CoeGSS

Centre of excellence

D6.5 – First annual report on training, standardisation, collaboration, dissemination, and communication

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Abstract

This meta-deliverable presents the state of work in several tasks of WP6 "Awareness Creation and Community Support" at the end of the first project year, in particular, it comprises the activities and achievements of the tasks

- T6.2 Event Management and Collaboration

- T6.3 Training

- T6.4 Standardisation

- T6.5 Dissemination and Communication

Work done in these tasks has begun to set up a network of collaborations of CoeGSS, has prepared training at the intersection between the HPC and GSS worlds, has structured standardisation contributions CoeGSS can make, and has planned how to create impact through dissemination, as well as started to do so.

The work package on awareness creation and community support, that apart from the tasks presented here includes T6.1 "Community Building, CoeGSS Brand and Website", is a keystone to secure the project success, given that CoeGSS aims at establishing a self-sustaining interface between stakeholders (politics, business, public) and experts in the global systems science (GSS) and high performance computing (HPC) fields.

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1 Introduction

This deliverable presents the first project year progress of tasks T6.2-T6.5 in WP6 "Awareness Creation and Community Support" of the Centre of Excellence for Global Systems Science (CoeGSS), which merges High Performance Computing (HPC) and Global Systems Science (GSS). These are

- T6.2 Event Management and Collaboration

- T6.3 Training

- T6.4 Standardisation

- T6.5 Dissemination

These tasks are closely related among each other, and closely related also to T6.1 "Community Building, CoeGSS Brand and Website" as, for example, community building can occur through awareness creation which is one aspect of dissemination (e.g. in the form of a newsletter) or through personal engagement which is a form of collaboration with other people, projects, or institutions. This deliverable is therefore closely related with D6.2 "First Annual Report on Community Building". In order not to double information, there will be references to D6.2 wherever appropriate.

Similarly, as the WP6 activities are key to the project's aim of establishing a self-sustaining Centre of Excellence for Global Systems Science, this deliverable is closely related to D2.1 "Stakeholder Analysis and Initial Sustainability Model" and will therefore reference the latter, instead of repeating information, wherever possible.

Some background information on the project is needed for some of the sections presented below: Three pilot studies – Health Habits, Green Growth, and Global Urbanization – are at the core of CoeGSS. They build synthetic information systems, each for investigating a policy related question from their field. A synthetic information system represents a real-world system on a computer to run simulations for exploring, as in a virtual laboratory, possible scenarios of the system's future evolution and thus help assess possible consequences of decisions. In particular, such a system contains a synthetic population and an agent-based model. The former is a set of virtual agents that, for relevant characteristics, statistically match the corresponding distributions found in the real-world population represented. The latter is a simulation model, which implements interactions of agents. Running the agent-based model initialised with the synthetic population, that is, repeatedly carrying out the virtual agents' interactions, and then analysing the thus created simulation output, the synthetic information system helps understand potential system evolutions. The Health Habits pilot investigates smoking habits, the Green Growth pilot studies the evolution of the global car population, and the Global Urbanisation pilot analyses two-way relations between transport infrastructure and real-estate pricing; the interested reader is referred to D4.4 for more information on pilot work.

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2 Event Management and Collaboration

Event management concerns both the organisation of events, such as workshops and schools, and organising a presence of CoeGSS at various important events in the fields of HPC and GSS. Section 2.1 describes the activities of the first year in relation to existing events, while Section 2.2 presents events planned in the upcoming year.

Collaboration, especially with other GSS projects, other Centres of Excellence (CoEs), and initiatives in similar areas of FET (-HPC), is an essential component for community building and dissemination of CoeGSS. Section 2.3 gives an account of partners' collaborations that are relevant for CoeGSS, highlighting where these collaborations have already yielded fruit during the first project year.

2.1 CoeGSS organization of events

With the target of sharing ideas and points of view, disseminating results and obtaining feedbacks, in the first project year, CoeGSS has contributed to several conferences and workshops. The list of events where partners presented (some aspects of) CoeGSS is provided in the dissemination report below (see Section 5.2.3), this section focuses on events (co-)organized by CoeGSS.

Within the European HPC Summit Week, the EXDCI workshop (https://exdci.eu/events/hpc-summit-week-exdci-workshop) took place from the 9th to 10th of May 2016 in Praha, Czech Republic: the aim was to update the status of the ongoing FETHPC projects, the European Exascale projects and the CoEs in order to better understand the development of the HPC ecosystem for all the participants and stakeholders. CoeGSS participated in the organization and HLRS, as technical management, represented the project in this event and updated on the current status and achievements of the project. This raised a lot of attention and further discussions with other activities in similar areas were kicked off.

Figure 1: EXDCI webpage

CoeGSS organized a booth at ISC (http://www.isc-hpc.com/id-2016.html), which was held in Frankfurt, Germany, from the 19th to the 23rd of June 2016. The ISC-High Performance conference is Europe's largest international conference for high performance computing, network and storage; it attracted 3092 attendees from 53 countries and 146 companies and research organizations.

Figure 2: CoeGSS booth at ISC-HPC 2016

STATPHYS26, one of the major conferences in Statistical Physics, was held in Lyon, France, during July 2016; several satellite workshops were organized all over France in the same period. As a satellite of STATPHYS26, "*Statistical Physics for Financial and Economic Networks*" took place on 15th and 16th of July 2016 at Sorbonne, Paris, France (the program can be found at the link https://sites.google.com/a/imtlucca.it/statphys-spfen/). The main subject of the conference was the comparison of methods of reconstruction and analysis of economic and financial networks: these arguments are fundamental to support the pilots in modelling networks between agents. Apart from the very organization of the event, contributions from the work about economic networks reconstruction were presented by collaborators of the CoeGSS consortium (Diego Garlaschelli, University of Leiden; Andrea Gabrielli, ISC-CNR, Rome; Marco Bardoscia and Paolo Barucca, LIMS, London and University of Zürich).
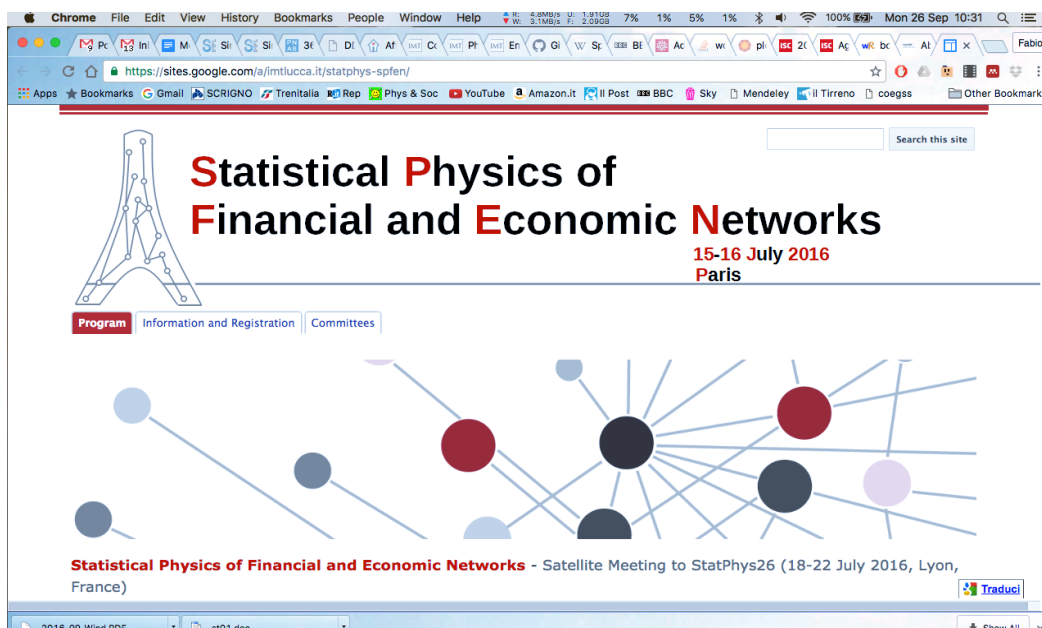

Figure 3: Statistical Physics of Financial and Economic Networks webpage

The CCS2016 conference is the Complex System Society's (CSS) official conference and the main conference on complex systems: it was held in Amsterdam in mid September 2016. CoeGSS organized a satellite, "*Multilevelcs: Multilevel Complex System*" (https://sites.google.com/site/multilevelcs/) on the 21st of September: the main subjects were the study of the interactions present among social, economic and financial networks and how to model them. CoeGSS contributed to the organization of the event and presented some of its research results through the seminars of Stefano Battiston (University of Zürich) and Fabio Saracco (IMT, Lucca).
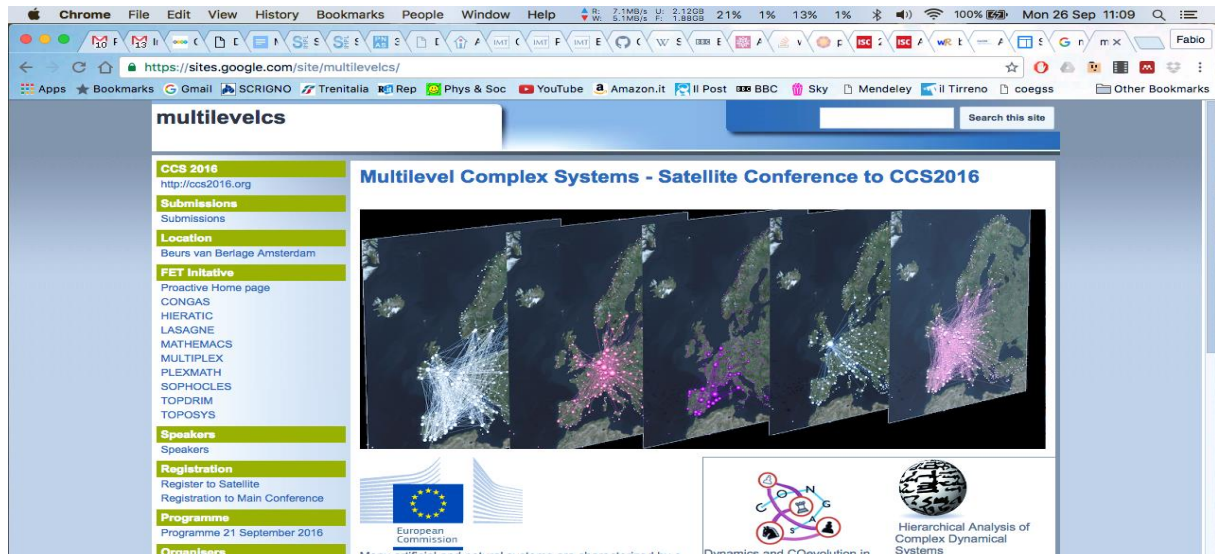
Figure 4: multilevecs webpage

2.2 Events planned

CoeGSS is present in the organization of "*System Science and Policy*" (https://sites.google.com/site/systemscienceandpolicy/), a workshop which is going to take place at King's College London on the 27th and 28th of November 2016, in collaboration with Tiziana Di Matteo (King's College). The aim is to bring together stakeholders who need to practically deal with the governance of integrated financial risk with scholars from specifically selected scientific communities, like global systems science, systemic risk and complex networks; thus, the target is, on one hand, to widen the audience and make policy makers aware of new insights obtained by non trivial analysis, and, on the other hand, to obtain feedback from the institutional world.

An innovation workshop is planned for the first quarter of 2017. It shall include as invited speakers experts from the areas of synthetic populations, agent-based modelling, HPC, and GSS. As the workshop audience, the consortium, selected stakeholders from the partners' networks and from the GSS and HPC communities as well as participants of related projects (in HPC and GSS) shall be invited. Bringing together the communities, the workshop will create innovation and visibility at the intersection of GSS and HPC, and it shall allow to collect feedback for the training task (see below).
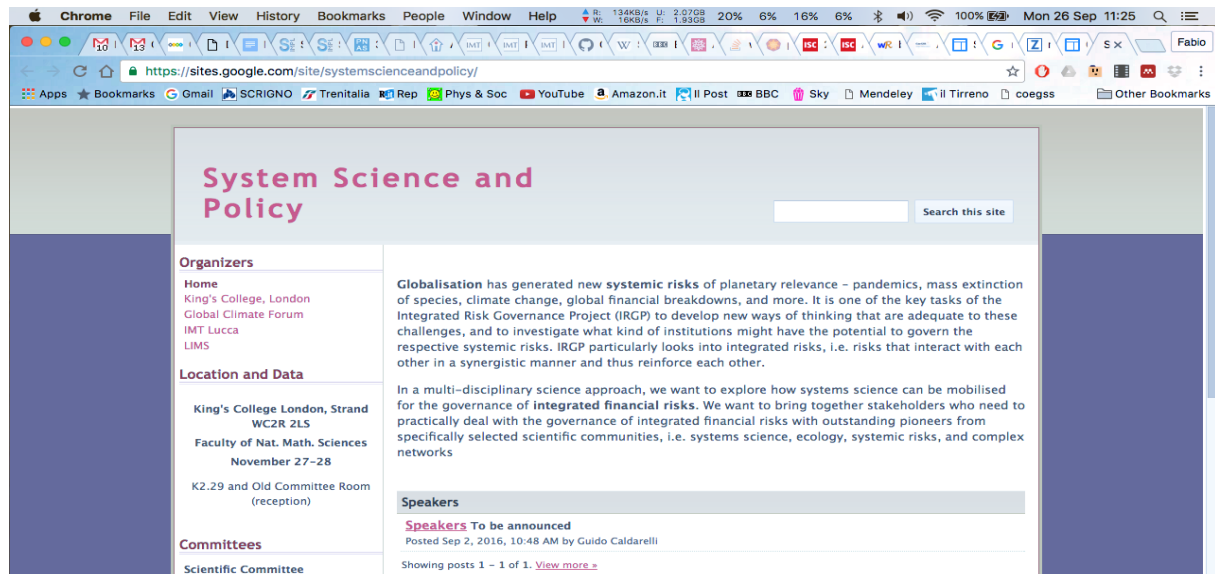
Figure 5: System Science and Policy webpage

2.3 Collaboration

As partners in CoeGSS come from various fields, among which HPC and GSS, and have different institutional forms (university, research institute, HPC centre, SME), the networks of partners cover a large spectrum of potential stakeholders and collaborators. In the first project year, partners have introduced the CoeGSS approach to contacts in their networks, finding interest and potential for cooperation. At the same time, partners share information on their contacts relevant for CoeGSS within the consortium to foster further synergies. A synthesis of this information is presented here.

On the HPC side, ATOS discussed similarities and differences with respect to the portal with contacts from the FORTISSIMO project, and the relevance of uniform contracts for managing legal risk and supply side with contacts from the SLALOM project. HLRS carried out initial talks, describing CoeGSS, with several network partners: possible cooperations were discussed with BioExcel (Erwin Laure) on life science and genetics, with ESiWACE (Joachim Bierkamp) on climate simulation, the Science & Technology Facilities Council (Peter Oliver) on data analytics; possible access to dedicated HPDA hardware and software were considered together with HUAWEI (Götz Brasche) and CRAY (Dominik Ulmer), with the latter, also possible support of CRAY was considered with Dominik Ulmer, Nurcan Rasig, and Wilfried Oed, a further possibility of cooperation was looked into with Intel (Helena Liebelt). GCF initiated an ongoing dialogue with Xavier Rubio-Campillo (previously Barcelona Supercomputing Center, soon University of Edinburgh) who developed the HPC-ABM framework Pandora used in CoeGSS; joint further development of the framework is of interest to both sides. GCF also began

discussing possible cooperation, e.g. about mathematical analysis of the Green Growth pilot model in an HPC context, with the group of Prof. Schütte at Zuse Institute Berlin.

In the field of GSS, cooperations exist with other projects: IMT and GCF are in collaboration with the groups of Prof. Stefano Battiston (University of Zurich; DOLFINS and SIMPOL projects) and Antoine Mandel (Université Paris 1 Panthéon Sorbonne; DOLFINS and SIMPOL projects). Cooperation on implementing the celebrated DebtRank, i.e. the proper framework that permits to evaluate the effects of stresses on a financial network, in HPC is a potential future application in WP4 (see D4.4). Closely related to this topic, IMT is collaborating on network reconstruction methods with Diego Garlaschelli (University of Leiden) and Paolo Barucca (London Institute for Mathematical Sciences), while with Kartik Anand (Deutsche Bundesbank), Laura Silverstri (Bank Of England), Marco Bardoscia (London Institute for Mathematical Sciences), and Chiara Osbat (BCE) they are working on the study of financial networks.

Another related topic is an analysis of the similarities between risk cascades in "conventional" disasters (like earthquakes) and risk cascades in global systems (like the recent financial crisis) introduced by Prof. Jaeger at an international workshop on 'Natural Hazard Uncertainties, Integrated Risks and Sustainable Development' in Beijing, together with renowned GSS expert Dr. Armin Haas from the Institute for Advanced Sustainability Studies in Potsdam. This made the CoeGSS work on simulating global financial risks (begun together with Prof. Battiston, Zurich) visible in the domain of ICSU, the International Council of Scientific Unions, as well as in the important community of Chinese risk researchers. Based on decisions at the workshop, risk related CoeGSS work will from now on have an outlet in the International Journal of Disaster Risk Science.

At Chalmers, cooperations with other projects are naturally given as some researchers work both in CoeGSS and other projects: Patrik Jansson is WP leader for Domain Specific Languages and site leader in the GSS-funded EU project GRACeFUL which has partly overlapping goals with CoeGSS. The GRACeFUL case study on Climate Resilient Urban Design is related to the CoeGSS pilot on Global Urbanization. Oskar Allerbo and Devdatt Dubashi are also involved in a project together with the "Energy and Environment" department at Chalmers and the Network Dynamics and Simulation Science Laboratory at Virginia Tech. This project investigates electric vehicle usage in Gothenburg using synthetic populations generated at Virginia Tech. It is highly related to CoeGSS since it involves both synthetic populations and agent based modeling.

GCF is in contact with agent-based modellers from Bielefeld University (in particular, Sander van der Hoog). Exchange on their macro-economic agent-based modelling activities with the EURACE@UniBi model on cluster computers provided valuable input for the Green Growth pilot modelling activity. Further exchange is foreseen.

Contacts of particular interest for the Green Growth pilot include a discussion of Michal Palka, Patrik Jansson, and Devdatt Dubashi with the Volvo Group, and scientific exchange of GCF with

Manfred Laubichler (Arizona State University and Leuphana University Lüneburg) and Jette Krause (Joint Research Center, Institute for Energy and Technology). From the cooperation with Manfred Laubichler, a joint project proposal titled "Bridging the great divide in sustainability science: linking high performance modelling and transition experiments to foster transformational change towards sustainability" has found funding by the Volkswagen Foundation; its topics complement HPC modelling aproaches like those of the Green Growth pilot with local analyses of future mobility options. The cooperation with Jette Krause may allow a combination of a JRC car fleet emissions model with the Green Growth pilot's modelled car population at a later stage.

An exchange of DIA with the Project "Simulierte Welten" (https://www.simulierte-welten.de/) on opportunities and limits of modelling and simulation provided input for work on the risk profile for CoeGGS.

Further collaborations are related to training and dissemination. Cezar Ionescu (Chalmers) informed various academics at the University of Oxford and especially Department for Continuing Education about the goals and methods of CoeGSS, among them Prof Jonathan Michie, Prof David Griffith, Prof Angus Hawkins, Prof Jeremy Gibbons and Assoc. Prof Alessandro Abate. GCF is in contact with Prof Jeffrey Johnson (The Open University) about the possibility of training on GSS from a CoeGSS perspective (see also Section 3.5). Finally, IMT has established collaboration with the Nature Editorial Board: with help from the journalist Mark Buchanan CoeGSS plans to disseminate results obtained more efficiently.

3 Training

In CoeGSS, two previously unrelated communities meet. This means that training is a prerequisite for a fruitful exchange. The training task, which started in M6 of the project, has a twofold goal:

- to define a curriculum for future HPC technology leaders related to GSS needs

- to identify best practices for educating and training.

Activities in this task included a first step of requirement analysis (Section 3.1), the preparation of an information page on training within the CoeGSS website (Section 3.2), the collection of feedback from consortium members who participated in existing courses (Section 3.3), providing the possibility for CoeGSS members to participate in an introductory HPC course (Section 3.4) and cooperating with the creator of an online introductory GSS course (Section 3.5).

3.1 Requirement analysis

The curriculum development includes a requirement analysis of needed topics as foundation for updating HPC curricula and to enable GSS tailored training activities. To begin the requirement analysis, a questionnaire was provided to partners via the project-internal wiki. In this first round, questions focused on introductory training to start bringing the communities together. Questions were addressed to HPC and GSS experts seperately, asking both what they would like to know from the experts of the other field, and what they would like to explain to them, respectively. This section presents information collected via the questionnaire and in personal interactions throughout the consortium. Considering the training task's aim of defining a curriculum for future HPC technology leaders related to GSS needs, introducing GSS to HPC experts (Section 3.1.1) seems the more important direction, however, introducing HPC to GSS experts (Section 3.1.2) is equally important for CoeGSS from a business point of view: GSS people need to be aware of HPC benefits to their work in order to become interested in using services of CoeGSS.

3.1.1 Introducing GSS to an HPC person

As background information, HPC experts who want to start focusing on GSS problems should be aware of the basic features of GSS:

- interdisciplinarity (from complex networks to social psychology)

- "policy informatics", that is, computational modelling of complex social systems to adress policy related questions

- transdisciplinarity and stakeholder involvement, meaning interaction between scientists and practitioners / decision makers, aiming at co-production of knowledge, that includes both the scientific method and the social context.

These features are explained well and quite concisely in the MOOC: Introduction to Global Systems Science, https://www.futurelearn.com/courses/global-systems-science (see Section 3.5).

Then, the part where HPC can become relevant is of course the activity of computational modelling. Here, the HPC experts should be informed about how a Synthetic Population is generated (algorithms, data gathering for the static part of a synthetic information system) and how the evolution of a Synthetic Population is simulated (algorithms, data gathering for the dynamic part of the SIS) as well as what tools are available for these two parts. An approach of particular importance is agent-based modelling. HPC experts wanting to provide support for HPC agent-based modelling need to learn about the basics of this approach (agents are implemented with characteristics and rules for interaction, simulations then consist of repeated interactions). The flexibility of this approach may be a challenge to HPC: concepts for individual agents, for their social interaction, and for a common environment influencing all agents, may differ largely between agent-based models. Passive knowledge of various aspects of social sciences (from characteristics of social networks to concepts like expected utility maximization given subjective beliefs) would be very helpful to facilitate future HPC experts' dialogues with their GSS-clients. This does not mean becoming an expert in the social sciences themselves, but having a passive vocabulary for understanding enough of what the GSS experts talk about to conduct a fruitful dialogue on the individual GSS application under consideration. Unfortunately, a "mathematics of agent-based models for GSS" is not so far available – hopefully the CoeGSS training work, and in particular innovation workshops, can contribute to filling this gap.

3.1.2   Introducing HPC to a GSS person

First of all, a general introduction of HPC is required: what is HPC, why is it useful, where should it be applied, which kind of prerequisites need to be fulfilled, first examples on how parallelization can be leveraged, etc. In addition, standard tools like performance benchmarking to understand the potential of applications would be useful as well.

In particular, the advantages of HPC against standard modelling/simulation software, computing in the cloud, or other big data technologies, should be explained. That is, it should be pointed out, which possibilities HPC provides that other technologies do not. This is relevant also from a CoeGSS business point of view, to be able to attract GSS community users.

With an eye to the data-intensity of GSS work, an introduction to High Performance Data Analytics for GSS, using technologies such as Apache Hadoop and Spark, seems useful, including best practices for HPC scaling of typical Data Analytics tasks.

3.2   Website: Training information

Together with WP2, information on available training activities in the HPC and GSS fields has been collected (see D2.1, Section 2.4.2). A webpage to appear within the CoeGSS website has been assembled to provide an entry point for what to read and where to find training opportunities for the two areas. It can be found at http://coegss.eu/resources/#training and shall be updated with more introductory material produced within the consortium, initially for internal use but useful also to external GSS and HPC experts, over the coming months. In particular, the website contains a commented list of the training courses available at HLRS, informing about the course content, prerequisites and levels required from participants, as well as on particular GSS relevance, if applicable.

3.3   Feedback from participation in HPC courses

GSS experts working on the Green Growth pilot study have taken two HPC courses (co-) organized by HLRS. Feedback was collected from these persons to identify the relevance of these trainings for GSS researchers who might be future customers of CoeGSS. This feedback was incorporated into the commented list of HLRS training courses mentioned above in Section 3.2.

3.3.1   Parallelization with MPI and OpenMP

This course took place on March 21 - 23, 2016, at Johannes Gutenberg-Universität Mainz, information can be found under https://www.hlrs.de/de/training/2016-03-21-mainz/. Steffen Fürst and Andreas Geiges (GCF) participated in this course.

The workshop is of particular GSS relevance as it provides a general background of programing in OpenMP and MPI in the languages C and Fortran. It is especially useful for GSS-scientists who aim to implement their GSS simulation tool as parallel frameworks or start working with HPC frameworks. All basic functionalities of MPI and OpenMP are introduced, together with the individual conceptual differences and application possibilities. Through different application examples, the participants become familiar with using both messaging interfaces appropriately and develop an understanding of which implementation will work best for their framework.

The workshop is also useful for participants that develop tools using agent-based models that already have the ability to run on HPC clusters, like Pandora, Repast or Flame. Understanding MPI and its inner logic will help to use, understand and extend the structure of such frameworks more easily.

3.3.2 Scientific Visualization

This course took place on April 18 – 19, 2016 at HLRS in Stuttgart, for information see http://www.hlrs.de/training/2016-04-18-vis1/. Andreas Geiges (GCF) participated in this course.

Its particular GSS relevance was found in the comprehensive overview of available visualization methods offered by the course with a special focus on the visualization of 3D information. In the context of GSS, the course allows to visualize complex network and graph structures, to interactively analyze simulation data and to use augmented reality. Big parts of the course are structured interactively and allow the participant to visualize her/his own data on the visualization infrastructure of the HLRS.

3.4 HPC course in cooperation with PRACE

In cooperation with PATC (PRACE Advanced Training Centre), HLRS offers a dedicated 5-days training event in Stuttgart to the members of the CoeGSS project. This Parallel Programming Workshop provides introductions to distributed memory parallelization with the Message Passing Interface MPI and shared memory parallelization with OpenMP for beginners. Then, it treats intermediate and advanced topics in parallel programming. Five members of the consortium have signed up for the course; feedback for the training task of WP6 will be collected after completion.

3.5 GSS online course

Since Global Systems Science is itself an emerging field, there are efforts within the community to create awareness and provide introductory information about GSS. As noted in D2.1 (Section 4.4.1), CoeGSS is perceived as a flagship project in the GSS world. It was therefore a win-win opportunity to start cooperation with Jeffrey Johnson, who is Professor of Complexity Science and Design at the Faculty of Mathematics, Computing and Technology at The Open University and who created an online introductory course on Global Systems Science. The course (see https://www.futurelearn.com/courses/global-systems-science/) teaches how Global Systems Science can inform and model the impact of social, economic, political and environmental policy making. Before the first presentation of the course in March 2016, Johnson asked Sarah Wolf, task leader of the training taks, for feedback on whether the course material fit with the CoeGSS view on GSS, which it did; from the review, small improvements of some parts of the material were suggested and included. In the second and third presentation (June and September 2016), Wolf contributed to the course as an educator. This means answering questions or in turn commenting on comments of the learners. In several occasions, when fitting with the learners' questions/comments, she referenced CoeGSS to raise awareness of the project among the learners.

3.6   Outlook

Cooperation on the online GSS course shall be continued. Reaping further synergies, a more technical online course, focused on modelling and computation, and thus moving from pure GSS training towards GSS-HPC training, could be set up in a similar format to that of the GSS online course described above.

With the pilot models evolving, and thus more and more concrete HPC requirements from these prototypical GSS applications, training requirements for future HPC technology leaders focusing on GSS will also become more concrete over the next project year. The requirement analysis shall be extended by M24.

Last but not least, the training task foresees innovation workshops to provide feedback for the centre's activities and especially for education tasks in WP6. An initial innovation workshop is currently being planned for the first quarter of 2017 (as mentioned in Section 2.2 above). Feedback collection from this workshop and from participation of HPC experts in GSS training activities as well as GSS experts in HPC courses shall allow to identify best practices for training at the intersection of GSS and HPC over the remaining duration of the project.

4   Standardisation

Within this section of the document, the initial processes and findings of Task 6.4 are highlighted. CoeGSS must take a holistic approach in technical developments. Specific components may be implemented (e.g. as part of the pilots or the portal services), but for evaluating standards for the centre as a whole, we do for example not make a distinction between standards that are effectively adopted in implemented components, and standards that are put in the baseline but are not (yet) present in specific CoeGSS components. Clearly, wherever possible, standards should be used as this promotes interoperability and increases customer choice without lock in.

It is important to understand that CoeGSS per se is not a standardisation project, but has introduced this activity, to be able to give input and make use of standards, when possible during its lifetime. Thus, this is a relatively small activity, which, in its first period, rather focused on the identification of standard candidates and (if at all possible) potential contribution to standardisation bodies. Furthermore, this activity is heavily dependent on the activities and the progress, mainly in WP3 and WP4 (and WP5) of the project. Both activities are technically realizing the pilots and the CoeGSS Ecosystem, thus also driving the standardisation activities.

In order to pursue this standardisation path of CoeGSS, a clear plan and a well-defined methodology are mandatory for success. Therefore, the following two subsections describe the standards management as well as the particular, potential future contributions to standards and standardisation bodies.
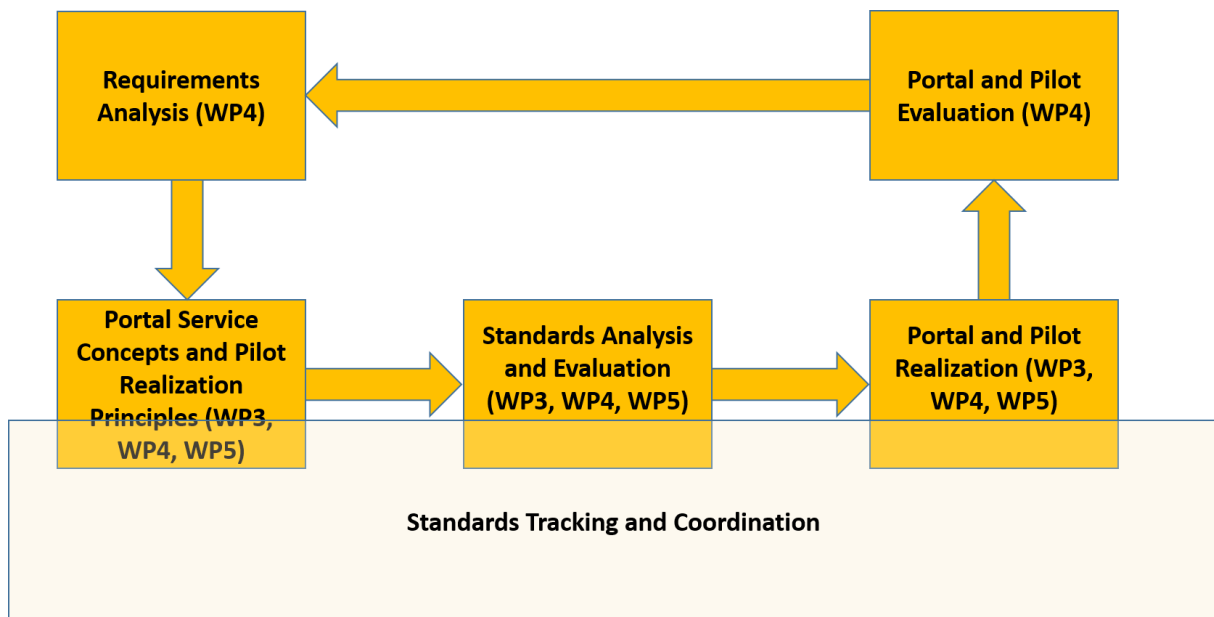

Figure 6: Task 6.4 Tracking of Standards Usage and Potential Contributions

4.1   Standards Management

In general, the standardisation activity in the CoeGSS project is divided into two categories: the standards management and the actual contributions to standards. This subsection focuses on the first one, the standards management.

Standards management is required in order to support the processes for appropriate and successful standardisation of results. However, the definition of the methodology is just the first step into the right direction, the defined processes need to be implemented and executed and finally, monitored.

Within the first six months of the standardisation task lifetime, the methodology for proper standardisation has been defined. Since CoeGSS is targeting innovative and novel solutions using and combining technologies and concepts from the High Performance Computing (HPC), High Performance Data Analytics (HPDA) and Global Systems Science (GSS) domains, there is a clear potential for either contributing experiences of standards use to the respective bodies or even standardising own results and outcomes in the involved communities.

Thus we can list the forseen possible standardisation means:

- the generation of new standards as well as

- the contribution to already existing standards.

This simple but efficient approach enables the project to standardise its results, but also to generate the required impact for successful and well-adopted standards. So in case a new standard is required, such as for example, agent-based modelling, the project works towards own standards that define the relevant technologies. However, this all will need to be aligned with a realistic and pragmatic approach. With the limited budget for technical realizations within the project and standardisation itself being in many cases a cumbersome activity, depending on the respective body it targets, the development of an own standard should be restricted to individual cases. Thus, the project will benefit from the clear identification of well-adopted standards (e.g. the Storage Network Industry Association Big Data standards) and it is expected that most of the standardisation effort will address contributions in order to make CoeGSS visible for all other contributors and users.

In short, the standards management does not only incorporate the actual standardisation process, it also takes care that the chosen standards are well-adopted and the relevant impact and interest for the components are created.

4.2   Contribution to Standards

In addition to the standards management, this subsection focuses on actual contributions to standardisation bodies and activities. In this early phase of the project, the developed

components are either not mature enough or simply just conceptually defined, so that identification of possible tools or services is quite cumbersome. As the pilots are still being defined, the standardization team has focused on identifying possible standardisation bodies and activities, where CoeGSS could generate impact.

The following list incorporates candidate standardisation activities for the GSS and HPC communities:

- Global Systems Science

For Global Systems Science in the context of High Performance Computing, there are basically no standards and standardisation bodies available so that the list is limited when creating this deliverable. However, all kinds of programming techniques and methods can also be submitted in the area of pure HPC.

- OpenABM, https://www.openabm.org

- High Performance Computing / High Performance Data Analytics

For HPC and HPDA, there are various standardization activities on-going, which are highlighted in the list below.

- NESSI, http://www.nessi-europe.eu

- ETSI, http://www.etsi.org

- CEN, https://www.cen.eu

- SNIA, http://www.snia.org

- ITU, http://www.itu.int

- OGF, https://www.ogf.org

- NIST, https://www.nist.gov

Nevertheless, standardisation requires stable and mature components in order to approach the standardisation bodies, activities and communities. Only with this maturity, interest of standardisation bodies and experts can be generated and trust can be established. Since those components are not fully available at the moment, also the list above only reflects the current project ideas and will be further elaborated during the project's lifetime. In summary, this list and the log of activities will be constantly updated during the lifetime of the project and thus act as a living document, representing the CoeGSS standardisation activities.

5 Dissemination and Communication

The aim of the Dissemination and Communication task (T6.5) in CoeGSS is twofold: to define a dissemination plan and to report on dissemination activities. As CoeGSS is not simply a research project but aims at establishing a self-sustaining Centre of Excellence, dissemination and communication are closely linked to the activities in WP2 "Business Models and Sustainability". The results of the stakeholder analysis that has been carried out in WP2 are presented in D2.1, and will therefore not be repeated here.

The dissemination plan is presented in Section 5.1; communication and dissemination activities that have been undertaken in the first project year to create awareness about the centre and its approach, as well as to invite feedback on work in progress are then reported in Section 5.2.

5.1 Dissemination plan

This section presents the dissemination plan developed during the first project year. Generally, a dissemination plan establishes how project outcomes such as results and deliverables shall be shared with stakeholders, relevant institutions, organizations and individuals. For any dissemination or communication activity, the following questions should be explicitly considered: to whom (audience), what (message), why (purpose), how (method), when (timing), with which success (evaluation)? These questions have therefore been given a closer look from the CoeGSS perspective.

In our case, the **audience** can be a project internal one, or refer to other projects, to external stakeholders, or to the HPC and GSS communities more generally:

- internal: given the many partners from different fields, explicit dissemination within the consortium is helpful

- other projects: in particular, the other centres of excellence, but also related HPC or GSS projects

- network: each partner has an existing network of external stakeholders and collaborators, for example, in other projects (see also Section 2). This constitutes a starting point for a stakeholder network of CoeGSS.

- external stakeholders: further, an analysis of external stakeholders has been conducted by WP2 and is presented in D2.1.

- the HPC and GSS communities: important players from either community that CoeGSS wants to interact with, or the communities in general.

- general, global: especially activities that want to raise awareness may be targeted to a general and (via use of the internet) global audience – where the idea is to find new potential external stakeholders

The **message** should be clear and easy to understand, as well as tailored to the target audience in any dissemination activity. For CoeGSS, the choice of an appropriate language, non-technical where possible, is of particular importance due to the lack of a pre-existing common language between the two fields involved.

Dissemination **purposes** can vary from raising awareness, via informing, engaging, or promoting to cooperation and community building. As a longer-term vision, impact is to be created by CoeGSS dissemination and communication activities in particular through a flow of knowledge on how to fruitfully use HPC in tackling GSS challenges to the wider network of GSS researchers, SMEs, industry, governments and NGOs, and through an uptake of HPC innovations generated by CoeGSS by the wider HPC sector, including research and industry. For these two ambitious goals, such knowledge and innovations first have to be produced. The production of such results requires effort and hence time, especially when merging previously unrelated research fields and aiming at innovation. Therefore, the CoeGSS dissemination plan has to be tailored in relation to different project phases. In the beginning, awareness can be created about the project's approach and the challenges it addresses. This has been done throughout the first project year (see Section 5.2). With a view to co-production of knowledge between science and society, it is essential to begin disseminating work in progress as early as possible to invite feedback and help build a community at the intersection between GSS and HPC. In particular, as CoeGSS shall provide services in an emerging market, engaging potential stakeholders is mandatory to validate the CoeGSS vision of future services with their feedback, allowing to meet users' needs. Such stakeholder engagement activities are essential in a second phase, before in a final phase the dissemination of project results can leverage industrial, academic and societal awareness of CoeGSS.

Methods or **activities** depend on the audience, the message and the purpose. For example, CoeGSS is using a newsletter, a flyer, and press releases to raise awareness. In the transition from the first to the second phase, face-to-face communication in dialogues or in smaller workshops is an important next step for CoeGSS to engage stakeholders. A larger workshop (as the planned innovation workshop, see Section 2.2) contributes to community building in a way that cannot be recreated without meeting also face-to-face. Based on these activities and on the production of scientific project results, books, reports, journal articles, and websites can then be used to transmit information to wider audiences. In particular, given that experts from a number of fields participate in CoeGSS, scientific publications targeting a range of journals shall be produced from the project. Results at the intersection between HPC and a GSS field shall be published in adapted journals of both fields, refocusing according to the perspective under consideration in each case, to increase impact. At the same time, working papers are crucial for inviting feedback on innovative work. A dedicated CoeGSS working paper series, published through the website, can be set up for early stage publication of results.

The **timing** or **date** of certain dissemination activities is determined by the project's progress, in particular, the availability of pilot demonstrators, by external events, which for CoeGSS include large conferences on HPC or GSS, complex systems, social simulation, and related fields, or by the agenda of the target audience. An example for the latter case might be events in the automotive industry for the case of the green growth pilot.

For **evaluation** purposes, one should define up front how impacts of each dissemination activity can be measured.

On this basis, the most relevant forms of dissemination for CoeGSS are summarized in Table 1 below.

	audience	activity	purpose	message	timing	evaluation	see
1	general, global	project website	awareness, information	approach of CoeGSS, results	throughout project duration	website statistics	D6.1 D6.2
2	general, global	electronic newsletter	awareness, information	news from CoeGSS	every six months	newsletter statistics	D6.1; Sect. 5.2.2 below
3	general, global	invitation to subscribe to newsletter	awareness	sign up for the newsletter!	prior to first newsletter release	newsletter subscriptions	Sect. 5.2.2 below
4	general, global	social media coverage	awareness	news from CoeGSS	throughout project duration	social media statistics	D6.2
5	internal	share on project wiki, deliverables	inform partners about work done	approaches taken and results	whenever available	communication: do other WPs, tasks know about and use what one task has done	
6	other projects from GSS or HPC fields	personal communication, interaction	cooperation	approach of CoeGSS, results, to find synergies with other projects	whenever possible	e.g. joint publications, further project proposals	Sect. 2.3 above and D2.1

	audience	activity	purpose	message	timing	evaluation	see
7	partners' collaborators	personal communication, interaction	cooperation	approach of CoeGSS, results, to find synergies with other projects	whenever possible	e.g. joint publications, further project proposals	Sect. 2.3 above
8	scientific community (HPC, GSS, other)	scientific publications	information	project results	whenever available	accepted for publication, published, citations	Sect. 5.2.5 below
9	scientific community (HPC, GSS, other)	presentation at conferences	information, gather feedback	project results	depending on timing of the events	submission accepted, number of people present, feedback obtained	
10	external stakeholders / scientific community	participation at conferences, workshops	information, feedback, engagement	approach, results	depending on timing of the events	invitations to events, number of people present, feedback obtained	
11	external stakeholders / scientific community	organisation of events (workshops, conferences)	information, feedback, community building	results	depending on project progress	people present, feedback collected, cooperations initialised, outcome of event (e.g. a publication)	Sect. 2.2 above

Table 1: Types of dissemination activities

To facilitate dissemination, project internal exchange routines have been set up. For internal dissemination (see point 5), information is shared via the wiki, a knowledge base, or via documents made available at a central point (an svn server) with emails informing about the availability of the documents. In order to share information on relevant conferences and workshops within the consortium, another wiki page has been set up. At the time of writing,

it lists more than 20 events of interest from the fields of HPC, GSS, complexity, social simulation, etc; it is updated by all partners whenever information is available. With the help of this information, partners can team up for dissemination activities (such as satellite workshops, presentations, community building events) at these events of the HPC and GSS communities.

To sum up, for the initial phase of the project, the most appropriate means to target stakeholders were focused on awareness creation around the approach used and the challenges tackled by CoeGSS, both in GSS (the questions addressed by the pilots) and in HPC (questions arising in bringing GSS models to HPC). The website and newsletter structure having been set up, activities involving personal interaction (6, 7, 9, 10, 11) are now the most important ones for community building in a field where trust relations between stakeholders and scientists play an important role (see also D2.1, Section 2.4.3). Throughout the project's lifetime, publications (point 8 above) will play a more and more important role. However, community building by personal interaction will always remain essential. For example, once pilots have the first "demo" versions of their synthetic information systems ready, engagement with the stakeholders from the respective areas is crucial to allow for co-production of knowledge for the three global challenges under consideration.

5.2 Report on dissemination and communication activities in the first year

This section reports dissemination activities of CoeGSS (Sections 5.2.1 and 5.2.2) and of individual partners in CoeGSS (Sections 5.2.3 to 5.2.5) during the first project year.

5.2.1 Flyer

A CoeGSS flyer has been designed to be placed and/or handed out at events. Its front and back side are shown below.

Figure 7: The CoeGSS flyer

5.2.2   Newsletter

The project newsletter shall be sent out twice a year. The first newsletter has been sent out on July, 18, 2016; technical details and monitoring results can be found in D6.1. The second newsletter is in preparation.

A newsletter invitation email has been designed, asking well-known people in the fields of HPC and GSS for a quote about CoeGSS. It was provided to all consortium members to be sent out to their networks.

To facilitate the creation of the newsletters, a generic table of content, which should apply to all newsletters, with the flexibility to take out one or another part and to put in other parts, has been defined. For each of the sections, a section owner has been assigned who is responsible for delivering a text. This does not mean this person needs to write the text, he or she can of course ask others to do so. Table 2 displays the structure with section owners.

Section	Content	Section Owner
News from CoeGSS	A short recent highlight from the project work	Andreas Geiges (GCF)
Message from the coordinator	self-explanatory	Carlo Jaeger (UP)
HPC	Selected news from the project from an HPC perspective	Bastian Koller (HLRS)
GSS	Selected news from the project from a GSS perspective	Margaret Edwards (CoSMo)
The people	short presentation of 2 partners and the people involved in each newsletter	Sarah Wolf (GCF), rotating partners for input
The pilots	Recent news from one pilot study in each newsletter	Sarah Wolf (GCF), rotating pilots for input
Events	Selected upcoming events CoeGSS wants to highlight	Mika Straka (IMT)

Table 2: Newsletter structure

5.2.3 Presentations at workshops and conferences

Table 3 lists presentations at workshops and conferences by partners throughout the first project year.

Date	Partner	Occasion	Aspects, comments
2015-09	GCF	Presentation, Satellite Workshop at CCS'15 conference Arizona	Overview, multi-agent/synthetic population approach as opposed to standard economic representative agent approach, focus: green growth
2015-09	HLRS	ETP4HPC Meeting in Rome	Presentation of the project to the ETP4HPC community
2015-10	HLRS	GSS Conference Genoa	Organization of a workshop and presentation of the project itself (presentation and booth).
2015-11	HLRS	e-Infrastructures Meeting	Presentation of CoeGSS and open discussion with other CoEs
2015-11	HLRS	SuperComputing Conference 2015 in Austin	Automated presentation of CoeGSS to the interested audience
2016-02	HLRS	Internal Meeting Intel	Introduction into CoeGSS
2016-03	HLRS	ETP4HPC Meeting in Barcelona	Representation of CoeGSS at the ETP4HPC Meeting in Barcelona.
2016-04	Chalmers	Alan Turing Institute Symposium on Reproducibility in Data-Intensive Research	Presentation by Patrik Jansson: Reproducibility, Proofs and Domain Specific Languages
2016-05	HLRS	EXDCI Workshop within the HPC Summit Week	Presentation of the current status of CoeGSS
2016-06	HLRS/ GCF/ UP/ TOPIX/ ATOS	ISC 2016, Frankfurt	General presentation of CoeGSS, booth
2016-06	HLRS	Automated presentation at the ISC 2016 booth of the EXDCI project	General presentation of CoeGSS

2016-09	GCF	Social Simulation Conference 2016	Poster presentation about work in progress of the Green Growth pilot

Table 3: Presentations by partners at conferences and workshops

5.2.4   Publications

Table 4 lists publications by partners that relate to CoeGSS from the first project year.

Partner	Type of publication	Complete bibliographical description with DOI, ISBN/eSSN	Peer review	Open access	Presented aspect/topic w.r.t. CoeGSS , target audience
UP/GCF	Article in Journal	Stefano Battiston, Doyne Farmer, Andreas Flache, Diego Garlaschelli, Andy Haldane, Hans Heesterbeek, Cars Hommes, Carlo Jaeger, Robert May, Marten Scheffer: **Financial complexity: Accounting for fraud—Response**, *Science* 15 Apr 2016: Vol. 352, Issue 6283, pp. 302 DOI: 10.1126/science.352.6283.302	yes	no	Relation to potential future application, see D4.4
UP/GCF	Article in Journal	Stefano Battiston, J. Doyne Farmer, Andreas Flache, Diego Garlaschelli, Andrew G. Haldane, Hans Heesterbeek, Cars Hommes, Carlo Jaeger, Robert May, Marten Scheffer: **Complexity theory and financial regulation**, *Science* 19 Feb 2016: 818-819 DOI: 10.1126/science.aad0299	yes	no	Relation to potential future application, see D4.4
UP/GCF	Publication in ejournal	Carlo Jaeger (2015). **The Coming Breakthrough in Risk Research. Economics Discussion Papers**, No 2015-65, Kiel Institute for the World Economy. http://www.economics-ejournal.org/economics/discussionpapers/2015-65	yes	yes	new methods for risk analysis

UP/ GCF	Technic al Report	Sarah Wolf, Franziska Schütze, and Carlo C. Jaeger. **"The Possibility of Green Growth in Climate Policy Analysis Models – a Survey"** GCF Working Paper 1/2016."	no	yes	Background to Green Growth pilot
IMT	Article in Journal	Fabio Saracco, Riccardo Di Clemente, Andrea Gabrielli, Tiziano Squartini **Detecting early signs of the 2007-2008 crisis in the world trade,** Σ*cientific Reports* 6, Article number: 30286 (2016), doi:10.1038/srep30286	yes	yes	Evolution of the bipartite World Trade Web (WTW) 1995-2010; structural changes in the WTW topology. Relates to network analysis for pilots.
IMT	Article in Journal	Fabio Saracco, Riccardo Di Clemente, Andrea Gabrielli, Tiziano Squartini, **Gran Canonical Projection of Bipartite Networks** , arXiv:1607.02481v2, physics.soc-ph, 2 Aug 2016	no	yes	Definition of a statistical mechanics approach to project bipartite undirected networks. It is of interest in the analysis of world trade network, as well as in financial networks.
IMT	Article in Journal	Tiziano Squartini, Giulio Cimini, Guido Caldarelli, **Stock markets reconstruction via entropy maximization driven by fitness and density,** New Economics Papers, 2016-06	No	Yes	Development of a new reconstruction method based on statistical mechanics concepts and tailored for bipartite market networks. The method is successfully tested on NASDAQ, NYSE and AMEX filing data, by correctly reproducing the network topology and providing reliable estimates of systemic risk over the market.
IMT	Article in Journal	Matus Medo, Giulio Cimini, **Model-based evaluation of scientific impact indicators**, arXiv:1606.04319v1, physics.soc-ph, 14 Jun 2016	No	Yes	Using bibliometric data artificially generated through a model of citation dynamics calibrated on empirical data, we compare

					several indicators for the scientific impact of individual researchers. The Agent Based Model proposed can be parallelized and it can inspire the pilots
IMT	Article in Journal	Stanislao Gualdi, Giulio Cimini, Kevin Primicerio, Riccardo Di Clemente, Damien Challet, **Statistically similar portfolios and systemic risk**, arXiv:1603.05914v1 , q-fin.RM, 18 Mar 2016	no	yes	Presents a method for bipartite networks where the presence of similar sets of neighbors is of interest. Applying this to social networks is of interest to the pilots.
IMT	Article in Journal	Paolo Barucca, Marco Bardoscia, Fabio Caccioli, Marco D'Errico, Gabriele Visentin, Stefano Battiston, and Guido Caldarelli, **Network Valuation in Financial Systems**, arXiv:1606.05164v2 , q-fin.RM, 27 Jul 2016	no	yes	Introduces a network valuation model that can inspire the pilots.
GCF / UP	Article in Journal	Sarah Wolf, Franziska Schütze, and Carlo Jaeger, **Balance or Synergies between Environment and Economy—A Note on Model Structures**, Sustainability, 2016 8(8), DOI: http://dx.doi.org/10.3390/su808 0761	yes	yes	Background for the Green Growth pilot

Table 4: Publications by partners

5.2.5   News Items, Press Releases, Web Presence

Table 5 presents web-based communication items on CoeGSS from partners or external sources during the first project year.

Partner / external	Activity	Aspect presented	audience reached
Chalmers	http://www.chalmers.se/en/departments/cse/news/Pages/CoeGSS.aspx	News item about the launch of the CoeGSS project	
UP	https://idw-online.de/de/news640402	Introduction of the CoeGSS project, its structure and partners.	
EC	https://ec.europa.eu/digital-agenda/en/news/coegss-new-high-performance-computing-centre-excellence-global-systems-science-born	News item about the creation of CoeGSS and its mission.	
HLRS	InSIDE magazine article	http://inside.hlrs.de/editions/15autumn.html#coegss-center-of-excellence-for-global-systems-science	2000
HLRS	First press release, no link available		
HLRS	Second press release, no link available		
HLRS	HLRS homepage entry, https://www.hlrs.de/about-us/research/current-projects/coegss/	Overview of the CoeGSS project, the mission and the used methodologies.	
HLRS	EXDCI newsletter & website, https://exdci.eu/collaboration/coe	Introduciton of the eight new Centres of Excellence (CoEs) including CoeGSS.	
ATOS	Atos Research & Innovation group website, http://booklet.atosresearch.eu/content/coegss	Introduction of CoeGSS within the Atos Research & Innovation program.	

ATOS	ATOS booklet, Research & Innovation 2015, Innovation is in our DNA, Come with us to the future of technologies, p.15; can be downloaded from https://atos.net/content/dam/global/documents/we-are/atos-brochure-research-innovation1.pdf	CoeGSS describbtion as a partner.	
PSNC	http://www.man.poznan.pl/online/en/projects/207/CoeGSS.html	Partner's project website	
ISI	http://www.isi.it/project-detail/?pid=coegss-centre-of-excellence-for-global-systems-science	Partner's project website	
IMT	https://www.imtlucca.it/research/projects	Partner's project website	
Dialogik	http://www.dialogik-expert.de/en/forschung/coegss.htm	Partner's project website	
GCF	http://www.globalclimateforum.org/index.php?id=coegss	Partner's project website	
The Integrated Risk Governance Project (IRG Project)	http://irg.bnu.edu.cn/project/centre-excellence-global-systems-science-coegss/		
Premium Weekly Magazine	http://primeurmagazine.com/flash/AE-PF-12-15-14.html		

Table 5: News items, press releases and similar communication items

6 Outlook

As presented, work in Tasks 6.2 through 6.5 has begun to set up a network of collaborations of CoeGSS, has prepared training at the intersection between the HPC and GSS worlds, has structured standardisation contributions CoeGSS can make, and has planned how to create impact through dissemination, as well as started to do so. Together with T6.1 in the same WP and with WP2, these tasks will continue to lay the ground for a sustainable Centre of Excellence for Global Systems Science. A focus of both the event management and the training task in the remainder of the project duration will be the foreseen innovation workshops. Similarly, face-to-face interaction will play an important role in community building and dissemination activities. For feedback collection and with a view towards co-production of knowledge, pilot demonstrators will mark the beginning of a next phase in dissemination and communication for CoeGSS.

7 References

D2.1 – Stakeholder context and initial sustainability model

D4.4 – First status report of the pilots

D6.1 – CoeGSS website and brand

D6.2 – First Annual Report on Community Building