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EVALUATING THE CROSS-IMPACT OF EU FUNCTIONS AS A GLOBAL ACTOR AND PROTECTOR OF CRITICAL INFRASTRUCTURES AND SUPPLY CHAINS

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Abstract: The paper presents main results of the analysis of cross impact between two of the 'big themes' in the FOCUS project: "EU as a global actor based on the wider Petersberg Tasks" and "Critical infrastructure & supply chain protection." The cross impact was evaluated by experts from both EU and non-EU countries. For each theme they were asked to estimate significance and interrelation of trends, thus allowing the research team to identify centres of gravity within each theme. Then they estimated the pairwise linkage of trends from the two themes. The study resulted in identification of key linkages among trends, to be further explored in the analysis of respective contexts, mission roles, and security research scenarios. This practical test of the presented model—having relatively limited number of domains and trends—contributes to the transparency and illustrative power of FOCUS methodology and can be expanded in future studies.

Keywords: Foresight, cross-impact, critical infrastructure protection, supply chain Petersberg tasks, centre of gravity.

Introduction

For decades, maybe even for centuries, there has been a clear cut distinction between at least three types of threats and challenges to a state and its citizens: those, coming from outside, e.g. a military aggression, breaches of law and order, and natural disasters and industrial catastrophes. With some variations, most countries have created separate organisational structures to deal with the respective type of threats. With time, these organisations have created specific concepts, decision making mechanisms and approaches to resource management, reflected for example in the ways they manage investments and research activities. This experience has often been replicated at the level of international organisations.

In the last two decades the processes of globalisation, rapid development and proliferation of information and communication technologies, among others, brought a pro-

found change in the security environment, ways and means of conflict, and organisational responses.[1] This change necessitates a paradigm shift and development of novel arrangements for dealing with current and future security threats and challenges, already underway in the European Union and some of its Member States.[2]

The organisation of the FOCUS project fully reflects this understanding. The project is organised along five 'big themes.' Researchers responsible for each theme explore the problem space, elaborate respective context scenarios and theme-relevant roles for the European Union, and define security research scenarios.[3] This paper presents results within a work package intended to provide synthetic analysis across the five big themes and integrated input for planning of security research, where researchers aim to identify commonalities across the thematic scenarios and to extract key critical transversal elements.

This paper presents the main results of analysing the cross impact between two of the 'big themes': "EU as a global actor based on the wider Petersberg Tasks" and "Critical infrastructure & supply chain protection." First, it briefly presents the methodological approach, adopted by the research team. The second part of the paper provides main results and analysis.

This focused study has been prepared by FOCUS partners CSDM, CBRA and SECEUR. The authors solicited expert opinion of policy makers and researchers, representing both EU and non-EU countries, in a session parallel to the DESSERT 2012 conference in Sevastopol, Ukraine.[4] Others participated in the assessment via e-mail communication, bringing the number of participating experts to 21.

Approach and Methods

Strategic decisions are made in uncertain context. Scenario analysis has long been used to represent uncertainty in fields like energy policy making and defence planning. In recent years, scenarios find wider application in support to long-term decision making such as in security research planning. Analysts support decision making by conceiving scenarios as possible views on the future, and then analysing these scenarios to deduct requirements of interest. In the field of security, scenario planners try to understand which are the factors—threats, risks, challenges, drivers, trends, strategic shocks, etc.—that trigger changes in the decision environment, and to envisage plausible and internally consistent views of the future, i.e. scenarios.

The factors, influencing future developments, are not independent of each other, and analysts need to be able to identify dependencies among factors and assess their combined effects.

Cross-impact analysis is one method, introduced in the 1970s, allowing to account for the interactions between a set of forecasts and facilitating the process of scanning the field of possible futures to reduce uncertainties. It is based on the evaluation of interrelations, e.g. conditional probabilities, within pairs of key influential factors. The method employs a family of techniques, originating in 1960s and intensively developed in the 1970s and 80s. Special-purpose software is available to support the application of cross-impact analysis methods.[5] A related cross-impact approach (or "Cross-Impact Balance Analysis") has been proposed for use in expert discourses while alleviating some of the problems of traditional cross-impact methods.[6]

The method, selected for the study presented here, is the variation of cross-impact analysis used in the "Global Risks 2012" report of the World Economic Forum (WEF).[7] The study underlying the WEF 2012 report examined 50 global risks across five categories and, rather than focusing on a single existential risk, it emphasized the singular effect of constellations of global risks in their interrelation. As a methodological novelty, the 2012 WEF report introduced the concept of Centres of Gravity (CoGs) to designate "those risks perceived by survey respondents to be of greatest systemic importance within each of the five risk categories" that in risk-related planning "should serve as focal points to guide strategic interventions."[8] Details on the actual implementation of the WEF 2012 method are provided in the second part of this paper, along with assessment results.

In addition to the method *per se*, it is important *who* does the assessment. In the exploration of complex developments with high level of uncertainty, such as in studies on alternative futures, there is a psychological phenomenon known as "groupthink."[9] It may occur, for example, in a research team when team members try to avoid conflict and get to a consensus without critically assessing alternative viewpoints. Therefore, the involvement of outside experts is considered key in order to avoid groupthink and reflect broader perspectives.[10]

Further, in scenario-based planning addressing complex and ambiguous problems, it is important to engage heterogeneous groups of stakeholders. Having widely different background, involved experts work collaboratively and rely on intuitive logic to elicit and discuss the range of possible and plausible outcomes under a broad range of driving forces, and then integrate these into internally logical storylines that, in combination, span the space of possibilities for the future.[11]

In the FOCUS study, the involvement of experts from countries outside the European Union is of particular importance in the consideration of EU security roles beyond its territory and the exogenous aspects of critical infrastructure protection and supply chain security. Of particular value are the views from the Russian Federation and countries in EU's Eastern Partnership. The EU already cooperates with these coun-

tries in the field of integrated border management, in initiatives in the field of civil protection, such as Prevention of, Preparedness for, and Response to natural and man-made disasters (PPRD), as well as through activities aiming to enhance energy and transport security [12] with potential impact on critical infrastructure and supply chain protection. On that basis, it was decided to study the cross impact of two of the five FOCUS 'big themes'—"EU as a global actor based on the wider Petersberg Tasks" and "Critical infrastructure & supply chain protection"—and to conduct part of the evaluation in Ukraine – the biggest partner country in the EU's Eastern Partnership.

The third key methodological issue is the level at which cross-impact is considered. Three possible levels of assessment were considered:

- at the level of potential missions and roles of the European Union
- at the level of context scenarios
- at the level of trends.

Crucial for this decision was the anticipated commitment of outside experts, as well as the exchange with the organisers of the DESSERT 2012 conference in Sevastopol, who kindly agreed to allot 90 minutes of conference time for the FOCUS assessment exercise. Hence, it was decided to organise the cross-impact analysis at the level of trends.

The conference attendees, participating in this exercise—mostly researchers and one policy maker—were from EU Members States, as well as from non-EU countries (further down designated for brevity as 'EU experts' and 'non-EU experts'). Other experts—two of them with rich experience in policy making—provided their assessments via e-mail communication.

The second part of this paper provides details on the implementation of the selected approach and the findings.

Evaluating Cross Impact

Experts were asked to assess cross impact among the two themes in three steps:

1. Evaluating the significance of trends within domains of each theme
2. Evaluating interrelation between trends within each theme
3. Evaluating the linkage within pairs of trends from the two themes.

The results of the evaluation are presented below in three respective sub-sections.

Evaluating significance of trends within domains

The analysis of the possible evolution of EU missions and roles in a FOCUS 'big theme' has been structured along domains and key drivers, trends, and possible strategic shocks have been identified for each domain.[13]

Five domains have been identified for the theme "EU as a global actor based on the wider Petersberg Tasks," as follows:

- Global order
- Globalised economic developments
- Ideological
- Technological
- Environmental.

The exploration of the "Critical infrastructure & supply chain protection" theme was organised in the following domains:

- Demographic, economic, and social changes
- Environmental and technological
- Values and beliefs
- New players and changing models of governance.

For the purposes of evaluating cross impact by external experts, the research team processed FOCUS deliverables 5.1 and 6.1 in order to extract a smaller number of trends (two or three per domain) that capture all major influences on future developments within the respective theme. Trends are listed in figures1 and 2 below.

With this information at hand, experts were asked to assess, individually, the 'significance' of trends within a domain, based on their estimate of likelihood and potential impact, using a scale from 0 to 10, so that assessments add up to ten.

Result for expert assessments—overall average, average for experts from EU Member States, and for those from non-EU countries—for theme "EU as a global security actors" are presented in Table 1. Table 2 gives the respective results for theme "Critical infrastructure & supply chain protection."

These results served to define centres of gravity for each of the domains (see Table 1, where the three digit designation means <theme #>.<domain #>.<trend #>). It shows for example that the trend of continuing multi-polarity where key players create their own geopolitical spaces and military alliances and the role of international law declines is evaluated to be a centre of gravity in the 'Global order' domain for theme 1.

TRENDS		EVALUATIONS		
EU as a Global Actor				
1. Domain 1: 'global order'		**average**	**EU**	**non EU**
	1.1. US steadily reduces its unilateral strategic role, while maintaining its global reach due to competitors' lack of long-range capacities and insufficient political will/interest in global engagement and responsibilities.	**4.64**	**4.0**	**5.0**
	1.2. Continued multi-polar world where key players, including EU, create their own geopolitical spaces and military alliances -- co-operating with each other on specific issues of common interest as result of predominent influence of constructivist approach to global (security) affairs. Role of international law declines due to 'moral inadequacy' of global players and its replacement by balance of interests.	**5.36**	**6.0**	**5.0**
2. Domain 2: 'globalised economic developments'				
	2.1. Global shift in relative wealth is underway without historical precedent in terms of its size and speed. Impact on globalisation of factors such as social transformation across Europe, the United States and societies of emerging powers remains unknown.	**4.64**	**6.0**	**3.9**
	2.2. Future evolution of global energy market remains unpredictable, as caught between the contradictory tendancies of centralisation of control over resources vs. decentralisation of markets.	**5.00**	**4.0**	**5.6**
3. Domain 3: 'ideological'				
	3.1. Spread of religious and ethnic radicalism between cultures and within societies as a result of social diversification, political dissatisfaction and lack of modern education.	**3.00**	**2.8**	**3.1**
	3.2. Declining attractiveness of the post-national state due to public concerns about societal/economic status and an unpredictable future.	**3.09**	**2.8**	**3.3**
	3.3. Growing political nationalism that erodes the EU's internal cohesion and feeds corrosive geopolitical rhetoric and ambitions at national level.	**4.09**	**4.5**	**3.9**
4. Domain 4: 'technological'				
	4.1. Technological competitiveness will spark new levels of global interaction and competition, especially in cyber, space, transportation, extraction technologies, hardware and know-how for military and intelligence, etc.	**4.36**	**4.0**	**4.6**
	4.2. No trend more important than success or failure of effort to prevent spread of weapons of mass destruction and uncontrolled access to technologies and materials for their production and delivery.	**3.55**	**4.0**	**3.3**
	4.3. Newly emerging characteristics of armed conflict including new causes of war and new means of war.	**2.55**	**2.0**	**2.9**
5. Domain 5: 'environmental'				
	5.1. The impact of degraded vital natural resources such as water, energy and food due to industrial policies that neglect investment in environmental preservation.	**6.27**	**6.8**	**6.0**
	5.2. Increased danger of rising sea levels, especially in northern hemisphere due to international community's failure to implement agreed environmental rules.	**3.73**	**3.3**	**4.0**

Figure 1: Trends' assessments per domains in theme "EU as a global actor."

A centre of gravity was defined for all domains but one when total average estimates were used. There are only sight differences between the averaged assessments of EU and non-EU experts which indicates similarity in perceptions between the two groups on the significance of identified trends. Nevertheless, there are cases when differences in assessments are relatively high (e.g. 20 % or higher). Such are the differences in assessing trends 1.2.1, 1.1.2 and 1.2.2 in the first theme, and 2.3.1 and 2.3.3 in the second. These are trends in the domains of "Global order," "Globalised economic developments," and "Values and beliefs." While a further study may be needed to define the reasons for these differences, varying perceptions might be the possible explanation.

TRENDS		EVALUATIONS		
CI & Supply Chain Protection				
1. Domain 1: "demographic, economic and social changes"				
	1.1. Global economics is characterized by shared economic benefits, compromises and good will. Developing countries' infrastructure that supports flow of essentials services, goods, commodities and energy quickly reaches Western levels. This leads to improved networks at global level. Business practices, local govermental agencies and global organizations aim to create infrastructure architecture based on fairness and sustainability.	**4.55**	**4**	**4.9**
	1.2. The global economy is characterized by economic rivals and protectionism, income disparities, wildly fluctuating energy and commodity prices. Population in megacities grows faster than investment in logistics, energy and communication infrastructures. Critical infrastructure development is fully market-driven, where reliable supplies of essential services are provided only for wealthy customers.	**5.45**	**6**	**5.1**
2. Domain 2: "environmental and technological"				
	2.1. Continual but slowing or tolerable climate change. Technologies are developed and adapted to promote sustainable use of natural resources (foresight oriented). New technologies and services increase resilience of critical infrastructure against unexpected harmful events. Security and environmental requirements are compulsory.	**4.91**	**5**	**4.9**
	2.2 Accelerating environmental change leads to intolerable conditions and finally to the collapse of eco-systems. Technologies are developed to keep supply chains and energy production going under challeging conditions (short-sighted problem-solving). Environmental technologies are not adapted to become financially attractive. Security and environmental requirements remain voluntary.	**5.09**	**5**	**5.1**
3. Domain 3: "values and beliefs"				
	3.1 Prolonged foreign political conflicts with no viable political solution spawn continual terrorist attacks and new terrorist organizations with or without political agendas (incorrigible terrorism).	**3.73**	**2.5**	**4.4**
	3.2 Prolonged economic crises with no balanced solutions generate violence and riots that target political decision makers. Extremist movements are born.	**3.73**	**3.5**	**3.9**
	3.3 Solidarity. Enviromental boycotts against unsustainable companies and industries grow across the globe, forcing industry to change its manufacturing processes and supplier strategies.	**3.45**	**4**	**3.1**
4. Domain 4: "new players and changing models of governance"				
	4.1. Free-trade rules prevail over security and environmental issues. The role of govermental regulation and national agencies is diminished. Negative side-effects are treated only when they encumber business interests (e.g. increasing power of criminal organizations in energy, banking and logistic business and decreasing neutrality of public supervisory operations due to goverment bias toward support for business interests)	**3.18**	**3**	**3.3**
	4.2. Rising national economic interests and conflicts between "rival empires". Security, environmental and sustainability standards and regulations are used as effective tools to hinder free movement of goods.	**3.18**	**3.25**	**3.1**
	4.3. Growing democratic movements and security/environmental awareness surface at all levels of society. Governements have clear role as regulator and supervisor to restrain negative side-effects of globalization. Compliance with security and environmental regulations is viewed as necessacity if private sector wants to sell goods and essential services to citizens. Social networks, communities and new ideologies such as eco-communalism grow stronger.	**3.73**	**3.75**	**3.7**

Figure 2: Trends' assessments per domains in theme "CI & SC protection."

Table 1. Centres of gravity per domain.

Domain	Centres of Gravity		
	Based on all assessments	Based on assessments by EU experts	Based on assessments by non-EU experts
Theme 1. EU as a Global Actor			
D1	1.1.2	1.1.2	-
D2	1.2.2	1.2.1	1.2.2
D3	1.3.3	1.3.3	1.3.3
D4	1.4.1	-	1.4.1
D5	1.5.1	1.5.1	1.5.1
Theme 2. CI and Supply Chain Protection			
D1	2.1.2	2.1.2	2.1.2
D2	2.2.2	-	2.2.2
D3	-	2.3.3	2.3.1
D4	2.4.3	2.4.3	2.4.3

Evaluating mutual influence of trends within a theme

On the second step experts were asked to asses how strong is the interrelation between trends from different domains within a team, again using a scale from 0 to 10. The results, in total average, are presented in tables 2 and 3 respectively.

Table 2. Assessments of mutual influence of trends in theme "EU as a global actor."

			EU as a Global Actor											
			D1		D2		D3			D4			D5	
			Trend 1.1	Trend 1.2	Trend 2.1	Trend 2.2	Trend 3.1	Trend 3.2	Trend 3.3	Trend 4.1	Trend 4.2	Trend 4.3	Trend 5.1	Trend 5.2
EU as a Global Actor	D1	Trend 1.1	x	x	4.6	4.8	4.1	4.0	2.4	4.0	4.1	4.9	2.2	2.1
		Trend 1.2	x	x	5.0	5.6	4.0	4.7	6.2	5.6	4.6	4.2	3.4	2.4
	D2	Trend 2.1	x	x	x	x	4.8	3.7	5.0	4.8	3.8	4.4	3.8	2.9
		Trend 2.2	x	x	x	x	2.3	3.1	3.2	4.2	4.2	4.0	4.9	4.2
	D3	Trend 3.1	x	x	x	x	x	x	x	3.3	4.6	5.1	4.0	2.4
		Trend 3.2	x	x	x	x	x	x	x	3.3	3.4	3.8	4.2	3.1
		Trend 3.3	x	x	x	x	x	x	x	3.0	3.9	4.9	3.2	3.1
	D4	Trend 4.1	x	x	x	x	x	x	x	x	x	x	3.3	3.7
		Trend 4.2	x	x	x	x	x	x	x	x	x	x	3.6	2.9
		Trend 4.3	x	x	x	x	x	x	x	x	x	x	3.2	2.1
	D5	Trend 5.1	x	x	x	x	x	x	x	x	x	x	x	x
		Trend 5.2	x	x	x	x	x	x	x	x	x	x	x	x

Table 3. Assessments of mutual influence of trends in theme "CI & SC protection."

			CI and Supply Chain Protection									
			D1		D2		D3			D4		
			Trend1.1	Trend 1.2	Trend 2.1	Trend 2.2	Trend 3.1	Trend 3.2	Trend 3.3	Trend 4.1	Trend 4.2	Trend 4.3
CI and Supply Chain Portection	D1	Trend1.1	x	x	**5.4**	**3.2**	**3.1**	**3.1**	**5.3**	**4.0**	**3.3**	**5.9**
		Trend 1.2	x	x	**2.7**	**6.1**	**5.7**	**6.3**	**3.4**	**5.6**	**6.4**	**2.9**
	D2	Trend 2.1	x	x	x	x	**2.8**	**3.0**	**4.8**	**3.3**	**4.6**	**5.4**
		Trend 2.2	x	x	x	x	**5.0**	**5.7**	**5.1**	**5.9**	**4.2**	**3.7**
	D3	Trend 3.1	x	x	x	x	x	x	x	**3.9**	**4.1**	**3.4**
		Trend 3.2	x	x	x	x	x	x	x	**4.0**	**5.3**	**4.1**
		Trend 3.3	x	x	x	x	x	x	x	**3.1**	**3.2**	**6.1**
	D4	Trend 4.1	x	x	x	x	x	x	x	x	x	x
		Trend 4.2	x	x	x	x	x	x	x	x	x	x
		Trend 4.3	x	x	x	x	x	x	x	x	x	x

These results were used to identify trends with strongest mutual influence with the centres of gravity within a theme, identified on the previous step. The results are presented in Table 4. The table lists the three trends with highest mutual influence with each of the centres of gravity; the first columns gives CoGs and the respective top three trends according to the total average of the expert assessments, the next two columns – according to the assessments by EU experts, and columns 5 and 6 – according to the assessments by non-EU experts. The final column lists the number of full and partial matches between the top three lists of EU and non-EU experts. 'Full' is the match when a trend is shortlisted by the two group of experts and in the total average assessment. 'Partial' is the match when a trend is shortlisted in two of the three assessments.

As seen on Table 4, there are domains where the short-listed linkages between centres of gravity and trends fully coincide, i.e. domain 3 for theme 1 and domains 1 and 4 for the CI & Supply Chain theme. For other domains assessments may differ to a considerable degree, possibly due to varying perceptions.

In addition, it is possible to visualise the mutual influence, as shown on Figure 3. The figure reflects the total average assessments for the centre of gravity in domain 'Global order' in theme 1. The centre of gravity is placed in centre of the figure. The closest to the centre is one of the other trends in theme 1, the stronger is the mutual influence between it and the CoG.

Evaluating cross-impact among trends

In the third step experts were asked to provide their pairwise assessment, i.e. to what degree a trend in theme "EU as a Global Actor" impacts a trend in theme "Critical infrastructure and supply chain protection" and vice versa. Table 5 presents partial results from processing expert assessments. For each centre of gravity from one theme,

Table 4. CoGs vs. three trends within a theme with highest mutual influence.[14]

All assessments		Assessments by EU experts		Assessments by non-EU experts		Matches
CoG	Trends	CoG	Trends	CoG	Trends	full/partial
EU as a Global Actor						
1.2	3.3	1.2	3.3			full: 0 partial: 3
	2.2		2.2			
	4.1		4.1			
2.2	5.1	2.1	1.1	2.2	1.2	full: 0 partial: 2
	1.2		3.1		5.2	
	1.1		4.3		4.1	
3.3	4.3	3.3	1.2	3.3	1.2	full: 2 partial: 1
	1.2		4.3		2.1	
	2.1		2.1		4.2	
4.1	1.2			4.1	1.2	full: 0 partial: 2
	2.1				2.1	
	2.2				5.2	
5.1	2.2	5.1	2.2	5.1	2.2	full: 1 partial: 2
	3.2		3.1		3.2	
	3.1		1.2		2.1	
CI and Supply Chain Protection						
1.2	4.2	1.2	4.2	1.2	4.2	full: 3 partial: 0
	2.2		3.2		3.2	
	3.2		4.1		2.2	
2.2	1.2			2.2	1.2	full: 0 partial: 1
	4.1				3.1	
	3.2				4.1	
		3.3	4.3	3.1	1.2	full: 0 partial: 1
			1.1		2.2	
			2.2		4.1	
4.3	3.3	4.3	1.1	4.3	2.1	full: 2 partial: 1
	1.1		3.3		3.3	
	2.1		3.2		1.1	

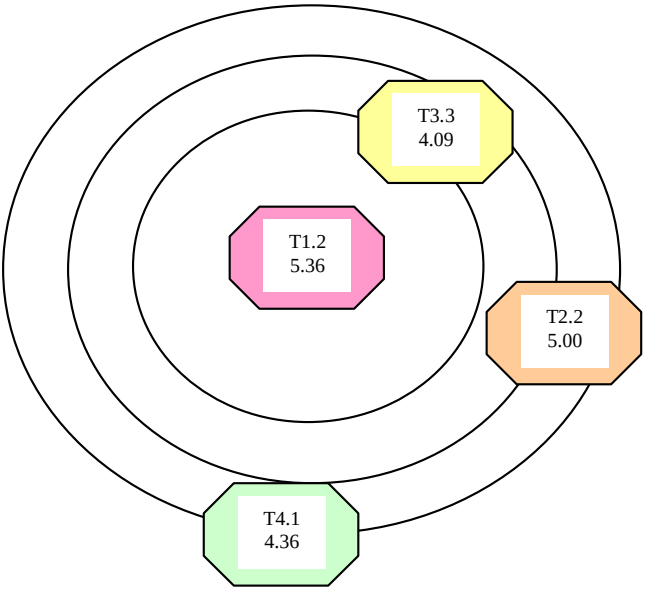

Figure 3: Visualising the strength of mutual influence between centres of gravity and trends.

it lists the three trends from the other theme most strongly linked (impacting or impacted by) it. Columns are organised like in Table 4 above. Discrepancies of assessments here are much higher. One reason is that they build on differences already available on previous steps.

The data in the upper part of Table 5 is visualised in Figure 4. It shows which trends in theme "CI & supply chain protection" have strongest impact on theme "EU as a global actor." Special consideration needs to be given to trends on the right-hand side of Figure 4 impacting two or more centres of gravity in theme "EU as a global actor." One example of a trend impacting all five centres is of gravity is trend 2.1.2, related to economic disparities and a widening gap between 'haves' and 'have-nots.'

The data in the lower part of Table 5 is visualised in Figure 5. It shows which trends in theme "EU as a global actor" have strongest impact on theme "CI & supply chain protection." In this case, the theme 1 trend that impacts all identified centres of gravity in theme "CI & supply chain protection" is 1.5.1, related to degradation of natural resources and neglect for the environment.

Conclusion

The study presented here allowed to identify strong mutual influences between trends within a theme, as well as across themes. While further research is necessary to better understand the cross-impact and its consequences, the latter clearly indicate transver-

Table 5. Assessments of cross impact between trends from the two themes.

All assessments		Assessments by EU experts		Assessments by non-EU experts		Matches
CoG	Trends	CoG	Trends	CoG	Trends	full/partial
EU as a Global Actor към CI → Supply Chain Protection						
1.2	1.2	1.2	1.2			full: 0 partial: 3
	3.2		4.2			
	4.2		3.2			
2.2	1.2	2.1	2.1	2.2	1.2	full: 0 partial: 2
	4.1		1.2		2.1	
	4.2		1.1		4.1	
3.3	4.2	3.3	4.2	3.3	4.2	full: 0 partial: 2
	1.2		3.1		1.2	
	3.1		1.2		3.1	
4.1	1.2			4.1	1.2	full: 0 partial: 2
	2.1				2.1	
	4.1				2.2	
5.1	1.2	5.1	4.1	5.1	2.1	full: 1 partial: 2
	2.2		2.2		1.2	
	4.1		1.2		1.1	
CI and Supply Chain Protection → EU as a Global Actor						
1.2	1.2	1.2	1.2	1.2	4.1	full: 1 partial: 2
	2.2		2.2		2.1	
	5.1		5.1		2.2	
2.2	5.1			2.2	5.2	full: 0 partial: 1
	5.2				2.2	
	3.1				3.3	
		3.3	2.2	3.1	1.2	full: 0 partial: 0
			4.2		3.1	
			5.1		3.2	
4.3	4.2	4.3	2.2	4.3	3.2	full: 0 partial: 3
	5.1		5.2		5.1	
	5.2		2.1		4.2	

sal issues and potential benefits of tailored studies crossing traditional thematic and organisational boundaries. Such studies may identify novel requirements, as well as opportunities for joint or coordinated capability development, and more efficient organisation of security research. The furthering of the study is likely to lead to definition of security research themes to address in a unified manner developments, re-

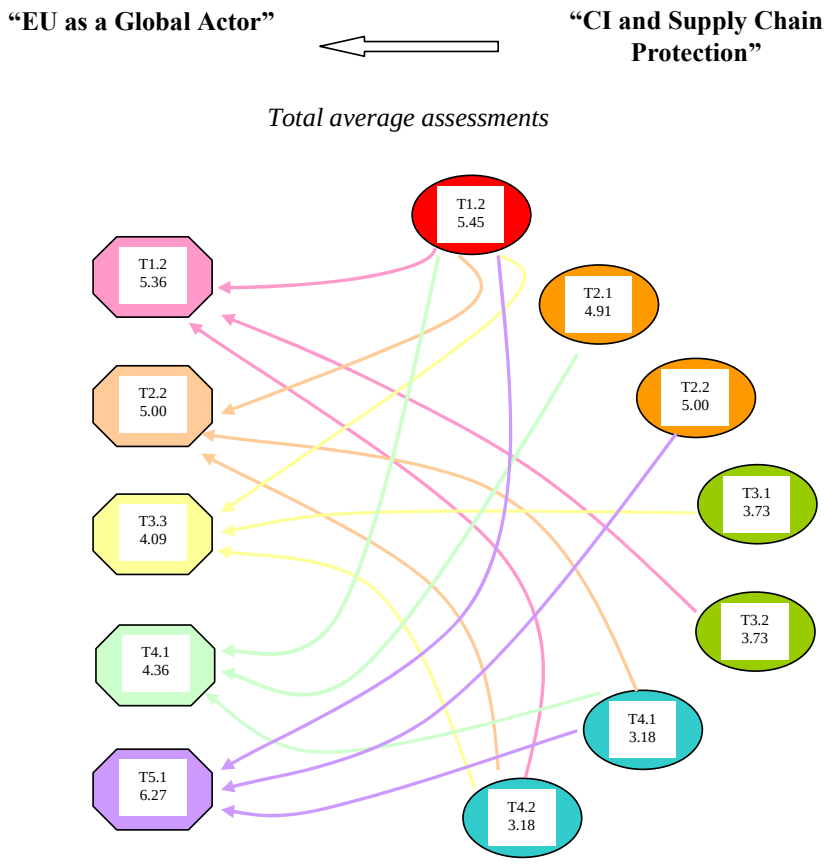

Figure 4: Most significant linkages between CoGs in theme 1 and trends in theme 2.

quirements and responses in future roles of the European Union as a global actor based on new or expanded Petersberg tasks and as a protector of critical infrastructures and supply chains.

The study identified a few cases where assessments of EU and non-EU experts differ significantly. While differences in perceptions might be among the obvious reasons, additional research by joint research teams of scientists from EU and Eastern Partnership countries would contribute to better understanding of cross-impact, vulnerabilities and potential remedies in the elaboration of future EU roles as global security actor and protector of critical infrastructures and supply chains coordinated with partners and the systematic approach to the development of respective capabilities.

Finally, the integration of efforts in such diverse, interdisciplinary teams needs to account for the specific cognitive processes and to overcome various compositional and contextual barriers to generating integrated and novel knowledge.[15] The experience

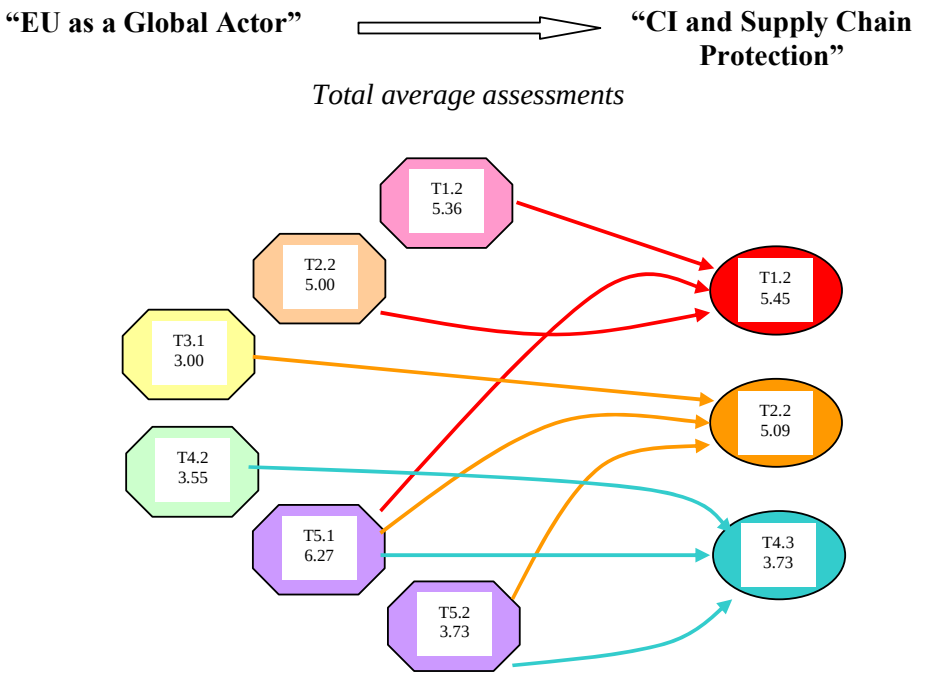

Figure 5: Most significant linkages between CoGs in theme 2 and trends in theme 1.

from the Sevastopol exercise, and the FOCUS project as a whole, provides as a side effect an insight into the ways to achieve efficient integration of cross-theme interdisciplinary teams, involving researchers with widely different culture and experience.

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Notes:

1 Velichka Milina, "Security in a Communications Society: Opportunities and Challenges," *Connections: The Quarterly Journal* 11, no. 2 (Spring 2012): 53-66; Mark B. Salter, "Surveillance," in *The Routledge Handbook of New Security Studies*, ed. J. Peter Burgess (London: Routledge, 2010).

2 Bengt Sundelius, "A Brief on Embedded Societal Security," *Information & Security: An International Journal* 17 (2005): 23-37, http://dx.doi.org/10.11610/isij.1702; J. Peter Burgess, ed., *The Routledge Handbook of New Security Studies* (Abingdon, Oxon, UK: Routledge, 2010): 187-196.

3 For details see the Editorial to this I&S volume on "Scenario-based Security Foresight" by Prof. Alexander Siedschlag, http://dx.doi.org/10.11610/isij.2901.

4 Dependable Systems, Services & Technologies (DESSERT 2012), 25-28 May 2012, Sevastopol, Ukraine, www.stc-dessert.com/conf2012.

[5] *The FOR-LEARN Online Foresight Guide*, developed within the FP6 FOR-LEARN project, Joint Research Centre, Institute for Prospective Technological Studies, http://forlearn.jrc.ec.europa.eu/guide/0_home/index.htm.

[6] Wolfgang Weimer-Jehle, "Cross-impact balances: A system-theoretical approach to cross-impact analysis," *Technological Forecasting and Social Change* 73:4 (May 2006): 334-361, http://dx.doi.org/10.1016/j.techfore.2005.06.005.

[7] World Economic Forum, *Global Risks 2012*, Seventh edition (Geneva: World Economic Forum, 2012), www.weforum.org/reports/global-risks-2012-seventh-edition.

[8] *Global Risks 2012*, p. 11.

[9] Irving Janis, *Groupthink: Psychological Studies of Policy Decisions and Fiascoes* (Boston, MA: Houghton Mifflin, 1982).

[10] The WEF 2012 report, for example, surveyed 469 experts and industry leaders. See *Global Risks 2012*, p. 13.

[11] George Cairns, Iftekhar Ahmed, Jane Mullett, and George Wright, "Scenario method and stakeholder engagement: Critical reflections on a climate change scenarios case study," *Technological Forecasting and Social Change* 80:1 (January 2013): 1-10, http://dx.doi.org/10.1016/j.techfore.2012.08.005.

[12] European Commission and High Representative of the European Union for Foreign Affairs and Security Policy, *Eastern Partnership: A Roadmap to the autumn 2013 Summit*, JOIN(2012) 13 final (Brussels, 15 May 2012), http://ec.europa.eu/world/enp/docs/2012_enp_pack/e_pship_roadmap_en.pdf.

[13] For the themes examined here see FOCUS deliverables 5.1 and 6.1 at www.focusproject.eu.

[14] No centre of gravity was identified based on the assessments by participating experts from EU countries for domain 4 of theme 1. Hence, the empty cells in the respective column. The same applies in cases of other empty cells in this and the following table.

[15] Maritza R. Salazar, Theresa K. Lant, Stephen M. Fiore, and Eduardo Salas, "Facilitating Innovation in Diverse Science Teams Through Integrative Capacity," *Small Group Research* 43:5 (October 2012): 527-558, http://dx.doi.org/10.1177/1046496412453622.

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