improvement Strategies - H_2S Seam Gas Project

Of all of the improvement strategies listed below, those associated with improving communication at all levels would provide the greatest potential for improvement, closely followed by project administration issues.

The proposed strategy relates directly to the findings of the data analysis and addresses the "underlying cause" of the specific issue, with action steps identified as sub-points.

1. Intergroup/Interpersonal Communication

a) Intergroup meetings:

Implement more frequent meetings, ensure the key person/s from each department is/are able to attend. Each department should hold its own internal meeting to gather information prior to intergroup meetings and after to disseminate information. Circulate a meeting agenda and keep to allocated times, agenda items should include reporting, decision making and feedback components. Record and circulate minutes of meetings and ensure that items are actioned and follow up on previously actioned items. Where appropriate, use visual and handouts, Designate responsibilities of chairperson

b) ACARP/Industry and University Meetings

Increase frequency of meetings, ensure optimal representation at meetings of key persons, who then feedback to other members

2. Role clarification and responsibility charting

a) Project Management/ Administration

Ensure project manager/ administrator has sufficient time to fulfil the duties of that role, and if not, delegate those duties to others. Overall, ensure that each of the responsibilities are completed by someone suitably skilled

b) Researchers roles and responsibilities

Clarify skills and technical expertise required, and the role and responsibilities of that person, ie ensure everyone knows what they are supposed to be doing, including those who should attend meetings, disseminate information, coordinated departmental discussions. Ensure new staff understand their role and the role of others as well as the overall project goals and objectives

3. General Administration

a) Scheduling

Prepare and communicate a more a detailed schedule of progress points/milestones for research activities, to improve accountability and internal and external communication

b) Reporting

i) Progress & Results

Increase frequency of reporting to industry and internally, and ensure that contracted reporting times are met. Set guidelines for content, length and frequency of reporting. Ensure feedback on reporting process occurs.

ii) Financial

Identify strategies to overcome the limitations of the University of Queensland's bureaucratic accounting systems. Adopt a standardised approach to the accounting across departments. Keep records up to date. Designate who is responsible for maintaining accounts in each department.

4. Organisational Learning

Institute a process of continuous evaluation and feedback, to accommodate emerging issues and to maximise efficiency. Learn from successes and failures and understand how to do things better next time.

Additional Improvement Strategies for Future Projects

Future collaborative, multidisciplinary projects will benefit enormously from the successful and early implementation of the project administration and communication strategies. If "the rules of the game" can be clearly established at the project outset and an appropriate project administrator appointed to deal with the numerous cultural, managerial and communication issues, the researchers will be able to concentrate on their important research activities while the project runs efficiently and effectively

1. Project Management/Administration

a) Larger projects

Appoint an independent project manager who has the demonstrated skills to manage a project of the type undertaken, with an ability to act as a "go-between" for industry and researchers. This person will handle all the administrative and organisational aspects of project, leaving researchers to concentrate on the research components, thus freeing up some of their valuable time. Ensure that this is adequately budgeted for when seeking funding. Consider also the added value contributed by this person with regard to legal issues, contract arrangements and intellectual property. Clarify the roles and responsibilities for the project manager for the project.

b) Smaller Projects

Select an internal project manager who has either undertaken formal project management training or who has demonstrated skills and ability to manage a project of the type being undertaken. Ensure this person has sufficient time to fulfil the role and responsibilities. Clarify the roles and responsibilities for the internal project manager for the project.

2. Intergroup/ Interpersonal Communication

a) ACARP/Industry and University

Implement a mechanism to resolve any intergroup conflict, through improving communication, building trust and understanding of each groups needs and expectations. Ensure

project manager has the skills to manage the differences in culture/values between the two groups. At commencement of project, set the "rules" up front, to ensure everyone understands what is expected of them and any relevant limitations or anticipated obstacles. Researchers to include more information regarding roles/ skills and expertise in the project proposal, not just the technical aspects. Industry to provide documentation outlining their expectations, scope, timeframes, involvement, penalties.

b) Intergroup

Conduct an induction program at commencement of, or entry into project to clarify project objectives and individual roles and responsibilities.

3. General Administration

a) Strategic Planning

Set clear goals, objectives and strategies for the project and ensure that these align with the project aims and individual skills and objectives. Communicate these to entire project team and industry sponsors.

b) Structure/Roles

Clarify roles needed for project and ensure that these fit with the knowledge, skills and abilities of project team, including both technical and organisational/management skills.

c) Scheduling

Produce both broad and specific progress points (and milestones if appropriate) to permit measurement of project achievements.

d) Resourcing

Create flexibility in funding allocation to resource emerging issues and changes to priorities/planning identified during the feedback and evaluation process. Optimise resource efficiencies by coordinating group resource requirements eg bulk purchasing and sharing resources.

4. Final Project Evaluation

All stakeholders to formally evaluate aspects of the project at its completion including process and outcomes. An independent third party to facilitate the process. Ensure that the results of the evaluation form part of the planning for future projects - ongoing learning.

IMPLEMENTATION PLAN

Successful implementation of the improvement strategies and actions detailed in the previous section is vital to improving the effectiveness and efficiency of the H_2S project and an important step towards reducing the "distance" between research and industry bodies.

The way people operate is generally a learned behaviour. Within academia and the coal industry, current behaviour patterns have been learnt and internalised over a long period of time. It will take a planned, deliberate and gradual process to change them to a new way of thinking and behaving.

Education of both industry and the research group is an important component of the implementation, so that each party can be made aware of the different perspective from which each view the world. Rokeach (1968) proposed that the similarity or congruence between group's belief systems is an important determinant of their attitudes toward one another. In addition, Fandt (1991) notes that the most complex interdependent behaviour patterns exist when, as for the H_2S project, tasks must be completed through collaborative teamwork.

The implementation process should create and nurture a learning organisation, initially facilitated by an external consultant and then passed to an internal facilitator. The role of the consultant would be one of coach or catalyst and he/she would need to be suitably skilled. The facilitator would work jointly with the H_2S project group to define the areas they wish to address, and select specific goals and actions for reaching these goals. The actions would be implemented and evaluated, with the results fed back into the group and appropriate variables altered based on these results.

Suggestions for implementing the improvement strategies for the H_2S project involve activities aimed at addressing the major issues of intergroup/ interpersonal communication, role clarification, project administration and organisational learning and assessment, and are summarised in Table 3.

The implementation plan can be evaluated using a double loop feedback system and the effectiveness of the interventions can be evaluated by assessing whether problems or mistakes are perpetrated, or are overcome, and organisational effectiveness improved.

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Table 3. Improvement strategies for H_2S project

Activity	Involving Whom	Goal of Activity
Meeting observations and debrief	External consultant/ facilitator with project administrator and key researchers	To identify areas done well and areas for future improvement
Meetings workshops	External consultant/ facilitator with project administrator and key researchers	To develop and build on meeting and group dynamics skills
Role analysis activity	External consultant/ facilitator with all project	Workshop/brainstorm to identify perceptions of roles and expectations of roles -> clarification
Culture, needs and expectations workshop	External consultant/ facilitator with representatives of H_2S group and industry	To explore people's expectations and understandings of each group, to build trust and greater communication, begin the shift in frameworks/models of organisational processes
Project management seminar	External consultant/ facilitator with project leader and key researchers	To educate re the important issues in administration of the project, and identify barriers and methods of overcoming these - a group activity
Organisational learning activities	External consultant/ facilitator with representatives of H_2S group and industry	To develop understanding of the basic skills required for double loop learning and workshop how it can be applied to facilitate project effectiveness
Preparation of Future project documentation/ agreements	External consultant/ facilitator with representatives of H_2S group and industry	To work with both groups to ensure project adequately addresses project management/administration needs, communication and cultural issues that the rules are "set up front" and any differences are negotiated and resolved at this time.
Hand over to internal facilitator	External consultant/ facilitator with internal facilitator/s	To outline the role of the facilitator and skills required - support them as needed during the remainder of the implementation process.

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