E.01.01 – D5.07 ComplexWorld Final Project Report

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Abstract

The final report of the ComplexWorld network provides a publishable summary of the results. In addition it lists all deliverables, dissemination activities, eligible costs, deviations, bills and lessons learned.

Authoring & Approval

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This deliverable consists of SJU foreground.

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Publishable Summary

ComplexWorld is a research network funded by SESAR-WP-E and coordinated by The Innaxis Foundation and Research Institute. The goal of ComplexWorld is to research how Complexity Science can contribute to understand, model, and ultimately drive and optimise the behaviour and the evolution of the ATM system, which ultimately emerges from the complex relationships between its different elements.

ComplexWorld aims to propel long term and innovative research in Europe in the field by bringing together the world's leading experts in the field of Air Traffic Complexity Management from academia, research establishments, industry and SMEs.

Objectives

The objectives of ComplexWorld are as follows:

- Define, develop and maintain a clear roadmap for establishing and consolidating a research community at the intersection of Complexity and ATM of clear added value for the European Air Transport sector
- Provide a structured forum for the development, exchange and dissemination of research knowledge in ATM Complexity Management
- Lower the access barriers for the ATM community and ultimately benefit from Complex Systems science
- Attract talented Complex Systems researchers towards the field of ATM
- Foster the interaction and idea sharing between the Air Transport and the Complex Systems research communities

- Building up a self-sustained research community

Key results

The ComplexWorld Wiki

ComplexWorld started its activities by reviewing the State of the Art on Complexity Science applied to ATM and defining the existing challenges and the roadmap to achieve them. This initial review was the basis of the **Position Paper**, which focused on 5 pillars: emergent behaviour, uncertainty, metrics, data science and resilience. Outlined within each pillar is the problem to be addressed, a literature review {of relevant empirical data?), and pertinent research challenges. These results are collected in the **ComplexWorld Wiki** (wiki.complexworld.eu), which was developed to enable the relevant research community to participate and contribute to the Position Paper as well as to provide the possibility of sharing their related research results with other researchers. Currently, the ComplexWorld Wiki also includes the key takeaways and results of the projects and PhDs developed under the WP-E, which are thematically linked to ComplexWorld. Lastly, the ComplexWorld Wiki also includes general information, presentations and recordings of the previous events available for anyone to view. This Wiki aims at acting as a dynamic, real-time repository of research content related to the topic of ComplexWorld.

The first book on Complexity Science in Air Traffic Management

After developing of the wiki, the ComplexWorld network members took the challenge of writing a book compiling selected topics in complex systems science applied to air transport and air traffic management. The selected topics are those for which traditional air traffic management research has not provided much of an answer as well as identifying specific complex systems science techniques hold particular promise. All of these topics, which are aligned with the Position Paper topics, are thoughtfully compiled for the first time in a single book dedicated to Air Traffic Management: **"Complexity Science in Air Traffic Management"** (2016. ISBN: 978-1-4724-6037-0) .

The Complexity Challenges in ATM report

In the final year of the network, ComplexWorld Network decided to take stock of the existing results, highlighting the most relevant outcomes and identifying the open gaps, considering all of the activities performed in our area of research, including the related projects and PhDs, The result of this comprehensive review is the report on Complexity Challenges in ATM (http://docs.innaxis.org/ComplexityChallengesInATM/ 2015). It presents external assessments on how the complexity challenges in ATM have been covered by the network related initiatives (including projects and PhDs programmes) along the 5 years of ComplexWorld activity. The report identifies existing gaps, paving the way for complexity science research in Air Traffic Management in the coming years. The review of the selected documentation was performed by an 18 member expert panel, external to the network, covering a wide spectrum of expertise relevant to the identified challenges.

A new research community

The previously mentioned outcomes are the results of the work of the ComplexWorld team but also the result of fruitful collaboration with other stakeholders. ComplexWorld is a research network, and according to this classification and mission, the activities devoted to create, enhance and enlarge the research community have been a integral part of all ComplexWorld initiatives. A total of 22 events have been organised by ComplexWorld, including various conferences, seminars, tutorials and workshops.

Take for example, the Data Science in Aviation Workshop. ComplexWorld created and promoted the Data Science in Aviation Workshop (www.datascienceworkshop.com) in 2013 with the objective of fostering the application of data science techniques to air traffic management. Following the success of its first edition in October 2013, it has become an annual Workshop that has celebrated its 4th edition this past September 2016.

In addition, ComplexWorld has funded 8 PhD students who have contributed to significant progress beyond the state of the art since the launch of the network. Even more, these PhD students are now part of this new research community. 6 out of the 8 PhD students have already finished their doctoral thesis and are now applying their learnings to the professional sector; 2 students have joined private companies and 4 students are in academia and research institutions.

Concluding remarks

ComplexWorld has proven to be a very effective vehicle for fostering innovative research. It began in an unfamiliar intersection of complexity science and ATM, and has provided

guidance and development to areas of research that today are sound elements in ATM research that includes uncertainty, data science or resilience.

ComplexWorld has pursued a balance among research activities and the network development initiatives. Facilitating the collaboration among network members and external experts has been a key objective for ComplexWorld. Accordingly, ComplexWorld has been very active in the organisation of events, which have become long-standing, to enable the debate among experts working on the same fields of research.

The achievements of ComplexWorld include the development of key resources for continual leverage of research in complexity applied to ATM and the promotion of a new research community working on this field. These resources have enabled a better understanding of the ATM behaviour and its evolution, as well as the complex relation among its different elements by applying non-traditional techniques derived from the complex network theory. The network resources, together with the results of the related projects and PhDs programmes, have ultimately demonstrated the potential of applying these techniques to the ATM field that can be continuously explored in future innovative research programmes.

1 Introduction

1.1 Purpose of the document

The purpose of this document is to:

- Summarise the technical results and conclusions of the project (Publishable Summary);
- Provide a complete overview of all deliverables;
- Provide a complete overview of all dissemination activities (past and in progress). Where appropriate, provide feedback from presentations. Describe exploitation plans.
- Provide a complete overview of the billing status, eligible costs, planned and actual effort (incl. an explanation of the discrepancies).
- Analyse the lessons learnt at project level.

1.2 Intended readership

The target reader is any stakeholder in the ComplexWorld Network or interested on its activities.

1.3 Inputs from other projects

N/A

1.4 Glossary of terms and acronyms

ATACCS: International Conference on Application and Theory of Automation in Command and Control Systems

ATM: Air Traffic Management

CW: ComplexWorld

CWW: ComplexWorld Wiki

ECCS: European Conference on Complexity Science

ICRAT: International Conference for Air Transport Research

JATM: Journal on Air Traffic Management

SIDs: SESAR Innovation Days

SME: Small and Medium Enterprise

WP-E: Work Package E

WS: Workshop

2 Technical Project Deliverables

Number	Title	Short Description	Approval status
Y1_D1.1	ComplexWorld Management Plan	Management	Approved
Y1_D1.2	1st Year Intermediate Report	Management	Approved
Y1_D1.3	1st Year Final Report	Management	Approved
Y1_D2.1	Research Coordination Plan	Plan to ensure scientific coordination among Network Members and Participants, including the organisation and engagement in events for the discussion and dissemination of research results	Approved
Y1_D2.2	Research Coordination Repository	Collaborative platform to gather the interests and capabilities of all the potential contributors to the Network activities.	Approved
Y1_D2.4	1st ComplexWorld Annual Workshop	Report on the event organization details and outcomes	Approved
Y1_D2.3	1st WP-E Networks Joint Event (INO)	Event jointly organized by HALA and ComplexWorld as part of INO WS	Approved
Y1_D3.1	Knowledge Development Plan	Plan to provide the scientific leadership for the rest of the activities of the Network, and to facilitate and foster effective knowledge generation	Approved
Y1_D3.2	Knowledge Repository	Collaborative platform to gather together the knowledge generated from the Network activities	Approved
Y1_D3.3	Complex ATM Master White Paper - Draft 0.1	First version of the ComplexWorld White Paper	Approved
Y1_D3.4	Complex ATM Master White Paper - Draft 0.2	Second version of the ComplexWorld White Paper	Approved
Y1_D3.5	Complex ATM Master White Paper - Iss.1	Final version of the ComplexWorld White Paper: state of the art, challenges and roadmap	Approved

Y1_D4.1	Network Development Plan	Defines the tasks to be carried out to enlarge the research community in complexity applied to air transportation and create awareness among them.	Approved
Y1_D4.2	Communication and Dissemination Material	Collection of communication and dissemination material developed for the network activities promotion	Approved
Y1_D5.1	PhD Plan	Key facts of the first ComplexWorld Call for PhDs	Approved
Y1_D5.2	PhD Selection Report	Report on the selection criteria and process of the PhD students, together with the list of the students/entities finally chosen.	Approved
D21.1	ALL ComplexWorld Plans-update	Management	Approved
D21.2	2nd Year Intermediate Report	Management	Approved
D21.3	2nd Year Final Report	Management	Approved
D22.3	SESAR innovation Days Report	Contribution of ComplexWorld to the SESAR Innovation Days organizing several research sessions and promoting interactions among researchers.	Approved
D22.1	Programmes for Conference/Workshop/Tutorials	Report on the events' organizational details	Approved
D22.2	Report from Conference/Workshop/Tutorials	Report on the events' outcomes	Approved
D23.1	Complex ATM Position Paper - draft	First version of the CW Position Paper	Approved
D23.2	Complex ATM Position Paper - Iss.2	Final version of the CW Position Paper:	Approved
D24.1	Mantaining network website / blog	Report on the website and blog traffic and visibility figures along Year 2.	Approved
D31.1	3rd Year Intermediate Report	Management	Approved

D31.2	3rd Year Final Report (including PhDs management)	Management	Approved
D32.1	ATOS and ECCS: Programmes and Report	Report on the CW activities organized during ATOS and ECCS conferences: agenda, presentations, speakers…	Approved
D32.2	Report on the Tutorial session	Report on the event organization details and outcomes, including programme, short bios and presentations	Approved
D33.1	Wiki infrastructure and Wiki Management Plan	Details on the ComplexWorld wiki platform and the plan to manage and update it.	Approved
D33.2	Submission of first ATM complexity paper & reporting on book publication progress	Including the paper: "Applying complexity science to air traffic management" published in the JATM and reporting on the content and status on the "Complexity science in air traffic management"	Approved
D33.3	Championing relevant projects & PhDs: Wiki report 1	Status of the content of the wiki as a platform to gather together the key aspects, outcomes, and results of the WPE related projects & PhDs	Approved
D33.4	Championing relevant projects & PhDs: Wiki report 2	Updated status of the content of the wiki as a platform to gather together the key aspects, outcomes, and results of the WPE related projects & PhDs	Approved
D33.5	ComplexWorld Workshops: report	Collection of the programme and minutes of the thematic workshops organized by ComplexWorld along the Year 3 with the objective of Validating and complementing the content of the wiki. The first Data Science in Aviation WS is reported in this deliverable.	Approved
D34.1	Mantaining network website / blog	Report on the website and blog traffic and visibility figures along Year 3.	Approved
D41.1	Year 4 Intermediate Report	Management	Approved
D41.2	Year 4 Final Report	Management	Approved
D42.1	ICRAT 2014, Seminar and tutorials: Programme and report	ComplexWorld activities during ICRAT 2014 including report on the tutorial session provided specially for students.	Approved
D42.2	ECCS2014: Programme and report	Satellite event organized by ComplexWorld as part of ECCS2014	Approved

D42.3	SIDs PhD session	PhD session organized as part of SIDs 2014 to present the progress of the CW PhD students.	Approved
D43.1	Wiki development: Intermediate report	Report on wiki content and traffic to the wiki during the first half of 2014	Approved
D43.2	Wiki development: Final report	Report on wiki content and traffic to the wiki during the second half of 2014	Approved
D43.3	CW book submission	Report on the key aspects of the book publication after being submitted to the publisher	Approved
D43.4	ComplexWorld workshops report	Organizational details and most relevant outcomes of the ComplexWorld Workshops developed in Year 4, including the second Data Science in Aviation WS.	Approved
D44.1	Website and blog maintainance	Report on the website and blog traffic and visibility figures along Year 4.	Approved
D5.01	Final CW conference	3rd Data Science in Aviation WS and kick off of the complexity challenges activities (D5.02).	Submitte
D5.02	Complexity challenges	Report “Complexity Challenges in ATM” identifying the progress achieved through the 5 years of the network as well as the future opportunities.	Approved
D5.03	CW Wiki development	Report on wiki updates, key figures and traffic to the wiki during 2015.	Approved
D5.04	Maintaining website and blog	Report on the website and blog traffic and visibility figures along Year 5.	Approved
D5.05	ECCS 2015: programme and report	Report on the Lipari Summer School which was organized instead of the ECCS 2015 Satellite Session.	Approved
D5.07	Y5 final report	Management	Submitted
D5.08	Report on final WS	4th Data Science in Aviation WS and presentation of D5.02 on Complexity Challenges in ATM.	Submitted
D5.09	CW Book Finalisation	Report on the book publication and delivery of the book (will be sent to SJU premises)	Approved

Table 1 - List of Project Deliverables

3 Dissemination Activities

3.1 Presentations/publications at ATM conferences/journals

The paper "*Applying complexity science to air traffic management*" was published on the Journal or Air Transport Management in 2015 and it is available at:

http://dx.doi.org/10.1016/j.jairtraman.2014.09.011

Cook, A.J., Blom, H., Lillo, F., Mantegna, R., Miccichè, S., S, , Rivas, D., Vázquez, R., Zanin, M. and Mantegnad, R. (2015) *Applying complexity science to air traffic management.* Journal of Air Transport Management, 42. pp. 149-158. ISSN 0969-6997

It presents an overview of complex network theory, with examples of its corresponding metrics and multiple scales. Complexity science is starting to make important contributions to performance assessment and system design: selected, applied air traffic management case studies are explored. The important contexts of uncertainty, resilience and emergent behaviour are discussed, with future research priorities summarised.

3.2 Presentations/publications at other conferences/journals

ComplexWorld has presented its activities on he annual SESAR Innovation Days (2012, 2013, 2014, 2015) and INO Workshop in 2011. In addition, the network has periodically reported its latests results to the SESAR Scientific Committee, specially on the last years of the network. In addition, ComplexWorld has been very active in the organization of events of different nature: conferences, seminars, workshops and tutorials; a total of 22 events have been organized by Complexworld. In particular:

Event	Date & Location	Description
First ComplexWorld Conference	July 6-8, 2011. Seville	1st Forum for Air Traffic Management scientists and PhD students, Complexity Science researchers and the ComplexWorld Network community, including Members and Participants and SESAR WP-E investigators. It included tutorial sessions, PhDs presentations and papers session.
Complexity Challenges and Opportunities in SESAR2020	April 7th, 2015. Brussels	Launching of the initiative of identifying the challenges of complexity science in ATM (Del 5.02). This event was combined with the 3rd Data Science in Aviation WS
Complexity Challenges in ATM	September 9th, 2016. Cologne	Final presentation of the task of identifying the challenges of complexity science in ATM (Del 5.02). This event was combined with the 4th Data Science in Aviation WS
Tutorials (Tutorials 2012 , Tutorials 2013 , Tutorials	June 21st, 2012. Delft	Annually, several keynote speakers were brought together

2014)	July 11th, 2013. Toulouse May 29th, 2014. Istanbul	to provide a tutorial session specially dedicated to the PhD students although attendance was open to the wide audience. The topics were diverse, but all related to CW topics and therefore relevant to their PhD thesis.
Workshops (Uncertainty in ATM Workshop , Resilience and Robustness in ATM , Air Transport Network: An Integrated View, Complex Metrics Workshop)	May 27th, 2013. Naples July 10th, 2013. Toulouse September 20th, 2013. Barcelona November 28th, 2013. Stockholm	Serie of 4 half-day workshops organized during 2013 around the CW thematic pillars to complement and validate the content of the CW wiki and give it visibility among the community.
Data Science in Aviation Workshop (2013 Data Science in Aviation, 2014 Data Science in Aviation, 2015 Data Science in Aviation,2016 Data Science in Aviation)	October 15th, 2013. Madrid May 21st, 2014. Paris April 8th, 2015. Brussels September 8th, 2016. Cologne	Annual 1-day workshop aimed at promoting the application of data science to the ATM field and positioning ComplexWorld as a reference in the field.
Seminars (2012 Seminar , 2013 Seminar, 2014 Seminar)	June 20th, 2012. Delft July 10th, 2013. Toulouse May 28th, 2014. Istanbul	Papers sessions organized annually by the CW network around topics related to the complexity field. During the first year of CW activity, all its annual public activities were concentrated in the 1st ComplexWorld Conference. In the following years, ComplexWorld has organized its Seminars alongside with bigger events: • 2012 Seminar, TU Delft-Delft, alongside with ATOS 2012 • 2013 Seminar, ENAC-Toulouse, alongside with ISIATM, ATOS and ASDA 2013 • 2014 Seminar, Istanbul TU-Istanbul, alongside with ICRAT and ATACCS 2014
ECCS satellites (CW satellite 2011 , CW satellite 2012 , CW satellite 2013 , CW satellite 2014 , CW satellite 2015)	Vienna, September 15, 2011 Brussels, September 6, 2012 Barcelona,September 18, 2013 Lucca,September 22, 2014 Lipari, July 15th, 2015	Satellite event organized by ComplexWorld annually as part of the European Conference of Complex Systems to enhance the link with the more academic complex systems community. In 2015, as the ECCS was moved to the USA, the satellite event

		was changed by a satellite event of the Lipari Summer School. The topic of this event was complexity science and transportation systems.

3.3 Dissemination and communication tools

The key results of the ComplexWorld network are collected in the ComplexWorld Wiki (wiki.complexworld.eu) which has been regularly updated to include complete project and PhDs information. It also collects the relevant data of the events organized by ComplexWorld, the agenda and most of it´s presentations. In the case of the DSIAW 2015 and 2016, video recordings are also included. This wiki will be maintained until the 31st of December, 2017. The initial website of ComplexWorld is not anymore updated.

3.4 Demonstrations

N/A

3.5 Exploitation plans

N/A

4 Total Eligible Costs

This section is based on the Project Costs Breakdown Forms of the eligible costs incurred by project participants.

Date	Deliverables on Bill	Contribution for Effort	Contribution for Other Costs (specify)	Status
18NOV10	Y1_D1.1; Y1_D2.1; Y1_D2.2; Y1_D3.1; Y1_D3.2; Y1_D3.3; Y1_D4.1	83.433,00 €	949,85 € (travel costs); 7.500,00 (computation resources)	Paid
21FEB11	Y1_D1.2; Y1_D2.3; Y1_D4.2; Y1_D5.1; Y1_D5.2	54.702,00 €	6.832,14 € (travel costs)	Paid
29JUN11	Y1_D3.4	26.937,00 €	1.396,10 € (travel costs)	Paid
16AUG11	Y1_D1.3; Y1_D2.4; Y1_D3.5	66.908,00 €	9.648,84 € (travel costs); 6.333,68 € (network development)	Paid
09FEB12	Y2_D1.1; Y2_D2.3	14.091,25 €	12.443,75 € (travel costs); 7.500,00 (computation resources)	Paid
05SEPT12	Y2_D1.2; Y2_D3.1	54.395,50 €	2.271,90 € (travel costs); 238,41 € (network development)	Paid
31OCT12	Y2_D2.1; Y2_D2.2	21.858,15 €	14.224,90 € (travel costs); 6.000,00 € (network development)	Paid
21DEC12	Y2_D1.3; Y2_D3.2; Y2_D4.1	54.547,77 €	8.687,18 € (travel costs)	Paid
19JUN13	Y3_D3.1	6.630,60 €	376,01 € (travel costs); 279,29 € (network development); 7.500,00 (computation resources)	Paid
27AUG13	Y3_D1.1; Y3_D3.3	17.315,49 €	15.624,20 € (travel costs);	Paid
28NOV13	Y3_D2.1; Y3_D2.2	21.686,31 €	9.118,54 € (travel costs); 5.995,48 € (network development)	Paid
13FEB14	Y3_D1.2; Y3_D3.2; Y3_D3.4; Y3_D3.5; Y3_D4.1	99.758,46 €	8.202,86 € (travel costs); 186,47 € (network development)	Paid
27AUG14	Y4_D1.1; Y4_D2.1; Y4_D3.1; Y4_D3.4	29.973,00 €	15.304,87 € (travel costs); 900,00 € (network development); 7.500,00 (computation resources)	Paid
31OCT14	Y4_D2.2	6.752,50 €	2.466,12 € (travel costs)	Paid

7APR15	Y4_D1.2; Y4_D2.3; Y4_D3.2; Y4_D3.3; Y4_D4.1	109.580,55 €	5.700,37 € (travel costs); 4.680,00 € (network development)	Paid
24SEPT15	Y5_D5.01; Y5_D5.05	36.721,00 €	8.280,03 € (travel costs); 5.427,52 € (network development); 7.500,00 (computation resources)	Paid
29MAR16	Y5_D5.03; Y5_D5.04; Y5_D5.09	31.710,50 €	3.870,61 € (travel costs); 40.104,55 € (network development)	Paid
29MAR16	Y5_D5.03	997,50 €		Pending of payment
25MAY16	Y5_D5.03	26.843,75 €		Paid
OCT16 (TBC)	Y5_D5.07; Y5_D5.08	16.345,03 € (TBC)	4.926,11 € (travel costs); 4.862,77 € (network development) (TBC)	Pending of invoice
GRAND TOTAL		**781.187,36 €** (TBC)	**242.832,55 €** (TBC)	

Table 2 Overview of Billing

Company	Planned man-days	Actual man-days (TBC)	Total Cost (TBC)	Total Contribution (TBC)	Reason for Deviation
Innaxis	662	726	321.566,76 €	239.860,00 €	
Universidad de Sevilla	419	419	194.695,00 €	191.720,00 €	
DLR	101	104		58.975,13 €	
NLR	112,40			102.473,84 €	
University of Palermo	150			73.446,84 €	
University of Westminster	149	226,5	175.577,90 €	110.066,52 €	Publication-related network activities have required substantially more effort than planned: complex ATM white paper (Y1), complexity science paper (Y3) and, in particular, the complexity science book (Y4-Y5).

GRAND TOTAL	**1.593,40**	**(TBC)**	**(TBC)**	**(TBC)**	

Table 3 Overview of Effort and Costs per project participant

5 Project Lessons Learnt

What worked well?
The collaboration among ComplexWorld partners has enabled to produce relevant outcomes with limited resources, even the book “Complexity Science in Air Traffic Management”. The network has been able to publish one key outcome every year: the White Paper, the Position Paper, the ComplexWorld Wiki, the book and the report on Complexity Challenges in ATM.
ComplexWorld has created a bridge among the complexity science community and the ATM field creating a new research community. This new line of research has proven to be promising in the ATM and is already producing results as, for example, helping to understand the uncertainty or enhancing the understanding of the system through the application of data science techniques.
The different activities organized (22 in total, including workshops, seminars, conferences and tutorials) have helped to enhance the cohesion of this network of experts that includes 8 PhD students.
Preparing a work order every year has given the network the possibility to adapt its initiatives to the needs of the community and the evolution of this field of research. This allows for both better planing of the activities, and also adoption of new ideas that could have emerged but had not been initially planned or included in the original Work Order. Being a new field of research in ATM, this flexibility has been key to the success of the network.
Overall, ComplexWorld has been able to run efficiently within budget taking into account limited resources and variety of activities (53 deliverables, 22 events). Network activities have been proven very beneficial for the community and the team has provided high value added considering funds available. For instance, ComplexWorld has become a reference in the promotion of the application of Data Science techniques to the air transport field. This promising line of research has significantly grow since ComplexWorld launched the first Data Science in Aviation Workshop.
What should be improved?
Actively involving PhD students not only helps to support the overall CW Network, but also helps students to improve their communication/presentation skills and connect with experts in their field of expertise. It would be ideal to have a deeper involvement with PhDs with additional support from SJU. Not only having a more detailed following of the PhD evolution but also enabling a space for PhD student input in the thematic areas would be thought-provoking and interesting.
The development of the ComplexWorld Wiki (CWW) was considered the best vehicle for a repository of research collecting all inputs from a variety of research programmes, research institutions and scientific events. However, in order to succeed as a credible point of resource, the volume and number of references need to continue to match the increase of visits/users. Requiring contractually research projects to update their content is needed to ensure all projects and research findings are duly updated.
The flow of knowledge from the long term research programme into the SESAR Mainstream programme has been weak. The network activities have not been sufficient to raise interest among the SESAR partners on the complexity research results. In order to mitigate this, additional resources would be required and, specially, a coordinated approach from the different stakeholders involved: long-term programme researchers and SESAR members with the committed collaboration of the SJU to foster the transfer of knowledge. Combined events would be helpful. Representation of the SESAR members in the close-out meetings would also be recommendable.
ComplexWorld has done a noteworthy job in building a critical mass of entities to form an innovative network. However, for the Network to advance and expand into a source of interactivity of highly engaged entities, then specific benefits should be allocated to additional participants- in terms of funding, in-kind resources (e.g. potential inclusion in future research Calls) or others (e.g. prizes).
The existence of a network that is thematically linked to projects and PhD helps to enhance the alignment with the WPE initiatives in similar fields, which is one of the objectives of the network. Nevertheless, projects never

had any requirement to either be aligned with the network position neither to report results, which led to misalignment of those projects that were led by partners not involved in the network. The coherence between the network leadership and projects results could be improved.

Table 4 - Project Lessons Learnt