

# INTERNATIONAL CENTRE FOR NUMERICAL METHODS IN ENGINEERING - CIMNE STRATEGIC PLAN

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## 1. Introduction

The International Centre for Numerical Methods in Engineering, CIMNE, is a research and innovation centre established in 1987 between the Universitat Politècnica de Catalunya (UPC) and the Generalitat de Catalunya (GENCAT). It is a member of the CERCA network of research centres of the Catalan government and a Severo Ochoa centre of Excellence of the Spanish Government. Over its 35-year history it has earned a strong international reputation and presence in the field of computational mechanics with applications in civil engineering and industrial processes. It has also a long standing and successful record of technology transfer through established companies and numerous spin offs created during the past decades.

This document presents the strategic plan for CIMNE for the next 5 to 10 years. It has been developed over the months September to December 2022 with inputs from CIMNE staff, key stakeholders from UPC and GENCAT and scientific input from the Science Advisory Council of CIMNE. It is intended to guide the development of the centre for the next decade and facilitate the generational transition in leadership and key staff in the centre.

## 2. Executive Summary

CIMNE aims to strengthen its international position as the world leading centre in the development of computer modelling technologies applied to important engineering problems that respond to societal challenges and UN sustainable development goals. The strategy to achieve this over the next 5 years comprises four key elements:

### 1- Developing a research strategy and structure fit for the next phase of CIMNE.

CIMNE will focus its research along 5 key themes and 4 enabling technologies.

The key themes respond to UN Sustainable Development Goals and government priorities at EU, Spanish and Catalan levels. These are:

- *Adaptation to Climate Change*: including the assessment of hazards and risk of extreme events; coastal, floods & landslides protection; infrastructure assessment and adaptation; resilient and sustainable land management.
- *Mobility, Cities and Territory*: transport & civil infrastructure; cities & urban mobility; transport systems and logistics; aerospace and vertical mobility; maritime transport; automotive transport.
- *Energy and Environment*: renewable energy; materials for energy; fusion, nuclear, waste treatment; energy storage and conversion technologies; energy efficiency and distribution; water production, storage, treatment and distribution; air, water and land contamination.
- *Industrial processes*: advanced and innovative manufacturing; automation and optimization of industrial processes; emerging materials – metamaterials; smart construction.
- *Health*: modelling bio-systems and bio-materials; patient-specific approaches for detecting and predicting diseases; medical devices; bionic systems; mechanobiology

The key enabling technologies are:

- *Discretization techniques*: novel grid and grid-free approaches; particle methods; unfitted methods, error assessment and adaptivity.
- *Physical and mathematical models*. Comprising multiphysics constitutive models and formulations, variational and mathematical principles, optimization techniques and similar technologies.
- *Data driven technologies*: including machine learning and artificial intelligence, reduced order models, big data, uncertainty quantification and digital twins.
- *High performance computational models*. For instance, modelling technologies to exploit emerging computer architectures.

CIMNE will structure itself into a number of Research Groups with sufficient critical mass and academic leadership, defined and measured according to clear expectations of international research excellence. They will have a research focus closely aligned to the themes and technologies described above. In addition, a smaller number of Innovation Units will be established to work alongside research groups to concentrate on applied research, innovation and technology transfer.

### 2- Enhancing relationships with our patrons and international partners.

Effective relationships with the patrons of CIMNE, namely the UPC and three departments of the Generalitat represented in the governing body are critical to the future success of CIMNE. Generalitat departments (Territory, Research and Universities and Business and Labour) will be asked to increase their core funding to CIMNE to reach 4 M€ from the current 2.1 M€. This would represent just under

1/3 of current turn over. In addition, the very significant in-kind contribution that UPC makes through the time of academic staff affiliated to CIMNE will be formally evaluated and recognized.

CIMNE has an international network of collaborators, some formally established through Aulas-CIMNE in Spain and Latin America. As part of the strategy for the next period, CIMNE aims to extend this network by establishing joint research laboratories with European and other international partners. These networks will be exploited to secure project funding through schemes such as MSC-doctoral Networks. CIMNE will also enhance its leading presence in international learned societies beyond IACM, ECOMASS and others where we currently already play a significant role.

### **3- Attracting, retaining and developing the best international researchers, innovators and professional support staff.**

The ability to attract the best staff is key to the success of CIMNE. CIMNE will particularly endeavour to improve its ratio of female to male academic staff, especially in leadership positions. This will require proactive and focused efforts in recruitment and creating a supportive environment of attractive work life balance measures.

CIMNE will consolidate its academic career structure with internationally recognised excellence criteria and will create a new Figure of Distinguished Research Professor, which will typically be on an honorary basis, but can become contractual under the “Investigador Distinguido” category when appropriate project funding is available. CIMNE will also create a new career pathway for those involved in innovation activities. This will comprise three stages: Innovation Assistant, Innovation Leader and Senior Innovation Leader and will consolidate current scales for Research Engineers and Staff Scientists.

### **4- Ensuring that our research has maximum impact in society through the establishment of technology transfer pathways, a culture of innovation and facilitating the creation of spin-off companies when appropriate.**

CIMNE will endeavour to demonstrate the societal impact of its research and facilitate the transfer of technology to existing industries or create new ones through spin-offs. For this purpose, an Impact, TT and commercialisation unit will be created. CIMNE will also establish a governing panel to steer decisions on technology transfer and spin-off investments. This will incorporate the director of CIMNE-Tecnología, the wholly owned company of CIMNE that holds its shares on Spin-Off companies, the director of CIMNE and key external advisors with appropriate expertise.

In order to ensure that research at CIMNE is focused on addressing real needs of its stakeholders, CIMNE will:

- create an *Industrial Advisory Board* comprising of industries and government departments that interact with the research and innovation at CIMNE;
- carry out a centre wide *Road Mapping Exercise* using the methodology of the Institute for Manufacturing in Cambridge University. This will help us refine our themes of research and map the route between technology developments and future applications.

The strategic plan of CIMNE has established an action plan and set of key performance indicators that will be used to monitor progress towards its objectives. These will be measured at least annually and reported to the governing bodies of CIMNE. Meeting these targets will ensure that CIMNE remains a world leading reference centre in the field of computational simulation in areas of interest to its stakeholders and contributes strongly to the local innovation ecosystem.

### 3. SWOT Analysis

The analysis of Strengths, Weaknesses, Opportunities and Threats is presented in the tables below. This has been used to inform the development of the strategy.

| <p><b>S</b><br/><b>STRENGTHS</b></p>  | <p><b>W</b><br/><b>WEAKNESSES</b></p>   |
|---|---|
| <ul style="list-style-type: none"> <li>• A strong international reputation for the development of innovative NME earned during its 35 years of history.</li> <li>• The prestige of being a Severo Ochoa Centre, the maximum level of quality recognition in Spain.</li> <li>• A strong team of academics at all levels of career development, who have earned multiple prizes nationally and internationally and have achieved the highest levels of international recognition.</li> <li>• A track record of winning competitive funding from national and EU programmes as well as industry; leading and participating in large multinational consortia with academic and industrial partners across the world.</li> <li>• A strong presence in national, European and international learned societies such as SEMNI, ECCOMAS and IACM. As well as the development of a network of some 30 “Aulas CIMNE” across the world.</li> <li>• The development of a series of widely used software packages and tools such as GiD, KRATOS, IBER, among others.</li> <li>• A large and strong body of CIMNE alumni across the world and industry</li> <li>• A strong track record of knowledge transfer and societal impact achieved through industrial collaboration and many spin-off companies.</li> <li>• Well established administration, management and governance structures ensuring a healthy financial position, good quality physical resources and a positive and supportive working environment.</li> </ul> | <ul style="list-style-type: none"> <li>• A limited amount of core funding in relation to the overall funding of CIMNE, which makes the activities over reliant on success in project funding and makes it difficult to develop a long-term strategy.</li> <li>• Lack of diversity in relation to gender, particularly amongst senior academic staff at the Centre.</li> <li>• Uneven distribution of research excellence across different groups in CIMNE.</li> <li>• Weak levels of collaboration between theoretical groups and those more focused on the applications of Numerical Methods in Engineering (NME).</li> <li>• A weak talent management strategy and structure capable of attracting and developing leading worldwide researchers.</li> <li>• A strong reliance on UPC academics over CIMNE own staff, particularly in relation to senior staff who are close to retirement.</li> </ul> |

## O

### OPPORTUNITIES

- Leveraging the international prestige of CIMNE to attract the best researchers to the centre.
- A greater recognition in Catalan and Spanish society of the importance of science and innovation as an economic driver.
- A generational change in leadership bringing new ideas and practices from other international environments.
- The recognition that predictive computational modelling is becoming an essential tool in government and industrial decision making.
- The emergence and development of new topics and trends in NME around artificial intelligence, machine learning, digital twins and the need to create novel technologies to exploit future disruptive computational architectures such as quantum computing.
- The financial opportunities through new national and EU funding programmes such as Next generation EU funds, the new framework Horizon Europe.
- The contribution that NME can make to address societal challenges such as climate change adaptation, green energy, industry 4.0, etc.
- Income generation through the sale of successful spin-off companies.

## T

### THREATS

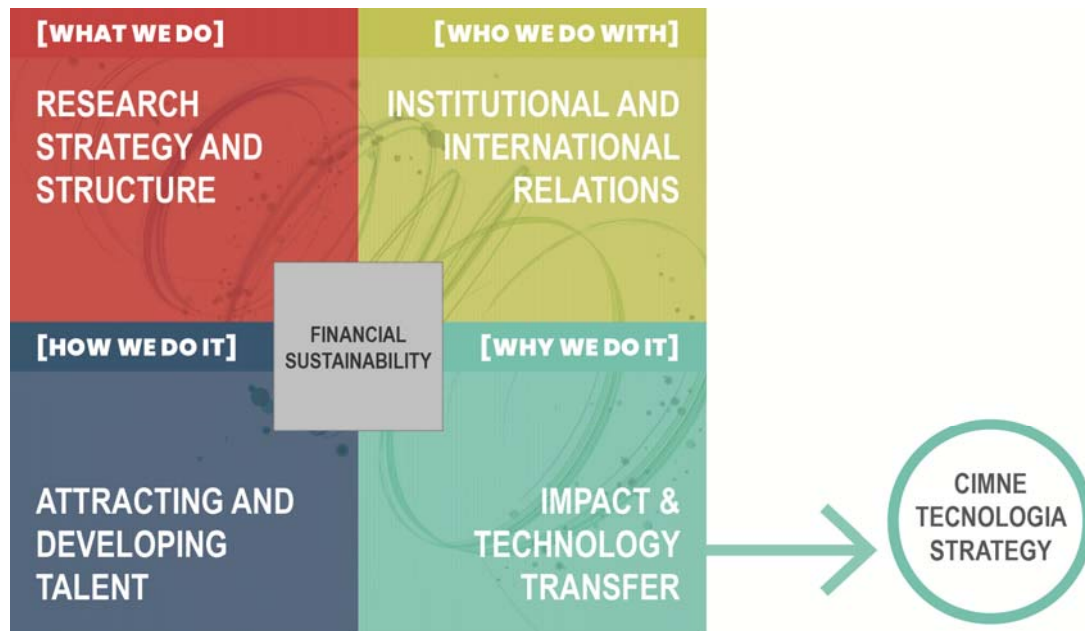
- Increasing competition for human and financial resources from similar groups nationally (e.g., BSC) and internationally (e.g., ZCCE, The Oden Institute at Texas...).
- The inability to carry out the generational change successfully, particularly in relation to the new leadership of the centre.
- Failure to attract sufficient funds from competitive funding.
- Failure to renew the Severo Ochoa programme in view of the extremely high levels of competition for this award.
- Failure to maintain strong mutually beneficial relationships with UPC.
- Failure to renew the core funding from the Catalan Government.
- Failure of significant numbers of spin-off companies.
- Failure to convince long established members of CIMNE of the need to develop and implement a new strategy to secure the future of CIMNE.

## 4. Vision and Strategic Aims

The overall vision of CIMNE for the next years is to be an internationally leading centre of impactful research in computational models applied to engineering problems, capable of developing new numerical technologies that address current and future societal challenges. The strategic aims will be:

- Developing a world leading programme of scientific research in the next generation computational modelling technologies to solve current and future societal challenges
- Attracting and developing world leading talented researchers
- Attracting and efficiently managing financial resources to ensure financial sustainability
- Strengthening our relationships with our patrons, UPC and Generalitat; and enhancing our national and international profile and institutional links
- Creating and effectively communicating societal impact from our research by facilitating the transfer of novel technologies into new or existing companies

These strategic aims are developed further in the next sections and illustrated in Figure 1. Under each strategic aim a number of objectives, actions and performance indicators will be described in order to define each aim in sufficient detail to develop an implementation plan.



**Figure 1.** Strategic aims of CIMNE



## 5. Research Strategy and Structure

### 5.1. Introduction

Developing a world leading programme of scientific research is the main strategic aim of CIMNE. This programme is described below in terms of two axes, one axis defining the research themes or societal challenges that our research aims to address; and the second axis describing the transversal methodologies or specific technologies that CIMNE researchers aim to develop in order to address these challenges. The structure of research and innovation groups within CIMNE will map onto intersections points of these axes. In addition, in order to better define the connections between themes and methodologies and to provide more definition to the themes established below, a Road-mapping exercise will be conducted during 2023 following the methodology established by the Institute for Manufacturing of Cambridge University as explained in more detail in Section 7 dealing with technology transfer, innovation and impact. The aim of the centre of achieving the highest standards of research excellence must be demonstrated in the renewal of the Severo Ochoa recognition of the Centre in due course.

### 5.2. Objectives

The specific objectives under this strategic aim are listed below:

- To identify priority research themes according to current and future needs of society
- To establish key technologies and methodologies in which to develop international competitiveness
- To consolidate a structure of research groups and innovation units that are aligned to our themes and technologies and have critical mass to be impactful and financially sustainable
- To establish clear expectations and targets at individual, group and centre level
- To renew the Severo Ochoa recognition

### 5.3. Research Themes

The motivation for the themes of CIMNE research is taken from a number of external drivers. These are:

- [The 17 sustainable development goals](#) defined by the UN and shown in Figure 2.
- [The 5 EU missions](#), namely, Climate, Cancer, Ocean and Waters, Cities and Soils.
- [The strategic lines of the Spanish Government](#), Health (New Diagnostic and Therapeutic Techniques); Security for Society (Protection against new security threats); Digital World, Industry, Space and Defence (Mathematical modelling and analysis and new mathematical solutions for science and technology & Advanced materials and new manufacturing techniques); Climate, energy and mobility; Food, Bioeconomy, Natural Resources and Environment
- [The thematic axes of R&I of the Department de Territori of the Generalitat de Catalunya](#)





**Figure 2.** UN sustainable Development Goals

On the basis of the above societal challenges, CIMNE has established five key thematic areas of research focus for the next decade:

- **Adaptation to Climate Change:**
  - Induced hazards assessment, risk of extreme events
  - Coastal, Floods & landslides protection
  - Infrastructure assessment and adaptation
  - Resilient and sustainable land management
- **Mobility, Cities and Territory:**
  - Transport & Civil infrastructure
  - Cities & urban mobility
  - Transport systems and logistics
  - Aerospace and vertical mobility
  - Maritime transport
  - Automotive transport
- **Energy and Environment:**
  - Renewable energy
  - Materials for energy
  - Fusion, Nuclear waste treatment
  - Energy conversion technologies
  - Energy efficiency and distribution
  - Water production, storage, treatment and distribution
  - Air, water and land contamination
- **Industrial processes:**
  - Advanced and innovative manufacturing
  - Automation and optimization of industrial processes
  - Emerging materials - metamaterials
  - Smart construction

- **Health:**
  - Modelling bio-systems and bio-materials
  - Patient-specific approaches for detecting and predicting diseases
  - Medical devices
  - Bionic systems
  - Mechanobiology

These themes are illustrated in Figure 3 below.



**Figure 3.** Research Themes and connection to SDG

#### 5.4. Research Methodologies

In order to find solutions for the above challenges, CIMNE will develop research into a number of methodologies within the wide context of numerical methods or computational modelling techniques. These are grouped below into four distinct transversal methodology themes:

- **Discretization Techniques:**
  - Novel grid-based approaches
  - Particle and meshfree methods
  - Unfitted methods
  - Techniques for coupled problems
  - Error assessment and adaptivity
  - Geometry and simulation representation
- **Physical and Mathematical Models:**
  - Constitutive formulations

- Material models for multiphysics and multiscale phenomena
- Novel variational formulations
- Optimization
- Agent or subject based models
- **Data Driven Models:**
  - Science based Machine Learning and Artificial Intelligence
  - Reduced-Order Modelling
  - Inverse methods
  - Big data management
  - Uncertainty Quantification
  - Digital twins
- **High Performance Computational Models:**
  - Domain decomposition and pre-conditioning
  - Emerging architectures (e.g. Quantum computation)
  - New coding paradigms

### 5.5. Research Structure

CIMNE will structure itself into a number of **research groups** and **innovation units** with adequate critical mass and capable of ensuring their financial sustainability. These are defined below together with the delivery expectations.

#### Research Groups:

Research groups will be made up of a number of researchers including at least one senior academic (Professor or Associate Professor) with tenure and more than two doctors. Their work will typically be strongly anchored on one or more of the methodologies described in section 4.4 and closely aligned with the thematic priorities defined in section 4.3. The group must have in kind or direct core funding allocation to support its leadership and attract sufficient project funds to maintain its team of researchers.

Research groups must demonstrate their sustained international scientific excellence through:

- **Significant** academic impact in terms of
  - Research outputs in leading journals
  - Citations
  - Participation and organization of congresses
  - PhD Supervision
  - Prizes and Awards
- **Research Income** from several of:
  - EU-ERC, EU-Thematic calls, EU-MSC DN,...
  - Generación del Conocimiento, Retos,...
  - Industry...
- Engagement in **societal impact** (likely in collaboration with innovation groups)
  - Impact case studies aligned with priority research themes
  - Innovation, TT and commercialization
  - Public dissemination and outreach

The above indicators will be collected and measured annually and will serve as basis for distributing internal CIMNE funds.

### Innovation Units:

Certain groups within CIMNE will be more closely focused on innovation than research and will in future be recognized as Innovation Units. They will at least include one Senior Innovation leader with tenure, preferably more, but will have at least three staff members. They must have sufficient core funds and project funding to be financially sustainable and maintain their critical mass.

Innovation units will be strongly anchored within one or more priority themes of section 4.3 and align their activities within the range of technologies described in section 4.4. They will often work in collaboration with Research Groups to facilitate the pathways to impact of their research. Innovation Units must demonstrate their excellence in innovation through the following indicators:

- **Significant** societal impact terms of
  - Impact case studies
  - Technology transfer into industry
  - Public dissemination and outreach
  - Prizes and Awards
- **Innovation Income** from several of:
  - Industry
  - Valorisation: Consultancy, Licenses, Spin-offs, ...
  - EU Innovation funds (EUIF, ...)
  - Colaboración Público-Privada, CDTI, ...
  - Acció and local funds...
- Engagement in **academic** (likely in collaboration with research groups)
  - Research outputs
  - Industrial Doctorates
  - Participation in research income through TT

The above indicators will be collected and measured annually and will serve as basis for distributing internal CIMNE funds.

### 5.6. KPI's

In order to assess the achievements of the objectives set out in this strategic aim, the following centre wide indicators will be monitored, and where appropriate broken down into research centre and innovation group (Table 1).

| Code | Description                          | 2022 Value | 2028 Target |
|------|--------------------------------------|------------|-------------|
| I1.1 | Publications in Q1 Journals (Scopus) | 131        | 170         |
| I1.2 | Citations (Scopus)                   | 4400       | 6000        |
| I1.3 | Severo Ochoa Recognition             | Yes        | Yes         |
| I1.4 | Competitive income                   | 6,5 M€     | 8 M€        |
| I1.5 | Non competitive income               | 2,4 M€     | 4 M€        |
| I1.6 | PhD completions                      | 13         | 20          |
| I1.7 | Prizes & Awards                      | 8          | 10          |

**Table 1.** Actions associated to Strategy aim 1 (Research themes and structure)

### 5.7. Action Plan

Table 2 describes the actions needed to implement this strategic aim in accordance with the narrative above. Actions in boldface are strategic and the rest operational.

| Code               | Description  | Responsible                 | Timescale               |
|--------------------|--|-----------------------------|-------------------------|
| A1.1               | Consolidate current groups into Research Groups and innovation units                     | Scientific Director         | 2023                    |
| A1.2               | Map new groups and units against research themes and technologies axes                   | Scientific director         | 2023                    |
| A1.3               | Renew Severo Ochoa recognition   | General & Sci. Directors    | Annually until achieved |
| A1.4               | Provide targeted funding information to groups/units and pro-actively facilitate bidding | Project Director            | Quarterly               |
| A1.5               | Establish mechanisms for identifying KPI's at Centre and group level                     | Managing director           | First half 2023         |
| A1.6               | To assess the scientific and innovation performance of groups and units (with SAC)       | Scientific/General Director | Annually                |
| A1.7               | Allocate core funding to groups and units based on KPI's                                 | Managing Director           | Annually                |
| A1.8               | To monitor income and expenditure of research groups and innovation units                | Managing Director           | Bi-monthly              |
| A1.9 (& A2.6 A4.6) | Carry out a wide ranging Road-mapping exercise to connect technologies with themes       | General Director            | September 2023          |

**Table 2.** Actions associated to Strategy aim 1 (Research themes and structure)

## 6. Institutional and International Relations

### 6.1. Introduction

A fundamental aspect of the strategy of CIMNE is to enhance the health and strength of its relationships with its patrons: the UPC and the Generalitat de Catalunya (GENCAT). Within GENCAT CIMNE is currently attached to the Departament de Territori, but the Departments of Recerca i Universitats and Empresa i Treball have representation at Director General level in the consortium and have both hosted CIMNE in previous years. Within the UPC, CIMNE originated from the School of Civil Engineering (Escola Tècnica Superior d'Enginyeria de Camins, Canals i Ports de Barcelona) and has maintained a very close connection with this School and the Departament of Enginyeria Civil i Ambiental (DECA) over the years. In more recent times staff from other Schools in UPC (Escola Tècnica Superior d'Enginyeria Industrial de Barcelona (ETSEIB) , Escola d'Enginyeria de Barcelona Est (EEBE), Facultat de Nàutica de Barcelona (FNB), Escola d'Enginyeria de Telecomunicació i Aeroespacial de Castelldefels (EETAC), Escola Superior d'Enginyeries Industrial, Aeroespacial i Audiovisual de Terrassa (ESEIAAT), ...) and beyond (Universitat de Lleida (UdL), Universidad Politécnica de Madrid (UPM), Universitat de Vic (UVic),...) have joined the centre's activities. Nevertheless, a significant amount of activity continues to centre around Civil Engineering. CIMNE has traditionally relied on a big number of UPC academics whose research time has been assigned to CIMNE than other Catalan CERCA centres. This represents a significant in kind contribution from UPC to CIMNE which has benefits for both sides.

CIMNE has developed an extensive portfolio of international links and activities which go well beyond partnering in research projects. These include a network of Aulas-CIMNE, joint labs with institutions in Spain and Latin America, and active presence in national and international associations of computational mechanics and extensive expertise in the organisation and administration of scientific congresses across the world. This section and strategic aim reflect these strengths and seeks ways to develop them further to mutually benefit CIMNE, our patrons and our institutional partners.

### 6.2. Objectives

The specific objectives under this aim are:

- To have a close and mutually supportive relationship with UPC
- To have a close and supportive relationship with cognate departments of GENCAT
- To raise levels of core funding (in kind from UPC and in cash from GENCAT) that ensure the financial stability and sustainability of the Centre
- To consolidate our international presence and enhance further our profile through leadership and participation in learned societies
- To consolidate and enhance our congress activities
- To increase the amount of funding attracted to CIMNE

### 6.3. Relationship with UPC

The relationship between CIMNE and UPC is formally governed by an agreement signed in 2020. This document establishes the mechanisms for UPC academic staff to carry out research at CIMNE. Unfortunately, this agreement does not quantify the in kind contribution resulting from this practice or from the use of building space. These items should be properly quantified in order to ascertain the importance of the in kind contribution of UPC versus the cash contribution of the other patron, namely GENCAT.

Furthermore, it is essential that the relationship between UPC and CIMNE is mutually beneficial, both at the level of the individual academic and at an institutional level.

Institutionally, UPC benefits from co-owning CIMNE through:

- Increased reputation due to large scientific production of CIMNE staff (who should also publish with UPC affiliation) and affiliated UPC academic staff
- The large number of PhDs registered at UPC and financed by CIMNE
- International recognition of CIMNE as a UPC entity
- Effective technology transfer through CIMNE and CIMNE Tecnologia
- Institutional access to CIMNE tools and software (GiD, Kratos, ...)

In addition, UPC academic staff benefit from affiliating themselves to CIMNE by:

- Access to funding programmes not available to UPC like Severo Ochoa, or Contracte Programa provided by Departments of GENCAT
- International recognition through the profile of CIMNE
- Potential for international networking through CIMNE research environment
- Enthusiastic and experienced administrative support
- Supporting environment for research training and dissemination (CIMNE Coffee talks, Seminars, ...)

CIMNE affiliation of UPC staff, however, must imply a number of expectations:

- Scientific excellence commensurate with CIMNE international profile
- Income generation and financial accountability
- Alignment to CIMNE priority themes and technologies
- Contribution to SO and CERCA programmes
- Contribution to the research environment (Seminars, Coffee talks, ...)
- Contribution to impact, innovation and technology transfer

At an administrative level it is necessary that the management teams at CIMNE and UPC work more closely together. In order to achieve this, it is proposed that the Executive Commission of CIMNE, a statutory body that oversees the functioning of the Centre, should be subdivided by creating a new subgroup dedicated to management aspects such as budgets, legal affairs, auditing and compliance. Senior operational managers from UPC should be members of this group, which should meet before the Governing Body to review items prior to their formal approval.

#### 6.4. Relationship with GENCAT

GENCAT is the patron that provides CIMNE with direct financial resources within the context of CIMNE being one of the CERCA research centres. The Science Law recently approved at the Catalan Government increases the aspirations for science and innovation efforts in Catalunya and the funding associated with these activities. It consolidates the CERCA network and establishes mechanisms for regulating and standardising the treatment, funding and assessment of its centres.

##### **Core Funding:**

CIMNE aspires to increase its core funding to reach the expected average for CERCA centres of around 30% of total income. Given the number and nature of the research themes of CIMNE and the representation of different departments within the Governing Body of the Centre, the aspiration of CIMNE for the next period of the core funding contract is to receive funding as follows:



- Department of Territory: 2 M€
- Department of Research & Universities 1 M€
- Department of Business & Labour 1 M€

The above increase in resources will enable CIMNE to:

- Closely align the research themes described above to the needs of GENCAT departments, in particular through Road-mapping exercises
- Invest in replacing retiring or retired staff to provide CIMNE with the internationally leading research base needed to deliver its strategy in the face of increasing international competition for talent
- Provide a platform of stable funds to support the leadership of research and innovation groups as the necessary basis from which to secure external project funding
- Invest in impact and technology transfer activities with the aim of fostering an innovation ecosystem around the development of novel modelling and digital technologies applied to areas described in our research themes
- Attract external resources with a multiplying factor of at least 2 to 1

Finally, similarly to the involvement of UPC management staff in a subgroup of the Executive Commission, operational staff from the departments of Territory and Research and Universities should also be members of this group.

#### 6.5. International presence and institutional links

CIMNE has developed a very strong international presence over the last decades. It is firmly embedded into national and international computational mechanics societies such as [SEMNI](#) (Spain), [ECCOMAS](#) (Europe) and [IACM](#) (International). CIMNE members sit on the Executive of all these societies and play or have played leadership or even founding roles. Currently, the vice president of ECCOMAS is a CIMNE member and until recently the president of IACM was also a UPC/CIMNE professor. CIMNE is also well represented in other scientific communities like [EASN](#) (Board of Directors) and [ERCOFTAC](#). CIMNE needs to maintain this strong presence and influence in the computational mechanics and scientific communities but it should also extend its reach into cognate disciplines such as applied mathematics and applied mechanics. There are well respected societies in these fields at Spanish, European and international levels (e.g., [REM](#), [SIAM](#), [IUTAM](#), ...) where our presence is weak and could be strengthened. In addition, research and innovation groups within CIMNE will want to participate in more subject specific societies aligned with their interest. This should be encouraged and supported.

CIMNE currently has a network of joint laboratories (AULAS-CIMNE) distributed through Spain and Latin America. The same concept can be extended into the European space and develop similar networks of joint research laboratories with institutions such Swansea University, Università di Pavia, TU Braunschweig, National Technical University of Athens, and many others where strong links already exist. The aim would be to use this network through formal MOU's as a platform to develop joint EU projects, particularly in relation to programs such as the MSC-Doctoral Networks.

An important activity of CIMNE that enhances its international presence and assists with the dissemination of its research is the organisation of conferences and congresses. Over the years, the centre has created a congress secretariat which has earned a strong reputation as a unit offering a professional service at competitive costs, capable of organising events at any scale. The strategy of CIMNE in this regard is to continue supporting this activity but to ensure that it is financially sustainable through an appropriate charging structure.

## 6.6. KPI's

In order to measure the progress against this strategic aim the following indicators will be measured (Table 3).

| Code | Description   | 2022 Value | Target |
|------|---|------------|--------|
| I2.1 | In kind funding from UPC  | €1.2M      | €1.5M  |
| I2.2 | Core funding from GENCAT  | €2.1M      | €4M    |
| I2.3 | Leadership roles in societies                                       | 3          | 5      |
| I2.4 | % papers with international partners                                | 60%        | 67%    |
| I2.5 | % income from international sources (competitive + non-competitive) | 44%        | 50%    |
| I2.6 | Total number of participants at CIMNE Congresses                    | 3560       | 4000   |
| I2.7 | Number of projects with CIMNE Aulas or joint labs                   | 1          | 5      |

**Table 3.** Targets associated to Strategy Aim 2 (Institutional and International Relations)

## 6.7. Action Plan

Table 4 describes the actions needed to implement this strategic aim in accordance with the narrative above. Actions in boldface are strategic and the rest operational.

| Code                          | Description   | Responsible  | Timescale              |
|-------------------------------|---|--|------------------------|
| <b>A2.1</b>                   | <b>Establish the new groups of the Executive Commission, their membership and Terms of Reference</b>                        | <b>Institutional Relations Director</b>            | <b>First half 2023</b> |
| <b>A2.2</b>                   | <b>Quantify and agree UPC in kind contribution</b>  | <b>Institutional Relations Director</b>            | <b>First half 2023</b> |
| A2.3                          | Meet with UPC academic staff associated with CIMNE to clarify mutual expectations   | General & Institutional Relations Director         | Annually               |
| A2.4                          | Convene UPC/CIMNE Agreement Commission  | Institutional Relations Director                   | Annually               |
| <b>A2.5</b>                   | <b>Discuss and agree the Centre aspirations in relation to new core funding programme (Contracte Programa) with GENCAT</b>  | <b>General Director &amp; Vice-President</b>       | <b>First half 2023</b> |
| <b>A2.6 (&amp; A1.9 A4.6)</b> | <b>Carry out a wide ranging Road-mapping exercise to align themes to GENCAT priorities</b>                                  | <b>General Director</b>                            | <b>September 2023</b>  |
| <b>A2.7</b>                   | <b>Extend our institutional involvement beyond IACM, ECCOMAS, SEMNI into cognate societies such as REM, SIAM, IUTAM,...</b> | <b>Scientific Director</b>                         | <b>Ongoing</b>         |
| <b>A2.8</b>                   | <b>Enhance our partnership with ECCOMAS and use it for lobbying purposes in EU commission</b>                               | <b>Scientific Director</b>                         | <b>2023</b>            |
| <b>A2.9</b>                   | <b>Extend Aulas-CIMNE by establishing network of joint-labs in Europe and Mediterranean region</b>                          | <b>Scientific &amp; Institutional Relations D.</b> | <b>Ongoing</b>         |
| A2.10                         | Review Congress activity charges to ensure financial sustainability   | Managing Director                                  | First half 2023        |

**Table 4.** Actions associated to Strategy Aim 2 (Institutional and International Relations)

## 7. Attracting and Developing Talent

### 7.1. Introduction

Attracting talented staff to CIMNE is an essential first step to ensure the success of the Centre. It must be followed by the ability to develop their talents and encourage career progression within CIMNE or out into University, industry or other public bodies. CIMNE must provide an attractive and nurturing environment for those who want to pursue research in our priority topics but also for innovators, that is, those who want to turn research results into new products, processes or services, and those who want to contribute to the administration and management of research.

### 7.2. Objectives

The Specific objectives associated with this strategic aim are:

- To establish CIMNE as a leading destination of choice for senior and junior researchers worldwide in the field of numerical methods and computational mechanics
- To improve the gender balance of researcher community
- To develop a comprehensive programme of research training
- To establish clear and comprehensive career pathways for research, innovation and administration
- To provide a supportive and attractive working environment for all staff
- To retain talented researchers, innovators and administrative staff

### 7.3. Attracting talent

CIMNE should be a destination of choice worldwide for those who want to pursue a research career in the field of computational mechanics or numerical methods. Ultimately, our success relies on having academic staff who can compete internationally for research funding which closely follows excellence. Hence, the Centre must have merit based recruitment processes capable of reaching, identifying and selecting the best possible candidates in competition with other centres nationally and internationally. This is true both at senior and junior levels. Specifically, the following additional actions are envisaged:

Actions to attract Senior Research Talent:

- CIMNE's Managing Board should identify the areas where it needs to incorporate senior leadership and approach candidates directly
- Foster the engagement of senior leaders, specially through ICREA. There should be one CIMNE applicant in each ICREA (Engineering) call

Actions to attract Junior Research Talent:

- Develop open on-line sessions to explain to future PhD, PostDocs and junior academics our research themes and priorities, emphasising the benefits of joining CIMNE. Sessions should be organised before deadlines for funded fellowships calls. The recording of these sessions could be uploaded in the landing page for "Join us" at CIMNE's web site.
- Using CIMNE conferences to disseminate junior (or even senior positions).

At a practical level, CIMNE needs to improve its web pages for prospective staff by having a clear and prominent landing page for those who are considering joining us. This should explain:

- Why is working in CIMNE attractive (what we offer apart from the position itself)
- Clear explanation of open positions

- Clear view of existing or future funding mechanisms/scholarships/fellowships for joining CIMNE at different levels of seniority

In addition to attracting the best research and innovation staff, the Centre needs to be able to recruit highly capable administrative staff who have a supportive attitude to researchers and are experienced and knowledgeable of project management, compliance and administrative procedures. They are a vital part of the centre and should also enjoy a supportive environment with access to training, mentoring and career progression.

Finally, our Welcome Strategy needs to be improved. For this purpose, a number of initiatives are considered:

- Initiate a social programme that could include: sports, off-site activities, mindfulness, among others.
- Start a mentoring programme, where PhD students of last year accompany new students. We should open an internal call to select the mentors and decide how we remunerate them.
- Support arrivals of new researchers: picking them at the airport, help with accommodation, guided tours of the campus and CIMNE's premises, assistance with legal/administrative procedures (NIE, registration, banks, etc.), among others.

#### **7.4. Gender Balance and diversity**

CIMNE is an institution committed to diversity in general and gender diversity in particular. The Centre will provide an inclusive and supportive environment and will ensure that its members strictly behave in accordance with this principle, so that everyone, regardless of background, feels supported and celebrated. Staff will be expected to be respectful, fair, polite and compassionate to each other regardless of status or position.

Like many institutions focused on engineering, CIMNE is somehow from meeting its gender balance aspirations. However, there has been notable improvements in recent years and the ratio of female researchers has grown from 18% to 25%. Still, further improvement on this front is necessary and will require proactive measures in terms of recruitment of researchers. In particular:

- Specifically inviting female researchers to apply to CIMNE's open calls
- Maintaining files of female CV applicants or enquiries that arrive at CIMNE's mailboxes so that they can be invited to future calls.
- All calls to have specific wording encouraging female applicants with an expectation to have female applicant to every call
- Shortlisting and selection panels to have gender diversity
- Increase work balance measures: up to 2 WFH days, giving more flexibility to parents with children under a given age, etc.
- Use high profile event days like "dia de la dona" to organize female researcher events.

#### **7.5. Training programme**

Training and developing the skills of CIMNE staff is a key action to secure the success of the Centre. Training of researchers must comprise technical knowledge and professional skills, typically imparted through:

- Attendance at formal technical events such as CIMNE Summer School and CIMNE Winter School. The former provides generic preparation in computational mechanics whilst the latter provides in depth training in a specific topic of research of interest at CIMNE.
- Weekly seminars delivered by world leading researchers, often visitors to CIMNE from abroad, and coffee talks delivered by staff from CIMNE.
- A comprehensive set of professional skills modules shown in Table 5. These are aimed at providing career development training for our staff, opening opportunities for them beyond academia.
- A set of modules at master's level delivered as part of the Numerical Methods in Engineering MSc course. In this regards, efforts should be made to increase the attractiveness of this course through Erasmus Mundus funding as this is often a route to bring future researchers to CIMNE.

| RESEARCH AND INNOVATION STAFF                      | PhD Student | Post Docs | Assistant Prof. | Associate Prof. | Full Prof. | Innovation |
|--|-------------|-----------|-----------------|-----------------|------------|------------|
| Presentation Skills                                | X           | X         |                 |                 |            |            |
| Professional Development for Young Scientists      | X           | X         |                 |                 |            |            |
| Career Development for Young Scientists            | X           | X         |                 |                 |            |            |
| Leadership and Management Skills                   |             |           | X               | X               | X          | X          |
| Leadership and Management Skills Follow Up         |             |           | X               | X               | X          | X          |
| Grant Writing for PIs                              |             |           | X               | X               | X          | X          |
| Research Integrity and Ethics                      | X           | X         | X               | X               | X          | X          |
| How to publish a scientific article                | X           | X         |                 |                 |            |            |
| Prevention of labour risks                         | X           | X         | X               | X               | X          | X          |
| Information security awareness and data protection | X           | X         | X               | X               | X          | X          |
| ERC Grants Writing Training                        |             | X         | X               | X               | X          |            |

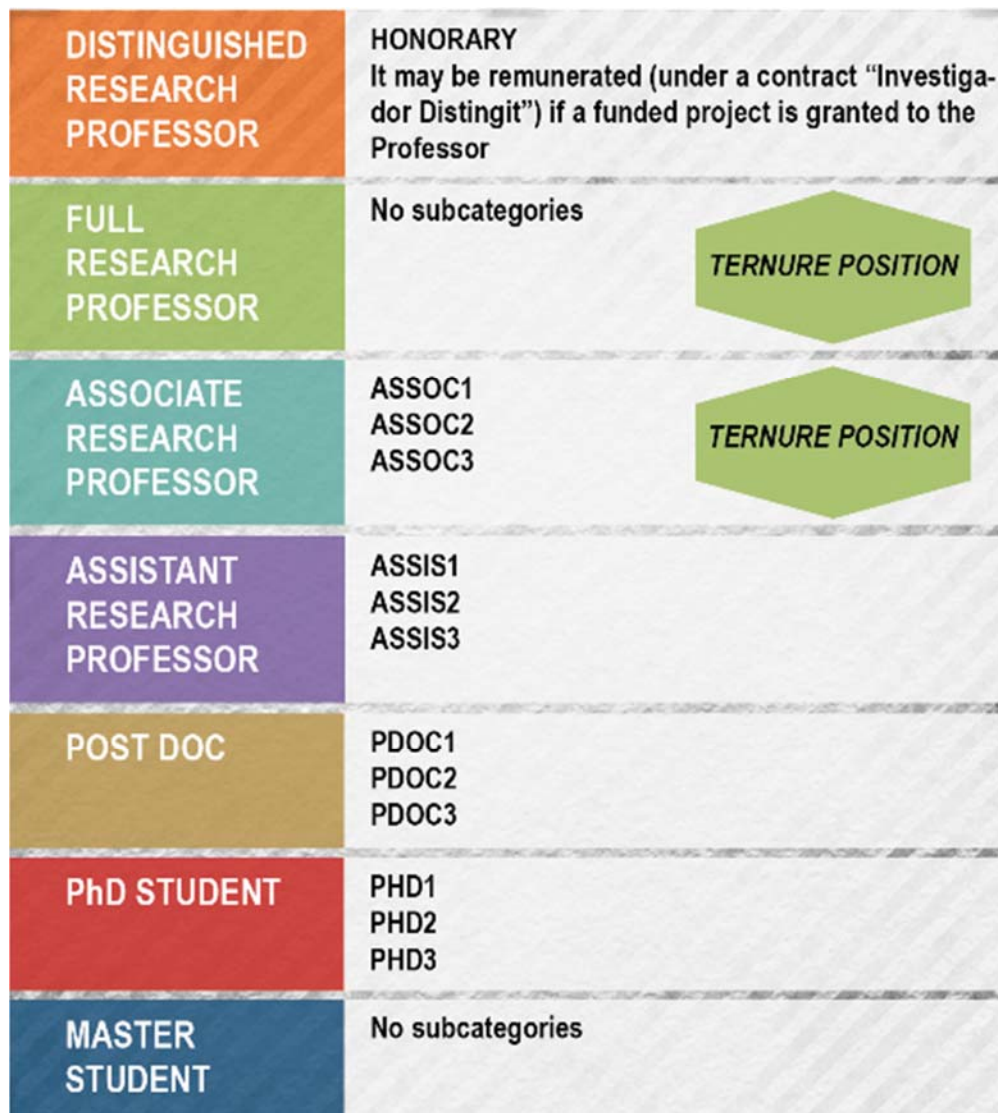
Table 5. Professional skills training programme

## 7.6. Research and Innovation Career pathways

Academic staff at CIMNE must have a clear career structure with merit based progression in accordance with the aspirations for excellence of the Centre. In this regard, staff from UPC affiliated to CIMNE have their progression determined by common university practices independently of CIMNE. Alternatively, for staff employed by CIMNE directly, the Centre has already established a career structure as shown in Figure 4 with the internationally recognised steps of doctoral student, post-doctoral researcher, assistant research professor, associate research professor and full research professor. The last two categories will imply a tenured position at CIMNE, funded through core funds, whereas the earlier ones will be subject to funding from project income. Criteria for promotion to these categories is already in place but will be refined to ensure that meets with international standards of excellence. A panel, with appropriate diversity, will be constituted to consider applicants for promotion. For those seeking the level of associated professor or above, members of the Scientific

Advisory Council will be asked to comment on their achievements on the basis of international expectations.

In addition to the academic steps described above, CIMNE as part of this strategy intends to create a new category of Distinguished Research Professor to incorporate senior professors who wish to be affiliated to CIMNE, have a trajectory of research in topics aligned to CIMNE priorities and have achieved a distinguished record of international recognition through their careers. These positions will not be generally remunerated but can be associated with an employment contract as “Investigador Distinguido” in cases where project funding supports it.



**Figure 4.** Academic research career pathway

#### **Innovation Career Pathway**

CIMNE is a centre with a tradition and commitment to innovation and technology transfer. The section on research strategy and structure has described the aim of separating research groups from those



more focused on innovation. It is expected that staff leading and making up this groups will not be as focused on traditional academic research outputs like publications. Therefore, the standard academic career pathway may not offer them a suitable career progression pathway.

It is recognised in this strategy that taking innovation seriously implies formalising an appropriate career structure with similar steps to those of research but with criteria and terminology more appropriate to the expectations enshrined in the definition of Innovation Groups given in section 4.5. For this reason, a three stage career progression is proposed, comprising stages as Innovation Assistant, Innovation Leader and Senior Innovation leader. These are shown in Figure 5 together with salary steps. The stage of Senior Innovation leader will imply tenure with associated core funding whilst other levels will be project funded. At present, levels equivalent to Research Professor and Distinguished Research Professor are not immediately contemplated but may be considered in the future, depending on need and the evolution of innovation activities within CIMNE.

|   |   |                         |
|---|---|-------------------------|
| <b>SENIOR<br/>INNOVATION<br/>LEADER</b> | <b>INCLUDES FORMER:</b><br><b>RENG1+</b><br><b>RENG1</b><br><b>STAFFSC1</b>                         | <b>TERNURE POSITION</b> |
| <b>INNOVATION<br/>LEADER</b>            | <b>INCLUDES FORMER:</b><br><b>RENG2      STAFFSC2</b><br><b>RENG3      STAFFSC3</b><br><b>RENG4</b> |                         |
| <b>INNOVATION<br/>ASSISTANT</b>         | <b>INCLUDES FORMER:</b><br><b>RENG5</b><br><b>RENG6</b>   |                         |

**Figure 5.** Innovation career pathway



### 7.7. Research support career structure

In addition to research and innovation career pathways, the centre relies heavily as well on its administrative and support staff. This comprises professional staff with expertise in finance, project management, human resources, congress organisation, IT systems support, publications and communications and general administration. The career structure of administrative staff is shown in Figure 6. Progression along this structure is often determined by staffing and operational needs as well as individual merit. Nevertheless, in order to develop the skills of support staff a specific set of training modules have been devised and are shown in Table 6.

|                          |  |
|--------------------------|--|
| <b>SERVICE HEAD</b>      | CAP N1-1<br>CAP N1-2<br>CAP N2-1<br>CAP N2-2 |
| <b>HIGHER OFFICER</b>    | TECSUP 1<br>TECSUP 2                         |
| <b>TECHNICAL OFFICER</b> | TECMIG 1<br>TECMIG 2<br>TECMIG 3             |
| <b>ASSISTANT</b>         | AUX 1<br>AUX 2<br>AUX 3                      |

Figure 6. Support career pathway

| RESEARCH SUPPORT STAFF                             |
|--|
| General English & English for Work                 |
| Team Building                                      |
| Effective communication and productivity           |
| Stress management                                  |
| Excel  |
| Prevention of labour risks                         |
| Information security awareness and data protection |

Table 6. Training programme for support staff

## 7.8. KPI's

In order to measure the progress against this strategic aim the following indicators will be measured (Table 7).

| Code | Description  | 2022 Value | Target    |
|------|--|------------|-----------|
| I3.1 | Number of applicants per post (average)  | 5,6        | 6         |
| I3.2 | % female applicants  | 28%        | 30%       |
| I3.3 | Number of leading Fellowship awards (ICREA, RyC, JdIC, MSC,...)                      | 3          | 5 (total) |
| I3.4 | % female staff in research and innovation  | 16,80%     | 30%       |
| I3.5 | % International staff  | 32,80%     | 40%       |
| I3.6 | % Positive participation in staff survey   | N/A        | 67%       |
| I3.7 | Attendance at training events (researchers + innovation officers + research support) | 169        | 220       |

**Table 7.** Targets associated to Strategy Aim 3 (attracting and developing talent)

## 7.9. Action Plan

Table 8 describes the actions needed to implement this strategic aim in accordance with the narrative above. Actions in boldface are strategic and the rest operational.

| Code        | Description   | Responsible                        | Timescale             |
|-------------|---|------------------------------------|-----------------------|
| <b>A3.1</b> | <b>Identify staff coverage gaps in the research themes/methodologies axes and search external candidates</b>        | <b>General Director</b>            | <b>2023</b>           |
| A3.2        | Develop "Join-us" web pages and increase dissemination efforts of new positions, particularly for female applicants | Managing Director                  | First half 2023       |
| A3.3        | Carry out recruitment events for PhD, PostDoc candidates, actively inviting female participants                     | Managing director                  | Annually              |
| A3.4        | Develop and implement a Welcome programme   | Managing director                  | Ongoing               |
| A3.5        | Seek renewal of Erasmus Mundus funding for MSc in Computational Mechanics   | Inst. Relations Director           | February 2024         |
| <b>A3.6</b> | <b>Improve work-life balance conditions at CIMNE, including mentoring and social activities</b>                     | <b>Managing director</b>           | <b>Annually</b>       |
| <b>A3.7</b> | <b>Design and implement a comprehensive technical and non-technical training programme</b>                          | <b>Managing Director</b>           | <b>Annually</b>       |
| <b>A3.8</b> | <b>Create the position of Distinguished Research Professor and invite applicants</b>                                | <b>General Director</b>            | <b>September 2023</b> |
| <b>A3.9</b> | <b>Develop criteria for the stages of the innovation career pathway</b>   | <b>Project &amp; Sci. Director</b> | <b>2023</b>           |
| A3.10       | Map and transfer existing innovation staff to new pathway   | Managing Director                  | 2024                  |

|       |   |                   |            |
|-------|---|-------------------|------------|
| A3.11 | Constitute a promotions panel with appropriate diversity and implement annual calls for promotion | General Director  | 2023       |
| A3.12 | Carry out biennial staff surveys  | Managing director | Biennially |

**Table 8.** Actions associated to Strategy Aim 3 (attracting and developing talent)

## 8. Impact, innovation and technology transfer

### 8.1. Introduction

CIMNE has a long standing tradition of technology transfer and innovation. This has led to over 14 spin-offs during its history, some of which have been sold for large sums of money, allowing for the re-investment into research activities. In addition to the creation of spin-offs, the research at CIMNE has been transferred into impact in society by alternative pathways, often through the development of contract research for companies or external public bodies or, occasionally, via the employment of staff trained at CIMNE. Impacts have been achieved beyond economic returns, for instance, through carbon reduction or other environmental benefits. Consequently, a significant component of the future strategy at CIMNE is based on the formal recognition of the different pathways to societal impact, developing mechanisms for the collection of evidence of such impacts and strengthening routes to turn research ideas into innovative products, processes or services either through spin-off or working with external partners. Clearly, all these forms of technology transfer require investment and strong governance mechanisms.

In the last 10 years, CIMNE spin-offs have operated under the umbrella of CIMNE-Tecnología, a wholly owned company of CIMNE which acts as shareholder of spin-off and has provided financial, HR and other business services to the companies. CIMNE-Tecnología is in the process of adapting its strategy to align with the strategy of CIMNE and decrease the amount of services provided to the spin-offs in favour of greater assistance in the area of generating greater investment and commercial income.

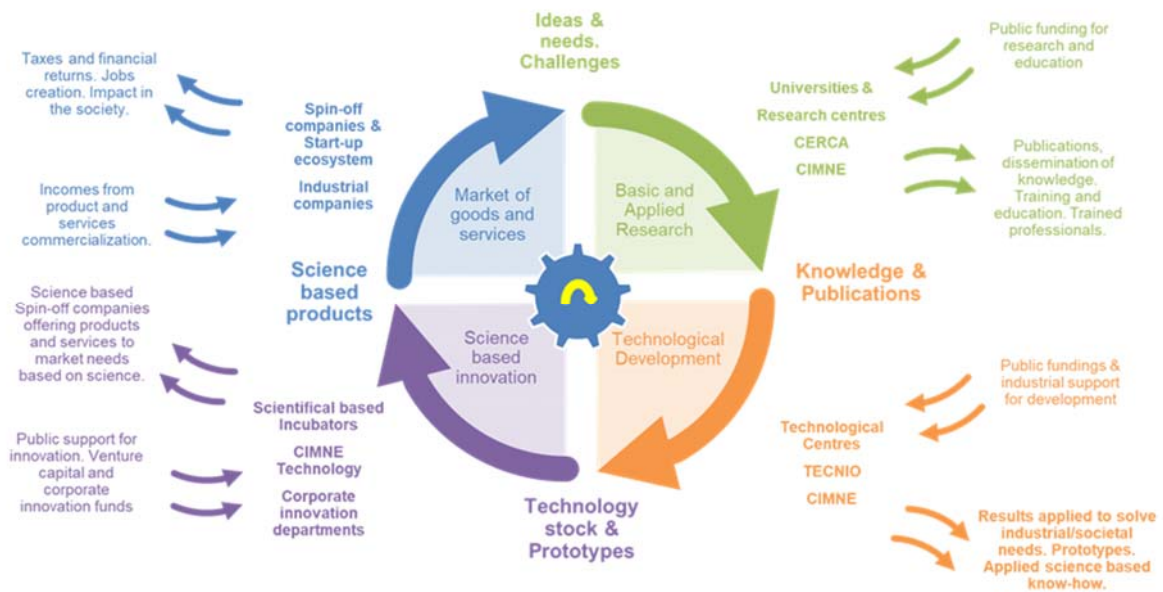
### 8.2. Objectives

The Specific objectives associated with this strategic aim are:

- To ensure that CIMNE maximizes the impact of our research in society
- To promote all forms of technology based innovation
- To have robust mechanisms for making decisions to protect and exploit intellectual property
- To ensure that CIMNE is well informed of stakeholder and market needs in relation to simulation technologies
- To obtain appropriate financial returns from exploitation activities so that that they can be reinvested into research and innovation
- To disseminate effectively our achievements beyond academic communities
- To identify new funding opportunities

### 8.3. CIMNE Impact and Innovation model

The traditional CIMNE innovation model has been described as the cycle of ideas and is shown in Figure 7. Different quarters of the cycle represent different stages of progress from ideas into products, processes or services. This progress is often also represented in terms of technology readiness levels from 1-3 in quarter 1 to 7-9 in the final quarter, which is the realm of spin-off companies or external industries. The second and third quarters of the cycle describe the core of the technology transfer process. In this regard, a number of alternative forms of technology transfer forms must be recognised:



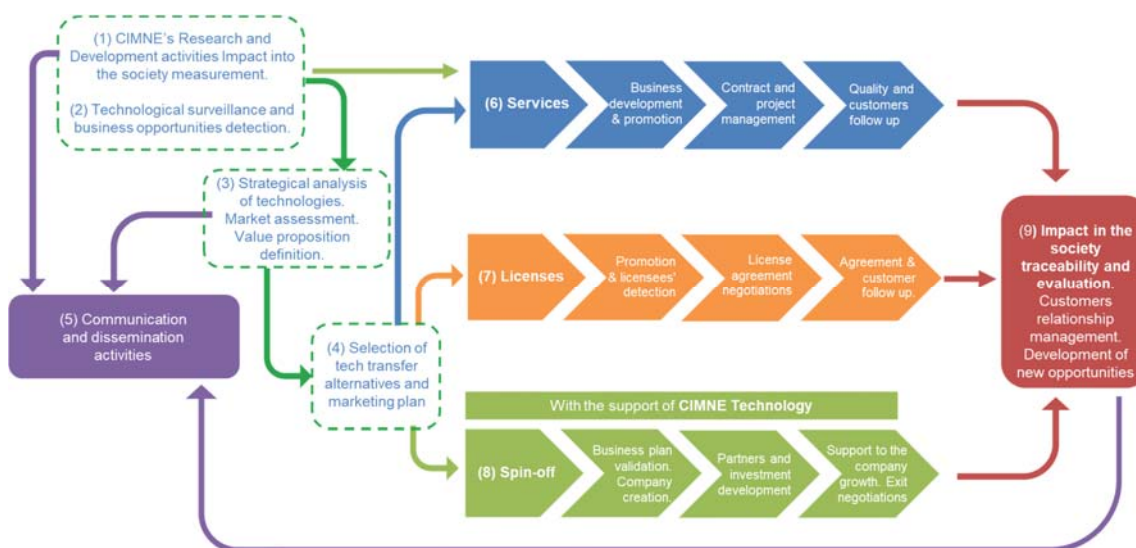
**Figure 7.** CIMNE Science based innovation model

- **Services** such as consultancy, training and personalized development under direct contract.  
This has a number of advantages and disadvantages:
  - No IP transfer
  - Objectives achievement-based Incomes
  - Short term returns
  - No additional investment needed
  - No financial risks
  - Low margin financial returns
- **Licensing** under technology transfer agreements, which involves:
  - IP transfer to companies
  - Usually should be combined with services
  - Royalties based incomes. Business risk.
  - Medium term returns
  - Medium size investments
  - Low financial risk
  - High margin and Mid-term returns generation
- **Spin-offs** based on CIMNE technologies, involving:
  - IP transfer to companies
  - Usually should be combined with services and licenses
  - Incomes trough royalties and benefits
  - Returns in mid and long term
  - Medium / high investments are needed
  - Higher financial risk
  - Very high margin and financial returns

The activities involved in the above modes of technology transfer are depicted graphically in Figure 8. It is important to emphasise steps (9) and (5) comprising gathering the evidence of the impact of

our research to ensure its traceability and the dissemination of achieved impacts through clearly laid out case studies. These should provide a full trace of the pathway from research outputs to measurable impacts or benefits, financial or otherwise, in society.

To ensure success in the above activities, CIMNE will establish an Impact, innovation and TT office that will work alongside research and innovation groups, identifying opportunities and funding avenues for innovation and TT as well as collecting evidence of impact. The office will work also in conjunction with CIMNE-Tecnología management, who will have a greater emphasis on identifying investment income and generating commercial income for spin-offs and CIMNE products via licensing, as well as advising CIMNE leadership of commercial viability of potential opportunities and business plans.



**Figure 8.** Activities in support of impact and technology transfer

#### 8.4. Technology transfer Policy and Governance

CIMNE has a policy for the protection of intellectual property and the creation of Spin-offs which will need to be reviewed in the light of existing legislation, best practice in the sector, the agreement between UPC and CIMNE and the compliance requirements as a public body. It is important that the policy is formally approved by the Governing Body of CIMNE and has the support of its staff and researchers. It must be conducive to exploiting opportunities and distributing potential benefits in a fair and compliant manner. It must address:

- IP and patents property
- Exploitation rights
- Economical returns distribution
- Consideration of the CIMNE and UPC agreement
- Rights over the IP and Patents of the research staff
- Procedures to license technology to companies
- Procedures to create spin-off companies
- Procedures to present patents
- Procedures to invest CIMNE resources in companies, products or services
- Procedures to provide services to spin-off companies



As part of a new policy and procedures on IP and TT, a governing panel will be established that will advise the directors of CIMNE and CIMNE Tecnología in relation to:

- The IP and exploitation strategy of CIMNE
- Making strategic decisions over technologies to be exploited and analysis business plans
- Making decisions on IP protection, needs and costs
- Defining and monitoring Technology Transfer agreements
- Defining and monitoring of services agreements between CIMNE and Spin-off companies
- Monitoring de evolution of the Technology Transfer activities.

It will be formed by:

- The Vice-President of CIMNE
- The Director of CIMNE
- The Managing Director of CIMNE
- The Director of CIMNE-Tecnología
- The Head of TT of CIMNE
- Up to two external advisors

It will meet regularly, at least twice a year. The minutes of its meetings will be regularly reported to the Executive Commission of CIMNE and any formal decisions, such as changes to the IP policy or the creation or significant new investments in Spin-offs, submitted for approval to the Governing Body. The IP and TT Governing panel will replace the need to constitute a formal Governing Body for CIMNE-Tecnología.

### 8.5. Market awareness and Road-mapping

The current CIMNE structure includes a Scientific Advisory Council made up of world leading scientists that ensure the relevance and excellence of our research in the international context. However, there is an absence of an advisory body that connects CIMNE activities to the industries and public bodies it serves. It is therefore proposed to create an Industrial Advisory Board formed by:

- CIMNE Director
- Head of Technology Transfer
- Director CIMNE Tecnología
- External Technology Transfer experts
- Selected Heads of Research Groups and Innovation Groups
- Senior external industrial advisors from different industries and fields (public & private) representing different target organisations related to CIMNE knowledge areas, including SME's, CIMNE spin-offs and large organizations

This advisory board, unlike the IP and TT panel, will have no formal governing role but will:

- Advise on industrial relevance of CIMNE research and future industrial technology needs
- Advise on the market evolution and identify opportunities for CIMNE Technologies in the market
- Support the validation of business opportunities for proposed CIMNE Technologies
- Support the dissemination of CIMNE research activities amongst the industrial and external communities
- Detect new challenges and threats from CIMNE's potential industrial markets
- Support the integration of CIMNE into the industrial ecosystem at national and international levels



The Industrial Advisory Board will be chaired by a senior external industrialist and a summary of its discussions will be reported to the Executive Commission and Governing Bodies of CIMNE.

A particularly useful mechanism for connecting CIMNE capabilities and market needs is the Road Mapping methodology developed by the Institute for Manufacturing (IfM) at Cambridge University. This methodology has been used extensively in the UK in a variety of sectors and regions and could be deployed effectively in the Catalan context. For this purpose, a general road mapping exercise will be conducted at CIMNE wide level with help from IfM during 2023. One of the objectives of the exercise will be to train internal CIMNE staff in the methodology for that future more focused exercises in specific technologies or sectors can be led by our own staff.

### 8.6. KPI's

In order to measure the progress against this strategic aim the following indicators will be measured.

| Code | Description   | 2022 Value | Target     |
|------|---|------------|------------|
| I4.1 | Impact case studies as per UK-REF model evidencing very significant impact in terms of reach and significance | 0          | 10 (total) |
| I4.2 | IP protection (e.g. patents) awarded (cumulative)   | 8          | 12         |
| I4.3 | Spin-off companies created  | 0          | 3 (total)  |
| I4.4 | Income from TT activities (licenses, spin-offs, ...)  | 166K€      | 250K       |
| I4.5 | % Papers with industrial (non-academic) partners as co-authors  | 5%         | 7%         |
| I4.6 | Participation in public (non-academic) dissemination activities (talks, press,...)                            | 5          | 8          |

**Table 9.** Targets associated to Strategy Aim 4 (Impact, innovation and TT)

### 8.7. Action Plan

Table 10 describes the actions needed to implement this strategic aim in accordance with the narrative above. Actions in boldface are strategic and the rest operational.

| Code        | Description   | Responsible                             | Timescale               |
|-------------|---|---|-------------------------|
| <b>A4.1</b> | <b>Formalise the impact, innovation and TT office by defining specific tasks and objectives</b> | <b>General Director</b>                 | <b>First half 2023</b>  |
| <b>A4.2</b> | <b>Develop a TT and IP Policy</b>   | <b>Institutional Relations Director</b> | <b>Second half 2023</b> |
| <b>A4.3</b> | <b>Establish a TT &amp; IP Governing Panel, defining ToR and membership</b>                     | <b>General director</b>                 | <b>Second half 2023</b> |
| <b>A4.4</b> | <b>Establish an Industrial and TT Advisory Board defining ToR and membership</b>                | <b>Project Director</b>                 | <b>Second half 2023</b> |
| A4.5        | Carry out an internal inventory of patents, licenses and other IP instruments held by CIMNE     | Managing Director                       | Second half 2023        |
| <b>A4.6</b> | <b>Carry out a CIMNE wide Road Mapping exercise</b>   | <b>General Director</b>                 | <b>September 2023</b>   |

**Table 10.** Actions associated to Strategy Aim 2 (Institutional and International Relations)