RESPONSE by the DIRECTORATE

of the

CENTRE OF EXCELLENCE FOR INTEGRATED MINERAL AND ENERGY RESOURCES ANALYSIS

(CIMERA)

to the

EVALUATION REPORT

Report compiled by

Profs Nic Beukes and Judith Kinnaird

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1. Introduction

We would like to thank the review panel (Appendix 1) for a highly informative and wide-ranging evaluation report that highlights both major achievements and shortcomings in the operation of CIMERA over the past four years. This is followed by some constructive recommendations on how to adapt and improve the operation and relevance of CIMERA during the next five-year cycle of support and beyond.

Having said that, we also recognize in our minds three basic shortcomings in the review report that should be highlighted to place some of our responses to the report in full context. These are:

a) There seems to be little appreciation by the panel that CIMERA is a virtual CoE and that almost all of our collaborating scientist are full-time faculty staff members with not only obligations to research and postgraduate training, but also heavy undergraduate teaching loads. There is, thus, a fine balance to be managed between obligations in teaching and research performance at the different Universities and associated Earth Science/Geological departments, and that expected from the DST-NRF CoE CIMERA. Some shortcomings highlighted and recommendations made in the report thus apply more on the operation and performance of individual departments and/or universities as such, rather than to that of CIMERA *per se.*

b) There appears to be too little appreciation by the panel on the tremendous pressure from both University and NRF Management to publish research in high-impact leading scientific journals that most typically involve basic research output with less so applied research. The whole system is largely geared to that, including performance management at Universities, world rating of University status and the peer review rating system at the NRF. It is also one of the fundamental requirements for the existence of a CoE, namely to perform research that can be classified as leading in the world. Applied research can certainly lead to such stature, but then it requires very careful definition and not a rather "loose" usage of the word as in the panel's review report. Almost certainly, performing short-term applied research projects for companies on specific problems they may have in mining or exploitation of a mineral deposit, would seldomly lead to international recognition and stature. It should be more broad and long term as outlined later in this reply.

c) There is no feedback in the panel's report on what we considered to be a very important aspect raised in our self-evaluation report, namely, the need for the DST-NRF to carefully re-evaluate and consider aspects of their whole funding strategy for research support. This strategy has two flaws in our opinion, namely (i) that it focusses largely on support of individuals with little emphasis on building out larger cooperative initiatives or consortia of which the CoEs can be used as platforms and (ii) not giving sufficient attention to research areas that can lead to increased

work opportunities (economic growth) in South Africa, but at the same time having distinct and clear-cut geographic advantage. Geological sciences and specifically Mineral Resource Studies are prime candidates as would be outlined later in this document.

The report by the review panel has an executive summary highlighting the major achievements of CIMERA, shortcomings in its past operation and recommendations for improving its relevance into the future. This is the only real cohesive narrative in the report, with the main body essentially lists of individual aspects grouped under the three topics mentioned above. The way we decided to structure our response is to make broad general comments as infill between the paragraphs touching on different aspects of the operation of CIMERA as outlined in the executive summary followed by short replies on each of the individual aspects listed later with emphasis on shortcomings and recommendations. In some cases we have reorganized parts of the evaluation report to place related aspects/topics together as entities without changing the wording by the panel.

2. Broad Comments on the Aspects Raised in the Executive Summary

2.1 Summary of Achievements

Panel Remarks: CIMERA has made an impressive number of achievements in the period that we have evaluated (27 March 2014 to 30 December 2017). Over the last five-year period, CIMERA has been successfully set up, been adequately staffed, and runs a number of high-precision, high-quality analytical laboratories of world-class-standard that have placed CIMERA amongst the globally competing facilities for geosciences. At the core of CIMERA are two formerly competing but now closely cooperating geoscientific institutions, that is, UJ and Wits. The laboratories, which are central to CIMERA, are operated for all member institutions of CIMERA although currently used by these members to strongly varying degrees.

Response: We agree with the remark that CIMERA has accomplished some major achievements in the four years of the review period. However, we would like to acknowledge the support we received, not only from the NRF but also from Management of both UJ and Wits in establishing the modern laboratory facilities and also the hard work by the scientists in CIMERA that actually motivated for the equipment and are currently overseeing their effective operation. Along the same lines, we have to acknowledge the operation of facilities at our partner institutes, the scientists operating the facilities and the support they receive from their University management.

Panel Remark: The successful application for and prosperous establishment of CIMERA is largely due to the immense scientific contribution and personal input by the two senior scientists, Professor Nic Beukes and Professor Judith Kinnaird, who have been truly central to this entire project. The high-ranking international standing of these two individuals has helped to turn CIMERA into a South African scientific flagship institution.

Response: This remark may be valid for the initiation and early stages of the development of CIMERA, but certainly later on the scientists taking part in the activities of CIMERA have contributed tremendously in building out the ranking and international standing of CIMERA, not only by research output, but also collaboration with industry, supervision of postgrad students, collaborative projects on a wide front, and worldwide and conference participation.

Panel Remark: The number of high-impact publications, both on fundamental sciences and on applied sciences to the mining industry has increased considerably in CIMERA, compared to the output of the involved scientists prior to the establishment of CIMERA. Centralized laboratory facilities, such as the established and newly installed ones have increased the national and international visibility of CIMERA even further. This applies particularly to analytical projects carried out in close cooperation with industry, where mining companies provide sample material and access to mines and data. CIMERA features a large network of international cooperation partners and aims at becoming more involved in global cooperation schemes such as the IODP/ICDP.

Response: The statement on increased publication output requires some modification. Scientists that became involved in CIMERA had high publication outputs even before the establishment of CIMERA. However, with research becoming more focused towards mineral and energy resource studies under the various research themes in CIMERA, the number of publications relevant to the mineral and energy industry have increased considerably, and would even do more so as findings of student projects funded in the past few years are being published. The support (both logistically and financially) CIMERA scientists receive from the mining and exploration companies to undertake relevant research projects and contributions by international co-authors in preparation of publications should also be acknowledged. It is also important to note that publication numbers also increased because Universities now require at least two publications from doctoral candidates before they can be awarded the degree. Students are thus also given an option to produce their theses either as one document, or as a compilation of papers. The latter option has become very popular, and perhaps more so at the University of the Witwatersrand than some of the other collaborating partners.

Panel Remark: A widely and publicly recognized drilling project for unconventional shale gas in the Karroo has been substantially supported by CIMERA in that the communication and interaction with all stakeholders, not least the initially poorly informed local community and regional population, has been entirely handled by CIMERA staff. It can be regarded as an exemplary case and a blue print of how such projects can be communicated, discussed, and mediated for and with the local population in future.

Response: We appreciate this positive remark. However the main lesson to be learned from this is that if funding is made available from industry, as in this case a R20 million donation to undertake research towards a specific goal, incorporating both basic and applied parameters, there is the necessary know-how and experience available in CIMERA to successfully plan and execute such projects. The KARIN project was, however, not the only one of its kind undertaken. Others that fall in the same category are, for example, a) the work undertaken by the geophysics unit at Wits on the deep structure of gold and platinum mines with data made available from industry, b) the involvement of CIMERA scientists at Wits in delineating and investigating the extension of the Bushveld Complex to the north under Waterberg cover, c) the international Agouron drilling project to research the exact nature of the so-called Great Oxidation Event (GOE), and d) the recently launched THRIP project on mineralization associated with the acid phase of the Bushveld Complex.

Panel Remark: CIMERA has managed to increase the number of African and female students as well as technical and academic staff members to some extent, thus contributing in part to the urgently necessary transformation and widening participation processes. This preliminary achievement needs to be seen against the severe socio-economic obstacles, which the majority of African students and young scientists face by their specific additional burden of supporting their families.

Response: It is our view that the panel does not give full recognition to the massive improvement in enrollment and supervision of African and female students seen in historical perspective. They correctly state that there is much pressure on African students to go into the job market after finishing Honours studies. In addition, the mineral industry is also under pressure to transform their work force. Thus there is very large competition for these students, and especially ones that performed better during their undergraduate studies. It is thus quite an achievement that in the 3 years covered by CIMERA's mid-term report that 65% of students that completed studies under its umbrella (including Honours from Venda and Fort Hare) were black with 39% female (refer to self-evaluation report). Our compliment of ongoing postgraduate students (Masters and Doctoral during 2018) comprises 50% black, 6% Indian and 2% Coloured students. The percentage of black Masters and Doctoral student are also going to increase

dramatically in near future as at, for example UJ, 94% of the current Honours class is black, and at Wits this figure was 85% in 2017. We do not think that the panel has taken note of these developments in the training of students especially in the two main partners in CIMERA, namely Wits and UJ.

2.2. Summary of Challenges and Recommendations

2.2.1. Successors for Current Directors

Panel Remark: One of the biggest challenges to the future course of CIMERA lies in the imminent retirement of both its Director and Co-Director and the members of the MEP firmly believe that this challenge holds some threats but even bigger opportunities. Leadership of CIMERA has been highly personalized in the past five years and this has been crucial in the successful setting up of such a high-level institution. However, the time is ripe for a new CIMERA leadership team of Director and Deputy Director, which significantly reflects the national role of CIMERA, rather than its role within UJ and Wits. The new leadership team will have to incorporate more strongly all other South African member institutions, including those already cooperating as well as the ones that still have to be taken on board. In order to overcome the understandable bias towards the two hosting institutions, it is highly advisable to install at least one highly qualified external scientist to these positions, who - ideally - can communicate in a creative and productive manner with both academic scientists and industry partners alike.

As one of the most urgent recommendations, the MEP strongly advocates for a wide international advertisement for the successors of the current and soon retiring leadership team of CIMERA. The leadership positions should be filled for a period of five years by a team of a scientifically and professionally outstanding and experienced Director together with a younger Deputy Director who could subsequently take over the role of Director, in turn being seconded and followed by another upcoming more junior Deputy Director.

Response: We agree that one of the challenges for the future course of CIMERA is to appoint a new leadership team in the near future. However, we disagree with the concept that the leadership has been quite personalized in the past four years and reflects only the role of CIMERA at Wits and UJ. The panel seems to overlook the fact that CIMERA has been from its initiation one of the most widely diversified CoEs in South Africa, starting off with seven collaborating partners that has been built out to eleven at present, all with full Memoranda of Agreement. It is because of this development that CIMERA is more and more considered to represent a "National Entity" rather than one with local UJ-Wits relevance. Having said, that we also believe that there is sufficient potential in the academic staff at both UJ and Wits to take over the positions of Director and Co-Director of the CoE without having to advertise externally.

The recommendation by the panel to advertise the positions internationally and appoint persons from outside UJ and Wits sounds very "noble" and may have certain benefits. However, the panel ignores the fact that CIMERA originated as a virtual CoE based on collaboration of full-time academic staff members at the two institutions and that there are no official posts available for appointment of the Director or Co-Director. Also, all universities are under great financial stress, and there is no way that they can afford the luxury of creating new posts to take over management of DST-NRF CoEs. If the DST-NRF wants to follow this route, then they should provide the extra funding to the institutions. This would mean that the DST-NRF should alter their "prescriptions" on the funding of CoEs. These clearly state that the payment of salaries to Directors and Co-directors are the responsibility of the host institutions, with only a subvention allowed to come from the budget of the CoE derived from DST-NRF funds. However, it also seems to us that this rule is not followed consistently in all cases. During the recent CoE Director's Forum (Aug 2018) in Kimberley, a remark was made by one of the senior NRF representatives that, Yes "he remembers that the salary of the director of one of the CoEs (he was referring to the Director of the CoE in Food Security at UWC) was paid by the NRF". The remark went unchallenged at the time but we would like to ask more clarity on what was meant as it seems like a precedent was created in this specific case (or are we mistaken?).

We are also fully aware of the expectations of DST-NRF for transformation in leadership and, ideally, with positions being filled by South Africans or permanent South African residents. Through the lists of SACNASP registered geologists, members of the Geological Society of South Africa and NRF evaluations, we know that there is a very limited pool of persons that would qualify fulfilling the definition of transformation combined with being a high-profile outstanding and experienced leading scientist. Even if we would be placed in a position (essentially financial) to be able to advertise the positions, it may not produce the required results. The preferred option would be, to be able to advertise the positions and appoint the best qualified and experienced applicants regardless of race or gender. The suggestion by the panel to appoint a high profile and experienced Director on a five year contract seconded from another CIMERA partner institute, or the National and International Mineral Industry in general, could also be considered. Experience at UJ with appointments of Distinguished Professors on similar conditions, has, however, shown that the chances of success is very low, even if salaries were almost double that of "normal" professorial positions. One of the main reasons for this is that very few high-profile people are willing to vacate positions for short term 3-5 year contracts combined with the disruptions it causes in not only their own lives, but also in that of their families.

In summary we would also like to state that plans are in place to ensure a seamless transition with a new

Director in place of Prof Beukes who plans to step down at the end of 2018. He has been offered 2-year extension of his current contract by UJ and would thus be available for providing advice and support to the new Director if required. UJ is currently in consultation with DST-NRF on various options of filling the Directorship position. Also Prof Kinnaird is to stay on at the University of the Witwatersrand during 2019, and candidates have been identified to take over her position in consultation with DST and the NRF.

2.2.2. Stronger Focus on Applied Research and Interaction with Industry

Panel Remarks: The members of the MEP are of the opinion that CIMERA has to re-focus on the mandate that it has been given and this is to reward, retain, sustain, and improve scientific excellence in the transformation process for the South African Mineral and Energy Resource Industry. This includes a stronger focus on applied research that is more directly applicable to the exploration, mining, mineral processing and oil- and gas-industry, rather than focusing too much on fundamental research. Industry has a long list of applied geoscientific problems, where scientific support from CIMERA will be much appreciated. The access to these unsolved geoscientific problems needs to be unlocked by more appropriate communication with industry partners and more active acquisition of new projects.

The large scientific topics investigated by CIMERA so far have been predominantly on the national scientific agenda for decades and some of them still hold challenging and intriguing challenges. However, we feel that not enough effort has been placed upon the identification of radically new research topics, especially with the aim to support the exploration and mining industry for the identification of future mineral and energy resources. Geoscientific aspects of more efficient and sustainable resource identification, extraction, and recovery should also feature more prominently on the future agenda of CIMERA.

Response: We shall address the statements in the above two paragraphs by the panel under the headings a) refocus of mandate, b) applied vs basic research c) interaction with industry d) identification, acquisition and funding of new projects.

a) Refocus of Mandate.

We think that it is very unfair that the panel state that we have to "refocus on our mandate given by the DST-NRF, namely to reward, retain, sustain, and improve scientific excellence in the transformation process for the South African Mineral and Energy Resource Industry". In our mind this is exactly what we have been striving to do in the past four years as outlined very clearly in our "self-evaluation report". Not only have we done very well in high-quality research output, but also training of human resources

(including large numbers of African students), information brokerage, networking and service rendering (the five areas in which CoEs are supposed to perform). Also in our minds, we have fully complied with the definition of a CoE as stated in the 2015 NRF Handbook for Operation of CoEs, namely *"Centres of Excellence (CoEs) are physical or virtual centres of research which concentrate existing capacity and resources to enable researchers to collaborate across disciplines on long-term projects that are locally relevant and internationally competitive in order to enhance the pursuit of research excellence and high-level capacity development"*. Certainly we have succeeded in all of these aspects, having concentrated a pool of existing human capacity with expertise in mineral and energy resource studies and resources that were available to them into a coherent virtual centre of research excellence that undertook projects that were both locally and internationally relevant and competitive, and at the same time trained high-quality human resources. The point of all of this is that we do not see how we can "refocus on our mandate" except for if we would move away from that mandate.

b) Applied vs Basic Research

The question of the ratio of basic vs applied research to be undertaken in CIMERA is not a simple one to address as already outlined in the introduction of this reply and specifically referring to the pressure on researchers to publish in high-impact scientific journals. In the 2015 guide to successful operation of a CoE there is also no clear directive that one should focus more on applied research than basic research as the panel suggests CIMERA should do. The only statement that can be taken implicating at least some applied research component is in the first aim of a CoE, namely "to promote knowledge and human capital in areas of strategic importance to South Africa". This should, however, be read in conjunction with another of the aims, namely "to strive for the highest standards of quality, international competitiveness and esteem of their science" and that requires production of new and original data that can be published in high-impact international journals. The latter aim should thus also be fulfilled in any applied project.

In a CoE like CIMERA, with the focus on Integrated Mineral and Resource Analysis, the ideal situation would certainly be to do as much research as possible that can contribute to the development and utilization of the mineral and fossil energy resources, not only in South Africa, but also in Africa as a whole. We are of the opinion that we have done very well in this field over the past four years considering the way we formulate the concept of applied research in our mission (also reiterated in our self-evaluation report), namely "that research projects undertaken in DST-NRF CIMERA basically have a focus on developing new concepts and ideas in the science of Economic Geology and thus largely looks into the future. *It is not the mission of DST-NRF CIMERA to undertake purely applied research on the mineral and energy resources for day-to-day operation by the exploration, mining and ore*

beneficiation industry; that is seen as their responsibility. Rather DST-NRF CIMERA research projects are more broadly defined to understand the origin and genesis of mineral and energy resources in broad terms, spanning across borders of specific mineral and energy fields, and in this way contribute to sustained exploration and exploitation activities into the future". This broad definition allows research undertaken in CIMERA to be relevant to the mineral and fossil energy sector at the same time allowing for publication of results in high-impact journals and development of "leading international stature".

The contributions we made in applied aspects of mineral and energy resource analyses in the past four years are clearly spelled out in our self-evaluation report. We have made such contributions in every single one of our eight research focus areas as discussed under the headings of information brokerage and service rendering. The applied component of some of these outputs are perhaps more clear to the casual reader than others. Publications with obvious direct application are, for example, those on geophysical delineation of geological structure in deep gold and platinum mines, geometallurgical and ore grade studies, the nature and origin of ore beds in layered igneous complexes, composition of coal beds, and the shale gas potential of the Karoo to name but a few. Overview publications on the distribution and character of various ore types not only in South Africa, but Africa as a whole are also excellent examples of research outputs with direct application in especially earth resource estimation studies and exploration geology. The applied component or significance of some of our other outputs may, however, not be immediately obvious to the casual reader but certainly to more informed specialists with a vision of the future and global earth resource systems. Such studies include, for example, understanding the exact timing and duration of the Great Oxidation Event in Earth's history, crustal evolution through time (for example, when did modern plate tectonic style systems develop?) and paleomagnetic reconstruction of ancient continental masses to name a few. All of these have direct application in formulating exploration targets for different styles and types of mineral deposits in space and time in both regional and global context. *So the definition of applied research and its component in research outputs may have a different meaning to different people with two end spectra; those concerned with very local mine or deposit scale problems and the others having to identify exploration targets on global scale.* They all have a place in mineral and energy resource studies but with the more regional and global understanding of controls on the distribution and nature of ore and fossil fuel deposits most probably going to become more important in future as the world becomes faced with a scarcity of resources. Another important component is the characterization of mineral deposits that at present may not be of sufficient grade to economically exploit and also investigations into processes that would allow efficient utilization of low-grade ores (the field of geometallurgy). *We do not think that these aspects on applied vs basic research comes out as having been considered appropriately by the review panel in their report.*

c) Interaction with Industry

CIMERA researchers had collaboration, funding and logistical support on both formal contract and more informal goodwill understanding with some 52 mineral and energy resource companies in the past four years as outlined in Appendix 11 of our self-evaluation report. This clearly illustrates the close involvement of CIMERA scientists with industry. The three days set aside for the evaluation of CIMERA activities by the panel allowed time for only 4 persons from industry to be interviewed so that the feedback received by the panel was certainly not representative of all our activities. This clearly led to the panel not receiving the full story or absolutely correct information on the activities of CIMERA as illustrated, for example, by one of the shortcomings listed in their report, namely, that "*the links between Industry and University (implying CIMERA) so far are mostly informal and on an* ad hoc *basis. From the industry side they seem to o.k. with informally communication as long as there is excellent feedback. However, MoUs should be negotiated and emplaced with industry partners, even without fixed expenditure commitments. This would establish stronger links with the mining community"*. However, the true situation is that there does exist formal contracts and/or MoAs with industry partners in the majority of projects undertaken by researchers under the umbrella of CIMERA. These are administered by the legal and governance departments of the Universities in close consultation with the CIMERA scientists involved. Management of the Universities remain the legal entities for activities of CIMERA and, therefore, these contracts are signed by persons in top management ranging from either the Dean of Science to the DVC Research and even the VC depending on the extent and size of the project. These legal contracts ensure clarity on the ownership of intellectual property and ensure that scientific results can be published.

Despite the existing close association and collaboration between CIMERA researchers and the mineral industry, we are fully aware that there are opportunities for improving this relationship. The main opportunity is vested in the fact that collaboration with industry has largely been left to the initiatives of individual researchers in CIMERA or to small working groups. These initiatives typically involve short term projects with the individual researchers or leaders of small working groups taking full responsibility for the outcome. There has, however, been very little initiative from the management of CIMERA up to now to investigate possibilities of industry to make consortium funding available, coupled with overriding MoAs, to ensure self-sustainability of the CoE as a "National academic research entity" for the mineral and fossil fuel industry in South Africa. This is something that has always been on our agenda and as indicated in our Self-Evaluation report we think that with the outputs of the past four years, the time is now ripe to approach industry to develop such long-term consortium funding support for CIMERA. As also suggested by the review panel, these are certainly intended to be one of the priorities of the leadership of CIMERA during the next five year cycle of operation. This process should, however, be very

carefully planned and executed not to interfere with the initiatives of individual researchers and small research groups in CIMERA to approach Industry for research support; a concept that has worked very well in the past four years. More about this in following sections of this reply.

The panel also suggested that CIMERA should appoint an Advisory Committee or Board composed of largely of senior geologists in Industry. This is seen as a constructive suggestion that would be discussed with industry members of our steering committee to plan the way forward

d) Identification, acquisition and funding of new projects.

As stated above, CIMERA has excellent collaboration with industry via its individual researchers and small research groups. Projects identified often come from discussions or contact between researchers and individuals in the mineral and energy industry that recognize certain problems to be investigated. However, it is also so that a large number of projects stems from original initiatives by CIMERA researchers who then contact industry to acquire permission to work on their properties or to obtain sample material from them. Here again there is certainly scope for more organized efforts from CIMERA as an entity to approach Industry to discuss in smaller work-shop sessions how we can assist in answering some of the unsolved problems they are dealing with. This is also probably exactly what the panel suggest CIMERA should do. These discussions or workshops should, ideally, apart from a panel of senior CIMERA scientists, involve the chief geologists and process/resource managers of as many possible of the companies involved with the mineral and fossil fuel industry in South Africa. From the outcome of such workshops, smaller working groups can then be established to take the process further. In these discussions, the focus should be on developing long-term large scale project solving that applies to the industry in general, or to specific mineral deposit types. With reference to the latter, the eight research focus areas of CIMERA and the deposit types involved could serve as a basis for discussion. The ideal situation would be to obtain "consortium support" (both financially and logistically) from groups of companies to address the problems that need to be solved applied to exploration and mining of the deposit types mentioned under the eight focus areas, and to perhaps review that classification and develop new focus areas.

The concept of "consortium long term financial support" should, however, be very carefully handled to avoid companies using it as an "excuse" not to fund short term projects proposed at the initiative of individual scientists and small research groups in CIMERA. Such funds would be administered through account entities of the specific main proponent at his/her own the university and not go through the primary books of CIMERA at the host institute (UJ). Only funds made available for consortium support by industry (including Government and Parastatal departments) that were negotiated directly by CIMERA

management would become part of the primary book-keeping system. These regulations are necessary because individual applications for support from Industry have been very successful in the past as indicated in our self-evaluation report. Some R23.5 million was raised from industry to support research projects in the period 2014 to early 2018, covered by our self-evaluation report. This figure excludes the R38 million that was raised for scientific drilling projects and large sums raised for acquisition of new research equipment and laboratories. In raising funds from Industry for pure running cost of projects, Prof Kinnaird at EGRI was the most successful, having raised R2.73 million. Dr Musa Manzi (Wits geophysics) was also very successful having raised R4.2 million, but that included R3.0 million from Shell for upgrade of his laboratory and staff support.

There is also a new project on mineralization associated with the acid phase of the Bushveld Complex undertaken under leadership of Prof Robb and other researchers at Wits funded to a value of almost R6,0 million by THRIP under its revised/new funding model. We shall carefully monitor how well this new funding model works and if constructive, this revised THRIP avenue of possibly raising additional funds would be promoted more vigorously to our CIMERA researchers.

A criticism from the panel was that the research topics CIMERA investigates have all been on the agenda for many decades (maybe except the Karoo oil and gas topic). However, elsewhere in the document, the panel expressed its concerns that CIMERA needed to respond more to the needs of industry. As many issues on for example the Witwatersrand goldfield, Bushveld Complex, giant Kalahari Manganese Field, Sishen-type large iron ore deposits and Gondwana coal deposits remain to be solved, and they are major contributors to South Africa's economy and job opportunities, ongoing research on aspects of these 'decades-old issues' are essential to help the mining industry because there are still more questions than answers.

In addition, CIMERA is responding to the needs of industry and society by pursuing a theme of Critical Metals led by Prof. Paul Nex. Under this theme, the following commodities are being investigated in collaboration with industry: lithium, germanium, tin, antimony, rare earths, tantalum and cobalt. This is certainly not a theme that has been on the books for decades and neither has, for example, the study of early earth mineral systems, geometallurgy, paleomagnetic studies and advanced ore body characterization in deep mines to name but a few. Also with new analytical equipment purchased and laboratories opened researchers in South Africa can now more readily perform high-quality modern sophisticated isotopic analyses and large scale radiometric dating on ore deposits and host rocks without having to depend on laboratories abroad. However, we are keeping other options open and in the

discussion with industry envisaged as outlined above, some radically new topics and/or research focus areas may come to the fore.

The panel also makes the suggestion that Geoscientific aspects of more efficient and sustainable resource identification, extraction, and recovery should feature more prominently on the future agenda of CIMERA. It is not very clear what the panel means by this remark as no examples or directives are provided of shortcomings and how CIMERA can address that. What we do know is that several of the research projects undertaken in CIMERA deal fully or in part with such issues as already outlined above in our discussion on applied vs basic research. Again we are open for receiving more directives and ideas that may result from the suggested think-tanks in close collaboration with leaders in industry. Having said that, the NRF and industry should realize that with the current complement of full-time academic staff in CIMERA, their undergraduate teaching loads and post-graduate supervision responsibilities, we are essentially at our limit of capabilities. *If we have to take on more responsibilities, becoming increasingly involved in resource identification, extraction, and recovery of mineral deposits (that are the basic components of a mineral resource company) then we would require much larger budgets with medium to long term security so as to be able to appoint additional dedicated well-qualified research associates.* These could include the retention of post-docs who came through our system and in this way could enhance proper transformation in the earth science research community. Several pertinent ideas on how to ensure a larger budget for CIMERA are provided in the following section.

2.2.3. CIMERA as National Research Asset

Panel Remark: One of the most prominent tasks of the new leadership team will be to increase the national role of CIMERA and to embed the other national member units into a far stronger and more equally structured cooperation network. The new leadership team will have to focus strongly on CIMERA's communication with stakeholders both internally and externally to increase the self-perception and visibility as the national CoE for applied research in collaboration with the mineral and energy resource industry. The ratio between fundamental research and applied research for the mineral industry needs to be adjusted from the former to the latter, whereas the former maintains undoubtedly its legitimate role in the universities of South Africa but more strongly outside CIMERA.

Response: We have already, in part, addressed suggestions made in the paragraph above by the panel towards stronger communication with stakeholders and the issue of applied vs basic components in research projects undertaken by CIMERA. Here we want to concentrate on the prospects (steps that can be taken) of enabling CIMERA to increase its capabilities of operating as a fully recognized "National CoE"

for research in collaboration with the mineral and energy resource industry (including public companies and Government departments such as Mineral Resources, Energy and the DTI apart from the DST-NRF). This is an important aspect to consider as we were highly encouraged by the conclusion reached by the evaluation panel, namely that *"Within the mid-term evaluation process, the members of the MEP have come to the conclusion that CIMERA is undoubtedly a highly valuable asset for South Africa as a whole. CIMERA is already and should in future remain the applied geoscientific flagship-institution of South Africa. The value of CIMERA as a national institution is recognized - although currently still to a varying degree – i) by the national scientific community, ii) world-wide by cooperating high-level scientific institutions and individuals, iii) largely by the South African exploration and mining industry, and iv) - in some regions - already by the regional and local communities"*. Closely linked to this remark by the panel, is their iteration of an ideal we expressed in our self-evaluation report that "CIMERA should strive to incorporate scientists from the earth science departments in the four universities in South Africa that are currently not formal partners of the CoE (referring to Limpopo, Nelson Mandela, UKZN and Walter Sisulu)".

Our biggest challenge to fulfill this ideal and to also get more closely involved with industry in resource identification, extraction and recovery (referred to in previous section) would be *increased financial support.* This we could do through establishing long term financial agreements with private industry and also through the DST get the Departments of Energy, Mineral Resources and even Trade and Industry to contribute to the budget of CIMERA (the latter is a suggestion made in our self-evaluation report and supported by the review panel). However, we would like to also suggest that a slight adaption of the science budget of the DST-NRF to focus more on science entities that have a "Geographic Advantage" (with focus on global recognition) and at the same time are linked to industries that make large contributions to South Africa's economy and create job opportunities. Projects funded by the DST-NRF under the heading of Geographic Advantages amounts to some R813 million (based on a presentation by the NRF at the 2018 CoE Directors' Forum held in Kimberley). Of this R538 million is dedicated to Astronomy and the remaining R275 million to Antarctic Research, Palaeosciences, Indigenous Knowledge and Biodiversity. None of these can in our minds be considered to make major contributions to the economy of South Africa or have the potential to create much new work opportunities in the long run. *We do not argue against the need to support these fields of science but wonder why Mineral and Energy Resource studies are not classified as having a research field with major and even perhaps more Geographic Advantages than the other disciplines in that group.* We base this question on the fact that South Africa undoubtedly represents the richest piece of mineral land estate in the world. It hosts the largest known resources of platinum group minerals, gold, chromium and manganese as well as refractory minerals and huge resources of iron, fluorspar and coal. Many of these deposits occur in unique settings.

In addition, some of the best preserved Archean to Early Proterozoic successions are present in South Africa with good outcrop apart from being intersected by large numbers of deep drill core intersections providing absolutely fresh sample material and detail stratigraphic insight. This is apart from the very high density of seismic data available on the Kaapvaal Craton, the first and best preserved of its kind globally. South Africa thus provides an ideal laboratory for unraveling some of the most ancient history of earth and especially Early Earth Mineral Systems (one of the focus areas of CIMERA). In combination all these aspects should qualify Mineral and Energy Resource Studies to be considered one of the disciplines with major Geographic Advantages. What differs from the other disciplines in this group, is that the study of Mineral and Energy Resource Systems has major economic and job-creation potential and impact. *However, currently it features minutely in the budget allocations of the DST-NRF being referred to as Earth, Marine and Environmental Sciences with a combined annual allocation of R172 million, representing a mere 7% of the R2 470 million reserved for Other Knowledge Areas (Information from a presentation by NRF at the 2018 CoE Directors Forum in Kimberley). A slight shift in this budget allocation by perhaps as little as R10-R20 million in the annual allocation to CIMERA (grouped under disciplines with Geographic Advantage) would assist greatly into developing it into a full scale National CoE for Mineral and Energy Resource Studies.*

Closely linked to the above, we want to come back to the point that the DST-NRF perhaps focuses research funding by far too much on developing and advancing the stature of individuals and programs run by individuals instead of supporting cooperative projects with a high potential for bringing economic growth and increased work opportunities to South Africa. CoEs like CIMERA and many of the others fall in this category and that program should thus receive a much higher budget in total than is currently the case. Within such cooperative projects, funds could be made available for Research Chairs but they would all form part of larger cooperative groups with a distinct broad focus. Such cooperative research groups, like the CoEs have proven, to produce, for example, much better return for investment of funds than the Research Chairs on their own (not implying that Research Chairs should be discounted). This is illustrated by the fact that in the past financial year, some R413 million was budgeted for supporting 226 Research Chairs. In the same period only R168 million was budgeted for all the 15 CoEs supported by the DST-NRF i.e. a budget of 41% that of the Chairs. However, the CoEs performed much better in producing highly trained post-graduate human resources than the Chairs. This is illustrated by the 206 PhDs produced by 15 CoEs compared to 380 by the 226 Chairs and 225 Master graduates from CoEs compared to 393 from Chairs (information from presentation by the NRF at 2018 CoE Director's Forum in Kimberley). The 432 MSc and PhD graduates produced by the CoEs divided by the amount they received (R168 million) shows that each degree cost an average of R388 888. The same calculation for the Chairs (773 degrees at a cost

of R413 million) averages R534 282 per degree. The CoEs thus certainly represent a better return on investment overall.

So perhaps the DST-NRF should carefully reconsider their whole research funding policy and concentrate on cooperative research support with high potential economic impact in turn enabling them to motivate for larger allocations from the country's budget.

2.2.4. Broadening the Internal Scientific Discussion and Communication Culture in CIMERA

Panel Remarks: There are two important closely related by the panel. The first from the Executive Summary and the other from the list of shortcomings. They are as follows:

a) The internal scientific discussion and communication culture within CIMERA should be broadened beyond the successful participation in, or organization of topic-focused conferences. CIMERA should establish a series of regular get-togethers (e.g. "Indabas") independently of conference sessions or progress report meetings, with the sole purpose of "ideation", in which "crazy" ideas can be presented by everybody without being "shot down" too early because they do not fit the established range of topics. This could establish a highly innovative "high-risk, high-yield" culture that might identify totally new and innovative approaches to science by "thinking outside the box". Especially heterogeneous teams tend to spark this type of scientifically fertile culture, from which radically new concepts can emerge.

b) Although it is understandable that such a feeling has established itself, it should be more promoted that CIMERA is a national institution. Except for the leadership team, this was hardly to not at all recognized by most staff and student members. Neither was the purpose of CIMERA to provide more HR to the country and the minerals resource industry.

Response: Both of the panel remarks are good and make suggestions that CIMERA management should follow up on. However, we should state that, apart from our annual research colloquium and participation in organization of conferences, CIMERA has organized "theme" workshops for bigger projects such as the Bushveld, KARIN and Witwatersrand Gold Projects apart from participation in several other workshops on energy resources and in geometallurgy. What we have not done and would consider organizing in future are "ideation" get-togethers as suggested by the panel. The idea of nurturing innovation is a good one, but we must make note of the fact that it is slightly at odds with earlier points raised by the panel that CIMERA should be more industry focused with less fundamental research.

Regarding the remark on marketing of CIMERA as a National Institution, we think that enormous efforts have been undertaken by CIMERA-supported staff to market CIMERA around the world. There is a well-maintained website, invitations to industry nationwide to attend report-back meetings, promotion of CIMERA at international conferences by oral presentations and poster displays, plus booths at relevant national conferences. The success of these promotional steps are illustrated by, for example, significant numbers of enquiries from foreigners about study and research opportunities, the fact that CIMERA has recently been invited to become a partner in a large multinational proposal to the EU to do research on extraction of alumina from anorthosites, and Prof Kinnaird was recently congratulated at a conference in the US on SA's Government efforts to create and support CIMERA.

Having said that, perhaps what we have not done optimally is to promote the national and international standing and research focus of CIMERA internally to some of our collaborating scientists and students. We accept that fact because if we had done it properly, then some of the remarks coming from interviews the panel had with students and staff should not have featured. We can improve on that by not only placing more emphasis on outlining the scope, purpose and activities of CIMERA during our colloquia and workshops, but also by providing such information to every new student and staff member as they become part of CIMERA.

2.2.5. Career Paths and Entrepreneurial Skills

Panel Remark: Successful scientific career paths of geoscientists from all ethnic and gender groups should be advocated and made known to students and young scientists to act as potential role models. Career paths can be in the academic university field, in industry but there is also a – presently not advocated – entrepreneurial geoscientific field, which is still rather underdeveloped in South Africa. Special skills for the latter can be trained in optional courses, such as in the field of economics, industrial funding, minerals market analysis, law, environmental regulations, and more general management and leadership skills.

Response: This remark by the panel to a large degree applies to the whole higher education training system in South Africa with very strict, and sometimes iconic old curricula. Fortunately there are some moves at Universities (referring specifically to the 4th Industrial Revolution initiatives at UJ) to allow students to participate in more "interdisciplinary curricula" combining

science subjects with components of, for example, economics, marketing and engineering. Because of the importance of multi-skilled abilities for geologists and especially mineral and energy resource analysis, CIMERA should certainly as far possible try to assist in producing post-graduates with such skills. One way of accomplishing that would be to organize, for example, annually a short course on entrepreneurial geology for our postgraduates from all of the collaborating partners. There are quite a number of highly successful entrepreneurial professional geologists in South Africa and the "trick" would be to convince one or two of them to prepare such a course for CIMERA. The chances of success finding persons willing to do this should be researched, and if feedback is positive, CIMERA should budget for it and obtain sponsorship from Industry partners.

2.2.6. Analytical Equipment

Panel Remarks: There are two pertinent remarks on analytical equipment by the panel, namely:

a) CIMERA needs to support the capacity-building of some of its collaborating universities for historically disadvantaged South African Universities by providing additional analytical equipment.

b) There is a notable lack of a Scanning Electron Microscope (SEM) laboratory, which could cover a large number of routine investigations prior to more specific microprobe analytical work. Ideally this SEM would be combined with a Mineral Liberation Analysis (MLA), which is by now internationally routinely applied for geometallurgy and other geoscientific research. Miniaturisation has led to the development of state-of-the-art desk top models at reasonable prices and this could allow for more than one SEM-MLA machine to be operated within CIMERA installed at regional hub-facilities.

Response: It is not the responsibility of CIMERA to provide analytical equipment to Universities. This is largely the responsibility of Top-management of Universities to see that equipment is provided for their research staff. Participation in CIMERA, however, makes it simpler for a scientist to make use of equipment available at all of the collaborating partners. CIMERA has a limited budget for purchase of equipment as prescribed by the NRF and this is only sufficient for acquisition of small instruments or for top-up to purchase of large instruments. The door is open for the historically disadvantaged partners to apply for such support from CIMERA.

The lack of a SEM laboratory applies specifically to Wits and their top-management should take steps to solve the problem. The term "reasonable prices" for "state of the art desktop models" is very relative taking into account the current very weak Rand to US Dollar exchange rate. However, we shall look into the cost of such instruments and if we find it reasonable shall make it known to our researchers that

can then try to raise funds for their acquisition.

2.2.6. Transformation

Panel Remarks: There are two remarks by the panel, namely:

a) The transformation process and gender equality efforts, despite some limited success, needs significantly more effort within CIMERA to reach the goals set up in the original scheme to train and retain future local African researchers. Focusing primarily on basic acquisition and support for African and female students and young scientists by CIMERA within the current South African socio-economic framework is not sufficient and will be too slow to provide the required human resource for the minerals and energy resource sector. It is recommended that more innovative, bold, and unconventional measures have to be taken to increase the transformation process, possibly by bringing in outside human resource expertise. One single problem has been identified as particularly pressing and detrimental to the transformation process and this is the inadequate support for (single) parenting (African) students and young researchers, which limits or even prevents them from studying and pursuing a scientific career.

b) A general recommendation to all CIMERA-hosting universities is the establishment of a "family friendly" study- and research-environment to support (single) parenting students and young scientists by offering child day care facilities. This could follow the well-established German model of certified family friendly universities, which could serve as a role model. This recommendation has been strongly and unanimously applauded by all interview partners during the on-site evaluation and would be a highly efficient way to support successful transformation and gender equality.

Response: The contribution CIMERA is making in the transformation of human resources the field of mineral and energy resource studies has already been discussed earlier on in this document. We are not sure what the panel implies by the statements that the current initiative would lead to results that are too slow for industry. Certainly the training of high-quality human resources takes time (typically five to seven years at least for producing Doctoral graduates) and we cannot speed up that process. We also do not follow what the panel means by the suggestion "to bring in outside human resource expertise". If the expertise is from outside of South Africa does that really fulfill the definition of "transformation" in local context? We do not think so. Rather we are very actively involved in CIMERA in training high-quality human resources for the future with mainly south Africa citizens involved to take over leading positions in the medium- to long-term.

The second remark by the panel to establish family support is very appropriate, but it falls outside the scope of capabilities of CIMERA. It is purely a problem to be addressed by top-management of the Universities.

3. Response to Some Specific Shortcomings/Challenges to be Overcome not Addressed Earlier

Most of the shortcomings and challenges to overcome have been addressed under Section 3 of this response document. Here we shall respond to a few that have not been addressed. They are as follows:

3.1 Panel Comment: The CIMERA projects are predominantly managed by Principal Investigators (PIs) from UJ and Wits. There should be more encouragement and possibilities for PIs from other member universities to propose and lead new projects.

Response: This is understandable as CIMERA was formed based on the performance of two large research entities, namely, the PPM Research Group at UJ and EGRI at Wits. We have incorporated as far possible researchers with interests in economic geology and good track records from other universities in South Africa. They are involved in all of the research focus areas of CIMERA, and some are in Leading Researcher positions in the NRF ranking system.

3.2. Panel Comment: Life is changing for a geologist and new technology can enhance many of the jobs, such as drone coverage of an open-pit. It is thus necessary to bring in geo-spectral imaging into undergraduate courses and it is problematic that fundamental subjects such as crystallography is no longer taught.

Response: These are issues that should be addressed by academic staff at departmental level with CIMERA scientists providing recommendations. We have to point out that such initiatives are already undertaken by several of the Geoscience Departments collaborating within CIMERA.

3.3. Panel Comment: Most of the research funding requirements is focused on the national government but local and provincial government could be included particularly with respect to reviving the mines and to obtain multi-lateral funding. It is not understandable, why a national CoE of applied research for the South African exploration and mining industry should not receive partial funding and financial support from more than one government department, i.e. the Department of Science and Technology jointly with

the Department of Mineral Resources and the Department of Energy.

Response: The suggestion to include other central government departments to contribute to the budget of CIMERA has been on our books for quite some time. We do, however, need support from the DST to get the process in full motion. The idea to obtain provincial government support is new and should certainly be followed up. In addition, it must be realised that reviving the mines is often a matter of commodity demand and international economic forces. Wonderful though it might be to revive a gold mine or a platinum mine, if the cost of production is higher than the market price – nothing can be done to revive a mine.

3.4. Panel Comment: The competition between the University of Rhodes and University of Wits is understandable as they both have a long-standing strength in economic geology whereas there is not the same between Wits and UJ, where the latter is more focused on basic research. Rhodes and Wits are thus competing for the same funding and projects.

Response: We do not know where these comments came from but we certainly disagree strongly and may reflect an outdated individual perception. It certainly does not apply to the present situation as illustrated by the fact that several of the academic staff at Rhodes are active researchers in CIMERA, including the leader of their long-standing and highly rated Masters' program in Exploration Geology.

3.5. Panel Comment: The proposed research advisory board should take on members also from the larger mining houses, communicate with them regularly and ensure that they are informed about the actual agendas of these mining houses. These companies are faced with a large number of technical, ecological and economical challenges, many of which could do with supportive applied research by CIMERA, especially in exploration and geometallurgy.

Response: Members from the mining houses and companies are already incorporated in the Steering Committee of CIMERA. All of them are coming to the end of their 3 year terms and the plan is to incorporate more members from the larger mining houses. We hope that some of the Steering Committee Members would also be willing to serve on the proposed new advisory committee that we think is a good suggestion.

3.6 Panel Remark: One industry partner (Tsodilo Resources) expressed that they have experienced poor quality of conduct in a cooperation project, which is detrimental to the concept of providing

applied research to the industry. Sample material had been provided but no feedback nor results were delivered to the company. A written code of conduct should be formulated and read and signed by all CIMERA members that are dealing and conducting industry project. A certain degree of a "service to the community" attitude should be established in the applied sciences.

Response: We have already responded on contracts that are normally signed by Universities for all contracts with outside sponsorship. Apart from that, we agree that a concise written code of conduct could be formulated to assist especially students in how to operate when doing projects involving industry and other agencies supplying support for research projects.

3.7 Panel Remark: There is also a partial absence of formal memorandum of understanding (MoU) between CIMERA and other international collaborators. As a result, the cooperation is simply based on the goodwill of scientists who trust each other. Although this might be sufficient in some case, it would be desirable to establish a number of MoUs with the international cooperation partners. Closely linked to the latter is an absence of an official request for student mobility between collaborators and CIMERA. As one scientist from MIT pointed out, had he been approached he would have considered to host a CIMERA student for short term study visits.

Response: We have started to develop such formal MoAs with international collaborators in, for example, Germany, Brazil and Ghana (refer to self-evaluation report). However, they can certainly be built out if there is support from both sides and funds can be made available for student and staff mobility. This has taken place in a number of instances with reference to students and researchers supported by CIMERA. If happening on regular basis, it would be worth formulating formal MoAs, but on a very selective basis with a clear understanding of the purpose and scope of the collaboration. It can also only succeed if the researchers would have time to undertake such responsibilities in addition to their current very full workloads. This re-iterates the statement made earlier that more funding would be required to appoint additional research associates.

3.1. **A special and important critical note by the MEP**

The panel was disturbed by certain remarks purportedly made by a supervisor towards a female masters' student and feel obliged to bring this to the attention of the NRF. The remarks made were as follows:

"When enquiring from my supervisor about geophysics, I was informed that women do not have the mathematical ability to do geophysics."

and

"When enquiring about presenting at an international conference I was informed that South African universities do not have the necessary level of quality for international participation."

The panel felt strongly enough about these remarks to request that the issue be addressed by the NRF with CIMERA management. It is requested that the responses to this and any outcomes be communicated to the panel through the chair.

Response: These are clearly remarks that should not be allowed to come from supervisors to students. It certainly does not reflect the usual student-supervisor relationships in CIMERA that are normally very supportive and pro-active, as indicated by the large numbers of our students attending conferences and workshops, both nationally and internationally. Also at Wits in the Geophysics Department some of their most productive students are female and their contributions are highly valued. We also have to state that at UJ students and supervisors sign formal agreements of conduct and collaboration when postgrad projects are registered. There is also clear guidance for procedures to follow when conflict develops between them. Universities also have ombudsman units that can assist in dispute resolution. This is normally done via the Heads of Department who can be assisted by the directorate of CIMERA to find solutions.

4. Responses to Selected Recommendations

4.1. Panel Remark: The regular exchange between DST, NRF and the CIMERA management to synchronise expectations, tasks, and directions of development should be intensified and should also include 2-year "target agreements". The initial five years were a suitable period covering the establishing and initial scientific production periods of CIMERA. As of now, a shorter period would be more advisable to fine-tune the direction of development.

Response: The steering committee of CIMERA meets twice a year and DST and NRF are well represented on the committee. There should thus be sufficient opportunity to exchange ideas and give advice on the directions to follow. CoEs are also expected to perform according to targets outlined in the Service Level Agreements signed with the DST-NRF and these evaluated annually.

4.2. **Panel Remark:** International research programs, such as the IODP/ICDP (International Ocean Drilling Program and International Continental Drilling Program) require seed money contributions by the countries that want to participate and that want and can apply for substantial internationally available

funding. This seed money should be paid by DST for South Africa in order to allow access to these projects and funding sources.

Response: *This is a remark that should be very seriously considered by the DST. It is so that, despite several attempts over the past 18 months or so to motivate DST to renew the membership of ICDP that they allowed to lapse in 2011, it has met with no positive response or action from them.* This is a real pity because, without that membership, South African earth scientist do not qualify to lead such international drilling projects.

4.3. Panel Remark: An MSc study program in geometallurgy is highly recommended and will help to steer CIMERA's activities more towards applied research that is highly relevant to the exploration and mining industry.

Response: A Chair in Geometallurgy is supported by the NRF at UJ and the working relation with CIMERA is excellent. Researchers at the University of the Witwatersrand are also involved in several geometallurgy research projects. If such a proposed MSc course is to be developed, it should be done in close collaboration between the two entities in CIMERA.

4.4. Panel Remarks: There are four closely related remarks by the panel on the need to increase collaboration with industry, namely:

A strong advisory role by senior industry- and academia-familiar individuals both in the recruitments process of a new leadership-/co-leadership team and in the future orientation of CIMERA's projects and funding is highly recommended.

A more applied scientific and industry-orientated advisory board is also strongly recommended. Ideally this should be chaired by an outstanding and proven senior industry/academic leader, Richard Viljoen or Lawrence Robb, who ideally would identify further members of such an advisory board who should be characterised by a large innovative potential and flexibility of mind (to be able to "think outside the box").

Currently there is no clear strategy within CIMERA on how to approach the large mining companies for structured cooperation and research funding schemes. This strategy should be established together with senior mining alumni from e.g. UJ and especially Wits, regardless of the present economic difficulties of the mining industry (if these difficulties really exist right now).

An industry-liaison-scientist should be emplaced, who speaks and understands the language of industry and who actively visits potential industry partners, identifying their needs in applied research.

Response: We have responded to the first three of these earlier in this document. We think favorably about the suggestion to consider appointment of an industry-liaison-scientist in CIMERA. It would, however, depend on funding available and whether we would receive a good return on investment.

4.5. Panel Remarks: There are six closely linked remarks on student finances listed by the panel, namely:

Discussion around the finances taken from student bursaries for university fees need to be communicated at the beginning of the year to avoid misunderstandings. So better communication is needed in the future.

UJ school fees and accommodation are cheaper than those at Wits, which means less funding for Wits students. A coordinated adjustment is recommended, since students work together and communicate with each other. Hard feelings can be avoided if fees could be synchronised for CIMERA student members if possible.

Grants are not supplied at the beginning of the year to enable payments of necessary deposits.

UCT student had to pay in extra due to even higher fees. There needs to be some subventions according to locations and bursaries should reflect that.

There is not enough funding available for Wits students to be self-sufficient, so students have to work to supplement their living.

Students are better paid up front as advanced money (e.g. 70%) rather than having a reimbursement after a field trip. Students typically do not have the savings to advance these travel costs out of their private budget. The organisation of this can be dependent on the supervisor and the institutions.

Response: These are remarks largely related to differences in the day-to-day functioning of Universities that are supposed to operate as "independent" or "self-governing" units. CIMERA cannot prescribe to the various universities how to operate. All we can do is to try to adjust allocation of funds to assist in having equal treatment. The financial office of CIMERA at UJ also pays over funds allocated for research support to the different universities as soon invoices are received from them. We have, however, noticed that there are sometimes large delays in receiving such invoices from some of the collaborating partners. This could certainly mean delays in payment of bursaries to students at those universities, and also in support of field trip costs. Certainly, we totally discourage a system where students have to provide funds from their private budgets for field work and claim back later. A solution to the problem may be for CIMERA to compose a memorandum in which we give directives for the preferred way to handle payments to students.

NJ Beukes

JA Kinnaird

24 October 2018

Appendix 1. Names and Associations of Panelists

Chairperson:

Prof. Gregor Borg (Economic Geologist)
Martin Luther University Halle-Wittenberg, Germany

Further panel members:

Prof. Tesfaye Kidane Birke (Structural Geologist) University of Kwazulu-Natal, South Africa

Prof. Akalemwa Kamona (Economic Geologist) University of Namibia, Windhoek, Namibia

Dr. Molefi Motuku (Group Executive: Research, Development and Innovation) Council for Scientific and Industrial Research, Pretoria, South Africa

Assessor:

Prof. Monde Ntwasa (Biotechnologist) UNISA, Pretoria, South Africa

Administrative NRF-Organiser:

Ms Asiphe Sahula

Scribe:

Ms Margret Steyn