



# SUBMISSION TO THE REVIEW OF AUSTRALIAN HIGHER EDUCATION

**(JULY 2008)**

The AusIMM

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## **PART A**

### **1. The AusIMM**

The AusIMM is the leading organisation representing minerals sector professionals in the Australasian region, primarily in the disciplines of mining engineering, metallurgy and geoscience. We have more than 9,100 members spread across industry, government and academia, of which 1,255 are student members currently enrolled in undergraduate studies.

Given their technical expertise and first hand practical experience of the sector, our members are uniquely placed to comment on higher education outcomes that are needed for an economically, socially and environmentally sustainable minerals sector in Australia.

As a professional organisation whose members have an ethical duty to put the community first, The AusIMM constitutes a forum through which technical experts in the minerals industry can comment on policy for sustainable industry, free from private and sectional interests.

### **2. The AusIMM Activities: Continuing Professional Development, Higher Education Outcomes and Professional Standards**

Our services and infrastructure are closely linked with higher education provision in Australia and with regulation of professional standards. We are active in providing:

- Continuing Professional Development
- Support for University Students
- Assessment of Professional Standards
- Recognition of Minerals Related Higher Education Programs

#### *Continuing Professional Development*

The AusIMM's primary mission is to facilitate the professional excellence of our members. To that end we offer a comprehensive professional development program incorporating:

- Conferences
- Technical workshops
- Publications
- Online Resources (podcasts etc)

Given the remote and decentralised nature of mining operations, the role of The AusIMM in facilitating knowledge transfer has been essential to Australia's mining success. That is, mining is a knowledge based industry, and the relative competitiveness of our industry is dependent on continuous innovation. The recently released Productivity Commission Report on Public Support for Science and Innovation stated that "over time the Australian mining industry has built up a competitive advantage by applying leading edge technologies, which have improved mining practices, reduced costs and increased productivity."<sup>1</sup>

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<sup>1</sup> See Chapter 6, 'Commercialisation and Utilisation', Productivity Commission, 'Public Support for Science and Innovation Draft Research Report (2 November 2006) at <http://www.pc.gov.au/study/science/draftreport/index.html> .

### *Support for University Students*

The AusIMM plays a strong role in supporting higher education students to become excellent minerals sector professionals. Our activities in support of students include:

- Delivering a comprehensive scholarships, grants and awards program for undergraduate and postgraduate students
- Providing administrative support for AusIMM student chapters and maintaining their link with AusIMM branches – communities of active professionals who are able to mentor them and provide career advice
- Developing material on careers available in the sector and career pathways

### *Recognition of Minerals Related Higher Education Programs*

The AusIMM also reviews programs of study that offer a large number of minerals related units and grants recognition to those programs which equip graduates with the necessary knowledge and skills to become world class minerals sector professionals. Having achieved AusIMM recognition, such programs are clearly identifiable to prospective students, employers, educators and the wider community.<sup>2</sup>

### *Assessment of Professional Standards*

The AusIMM is involved in formally assessing professional standards through our own Chartered Professional Program. We have also undertaken to assist Government by providing the following services:

- Assessing entity for the registration of professional engineers to practise in Queensland.
- Assessing Authority for the purposes of skilled migration of metallurgists and geologists

## **3. Stakeholder Consultation Undertaken in Relation to the Higher Education Review**

The AusIMM operates along a democratic structure, incorporating an Elected Board of Directors, and discipline specific Committees and Task Groups dedicated to particular activities.

Responses to this review were obtained by the following means:

- Direct input to the submission from discipline-specific Committees in the areas of Geoscience, Mining Engineering and Metallurgy
- Individual input from members following a call for feedback in our weekly e-newsletter
- Consultation with students and academics at The AusIMM New Leaders Conference

We also ran a comprehensive survey of academics, students and industry to gauge their views on key issues raised in the discussion paper.<sup>3</sup> We received more than 50 responses each from students and industry, and 13 responses from academia, including several Heads of Department. The findings from the survey will be canvassed in greater detail in our responses to the *Questions for Discussion*. However, in general, the key issues that were consistent across all stakeholders were as follows:

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<sup>2</sup> For a list of recognised programs, view Appendix 1 'AusIMM Recognised Programs'

<sup>3</sup> For the hyperlinks to each of the Surveys (for academia, students, industry) view Appendix 2

- **Funding for minerals related programs is grossly inadequate, and this is due to the structural disadvantage accorded to small, capital intensive programs under the current funding model**
- **There is insufficient practical and hands on learning being undertaken by students in minerals related programs**
- **The decline in quality of some minerals related programs coupled with the current climate of skills shortage has made it increasingly difficult for experienced professionals to mentor graduates to fill the ‘knowledge gap,’ leading to an overall decline in productivity**
- **There is a significant decline in the number of postgraduate students and a lack of research succession planning in minerals related schools**

The AusIMM also consulted with external bodies including the Queensland Resources Council and the Australian Geoscience Council prior to making this submission.

#### **4. The Importance of the Minerals Sector as a Driver of Economic Growth and Innovation**

Mining activity in Australia underpins our current prosperity. In 2006-07 mineral resources exports increased by 16 per cent to \$90.8 billion, accounting for more than half of Australia’s commodity earnings. During this time the industry contributed \$7.1 billion in State and Federal taxes.

The benefits of mining innovation go far beyond the immediate economic rewards. Innovative activities in mining are often conjoined with technological developments elsewhere in industry and the economy, creating spillover effects and generating further innovation, productivity, and prosperity. For example, the accelerated mining activity in Australia has underpinned major expansions in supporting services, and spurred growth in the high value-add mining technology services sector, which is worth more than \$4 billion in export earnings alone.<sup>4</sup>

The reported success of the mining technology services sector underscores the potential of the mining boom as a platform for firms to position themselves in global supply chains across a range of industries. While these firms are categorised by their primary customer base of mining, this conceals the fact that companies within this sector also provide Information Communication Technologies (ICT), advanced manufacturing and environmental technologies and high level consulting services to transport, energy, telecommunications, infrastructure and government sectors.

Ensuring that the minerals sector and related industries are able to draw on highly skilled technical experts is critical to ensuring that Australia continues to be able to leverage its current minerals strength.

#### **5. The Impact of the Skills Shortage on Minerals Sector Sustainability**

The skills shortage in the minerals sector has been well documented. In the past few years, the ABARE Report on projects in the minerals sector has consistently reported companies citing human capital shortages as the key cause of project delays.

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<sup>4</sup> Invest Australian and Austrade, ‘Innovation Australia: Backing Australia’s Ability’, Palamedia (2007) at <http://www.innovationaustralia.net/article/article.php?article=10,174>

Moreover, according to *The 2008 AusIMM Remuneration and Employment Survey* (hereafter, 'The AusIMM Survey') of members:

- 64.1% of respondents agreed with the statement that, 'the skills shortage has left my company short staffed'
- 56.9% of respondents agreed with the statement that, 'the skills shortage has meant we have more people performing in more senior roles without sufficient professional experience'
- 66.8 of respondents agreed with the statement that, 'the skills shortage has meant my employer now pays more for less experienced personnel'

With the current planned expansion of the industry, the professional skills needs of the industry are expected to increase over the medium to long term. According to the recently released Report, 'The Labour Force Outlook in the Australian Minerals Sector: 2008 and 2020,' prepared for the Minerals Council of Australia, an additional 8,952 professionals will be needed to staff mining operations by 2020. The report noted that the projections for additional professionals was limited exclusively to professionals engaged at mine sites, and made no allowance for the growth needs of head office staff in the capital cities and specialist consultants that service the industry.

The AusIMM submits that it is of deep concern that despite the increasing levels of activity in the Australian mining sector, there is an escalating professional skills shortage. A sustainable source of highly skilled graduates capable of meeting direct operational needs, related service needs and R&D requirements of the industry is critical. The AusIMM urges the Government to engage in forward planning for the professional skills needs of the minerals industry to ensure that we are able to sustain current rates of productivity and economic growth.

It should in particular be noted that in a highly technical industry such as mining, professionals with higher education qualifications are instrumental in the innovation process. That is, innovation calls on a person's ability to identify, acquire, assimilate, and exploit knowledge from the environment – including the outcomes of R&D undertaken by other firms, industries and countries. Without technical knowledge of the way a system works, an employee will merely perpetuate the processes into which they are inducted. The ability of higher education institutions to produce a sustainable number of graduates to staff our key industries is thus critical for the innovative capacity of the mining industry, and indeed all technical industries.

## **PART B**

### **Questions for Discussion**

Please note that not all questions were answered. In some cases the order of the questions from the discussion paper has been changed for the purposes of readability of this submission.

#### **Chapter 1 Higher education in modern Australia**

##### **2. *How adequate is the statement of functions and characteristics of higher education in modern Australia?***

The AusIMM supports the statement of functions and characteristics in the discussion paper. However we submit that it is imperative that higher education is flexible and adaptive, capable of responding to the changing needs of a dynamic economy. There is also a requirement for greater alignment with employer demand. Both of these characteristics should be explicitly expressed.

#### **Recommendation:**

Add the following characteristics to the list –

Australia's higher education system should be marked by a capacity to:

- \* Be adaptable and flexible in its ability to respond to a dynamic national economy and the changing shape of current and emerging industries
- \* Be appropriately aligned with the needs of end users both in terms of labour supply and R&D

#### **Section 3.8 Resourcing the system**

##### **28. *What incentives or unintended consequences are there in the current arrangements for higher education funding?***

During the past 10 years, the number of mining engineering, metallurgy and geoscience departments in universities has been steadily declining. Since 2000, eight minerals departments have closed and four have been merged into other degrees.<sup>5</sup>

The steep decline in the number of minerals-related programs is largely due to the funding arrangements instituted under the *Higher Education Support Act 2003* (Cth) which provides funding on a per student basis according to the field of education cluster. Minerals related programs have been disadvantaged under this formula for the below listed reasons.

**The programs are small and capital intensive.** That is, the low EFTSL means that there is lack of economies of scale for minerals related programs. The number of enrolments often does not reach minimum efficient scale under a per student model

<sup>5</sup> Galvin J. and Carter R., 'Strategic Review of Minerals Council of Australia Tertiary Education Initiatives,' *Minerals Tertiary Education Council of Australia* (May 2003) at [http://www.minerals.org.au/\\_data/assets/word\\_doc/4328/MTEC\\_Review\\_FINAL.doc](http://www.minerals.org.au/_data/assets/word_doc/4328/MTEC_Review_FINAL.doc)

of funding. Universities have thus found that the programs are financially unsustainable and are reluctant to run them.

**The cluster formula is historical and not indexed appropriately.** The cluster funding formula has been in place since 2003 and is indexed based on historical costs of teaching. It has taken no account of changes that have taken place over the past five years including:

- recent influx of students following the boom
- costs of new equipment
- increased reliance on computers and software in all aspects of operations
- mining salaries increasing at 8% per year cf academic salaries indexed at 2% per year
- Fewer postgraduates resulting in loss of demonstrators and tutors

Consequently, the current funding for minerals related programs falls far short of what is actually required to deliver the course.

**Clusters do not take into account mode of delivery:** The clusters do not differentiate between programs that are primarily 'chalk and talk' and those that also include a significant component of resource intensive practical training.

Field trips and use of equipment facilitated by lecturers or demonstrators are critical elements of any minerals related course and are capital intensive. Given that the real costs of the more practical component of education is not recognised within the cluster which weights all subjects in a given Field of Education equally, there are insufficient funds to run the more practically oriented subjects.

In a recent study by Access Economics<sup>6</sup> it was recommended that clustering funding based on mode of delivery of subject (MOD), rather than field of education (FOE) would be more appropriate. The AusIMM supports this recommendation as it would reflect the costs of the actual resources used in delivering particular subjects.

**29. To what extent are the current funding models adequate to secure the future of Australia's higher education sector? If there are better models, what are they?**

The current funding model is not adequate to secure the future of Australia's higher education sector in line with the characteristics outlined in the *Discussion Paper*.

That is, under the current funding model, higher education providers do not have the capacity to:

1. Meet the needs of the labour market and the industry for high skill levels; and
5. Play a vital role in the national research and innovation system

In order to meet current and future skills and innovation needs of industry, the composition of programs should be determined by reference to *what these needs actually are*. A comprehensive assessment of future human capital needs for key industries using a range of scenarios must be carried out, and used as the basis to determine future course allocations.

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<sup>6</sup> Access Economics, 'Higher Education: Cost Relativities and Pipeline', Report prepared for the Department of Science, Education and Training (6 March 2007)

Programs must be funded at a level where they are able to produce graduates equipped with relevant skills and knowledge. The funding formula for programs should be based on the actual cost of delivery. Considerations that should be taken into account in the funding formula include mode of delivery, infrastructure and equipment requirements, and salaries for professionals in industry comparative to academic salaries. This should be reviewed on an annual basis.

### **Recommendations**

1. Undertake a comprehensive assessment of future human capital needs for key industries using a range of scenarios, and use as the basis to determine future program allocations
2. Replace current 'student numbers' based formula with an appropriate mechanism that provides stable funding to teach minerals related programs at high quality

### **Section 3.1 Meeting labour market and industry needs**

#### ***2. Are there impediments to the higher education sector being able to innovate in the development of programs and programs? What are these impediments and how could they be removed?***

There are a number of impediments in the ability of minerals related programs in the higher education sector to innovate in the development of programs and programs.

The most obvious one is lack of sustainable funding – where many programs are struggling merely to stay afloat, innovation and program development needs must clearly be deferred.

A second key issue is the lack of a clear mission for universities. At present there is no formal requirement for programs to be aligned with the skills and innovation needs of industry. Whilst some programs have excellent relationships with industry and prepare their students well, a great many, particularly in the geosciences, have a strong academic focus and little industry relevant content.

The current divergence in quality and relevance of some minerals related programs is partly the result of the culling or absorption of programs into more generalist degrees in the minerals downturn. This was a highly short sighted action by all stakeholders: university, government and industry. Once a program is cut it is very difficult to get it reinstated at short notice. Resource cycles tend to be long-term (7-9 years) while the program management strategies were short-term (3 years). A formal dialogue between stakeholders needs to be put in place to guarantee future sustainable sources of funding for minerals related programs through the boom and bust cycles to ensure that this does not happen again.

The lack of alignment of higher education and industry focus has resulted in a situation whereby learning outcomes are not always in line with employer demands. This was evident in industry responses to the following survey question: **Do you feel that graduating students are adequately prepared for their professional role by their higher institutions? In your opinion, what could be done to improve the situation?**

A sample of responses appears below:

Senior Mining Engineer: *"I do not believe that there is enough industry training for graduates, especially in the earth sciences. Industry needs to take more responsibility for training and should take a larger part in undergraduate programs."*

Metallurgist: *"Work experience and practical experiments at uni, combined with the theoretical background knowledge is what is needed in the mineral processing field. While most universities encourage and require work experience, more practical laboratory experiments would create better graduates."*

Planning Engineer: *"I believe that there are many students who are missing key skills which can be gained from industry, through extended work experience, or extended industrial work experience."*

Mining Consultant: *"There is a need for greater integration of professional practice and education. This integration must continue into the first three to five years of professional practice, culminating in registration as a professional engineer and or statutory mine manager"*

Geologist: *"They [students] need a closer interaction with industry during their training years. Most academic institutions do give adequate academic training but it is often remote from the needs of the workforce."*

Senior Process Design Engineer: *"Exposure to the industry through the duration of the degree is very important...via excursions to operating sites/field work and most importantly work experience (not just for final year students). The key is to ensure the work experience is "hands on" so students can confirm their interest in their chosen career...sitting behind a computer crunching numbers doesn't promote the industry as challenging/exciting/good career option."*

In their responses to The AusIMM survey, industry stakeholders expressed a desire for greater input into course content and opportunity to lecture based on operational experience. Meanwhile respondents from academia expressed a desire to see industry take a more active and engaged role both in terms of financial support and in-kind support such as providing practical learning opportunities for students. Students also consistently expressed dissatisfaction with the lack of 'hands on' work available to them.

The AusIMM submits that clarity of mission in line with characteristics 1 and 5, as expressed in the discussion paper, is critical to ensuring that universities are able to innovate. There needs to be a well represented ongoing dialogue between industry, academics and government which incorporates a shared vision, goals and plan. A partnering approach between industry and universities is recommended, incorporating greater financial and in-kind support from industry. Partnering arrangements should be facilitated by Government.

The AusIMM also submits that a current barrier to innovation in delivery is the focus on EFTSL for funding, which discourages universities from collaborating for shared delivery as this reduces their student loading, and consequently their funding.

The AusIMM strongly supports greater collaborative delivery of programs such as Mining Education Australia and believes that this is a highly innovative program. We support further development of collaborative programs with the proviso that these are funded in line with the actual cost of overheads to deliver quality programs.

The AusIMM recommends caution in the use of 'pre-reading/on line delivery' as a means of cost cutting. Both students and academics have expressed the view that for highly practical programs some high-level, face-to-face contact is essential. On line teaching should complement class-room and/or field-based activities rather than replace them. For example, one respondent in academia made the following comment:

*“Suggestions regarding on line teaching are made by those who have never been inspirational teachers, it is a way of providing large numbers of graduates with no practical and little thinking skills and is the lazy low cost method of producing graduates (albeit poor quality). Nothing beats field work, projects at operational sites and touching/feeling/smelling/looking.” - Lecturer*

**Recommendations:**

1. Establish a clear mission for minerals related higher education providers, linking learning outcomes to industry skills and innovation needs
2. Based on the mission, Government to facilitate a well represented ongoing dialogue between industry, professional bodies and academia
3. Greater partnering between industry and academia for a more practically oriented and hands on learning experience
2. Remove structural barriers to collaboration such as EFTSL as key determinant of funding
4. Ensure that on-line delivery does not adversely affect learning outcomes or reduce practical component of programs

**3. What are the appropriate mechanisms at the national and local level for ensuring higher education meets national and local needs for high level skills? What is the role of state and territory governments in this area?**

It is desirable that a mechanism is developed to ensure consistency of competencies is delivered in professional programs across Australia. A balance would need to be struck between particular regional strengths and priorities for the higher education course, and the broader baseline competencies and curriculum that are required for industry nationwide.

The AusIMM, together with the Minerals Council and State Chambers are well placed to develop and assess learning outcomes in concert with higher education providers.

The AusIMM already has significant infrastructure in place that it can draw upon for the purpose of assessment. That is, we already have a process for assessing new migrant qualifications, and registration of professional engineers in Queensland. We also have strong links to the Student Body through our Student Chapters and Scholarship Program, and to Higher Education Institutions through the Course Recognition process.

**Recommendation:**

The AusIMM, together with the MCA and State Chambers and Universities to develop a consistent set of competencies (ie learning outcomes) to be delivered in professional programs across Australia.

#### **4. How adequate are the mechanisms for aligning supply and demand of graduates? How do pricing and labour market signals impact on student choices?**

Students are responding rationally to the employment opportunities in the minerals sector. A recent study from Graduate Careers Australia showed that four months after graduation, Geology graduates had the highest rate of employment (86%) for the Science disciplines, whereas Mining Engineering graduates had the highest rate of employment (99%) for the Engineering disciplines.<sup>7</sup>

A need for better awareness of career pathways, particularly for the geosciences, was expressed. As one lecturer put it:

*“The message about studies in the geosciences needs to get to secondary school students so more come to University with this in mind. Currently it is a numbers game and ‘familiar’ subjects win out over our discipline because students are conservative/low risk takers. They are paying a great deal for their education, and don’t like to risk paying for something they don’t understand or are uncertain about.”*

The AusIMM plays an active role in increasing student awareness of careers in the minerals sector through the Australian Student Minerals Venture (ASMV). The ASMV is a series of vacation programs held annually throughout Australia and is open to high school students in years 10, 11 and 12. These vacation programs allow students to find out about careers, lifestyles and opportunities in the minerals industry and investigate university programs that would suit their abilities and preferences in terms of subjects such as chemistry, physics, mathematics, geology and biology.

The AusIMM has also supported policy measures such as the Scientists in Schools program aimed at increasing teacher exposure to industry.

Overall we believe more could be done to improve both the quality of science teaching in high school and an awareness of the opportunities that flow from studies in Science, Technology, Engineering and Mathematical fields. We believe that Government should take a leading role in promoting awareness of careers to higher education students.

#### **Recommendations**

Implement a coordinated national approach aimed at increasing student awareness of Science, Technology, Engineering and Mathematical careers

#### **5. Are there particular examples of good practice where you can demonstrate either rapid response to skill shortages or successful initiatives to improve generic skills?**

There are a number of examples of good practice where there has been rapid response to skills shortages. These are largely ad hoc and the result of particular commitment by a company, state or organisation rather than a national strategy. The following are some examples.

*Example 1. Central Queensland University pathway to Mining Engineering at University of Queensland*

<sup>7</sup> Graduate Careers Australia, ‘Annual Graduate Survey 2007’, (December 2007)  
<http://www.graduatecareers.com.au/content/view/full/24>

BHP Billiton has recently establish a second year mining course at Central Queensland University (Mackay) to enable local students to study first and second year engineering in their region before completing their 3<sup>rd</sup> and 4<sup>th</sup> year of Mining Engineering at the University of Queensland. Considerable industry exposure was incorporated into early course studies.

*Example 2. Support in South Australia for Mining Engineering Program at the University of Adelaide*

The South Australian Government has been proactive in supporting future skills needs of its booming industry. A new Bachelor of Mining Engineering has been established at the University of Adelaide. Funding is derived through the Minerals Tertiary Education Council support as well as bursaries from the SA mining industry, PIRSA and the University of Adelaide. All Year II mining engineering students have bursaries.

*Example 3 Mining Engineering Australia Venture negotiated through the Minerals Tertiary Education Council*

Mining Education Australia is a national education joint venture between the major mining education providers in Australia: Curtin University of Technology, The University of New South Wales, The University of Queensland and Adelaide University. This collaborative model of delivery allows students to transfer between Universities.

Students who have completed two years of a suitable engineering degree (e.g. civil or mechanical engineering), can transfer into an MEA course and graduate with a BE (Mining) after a further two years of study.

The program has good support from academia and industry overall, however some concerns about the ability of the program to meet regional needs and deliver consistency of standards across campuses have been expressed.

As this model is the first of its kind it is inevitable that continuing refinement is required. The AusIMM strongly supports this mode of delivery, however its success depends on appropriate Government funding for Science and Engineering programs generally.

*Summary*

There are a range of effective and innovative models for responsiveness to skills needs driven by particular stakeholders. Long term guarantee of the sustainability of these models must be underwritten by Government to ensure that future skill needs are met, regardless of variable commitment by other stakeholders.

***6. How effectively are Australian higher education institutions responding to demographic change, especially in providing lifelong learning to meet the challenge of the ageing population and the need for upgrading of skills and re-training?***

A number of higher education providers are providing postgraduate qualifications in minerals related programs for people from other engineering or science disciplines (conversion programs).

The AusIMM as a professional body has a role in supporting these programs in outlining professional career pathways through the upgrade of skills and take-up of conversion programs. We are currently in the process of revising our careers and membership structure to better reflect the multiple pathways for entry into the mining professions.

***7. What is the relevance and applicability (to Australia) of the findings and approaches proposed in the United Kingdom paper, Higher Education at Work, for increasing skills levels in the workforce to Australia?***

The concepts outlined in the United Kingdom paper, *Higher Education at Work* were very broad. More information on the detail of the implementation of these concepts is required. However, in a general sense The AusIMM supports the following concepts as relevant to Australia:

- The need for higher education to take a more 'business facing' approach
- Creating a mechanism for tying higher education outcomes to business needs ie the Sector Skills Councils
- The need for more coordinated information provided by Government on the range of pathways available for a particular profession (for upskilling etc)
- Government support aimed at ensuring that postgraduate studies continue to be attractive to talented students
- A particular focus on Science, Technology, Engineering and Mathematics, particularly informing high school students of the range of careers available before they make decisions about higher education

**Section 3.2 Opportunities to participate in higher education**

***11. What evidence is available from institutions about the impact on individuals or groups of either failure to gain income support or the inadequacy of income support?***

Students in minerals related programs are more likely to have come from regional and remote Australia. Given the concentration of minerals schools and increased collaborative delivery, they are also more likely to be living away from home. Thus they are particularly well placed to comment on the costs of accommodation etc.

A number of student respondents to The AusIMM survey expressed the view that Government income support is inadequate for the following reasons:

- Accommodation is costly, particularly for students that are living out of home from the first year of their degree
- Students have significant contact hours and are unable to take a part-time job
- Vacation work can have adverse impacts on Centrelink calculations, making it difficult to budget
- Students are expected to outlay for expenses related to field trips.

For example:

*“Geology is an expensive subject as it is very field based and this requires money directly out of the student’s pocket (which isn’t always that deep). Some people have had to forfeit programs and fieldwork due to lack of funds” – Geoscience Student*

**Recommendations:**

1. The adequacy of student income support, particularly for those students living away from home, should be reviewed.
2. Centrelink support formula to be revised to ensure that students undertaking vacation work are not adversely affected.
3. Ensure that costs associated with practical learning are not inappropriately transferred from higher education providers to the students.

**Section 3.3 The student experience of higher education*****12. How can the quality of the student experience within Australia's higher education institutions be monitored nationally? Is there evidence that declining student:staff ratios have impacted on the quality of the student experience?***

The best assessment of quality of the student experience is achieved by asking the students themselves. A standardised survey should be developed in collaboration with industry and the professional bodies.

The AusIMM has the infrastructure to carry out and monitor a national survey of students, through our membership structure. We are keen to work with Government, the universities and industry companies to ensure that the best possible feedback is obtained.

Our survey indicated that declining student staff ratios have had a significant adverse effect on the student experience. Lack of staff particularly impacted on the students' ability to undertake field trips and practical work – areas of teaching which are human resource intensive.

***13. How can the quality of learning outcomes in Australian higher education be measured more effectively?***

The AusIMM could potentially play a role in assessing learning outcomes through process aligned with our migration Assessing Authority and our registration of Professional Engineers.

**Section 3.4 Connecting with other education and training sectors*****14. To what extent should vocational education and training and higher education continue to have distinctive missions and how should these missions be defined?***

Our members strongly felt that higher education and vocational education should continue to have distinctive missions. That is, the role of higher education is to provide an in-depth understanding of the underpinning science whereas vocational education should be around the practical aspects of working in the industry.

***16. Does the movement between the sectors of students with credit need to be improved? If so, in what ways?***

Many members suggested that vocational education was an effective feeder into mining schools. However there was not always adequate support to prepare students for units that they may not have completed (e.g. higher end mathematics).

It was also suggested that vocational education should be made more accessible and concurrent with students completing their degree, in more practical areas such as terminology, use of equipment, people skills and in particular mine manager certification.

**Recommendations:**

1. Universities to develop programs to assist vocationally oriented students with potential knowledge gaps to facilitate transition to university courses
2. Universities to review opportunities for students to undertake vocational learning concurrently with their degree

**Section 3.5 Higher education's role in the national innovation system**

***19. By what mechanisms should research activities in Australian universities be supported?***

The AusIMM submits that there are two areas that need to be addressed when looking at maintaining research excellence in Australian universities:

1. Mechanisms to ensure that collaborative research is attractive to industry
2. Mechanisms to support a critical mass of talented postgraduate students

*1. Mechanisms to ensure that collaborative research is attractive and relevant to industry*

For the most part, industry funding for collaborative research in Australia is sourced through research brokers such as AMIRA International, or via project by project agreements between research institutions such as CSIRO, Universities and CRCs and particular companies which initiate or are persuaded to buy-in to the project.

This model has been effective. However there are significant obstacles to effective collaboration with universities. These were discussed at the Biennial Exploration Manager's Conference held by AMIRA, where industry complained of differential timelines between research institutions and their exploration clients, owing to institutional pressure on researchers for work standards that were not necessarily relevant to industry.<sup>8</sup> Another issue was "mission creep" as poorly managed projects lost focus and sponsorship funds were tapped to support non-core avenues of enquiry.

In order to draw on a consolidated industry funding base, universities need to be more effective in meeting the needs of industry and communicating the value of their research to potential investors. This will not occur unless business and research priorities are more effectively aligned.

The Research Quality Framework proposed by the previous Government represented an attempt to channel public research more effectively to meet society's

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<sup>8</sup> 5th Biennial Exploration Conference, 'Maximising Exploration Efficiency and Success in a New World: Global Support for Research', (March 2003, WA).

demands. This policy instrument was flawed on a number of levels. However the disconnect between industry's demand for responsive, cost-effective, focused research, and academia's preoccupation with publications, tenure and peer assessment must be addressed by an alternative mechanism for aligning research outcomes with industry priorities.

The mechanism should be outward looking and recognise a range of contributions. As one academic stated in response to The AusIMM survey:

*"More emphasis on credit to universities for research performance should be linked to actual uptake by industry. That is, consulting income should be treated on an equal footing as research grants, as what better peer assessment is there than uptake by industry of research developments?"*

#### **Recommendations:**

1. Review the options for a policy measure to better align the priorities and timelines with researchers in publicly funded organisations with those of the private sector.
2. Ensure that a broad range of contributions from the university to industry are considered when assessing research performance

#### *3. Mechanisms to support a critical mass of talented postgraduate students*

A critical mass of capable postgraduate researchers is a prerequisite for strong innovative capability. For example, AMIRA International, a consortium of companies which contracts out precompetitive research to public institutions and is credited with spearheading Australia's research excellence, reported that between 1990 and 2004, more than 260 PhD students and 65 post-doctoral researchers were involved in its university-based research projects.<sup>9</sup>

Meanwhile the contribution of an employee with advanced research qualifications within a company can be invaluable. In his input to our submission, an AusIMM member, who has been involved in both research and industry for more than 25 years, reflected on the innovative capacity his advanced technical knowledge enabled him to bring to industry:

*"After two years at Berkeley I returned to Western Mining to do my doctoral research at the Kambalda nickel mines part time, whilst working as a senior geologist. The isolation from academe was a challenge, but I was compensated by the opportunity to apply my research outcomes at the mines. For example, I applied my results to important practical issues, such as guiding exploration for more ore, improving ore reserve calculations, mine planning and grade control, and to metallurgical processing. This experience convinced me of the power of integrative applied research. It also showed me the potency of effective bridges between industry and research institutions, and the high practical and scientific value of applied research; insights that became part of my life."*

Given the important role that PhD qualified professionals play in research institutions, in industry, and as a bridge between the two, maintaining a critical mass of such

<sup>9</sup> Whitman, D., 'A Mine of Innovation', in *Innovation Australia*, (2007) Palamedia, at <http://www.innovationaustralia.net/article/article.php?article=10.169>

individuals should be viewed as a priority. Under current policies this has not been the case. According to the Minerals Tertiary Education Council, PhD enrolments for metallurgy, mining engineering and earth science between 2000 and 2004 declined 40%, 50% and 36% respectively.<sup>10</sup>

Attracting and funding PhD students is a complex challenge. On the funding side, Universities need the facilities and staff to support them. There is also some question of whether Australia needs to do more to attract students to conduct postgraduate study in their fields. At present there is little financial incentive for a talented student, even one who is committed and passionate about research, to undertake a PhD, when salaries for a new graduate are around \$80,000 p.a., whereas postgraduate scholarships are around \$20,000 p.a.

A recent study by the Council for the Humanities, Arts and Social Sciences (CHASS) found that since 1999, the standard PhD scholarship has fallen from about half of average earnings to about a third. The scholarship is now worth about \$20,000, which means it has now fallen below the official Henderson poverty line. Meanwhile, it is unclear whether employers sufficiently recognise the value of a PhD.

Broader issues around funding for universities, promotion of the value of research capability to firms, and the adequacy of current scholarship arrangements all need to be looked at closely.

**Recommendations:**

1. Ensure that higher education institutions with records of research excellence in disciplines of national importance receive adequate funding to support PhD students
2. Investigate options for promoting the value of PhD graduates to employers in industry
3. Given current societal values and costs of living, review whether current scholarship arrangements are a sufficient incentive to attract talented students to PhD study

**21. Do you believe there is a place in Australia's higher education system for universities that are predominantly 'teaching only' universities? If so, why?**

A vast majority of all stakeholders who responded to The AusIMM survey – students, industry and academia – were opposed to teaching-only universities. The following reasons were given:

- Linkage with research is needed to ensure the course is up to date
- The opportunity to do research attracts better quality lecturers than could be attracted to a teaching-only university
- Mining is a knowledge-intensive industry and all graduates should have exposure to, and the opportunity to undertake, research activity

<sup>10</sup> Minerals Council of Australia, 'University Enrolment Statistics', (2007) at [http://www.minerals.org.au/mtec/what\\_we\\_do/mtec\\_research/statistics](http://www.minerals.org.au/mtec/what_we_do/mtec_research/statistics)

APPENDIX 1

**AusIMM Recognised Programs**

<b>University</b>	<b>Recognised Program/Course</b>
<b>MINING ENGINEERING</b>	
University of Ballarat	Bachelor of Engineering Science (Mining Engineering)
University of Ballarat	Bachelor of Engineering Science (Mining Engineering)/Bachelor of Computing
University of New South Wales	Bachelor of Engineering (Mining)
University of Queensland	Bachelor of Engineering (Mining)
University of Western Australia	Bachelor of Engineering (Mining Engineering)
University of Wollongong	Bachelor of Engineering (Mining Engineering)
University of Wollongong	Bachelor of Engineering (Double Specialisation including Mining Engineering)
University of Wollongong	Double Degree including Bachelor of Engineering (Mining Engineering)
WASM/Curtin University of Technology	Bachelor of Engineering (Mining)
WASM/Curtin University of Technology	Bachelor of Science (Mining)
WASM/Curtin University of Technology	Bachelor of Science (Mine and Engineering Surveying)
<b>METALLURGY</b>	
Murdoch University	Bachelor of Extractive Metallurgy
University of Ballarat	Bachelor of Applied Science (Metallurgy)
University of Queensland	Bachelor of Engineering (Chemical and Metallurgical)
WASM/Curtin University of Technology	Bachelor of Engineering (Minerals Engineering)
WASM/Curtin University of Technology	Bachelor of Science (Extractive Metallurgy)
<b>GEOSCIENCES</b>	
Australian National University	Bachelor of Science (Geology)
Australian National University	Bachelor of Science (Double Geology Major)
Australian National University	Bachelor of Science (Geology) (Honours)
Australian National University	Bachelor of Science (Environmental Geoscience)
Curtin University	Bachelor of Science (Applied Geology)
Curtin University	Bachelor of Science (Applied Geology) (Honours)
Curtin University	Bachelor of Science (Geophysics)

<b>University</b>	<b>Recognised Program/Course</b>
Curtin University	Bachelor of Science (Geophysics) (Honours)
Curtin University	Bachelor of Science (Land and Water Resource Science)
Curtin University	Bachelor of Science (Land and Water Resource Science) (Honours)
James Cook University	Bachelor of Science (Geology/Economic Geology)
Melbourne University	Bachelor of Science (Earth Sciences) (Honours)
Monash University	Bachelor of Science (Earth and Environmental Sciences)
University of Adelaide	Bachelor of Science (Environmental Geology)
University of Adelaide	Bachelor of Science (Geology)
University of Adelaide	Bachelor of Science (Geophysics)
University of Ballarat	Bachelor of Applied Science (Geology)
University of Ballarat	Bachelor of Applied Science (Honours) (Geology)
University of New England	Bachelor of Science (Geology)
University of New England	Bachelor of Science with Honours (Geology)
University of New South Wales	Bachelor of Science (Geology)
University of New South Wales	Bachelor of Science (Environmental Earth Science)
University of New South Wales	Bachelor of Science (Advanced) (Geoscience)
University of New South Wales	Bachelor of Environmental Science (Earth Science)
University of South Australia	Bachelor of Applied Science (Honours) (Applied Geology)
University of Sydney	Bachelor of Science (Geology & Geophysics) (Honours)
University of Tasmania	Bachelor of Science (Economic Geology) with Honours
University of Tasmania	Bachelor of Science (Geochemistry) with Honours
University of Tasmania	Bachelor of Science (Geophysics) with Honours
University of Western Australia	Bachelor of Science (Geology) (Honours)
WASM/Curtin University of Technology	Bachelor of Engineering (Mining Geological Engineering)
WASM/Curtin University of Technology	Bachelor of Science (Mineral Exploration and Mining Geology)
WASM/Curtin University of Technology	Bachelor of Engineering (Mining Geology)
WASM/Curtin University of Technology	Bachelor of Science (Mineral Exploration and Mining Geology) (Honours)



**University**

**Recognised Program/Course**

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**ENVIRONMENT**

Griffith University

Bachelor of Engineering (Environmental Engineering)

RMIT

Bachelor of Engineering (Environmental Engineering)

WASM/Curtin University of Technology

Bachelor of Engineering (Environmental Engineering)

## APPENDIX 2

### Excerpt from *The AusIMM WIR*

#### Call for Input into the Review of Australian Higher Education – Online Survey for Students, Industry, Government and Academia

Minerals related higher education programs have been under extreme funding pressures for some time. Meanwhile, skills pressures in industry continue to increase.

The Government is currently reviewing Higher Education. The outcome of the Review will inform the future shape of higher education in Australia with major (even radical) changes anticipated.

The AusIMM is calling for feedback from key stakeholders **students, industry, government and academia** to inform our submission.

A separate online survey – only one click away – has been developed for each stakeholder. The survey is short, and you may fill in as many or as few of the fields as you wish.

Please complete the survey by next **Monday the 28th of July**.

#### For Students

[http://www.surveymonkey.com/s.aspx?sm=TSAX7BGeRhIj9xEgW7Rww\\_3d\\_3d](http://www.surveymonkey.com/s.aspx?sm=TSAX7BGeRhIj9xEgW7Rww_3d_3d)

#### For Industry, Government and other employers

[http://www.surveymonkey.com/s.aspx?sm=ygVJcYQ31zQunGI0dQikTg\\_3d\\_3d](http://www.surveymonkey.com/s.aspx?sm=ygVJcYQ31zQunGI0dQikTg_3d_3d)

#### For Academia

[http://www.surveymonkey.com/s.aspx?sm=Q7wval8p0dzn1jE2bFf7wA\\_3d\\_3d](http://www.surveymonkey.com/s.aspx?sm=Q7wval8p0dzn1jE2bFf7wA_3d_3d)

All responses will remain confidential, including programs, institutions or company affiliation of respondents. For more information about the Review go to:

[http://www.dest.gov.au/sectors/higher\\_education/policy\\_issues\\_reviews/reviews/highered\\_review](http://www.dest.gov.au/sectors/higher_education/policy_issues_reviews/reviews/highered_review)