

Panel Consensus Report - 1st Phase

Reviewer 1 comments

A. Productivity and contribution to the NSTS

i. A number of units have had success with both knowledge and tech transfers. An example is G14 – In4Health. Health Informatics has spun out three companies. In addition, kits have been developed for detecting microorganism resistance to antibiotics and new point-of-care biomarker devices for cancer have been developed along with other products.

ii. A number of units in CINTESIS have well-established international visibility including impressive scholarship with output demonstrable in well-regarded publications as well as mature educational and training programs. The generation of new scholars through 6 PhD programs has been solid. Over the past 5 years, there has been successful supervision of 65 PhD students with 150 PhD students in early supervision at present. In addition, success in receiving external funding through grants is evident from a number of the units. A substantial number of conferences and presentations are reported. The group seeks to expand beyond Porto and engage other regional and national centres so as to strengthen the national scientific culture. Indeed, the success of the past round of funding now allows them to propose a challenging agenda to bring the footprint of science, technology transfer, and broader appreciation for the importance of science and technology to other parts of the nation with far less expertise in these domains.

iii. Excellent international collaboration is evident. A good number of high quality institutions are involved. Examples of collaboration are scattered throughout the description of work in following units: G8- NeuroGen, G6 – Ageing, G-7 PsychoLive, G20-Cardiology, G3 – GI Oncology, G14- Informatics, and G-15 EvidenS.

Further, current and planned patient databases should be valuable to basic, applied, and policy-relevant research.

B. Scientific and Technological merit of the research team

i. At the time of the prior review the evaluation rated the R&D Units “Very Good” and this report notes that all parameters in that proposal have been met and exceeded; further, the CINTESIS is reported as having an overall scientific track record that exceeds the national average. Essentially half of the published papers (48%) are reported to be in top quartile journals. In the 2008-2012 time frame, Scopus indexed publications/researcher/year was 1.8. Publications include top international journals and including collaboration with scholars in strong universities throughout the world.

ii. A review of the size and expertise in the research teams gives me overall confidence that the proposed program can be achieved. Indeed, a number are quite impressive. However, a few programs deserve deeper evaluation. In particular, while G1 has an excellent vision, its set of deliverables seems quite complex and, therefore, unachievable. Others deserving a closer look are G4, G5, G11, and G16. G4 identifies a large number of rather diffuse basic objectives combined with insufficient detail to assess overall rigor. Similarly, G5, while admirable and definitely worth including has a low publication record. In short, does it have the faculty needed to assure worthy research in this domain? Their specific projects look fine but the range of topics and goals within which they intend to work was very expansive and little detail is offered. G16 appears to be a new effort and its description suffers from being very general with insufficient detail to give this reviewer a real sense of specific goals. This unit might also consider reaching out toward policy research and public engagement and if such work is part of the plan, I missed it.

iii. A number of research teams are already internationally competitive with success in external funding of some scale. Further, a number of scholars are well networked into international societies. This involvement can help teams hone in on relevant and higher yield funding opportunities including both grants and contracts with government and industry. Examples are included in the proposal.

C. Scientific merit and innovative nature of the strategic programme

i. The proposed strategic programme is characterized perhaps more by relevance and impact than originality per se but this perception may not be fair. All proposed research teams and thematic areas reflect in general on the directions and priorities of European aspirations, e.g., HORIZON 2020, EU funding priorities as well as industrial and national priorities. I'm not sufficiently expert in all of the domains to assess the originality of the research projects but some are certainly solid. For example, the priorities of the informatics and evidence-based medicine teams are focused indeed on highly relevant issues to these disciplines internationally.

The strategic goal of reaching out beyond Porto to engage and generate research capabilities in other sites around the nation should have a major impact over time and is highly commendable. One might also argue that this plan is original compared to Portugal's past approaches but this would need to be confirmed.

The aim to enhance innovative partnerships such as CA50+ could yield a number of desired social outcomes as well as new industry, including original products.

ii. My reading of the proposal suggests that CINTESIS has given substantial thought and effort to match proposed scientific, technological, and cultural activities to the unique features of the various parts of the nation collaborating in this effort. Porto and Algarve are noted for clinical research while Aveiro is described as strong in soft skills (definition unclear), and Lisbon's strength is evidence-based medicine. The aim is to develop more research capabilities in all regions including a more relevant mind-set to emerging national and European priorities to enhance productive research throughout the nation.

iii. Certainly there are a large number of disciplines involved in this proposal. The degree to which multidisciplinary work will permeate the entire effort is unclear. One senses that this is seen as a clear goal but also presents a genuine challenge. Certainly, there are a number of teams that are both multidisciplinary and international in their focus and work. A major effort has been undertaken to improve knowledge and skills across a wide range of disciplines felt essential to address Horizon 2020 objectives. It is worth noting and commendable that engagement of learners includes those from less economically developed regions of the world, in particular Portuguese speaking area in Africa. Examples of interdisciplinary work is evident in 8 research workgroups, including G2, which while it focuses on cardiology, engages it very broadly. Others include G1; G3; G14 and G15 which tend to be interdisciplinary by nature, particularly when clinical issues are engaged; G10; G6; G9; and, G12. Many of these also have active international connections.

D. Feasibility of the work plan and reasonability of the requested budget

i. Considerable thought has been given to the infrastructure for this diverse and geographically challenging proposal. First, there is a governance team with the leader to be chosen from among the participants. Clearly, a number of the teams are already well formed and quite productive. The challenge will be in assuring that newer components achieve robust progress. Ultimately, this rests on the strengths of the faculty more than their numbers per se so the adequacy of human resources to adequately perform research and also supervise postgraduate and postdoctoral student needs to be examined in the next cycle, including site visits. Space allocations take on differing approaches as well. Some are well established and will be expanded while others will seek to function via looser organizational arrangements. The proposal describes the situation quite candidly which once again suggests that attention is being given to this parameter.

The Thematic Lines appear to have been pulled together by looking forward toward European priorities and examining which mix of current and anticipated research teams can move the total programme forward. It will be the responsibility of the leadership team to continue to relook at these themes and assess progress within each to determine if sufficient organizational energy is being given to developing these national capabilities into a 'force to be reckoned with' in terms of international competitiveness for grant and contract funding as well as scholarly output.

ii. Not being familiar with academic administration or cost structures in Portugal and Europe, I am poorly equipped to determine if the budget is 'right' to achieve the proposed programme. Looking at the distribution of funds among the various sites it is readily apparent that the heavy focus of the proposal is in Porto more than the Universities of Aveiro and Algarve, IPP, ESEP and ICBAS. Again, interviews and a site visit should enlighten this issue rather quickly.

iii. The success of CINTESIS over the past few years could only have been achieved with sufficient technical, scientific, organizational and managerial capacity. Past performance is most likely the best guide to judging future success. However, the degree to which progress going forward with the more complex multi-institutional arrangement is something that will need to be explored in some detail at later review cycles and tracked carefully by all parties throughout the duration of the grant period. While Portugal is a small country, it seems to be quite regional in its organization so this might be a real challenge for the project. Further, faculty skills and strengths can vary widely. Some of these disparities can be mitigated through visiting professorships, webinars, and regional conferences among the Thematic Lines. Even making efforts to link students across all regions is critical to both alert program directors to the quality and efforts being made by their own students and to help assure that the 'cream rises to the top', e.g., stronger students in weaker programmes get the attention they need and deserve.

Overall comment

This is a well written and well conceived, yet challenging proposal as it seeks to build on clear strengths while also reaching out beyond its current footprint to engage institutions and sites less developed in terms of scholarship and original research. It is apparent that the principals involved perform work at an international level of expertise. These capabilities create a sufficient level of confidence for this reviewer to give the proposal the benefit of the doubt in those circumstances where the rigor of a few research units is suspect.

Most of the research units are well established and they plan to build upon these strengths. Clearly, they have studied carefully the objectives of the programme for which they are competing for future funding. A great deal of effort has gone into their strategy for the future and how best to develop the scientific footprint in the health sciences across the nation and, with this new effort, to become more valuable and useful to the country and the health of its people.

They are making a genuine effort to align the overall national effort to desired national and European priorities. Like all ‘stretch goals’, some units appear to be weaker than others and will deserve continued support and evaluation.

Reviewer 2 comments

A. Productivity and contribution to the NSTS

While table 5.1. is empty I had to derive the indicators directly from the text. 35 Models, Computer Applications, Pilot installations and Laboratory Prototypes and 2 patents were produced, in the context of projects financed by FCT and the start-ups, which are used by more than 3,000 health professionals, and benefiting of over 100,000 patients. In addition monthly newsletter "CINTESIS'NEWS" is published to improve which has more than 600 subscribers, some of them from abroad. The CINTESIS researchers also direct 6 PhD and 9 Master programmes from different health disciplines, additionally complementing them with postgraduate courses, summer schools, etc., some also from non-health disciplines showing that their research endeavours have a strong multidisciplinary context. CINTESIS performed international cooperation activities with several EU member states and third countries, through joint projects, cooperation with international organisations, active role in scientific societies, publications, and PhD students. They cooperate with some EU and world leading research entities. CINTESIS also show substantial knowledge transfer activities through various ways like research partnership, research services, academic entrepreneurship and human training. Above activities taken in general show significant productivity and contribution to the NSTS, anyhow the number of patents is rather small and the activities to promote public understanding of science and technology is more or less non-existent. According to the post funds received the research outputs seem adequate.

B. Scientific and Technological merit of the research team

CINTESIS researchers published 1370 articles indexed by ISI and 1140 indexed by SCOPUS. About half of the ISI articles were published in the Top Quartile, with a total of 6283 citations, with an average impact factor of 3.7 ranging from IF = 0.09 to IF =51.66. Researchers also published 130 books or book chapters, 60 of them are in international circulation. The publications cover also less developed scientific areas like ageing, nursing and nutrition. Some of the publications are published in top journals (1st in their categories), but in overall the number of publications in top 5% rank journals is relatively small. The publication activities are well distributed between researchers. The number of citations is significant, most of the publications have been cited and an overall citation rate per output is far more than 3. The most publications are from medicine, gastroenterology, cardio medicine, health informatics and health information management, They are also significant number of publications in geriatrics/ageing, nursing and food sciences, the very important scientific fields in the future showing the ability of the CINTESIS to compete for the research grants and industry contracts. Overall the scientific productivity of the researchers are adequate and relevant demonstrating the skills and competence to successfully execute the proposed research.

C. Scientific merit and innovative nature of the strategic programme

The four CINTESIS research themes are Clinical and Health Services Research, Ageing and Neurosciences Research, Diagnosis, Disease and Therapeutics Research and Data and Methods Research. Proposed themes are strongly aligned with the major priorities defined by Horizon 2020 for health research and ICT in Europe. The four main research lines will be performed by 16 research groups, which cover modern and important research areas for the future of health. CINTESIS research is focused on translational research in real life environment. CINTESIS research relies in a decentralized and highly flexible management structure whereas researchers and dry and wet labs resources from 6 higher education which surely optimises the operating costs and improve research effectiveness and efficacy as well as the research adaptability. General objectives and vision of the future are not revolutionary, but well thought from the evolutionary point of view in other words it is innovative, but not so much creative. Without any doubt the research is highly multidisciplinary and also internationally focused and promised to have adequate impact. Expected strategic indicators are ambitious enough in the number of publications, books, PhD thesis, new models/software/devices and research contracts, but I miss conference presentations which anyhow are very important for young researchers, and activities to promote scientific culture, like dictionary and encyclopaedia entries, exhibitions, creative writing, web based resources and similar.

D. Feasibility of the work plan and reasonability of the requested budget

The budget proposed is in line with the program proposed and it should generate substantial income from public and private sources. The budget structure is adequate and the research activities and spending will be supervised by an external committee. The research team has critical mass and the capacity needed to achieve proposed objective and vision. The inclusion of research who directs PhD and Master programmes will enable proper inclusion and supervision of post graduate students, and probably also postdoc researchers (although not mentioned in the proposal). The flexible network of 6 participating institutions forms an attractive work environment and organisational structure providing adequate support for successful and effective research in the manner of research resources, equipment, manpower, management and administrative support.

Overall comment

Various health disciplines including not so developed areas like nursing, ageing, food sciences are complemented with some non-health disciplines like health informatics, computer science, ethics characterising CINTESIS research endeavours with strong multidisciplinary context. CINTESIS is also international active and cooperates with several EU member states and third countries, through joint projects, cooperation with international organisations, active role in scientific societies, publications, and PhD students. Among the cooperating institutions are some EU and world leading research entities.

CINTESIS also show substantial knowledge transfer activities through various ways like research partnership, research services, academic entrepreneurship and human training. CINTESIS activities taken in general show significant productivity, anyhow the number of patents is rather small and the activities to promote public understanding of science and technology is more or less non-existent. Overall the scientific productivity of the researchers are adequate and relevant, including some top journal publications, demonstrating the skills and competence to successfully execute the proposed research, but more it will be advisable to increase the number of publications in top 5% rank journals. The budget proposed is in line with the program proposed and it should generate substantial income from public and private sources. The budget structure is adequate and the research activities and spending will be supervised by an external committee. The research team has critical mass and the capacity needed to achieve proposed objective and vision.

A. Productivity and contribution to the NSTS

Research outputs - This new unit is the result of the fusion of 3 existing units and also integrates 24 researchers previously integrated in other units. The knowledge is huge, with 4 major thematic lines: TL1: Clinical and health services research; TL2: Ageing and neurosciences research; TL3: Diagnosis, disease and therapeutics research and TL4: Data and methods research, with 16 research groups addressing different aspects within these main research lines. TL1 and TL2 are mainly focused on major impact diseases and social aspects, with applied research lines. TL3 combines basic and applied research, using mainly wet labs, animal and cell models. L4 uses dry labs and in-silico models. Given the size of this fused unit (100 integrated members), this unit claims the production of more than 35 models, computer applications pilot installation and laboratory prototypes. There are also 2 patents (one indexed in ISI), which is rather on the low side, given the number of participants. That is also a particular aspect that the strategic plan hopes to improve.

CINTESIS has been particularly active with impressive figures, but one has to take into account that CINTESIS involves one major host institution, the Faculty of Medicine from the University of Porto and 5 other higher education institutions all over Portugal (ISEP (engineering) at Porto, University of Aveiro, University of Algarve, Institute of Biomedical Sciences Abel Salazar, and the ESEnf Porto (nurses High School)). That explains very high figures: 6 PhD programs, 55 defended PhD theses and 332 MSc theses, but several members are also involved in 1st cycle studies in relation with the 4 thematic lines. 6 summer schools were completed and 6 specialization courses (no information about number of attendees and affiliations). Since November a monthly newsletter is edited for internal communication, but the newsletter has more than 600 subscribers (domestic and foreign), providing also communication outside the unit.

Given the composition of CINTESIS combining 4 thematic lines, both wet and dry sciences, the multidisciplinary is very high, the 16 research groups largely encompass complementary expertise, knowledge, skills, that despite a unavoidable heterogeneity, can – if well managed – lead to successful translational research.

The composition of the External advisory board of CINTESIS is clearly international. The unit receives students from the Portuguese-speaking students from Africa and South-America, but also students from the EU. CINTESIS claims to be involved in several international networks and several international collaborations are mentioned in the description of the different research groups.

B. Scientific and Technological merit of the research team

CINTESIS has been productive (over the period 2018-2012, 880 publications, which means about 11,7 outputs per FTE, 6004 citations, 79,63 citations per FTE, Field-Weighted Citation Impact of 1,266), with an important variation according to the investigators (34 with less than 5 publications over the 2008-2012 period and 12 with more than 30 publications during the same period). 261 publications on a total of 1156 (22,6 %) reflect international collaborations. When compared to other units, CINTESIS scores very high regarding the number of publications per FTE, but a bit less when more qualitative criteria of the publications are taken into account, although the output remains high compared to other units.

Skills and composition of the research team to adequately execute the proposed.

Four thematic lines are proposed, each on involving several research groups (RG):

- TL1 Clinical and health services research with 5 RG ((G1-CriticalMed: Critical Care & Emergency Medicine; G2-CardioCare: Cardiovascular Sciences; G3-iGo: Health Technology Assessment in Gastrointestinal Oncology; G4-ProNutri: Clinical Nutrition & Disease Programming and G5-NursID: Innovation & Development in Nursing);

- TL2-Ageing & Neurosciences Research comprises 3 RGs (G6-AgeingC: Ageing Cluster; G7- PsychoLive: Psychology & Long Living and G8-NeuroGen: Neuronal Degeneration & Regeneration); - - TL3-Disease & Diagnostic Research comprises 4 RGs (G9-Innovis: Innovative Diagnostic Tools; G10- MicroMed: Medical Microbiology; G11-MedISP: Medical Imaging & Signal Processing; G12-PharmaHT: Therapeutics, Pharmacovigilance & Hypertension Diagnosis);

- TL4-Data & Methods Research comprises 4 RGs (G13-BioData: Biostatistics & Intelligent Data Analysis; G14-In4Health: Health Informatics; G15-EvidenS: Evidence-Based Medicine & Research Synthesis; G16-ManEthics: Healthcare Management & Ethics).

The wet labs (TL1; TL2 and TL3) involve about 80 % of the integrated members, have access to equipment (from cell biology to molecular biology), use in vitro and animal models, but have also access to patients (adults and children) from different hospitals and different areas. TL4 involves dry labs (20 % of the integrated members). This is a very large palette of expertise and skills, the challenge being to keep coherence and to have a clear coordinated strategy supporting all the thematic lines and all the research groups. Priorities will have to be defined, avoiding “frustrations” in some “neglected” research groups.

Ability to successfully compete for national and international research grants and contracts, including contracts with companies

The 16 RG of CINTESIS are very briefly presented in the application form and the main funding sources for the different groups are either only very shortly or not at all presented. However from the data presented by several groups, it appears that several groups were supported by different funding sources (generally national), but also with

industrial support for some groups (Pfizer, Nestlé, Johnson & Johnson, see for instance RG10, Portuguese food industry for RG4). Some spin-offs and start-ups have already been created (see for instance RG14). There has been one ERC starting grant (RG9 – Maria Goreti Sales). CINTESIS certainly has to strive for more international funding, in particular from the European Union. But again, this is a specific objective of the strategic programme, taking into account the 2020 horizon priorities.

C. Scientific merit and innovative nature of the strategic programme

Relevance, originality and impact of the proposed strategic programme;

The strategic programme wants to support a large virtual decentralized Portuguese network by 5 major strategic axes:

- (1) Promote knowledge/education
- (2) Develop new and good ideas to the market
- (3) Strengthen regional and social benefits
- (4) Deepen/implement innovation partnerships
- (5) Intensify international cooperation

The originality of the strategic programme is to rely on the scientific expertise and skills and critical mass of investigators and PhD students already present in the 6 institutions, but to invest almost exclusively in the organisational aspects and hire 5 experts (postdoc level) in respectively:

- (1) Innovation management, in order to enhance the technology transfer from this center,
- (2) Fund raising, mainly international,
- (3) Data management, for handling data bases of big dimension, to support research needs,
- (4) Information management, concerning informatics and,
- (5) Facilitation of internal relationships, as CINTESIS has 16 research groups, within 4 lines of research, in 6 different and geographically distant management structures.

The impact certainly will be high, the challenge being that all these 5 experts being affiliated to the Faculty of Medicine at the University of Porto, the unit will have to find a *modus vivendi* to guarantee that all the institutions and all the research groups will benefit from the strategic programme. The governance rules of this decentralized mega-R&D unit are described only very (too) shortly (6.3) and will have to be reformulated clearly.

The programme certainly supports translational research in Portugal by federating 6 major high education institutions covering different geographic areas and even though Porto remains the strategic center, CINTESIS is a national R&D unit aiming at giving access of stronger research activities in up to now “under deserved” regions (Algarve and Aveiro), contributing to attract in the future more qualified health professionals in these regions. Again, the success of this regional strategy is highly dependent of the governance rules that will have to be clarified.

Degree of multidisciplinary and of internationalization, when relevant.

As for A, the degree of multidisciplinary is clearly high in this proposal given the association of 16 research groups, with different competences, expertise and skills, but addressing some specific questions fitting within the 4 major thematic lines. The network is composed of wet labs (about 80 % of the investigators) and dry labs. There is clearly a concern for (big) data management, which is not always met in this kind of applications and this certainly is a plus.

D. Feasibility of the work plan and reasonability of the requested budget

Most of the participating research groups now assembled in CINTESIS have been active in the past, being involved in education, Master theses and PhD theses supervision, publishing in their field. Several groups are involved in international collaborations. So the critical mass certainly is present both for wet labs and for dry labs. CINTESIS will use available infrastructures in the different institutions, with 3000 m² lab and office space available in the Faculty of Medicine (Porto). The focus of the programme is to improve the management of the available resources by hiring 5 experts for a more efficient technology transfer, a better data management, a better access to international funding, and a better communication within and outside the unit. The RG and the 4 thematic lines have clearly defined objectives that for most of them, seem feasible given the demonstrated activities in the past. The programme should help some of the research groups to further improve the quality of the publications (by achieving higher field-weighted citations impacts). The only (major) concern is: will the governance allow to all groups to really benefit from the programme given the heterogeneity of the members and the geographical dispersion of the investigators at one side and the concentration of the task force in Porto.

Adequacy of proposed budget to accomplish the proposed strategic programme;
The aim of CINTESIS is with a critical mass of researchers (100 integrated members, about 135 PhD students and about 140 collaborator members) to “address in a better and more efficient way, complex research challenges raising from national needs taking into account and Horizon 2012 priorities”. CINTESIS is involved in both fundamental (mechanisms of diseases) and more applied research (health technologies assessment and clinical/health serves research) in particular in the field of ageing and neurosciences, but aims to accelerate technology transfer to healthcare industry and innovation in healthcare, implementing and delivering new products and services (diagnostic tools, medical software, medical devise, innovative medical methods, ...). Therefore 5 experts will be hired (affiliated to the University of Porto) as already described in C. There is also some budget for equipment (a personal computer for each of the 5 experts) and for servers required for high performance computing and (big) data management in the different host institutions. All the institutions have a budget covering mobility even though videoconferences are also planned. Finally all the institutions have an important budget for Service procurement and acquisitions for accommodating consumables and various expenses and services. Patent costs have also been budgetised in some of the institutions.

There is a clear commitment of the host institution (Faculty of Medicine, Univ. Porto), willing to provide 3000 m² of laboratory and office space, besides laboratory equipment and more than 100 faculty staff and technicians. The other host institutions also provide space, equipment and human resources. CINTESIS also includes 2 organic units from the Porto University, giving access to relevant facilities (communication, technology transfer, ICT infrastructure as well as legal and administrative services). The originality of this application is that CINTESIS does not

claim more common facilities and buildings requiring maintenance, but CINTESIS is a virtual and decentralized network where equipment, human resources and facilities are shared among member institutions.

Overall comment

Strengths

Very challenging and original truly strategic programme aiming at supporting translational research in Portugal by federating 6 major high education institution covering different geographic areas and even though Porto remains the strategic center, CINTESIS is a national R&D unit aiming at giving access of stronger research activities in up to now “under-deserved” regions (Algarve and Aveiro), contributing to attract more qualified health professionals in these regions. This new unit results from the fusion of 3 existing units and also integrates 24 researchers previously integrated in other units. The knowledge is huge, with 4 major thematic lines. Given the composition of CINTESIS combining 4 thematic lines, both wet and dry sciences, the multidisciplinary is very high, the 16 research groups largely encompass complementary expertise, knowledge, skills, that despite an unavoidable heterogeneity, can – if well managed – lead to successful translational research.

The originality of the strategic programme is to rely on the scientific expertise and skills and critical mass of investigators and PhD students present in the 6 institutions, but to invest in the organisational aspects and hire 5 experts (postdoc level) for a more efficient technology transfer, a better data management, a better access to international funding, and a better communication within and outside the unit.

Weaknesses

The strength of the unit, being a mega virtual unit dispersed not only in 6 different high education institutions, but also in different regions, can also be considered a potential weakness with a possible risk of dysfunctions and resulting frustrations in some RG. Porto has a central role and is over-represented in the 16 RG. The unit has to ensure by clearly defined governance rules that the strategic programme benefits to all research groups. However priorities will have to be defined, according to transparent and well-defined rules