



# CSIR

Touching lives through innovation

## Application Manual – Post-Graduate R&D Call

## Collaborative Program in Additive Manufacturing

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Funded by the



**science & innovation**

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Science and Innovation  
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# PART 1: Introduction

## 1.1. Purpose

This manual provides information on opportunities for funding supported by the Collaborative Program in Additive Manufacturing (CPAM).

The manual is intended to be an easy reference guide to the CPAM Phase 4 funding programs available and to assist potential participants to prepare proposals for funding support. It does not, however, constitute a complete set of policy, procedures or systems supporting the programme.

## 1.2. Background

Additive Manufacturing (AM) is defined as the process of joining materials to make parts from 3D model data, through a layer upon layer process. AM is, in comparison with machining based subtractive manufacturing processes such as cutting and milling, much more efficient in the utilisation of raw materials in the manufacturing process. More important though, is that AM is considered a digital manufacturing technology, one of the key advanced manufacturing technologies that enable the 4<sup>th</sup> Industrial Revolution.

AM enables new product development in high end markets as well as consumer driven markets. Due to the inherent characteristics of AM, it provides designers and manufacturers unparalleled freedom with respect to product conceptualisation and design. It allows the use of a wide range of materials, also materials that have traditionally been difficult to use as feedstock material for products. The freedom of design and wider use of materials for complex product design allow an innovative approach to the design and manufacture of new products.

AM has, however, also demonstrated that it is a useful manufacturing tool for repair and reinstatement of high value parts to their original design specifications. It has also demonstrated that it may even improve the performance characteristics of existing parts through the use of tailored alloys designed for specific operational conditions.

Although AM has created significant hype and interest from industry, considerable effort is still required to get AM accepted as a standard and reliable advanced manufacturing technology for high end applications.

The South African Additive Manufacturing Strategy was commissioned by the Department of Science and Innovation (DSI) and published in 2016. Since 2014/15 an implementation program for the strategy has been funded by the DSI. This program, the Collaborative Program in Additive Manufacturing (CPAM), over the past 10 years grew to a successful program supporting new knowledge generation in the field of AM. The program has

supported a large cohort of post graduate students who have done post graduate research projects based on research questions identified for both the metal AM and polymer AM technology value chains.

In support of continuing the implementation of the South African Additive Manufacturing strategy<sup>1</sup>, CPAM is now launching, as part of Phase 4 of the implementation of the SA Additive Manufacturing Strategy, a number of initiatives aimed at derisking technology and supporting the adoption of the technology as an advanced manufacturing technology by industry.

### 1.3. Strategic intent

At a high level the CPAM strategic objectives since inception were to:

- Advance the knowledge base in South Africa in selected focus areas of the SA AM strategy.
- Increase the technology readiness level (TRL) of AM to ease adoption by industry.
- Development of human capital
  - Focus is at post graduate level with research topics aligned with the elements in the AM value chain.
- New knowledge generation as measured through:
  - Publication outputs and conference papers presented;
  - Patent outputs;
  - Technology demonstrators and process documents.
- Commercial outputs to support development of an AM industry in South Africa
  - New processes, products;
  - Support for small, medium and micro enterprises (SMMEs).

### 1.4. CPAM programs

In support of Phase 4 of CPAM the following programs will be supported:

- Industry led R&D projects,
- Postgraduate study support R&D projects,
- Mentorship program,
- SMME support program.

In Part 2 of this manual more details are provided on the call guidelines, eligibility criteria, call timelines and evaluation criteria for these programs. This call document specifically addresses the details and requirements for the **Post Graduate R&D Projects program**.

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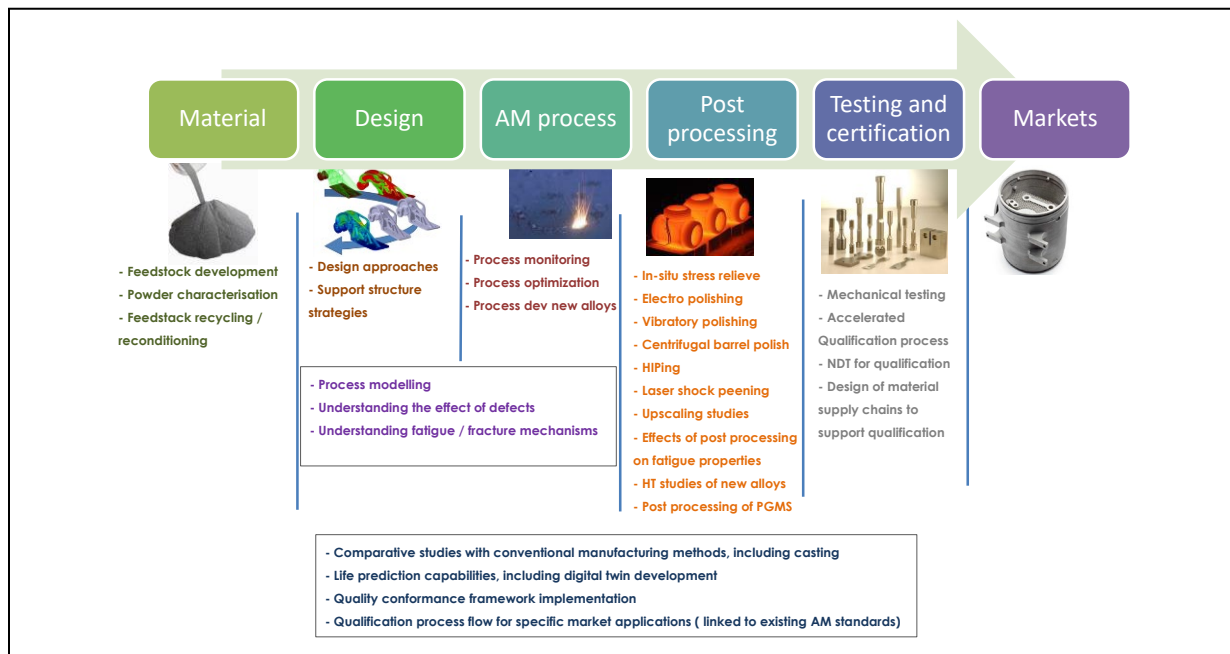
<sup>1</sup> <https://site.rapdasa.org/wp-content/uploads/2017/02/South-African-Additive-Manufacturing-Strategy.pdf>

## PART 2: Call, Eligibility, Funding and Timelines

### 2. Postgraduate Research and Development Projects

In this call proposals are solicited for post graduate research and development (R&D) projects. This call is directed to all South African tertiary educational institutions and science councils that are active in research and development of additive manufacturing technologies and who also has the capacity to supervise post graduate students on post graduate research projects in the field of additive manufacturing (AM). Any research institutions that have not benefitted previously from CPAM funding support is invited to also apply.

The purpose of the call is to invite proposals from the institutions as defined to support new knowledge generation in the field of additive manufacturing, whilst addressing research questions identified on any aspect of the AM technology value chain and at the same time supporting the human capital development (HCD) requirements for the next generation of engineers and technologists using AM technologies.



**Figure 1: Metal additive manufacturing technology value chain**

The proposed projects should be structured around the following key aspects:

- The focus is on conducting research and development projects to support key research questions along the technology value chain of AM, as illustrated for metal additive manufacturing in Figure 1.
- Project proposals will be accepted for both metal AM and polymer AM, including Design for AM projects that fit within either or both these technology themes.
- A project can be structured as a number of doctoral and master's subprojects structured around a specific research theme.

- The number of subprojects will be limited by the capacity of the research institution to support supervision of the students, based on the number of full-time equivalent research staff listed. Typically, a ratio of 1 doctoral and 2 to 3 master students per supervisor would be acceptable.

The call is not specific with respect to whether the focus is on Metal AM or on Polymer AM technology. The main criteria with respect to content will be that the proposal be structured around a well-defined research question or theme that supports the development of a better understanding and new knowledge generation on additive manufacturing processes along the AM technology value chain, with the ultimate aim to contribute to the maturing of the technology, the increase in the TRL of the AM manufacturing process and the qualification processes that will support implementation of AM as a mature manufacturing technology.

**Studies dedicated to investigation of material characterisation or material development will only be considered with strong motivation and intention of adoption by an industry partner associated with the project.**

## 2.1 Call for applications

The call for the CPAM Postgraduate R&D funding program is facilitated by the National Programs group at the CSIR Photonics Centre. A template for new applications is distributed by this office to interested parties via the CSIR website, the CSIR Photonics Centre's database of contacts, the Rapid Product Development Association of South Africa (RAPDASA) website and RAPDASA database of contacts, as well as through social media channels available to the CSIR, the DSI and RAPDASA.

Proposals in response to this call must be forwarded to the CSIR Photonics Centre's National Programs project office, at the e-mail address [hgreyling@csir.co.za](mailto:hgreyling@csir.co.za) and [nlcrentalpool@csir.co.za](mailto:nlcrentalpool@csir.co.za).

The scientific and technical contents of the proposed project will be refereed through a peer review mechanism to assess the quality of the research proposal submitted. Evaluation of the proposals will be done based on a predefined evaluation framework. Applications must be substantial and comprehensive to allow proper assessment of the research proposed.

Applicants are encouraged to approach the CSIR Photonics Centre for assistance with completion of the application.

## 2.2 Eligibility criteria

Proposals may be submitted by any South African tertiary educational institution or science council that is active in research and development of additive manufacturing technologies and who also has the capacity to supervise postgraduate students on postgraduate research projects in the field of additive manufacturing (AM). The applicant and his or her institution does not necessarily have to be from the present CPAM network.

The following should be noted with respect to the eligibility criteria:

- The applicant needs to be a full-time researcher at a South African research institution active in the field of additive manufacturing.
- The applicant should at least have a masters degree in a field related to AM. It is preferable that the applicant holds a doctoral degree and has a student supervision track record.
- The proposal needs to be structured around a research theme that addresses aspects of the AM technology value chain, broken down into a number of sub projects which are structured as post graduate student projects.
- The proposal may be developed for applications in any sector where AM may be utilised.
- Additive manufacturing processes and/or AM hardware must be core to the proposal<sup>2</sup>
- Proposals where there are industry partners directly involved will be given preference.
- Projects must be structured with defined outputs including the following:
  - HCD outputs as demonstrated through direct student involvement and student graduations.
  - Knowledge product outputs such as:
    - Publications in peer reviewed journals
    - Conference presentations, preferably based on peer reviewed papers
    - Technology demonstrators, verified by institutional Technology Transfer Offices or similar
    - Technology packages or process documents
    - Technical progress reports can also be included as deliverables.

Participation of postgraduate students (doctoral and masters students as key drivers), registered at a recognised South African higher education institution is of paramount importance as well as collaboration with other researchers based at the applicant's institution and other institutions. These should be stated clearly by the researcher in the application.

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<sup>2</sup> For example, the proposal cannot be a request for a full drone system/application development project, but typically just the development of the airframe using Design for AM or AM processes can qualify as a fundable proposal.

## 2.3 Funding

An annual budget request per project is dependent on the scope of work proposed, as well as the capacity of the institution and the applicant's research group to supervise post graduate students.

It is important for the institution to also demonstrate support for the project proposal with co-funding of the project through institutional bursaries. Other bursary funding attracted by the applicant from other sources will also support the application for funding from CPAM.

If possible, in-kind contributions from the applicant's institution need to be quantified.

Project applications should clearly articulate the budget requirement to support the execution of the project towards the realisation of the defined deliverables. The following costs are allowable costs:

- Labour costs: Labour costs associated with project execution is only allowable for the CSIR<sup>3</sup>.
- The allowable budgets associated with post graduate students are:
  - For doctoral student projects R 250 000 per year per project per student is allowed. This includes a bursary value of R 170 000 and R 80 000 for materials, testing and other consumables per student project.
  - For master students R 180 000 per year per project per student is allowed. This includes a bursary value of R 120 000 and R 60 000 for materials, testing and other consumables per student project.
- Materials and 3D printing (AM): Costs associated with the production of prototypes in support of the project execution and deliverables.
- Other costs: Costs associated with execution of the project, including traveling costs in support of the project execution. Local conference attendance is allowable.

The following costs are not supported:

- Costs associated with the acquisition of capital equipment.
- Cost associated with the purchase of computers.

## 2.4 Duration of the Project

The duration of a project supported by CPAM will depend on the scope of work to be undertaken. Project durations can be between 12 months and 36 months as a maximum. Depending on the number of projects supported and the availability of funding it is anticipated the CSIR will consider the possibility of additional calls to be issued on an annual basis.

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<sup>3</sup> The CSIR is a Schedule 3B organisation requiring that projects are fully costed, including applicable labour costs.



For multiple year projects contracting with successful applicants will be on a yearly basis from 1 April to 31 March of the next year. Continuation funding for a second or a third year for approved projects can only be considered based on the submission of a comprehensive Annual Progress Report at the end of each year of the project. Consideration of continuation funding is subject to the progress reported in the Annual Progress Report and the quality of the Annual Progress Report.

Continuation funding beyond the first three years can be considered if a new funding application is submitted to support a continued research program, subject to funding available from the DSI.

## 2.5 Timeline

The timelines for submitting a proposal to the CPAM Postgraduate R&D project call is shown in **Table 1**. Also listed in this table are the expected dates for the outcomes announcement of the applications.

**Table 1: Call & outcomes announcement**

Description	Start date	Closing date
Opening of Call for proposals	21 August 2024	20 September 2024
Announcement of outcome	Approximately 4 to 6 weeks after the closing date for proposals	
Contracting with successful applicants	Targeted be completed by end November 2024	
Call for 1 <sup>st</sup> Annual Progress Report	28 February 2025	24 March 2024

## 2.6 Intellectual Property considerations

The management of intellectual property developed during the execution of projects funded by CPAM will be determined by the funding model adopted to support the execution of the project. All Intellectual Property generated shall be subject to the provisions of the Intellectual Property Rights from Publicly Financed Research and Development Act, 2008 (Act 51 of 2008).

Intellectual Property developed in the execution of the projects will be owned by the research institution where the work is conducted. If the IP is developed in collaboration with parties outside the contracted institution it will be required that the collaboration partners establish the necessary agreements between the collaboration partners to formulate how the IP will be managed and commercially exploited.

For projects where there is an industry partner involved in the research project the following guideline apply.

**Table 2: Guideline for Intellectual Property management as function of the Funding model**

<b>Model:</b>	<b>Details and Requirements:</b>
A – Full Cost	<p><b>The industry partner will pay the full cost of the project.</b></p> <p>The industry partner will own the resulting IP.</p> <p><u>These projects do not require any funding support from CPAM, and is thus excluded from the program</u></p>
B – Co-Funded	<p><b>The industry partner and the research partner (through CPAM) will jointly cover the cost of the project.</b></p> <p>The Research Institution (HEI or CSIR) will own the IP.</p> <p>The commercial partner will be granted a commercial licence to exploit the IP for the identified field of use.</p> <p>Any royalty fee in terms of a licence will be discounted based on the contribution of the industry partner to the project.</p> <p>Where applicable exclusivity and a royalty holiday may be negotiated based on commercialisation milestones and commercial implementation requirements.</p>

## 2.7 Assessment process

All applications received by the CSIR will be screened by the CSIR CPAM management based on whether eligibility criteria in terms of the theme, funding and other resource requirements were met. Proposals that meet the eligibility criteria as stipulated in the call document, will be submitted to an independent CPAM review panel appointed by the CSIR, in consultation with the DSI.

The CPAM review panel members will be appointed subject to the signing of a non-disclosure agreement, as well as a conflict-of-interest declaration. Proposals will be shared with all reviewers for transparency, however, a reviewer may choose not to review a particular proposal. The evaluation criteria will be clearly stated in the evaluation documents sent to reviewers.

The role of the CPAM review panel is to assist the CSIR in the review of the proposals received. Upon conclusion of the review process the CPAM review panel will make a recommendation to the CSIR Photonics Centre on which proposals should be funded. The panel will consist of experts from industry, universities and international experts. The assessment will primarily focus on the following aspects:

- Quality of the R&D project proposed
  - Scientific and technical merit of the proposed work - 20%
  - Novelty of the proposed work within the local context - 15%

- Industrial attractiveness of the proposal – as demonstrated by the involvement of industry partners in the research or the possibilities for the establishment of new spin-outs - 20%
- Project management plan / Progress demonstrated - 15%
- Scope to support human capital development - 15%
- Outputs committed to by the project team - 15%

**Applicants are encouraged to ensure all the necessary information is captured in the proposal that will be required for the review panel to do a fair assessment of the proposed work.**

Continuation applications will also be assessed on progress against the project plan, hence progress reports submitted to the CSIR Photonics Centre will form part of the application and evaluation process.

It can be expected from applicants to present new applications to the CPAM review panel during the assessment process. This presentation usually happens through a virtual platform such as MSTeams, however, the CSIR can also request that this be done in person at a meeting to be scheduled by the CSIR.

The following aspects are important to consider when submitting a CPAM application.

### 2.7.1 Quality of the CPAM application

*Applicants are strongly discouraged, and warned, not to commit plagiarism in the preparation of CPAM project proposals, or in the reporting of work completed. The review process has in the recent past picked up an increase in this very serious transgression. The Merriam-Webster dictionary defines **Plagiarize** as “to steal and pass off (the ideas or words of another) as one's own : use (another's production) without crediting the source<sup>2</sup>”. Applications which are found to contain plagiarized passages will immediately be disqualified.*

*Applicants are also encouraged to follow the instructions as provided in the proposal or the annual progress report templates meticulously, to ensure that the review panel has the correct information available when assessing the information provided.*

*Assessment of new applications or progress reports will only be based on the written text as found in the proposal or annual progress report, as supported by the presentation made on the new application or on the progress reported.*

<sup>2</sup><https://www.merriam-webster.com/dictionary/plagiarize>

### **2.7.2 Management plan**

The management plan submitted as part of the application must be a clear executable plan for the project. The following aspects need to be addressed and should be clear when reviewing the management plan:

- The plan must include defined major project activities that will be executed as part of the project plan.
- For each activity, a start and end date must be provided.
- Resources (collaborators, team members, students and equipment) need to be assigned to each of the activities defined.
- Each of the activities should also have a clearly defined deliverable.
- It is a requirement that a detailed Gantt chart, which corresponds to the management plan, is submitted as part of the application.

### **2.7.3 Scientific and technical merit and novelty of the proposed work**

This section should clearly articulate the main research question that the proposed work intends to address. The section must support and reflect a detailed description of the technology background and demonstrate through the proposed research the pursuit of a high level of scientific/engineering and technical excellence.

The proposed work needs to be novel, especially within the South African context. The application must demonstrate a good understanding of what is state of the art, and what technology development has already occurred in the fields proposed within the proposal.

### **2.7.4 Industrial attractiveness and potential for uptake**

The proposal should clearly articulate the industrial relevance and the potential for impact and uptake of the proposed work by an industry partner, or through a spin-out.

The proposal should provide information on the principal investigator's (PI's) plan for commercialisation of the research undertaken. The proposal should also provide a description of a commercialisation route, as well as identify possible commercialisation partners. Even if there are no formal commercialisation strategy or commercialisation plan for the proposed work yet, applicants are encouraged to offer clear evidence that commercialisation of the technology is being considered. This evidence can be direct, or indirect or even anecdotal evidence, indicating that there is consideration of commercialisation of the technology.

### **2.7.5 Research team and collaborations**

The proposal format requires the applicant to provide detailed information on the research team including collaborations that will support the proposed project. The information should reflect the strength of the research team, also the number of team members since this will be used to verify whether the number of student projects applied for is justified.

A list of collaborators should be included, which clearly articulates the contribution of each of the collaborators to the project. The information provided must be presented in such a way that will allow reviewers to assess the expertise and experience of the listed collaborators.

It is important to also list all the members of the research team who constitute this collaboration. Ensure that all staff involvement, student involvement, postdocs, technical support and external collaborations are listed.

### 2.7.6 Project outputs

The proposal must capture all the planned outputs and deliverables from the various tasks that constitute the project plan. Applicants are encouraged to pre-plan the publications and the different types of knowledge outputs that will be produced by the project. In addition to publications, Knowledge Outputs include the following types of outputs:

- Technology Demonstrator – An incomplete version of a complete or scaled down/subset of a product put together as a proof of concept with the primary aim of showcasing the possible applications, feasibility, and method of an idea for a new technology. Different sectors use different terms to describe a technology demonstrator, e.g. in the chemical/bio-chemical sector the term ‘product’ or market sample is used. These terms are acceptable and will be considered to be technology demonstrators.
- Prototype – An early sample, model, or release of a product built to test a concept or process or to act as a thing to be replicated or learned from. There are different types of prototypes (e.g. proof-of-principle; visual; working; functional prototypes). It can also be market samples or similar concepts; depending on the nature of the industry.
- Technology Package – a TP is the key document or set of documents that are the basis for the activity of technology transfer. TPs are a means of communicating process information and knowledge to their recipients – the vendors that the sponsors select to perform the work.” This TP can be in the form of a “Process Document.

### 2.7.7 Human capital development

In the section on human capital development (HCD) the applicant needs to list all students that will work on the project. It is important **and compulsory** to identify the main supervisor and co-supervisor if applicable, as well as provide the thesis or research project title on which the student is working. Generic thesis titles or research project titles are not acceptable.

Attention should be given to accurately reflect on student demographics. It is expected of the applicant to demonstrate that this project will actively seek to involve South African black and female students.

## 2.8 Proposal assessment criteria

Assessment criteria will be used to maintain consistency during assessment of research proposals, with each criterion assigned a weight (see [Table 2](#) and [Table 3](#)).

**Table 2: Assessment criteria for new applications:**

Criterion	Details	Weight
<b>Management plan</b> 15%	Feasibility & efficiency of management plan	10%
	Quality of the proposal / presentation	5%
<b>Quality of the R&amp;D project</b> 35%	Scientific and technical merit of the proposed work	20%
	Novelty of the proposed work within the local context	15%
<b>Industrial attractiveness</b> 20%	Market potential	8%
	Potential for uptake	7%
	Commercialisation plan	5%
<b>Strength of the team and HCD</b> 15%	Research team strength	7%
	Student involvement (including demographics)	5%
	Collaborations	3%
<b>Outputs committed</b> 15%	Journal and publication output planned	5%
	Knowledge outputs planned	10%

**Table 3: Assessment criteria for annual progress reports:**

Criterion	Details	Weight
<b>Progress report</b> 15%	Progress achieved in the period under review	10%
	Quality of the proposal / presentation	5%
<b>Quality of the R&amp;D project</b> 35%	Scientific and technical merit of the proposed work	20%
	Novelty of the proposed work within the local context	15%
<b>Industrial attractiveness</b> 20%	Market potential	8%
	Potential for uptake	7%
	Commercialisation plans	5%
<b>Strength of the team and HCD</b>	Research team strength	7%
	Student involvement (including demographics)	5%

15%	Collaborations	3%
Outputs committed 15%	Journal and publication output planned	5%
	Knowledge outputs planned	10%

Based on the recommendations from the CPAM review panel, the CSIR Photonics Centre will do budget allocations, rank the proposals received and decide on the projects which will be funded in the next funding cycle.

## 2.9 General comments

It is important that proposals submitted are concise and only provide information relevant to what is requested in the proposal template. However, information provided must be comprehensive, to allow the reviewers an opportunity to accurately assess the potential of the proposal. The review team will only assess proposals based on what is written in the proposal / annual progress document, as supported by the presentation made by the applicant or the grant holder.

Applicants and grant holders should also respect the review process and the CSIR appointed CPAM review panel. Applicants and grant holders are encouraged to not copy and paste sections from one part of the proposal or annual progress report to another.

## PART 3: MANAGEMENT OF CPAM GRANTS

### 3.1 Contracting

For approved projects a CSIR CPAM contract will be established that contains the clauses and requirements for the management of the project funding. The contract addresses responsibilities, intellectual property issues, deliverables, as well as the financial arrangements associated with the project. The contract is between the CSIR Photonics Centre and the host institution of the applicant.

The contract will be an annual contract and will be renewed annually through a new contract or a contract amendment for the funding allocation in subsequent years **subject to the submission of an annual progress report, as well as a favourable review of the progress report.**

### 3.2 Reporting requirements

On accepting the award (signing the contract), the grant-holder will be required to deliver on the annual research plan that formed part of the accepted application. An annual review meeting is scheduled where all grant holders are required to report on progress. Attendance of this meeting is compulsory.

At the end of the financial year, or at the end of the project, the grant-holder will be required to prepare and submit an Annual Progress Report or a Final Progress Report on the project to the CSIR Photonics Centre. The annual report must address project progress, delivery on milestones, project outputs and outcomes as presented in the research plan. In instances where the original project application was a multi-year proposal, the annual progress report will be used in an evaluation process to determine whether the project will continue in the next financial year.

### 3.3 Payment of Grants

Claims for payments of costs associated with the project including labour costs, student support costs and running expenditure as approved as part of the project should be submitted to the CSIR Photonics Centre for payment. Claims should be submitted as an invoice. The CSIR reserves the right to also request associated proof of expenses in support of invoices submitted to the CSIR.

Invoices for payments should be addressed to:

The CSIR Photonics Centre  
PO Box 395  
Pretoria  
0001.

e-mail: [hgreyling@csir.co.za](mailto:hgreyling@csir.co.za)

All invoices should reflect the CSIR's VAT no. 4470114283

All invoices should also reflect the unique reference number assigned to the project, and available on the CPAM contract, or from the CSIR Photonics Centre.

### 3.4 Assistance

Should you require clarification on any of the processes, criteria or plans presented in this manual please do not hesitate to contact Hardus Greyling at 012 841 2713 or 082 445 4057, email [hgreyling@csir.co.za](mailto:hgreyling@csir.co.za)