FROM MULTIFACETED INFORMATION TO COHERENT AND WELL-FOUNDED SUGGESTIONS FOR A LAND TRANSPORT SECURITY RESEARCH AGENDA: PROCEEDINGS AND RESULTS OF THE FP7 PROJECT CARONTE

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Abstract

The main aim of the CARONTE project (www.caronte-project.eu, September 2014 to February 2016) was to provide well founded input to strategic research planning in the domain of land transport security, especially on the European level. In order to achieve this goal, information from various sources was analysed. The project culminated in the prioritisation of possible research fields and the development of several sets of ideas for future research.

Keywords: land transport security, research agenda

1. INTRODUCTION

Europe's prosperity relies on effective and safe transport systems. Any attacks or disturbances to land freight or passenger transport would have a major impact on economic growth, territorial cohesion, social development, and even on the life and health of European citizens. Unfortunately, there are weaknesses in Europe's land transport security, and these issues are diverse and complex. Continuous and coordinated efforts are needed to address them.

For 18 months, the CARONTE project has been working on issues like "What are the security challenges to land transportation and how can a strategic research agenda for the EU efficiently help to find answers?" During this time the consortium has carried out analyses on: the state of the art in securing land transportation, the threats facing the sector, and the current gaps and requirements for future research. On the basis of these assessments CARONTE has defined a future research agenda for land transport security that focuses on the sector's emerging risks while avoiding any doubling-up of research elsewhere. Special care has been taken to base the research agenda on the concept of fluent and efficient flow of passengers and goods, while bearing in mind the relevant ethical, societal and legal aspects.

Within this project "land transport" encompasses road, rail, and, to a lesser degree, inland waterway transportation, including the relevant interfaces. Both passenger and freight transportation were considered.

2. THE CARONTE APPROACH

Before any work was begun, the CARONTE consortium had to define common terms to forge a clear picture of their meanings in a land transport security context. Thus in the context of this project, the following terms were applied:

Need: A necessary requirement for the operability of land transport (e.g. secure critical infrastructures).

Solution: A technical or organisational measure to ensure that a need is met.

Gap: If the currently available solutions are not adequate to completely satisfy a need, there is a (capability) gap.

Threat: A potential event that challenges the functioning of transport systems. Countering a threat might be a "need" which requires "solutions".

In addition to that, a working definition of what "security" means had to be found to determine the scope of the project. From all conceivable security issues, the CARONTE project focussed on those that are caused by wilful acts of persons (mainly with criminal or terrorist intents). This definition of security is illustrated in Fig. 1.

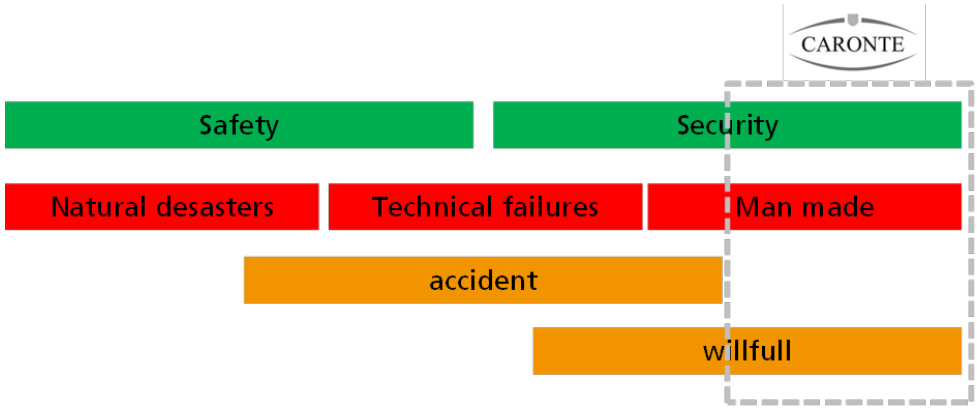

Figure 1: Defining the scope of the CARONTE project.

The sources of information used in the CARONTE project were manifold. More than a dozen meetings with internal and external experts ensured that as many voices as possible were heard. In this context, two meetings of the high level advisory board and two conferences with a total of more than 120 participants were of special importance. In addition to this, expert opinion was collected through questionnaires and structured interviews. The second important source of information was data on recently completed and on-going research projects relevant for the domains covered by the CARONTE project. More than 120 European and national research projects were evaluated in order to determine the state of the art, current research priorities, and existing research gaps. The third kind of sources were official policy papers, existing research programmes, and research agendas developed both by professional bodies and previous research projects.

2.1 Prioritisation of research issues

The information generated within the CARONTE project using the sources described above were collected, condensed and systematically sorted.

On this basis a longlist of "needs/requirements" for land transport security and corresponding "possible solutions" were generated and validated. The items on the longlist were further analysed systematically through a multi-criteria approach named "Weighted-Bit Assessment Table for Land Transport Problems and Solutions" (WBAT-LTPS).[1] In addition to this, more than one hundred research projects of relevance for land transport security were evaluated concerning their connection to the items on the

longlist. Finally, existing policy papers, research programmes and strategies, and centres of excellence in land transport security were analysed.

As this longlist generated contained more than 30 “needs/requirements” and approx. 50 “possible solutions”, further prioritisations were necessary in order to develop a meaningful research agenda.

For the preparation of a useful roadmap the prioritisation was performed in three different classes (see Fig. 2).

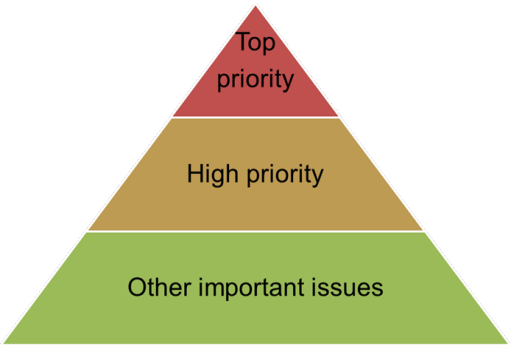

Figure 2: Prioritisation classes.

A set of seven criteria was developed to sort the issues of the longlist of “needs/requirements”. These criteria were designed to take into account as much of the information previously gathered as possible. By a deliberate choice, no “mathematical system” was devised to “calculate” a final priority score from the individual judgements, as this would only simulate calculability where in fact expert opinion is key.

These individual criteria are:

1 **Expert opinion** (stated during the CARONTE workshops and expert advisory groups)

2 Is this “need/requirement” a **burning issue** to be dealt with or is it less urgent or less important?

3 **Number of research projects** dealing with this “need/requirement” or providing solutions (is this issue already sufficiently addressed by current research work or are there only insufficient research projects dealing with this subject)

4 **Research is essential** for meeting the need or requirement (is research urgently needed or are there measures (e.g. new regulations, networking activities) other than research better suited to close the gap)

5 **Connection to land transport** (is this “need/requirement” a land transport issue or a more general problem and not specific for land transport)

6 General impression from the **WBAT-LTPS** (is there a serious lack of knowledge regarding the threat itself or is the threat well described, do affordable solutions exist to deal with the threat, is the information about possible solutions sufficiently disseminated among the people who need to know, are national or international standards and processes in place, do relevant authorities and first responders work successfully together)

7 **Connection to current policies** (is this “need/requirement” frequently mentioned in policy papers or is too new to be mentioned in policy papers or is it not considered to be a priority in policy papers)

On this basis a draft priority list was generated, discussed and agreed upon during a CARONTE workshop.

3. RESULTS AND GENERATION OF RESEARCH IDEAS

As a result of the process described above, the following priority lists were generated. The sequence of the items on the three individual lists is arbitrary.

Top priority issues:

- Staying operational in the event of a cyber-incident
- Timely and efficient threat detection (incl. Early threat detection in trains, stations and on track)
- Special security problems of railways as open systems

High priority issues:

- Balancing security requirements and privacy demands of passenger
- Security awareness of personnel and customers
- Crisis Management
- Security by design
- Security retrofit (ICT)
- Secure communication links for traffic control systems
- Protection of autonomous vehicles against cyber-attacks
- Secure critical infrastructures (cyber/road system)

Other important issues:

- Sharing of best practices among stakeholders
- Effective communication between companies, police and other administrations about threats
- Efficient security solutions (lifecycle costs)
- Sufficient financial support for the implementation of security measures
- Sufficient financial support for security research
- Applying the best security measures and technologies
- Securing legacy systems (physical)
- Secure critical infrastructures (especially tunnels and bridges)
- Data security / privacy
- User-friendliness of security systems
- Keeping pace with developing risks and threats
- Secure communication in freight transport chains
- Limiting damage in the case of an attack
- Professional security management
- Common standards and protocols for rail security
- Secure truck parking and protection of driving personnel
- Protection against inside threats
- Avoidance of dangerous routes or parking lots

The three top priorities and eight high priority issues were then analysed in more depth. For the remaining eighteen items classified to be important for land transportation security, short evaluations were generated.

These in-depth analyses of the 11 items identified to be of top or high priority was conducted in a five-step approach:

1. In a first step, **research projects** (with a focus on, but not limited to, European Framework Programmes) that had been identified to be connected to the individual topics were re-visited, and their relevance for a possible research agenda was thoroughly assessed.
2. In a second step, the research projects analysed were **clustered** to achieve a systematic overview of relevant research areas.
3. In the next step, available **research roadmaps and policy papers** and additional documents were analysed.
4. The fourth step compared the relevant **threats and gaps** of land transport (identified during the course of the CARONTE project) of this top or high priority area with the research activities and priorities identified in steps 1 to 3. Consequently, threats and gaps not sufficiently covered were identified.
5. The final step consisted in the description of **urgent research needs and possible approaches**, based on the information obtained in the previous steps.

Thus, the final output of this in-depth analysis is a list of research needs or research ideas how to overcome the security gaps identified in and around these 11 top and high priority areas described above. The last task of the CARONTE project was to sort these research ideas along the lines of the European security research programme. More than 20 research ideas are presented for the “Fight against Crime and Terrorism” (FCT) area, a total of 15 in the areas “Critical Infrastructure Protection” (CIP) and “Disaster-resilience: safeguarding and securing society” (DRS), and more than 20 ideas that address the “Digital Security Focus Area” (DS). A summary of these research ideas is presented in Fig. 3 to 5.

4. CONCLUSION

All in all, the CARONTE project has achieved its goal of providing input to strategic research planning in the domain of land transport security. Information from more than a hundred experts was collected through various methods, more than 120 ongoing and recently completed research projects were evaluated, and a large number of relevant policy papers and research programmes were analysed. This complex information was sorted and processed in a transparent way in order to obtain research ideas that are highly relevant for current and future strategic research planning. These ideas have been categorized and are presented in a way that allows an easy uptake in the strategic research planning processes of the European Commission and other authorities.

The CARONTE Consortium hopes that the work performed during this project will provide inspiration to all persons involved in security research planning, especially in the domain of land transportation.

REFERENCES

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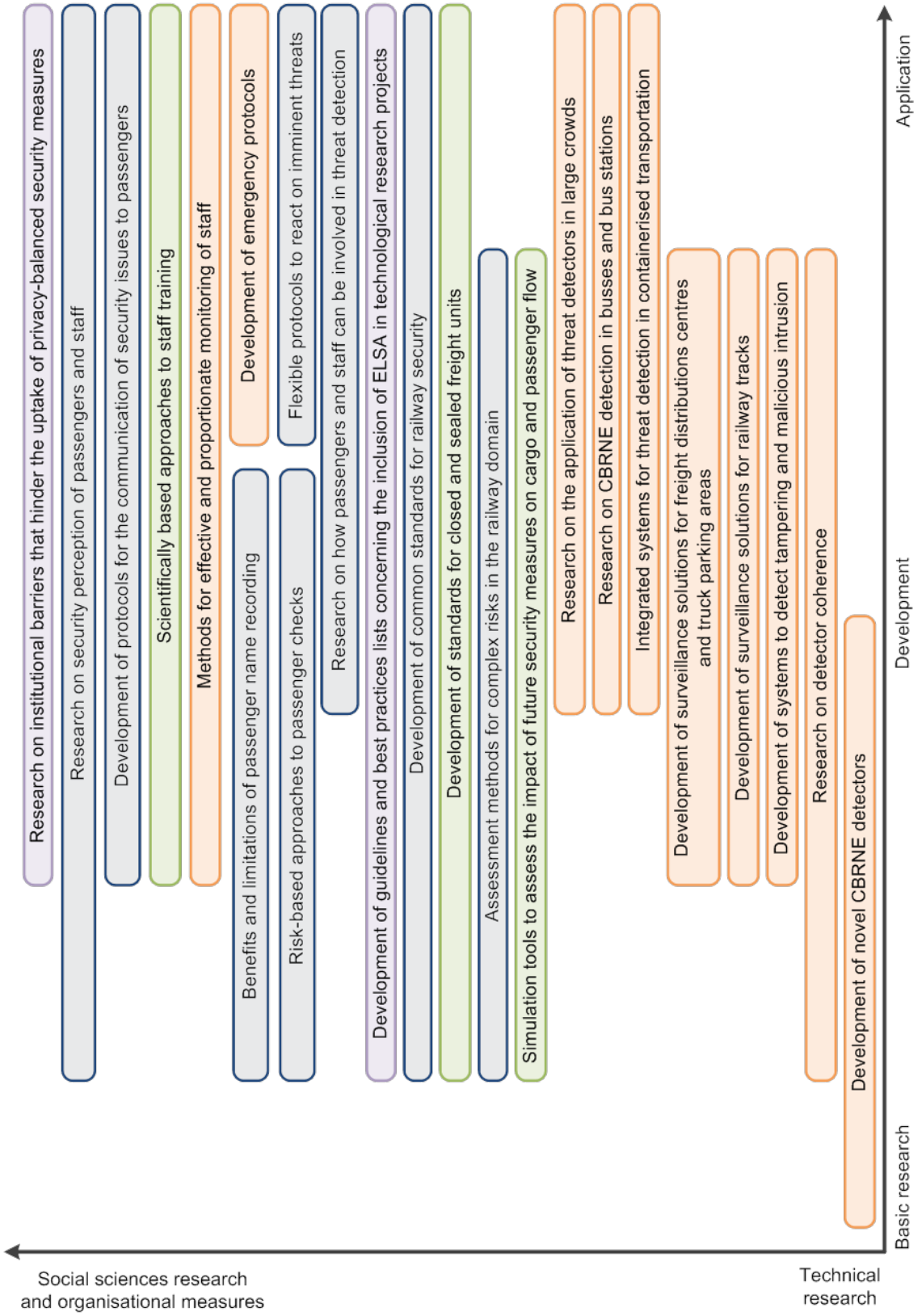

Figure 3: Tentative roadmap for “Fight Against Terrorism” (FCT) (the blue items relate to railway security, the orange items relate to threat detection, the purple items relate to balancing security and privacy, the green items relate to other domains)

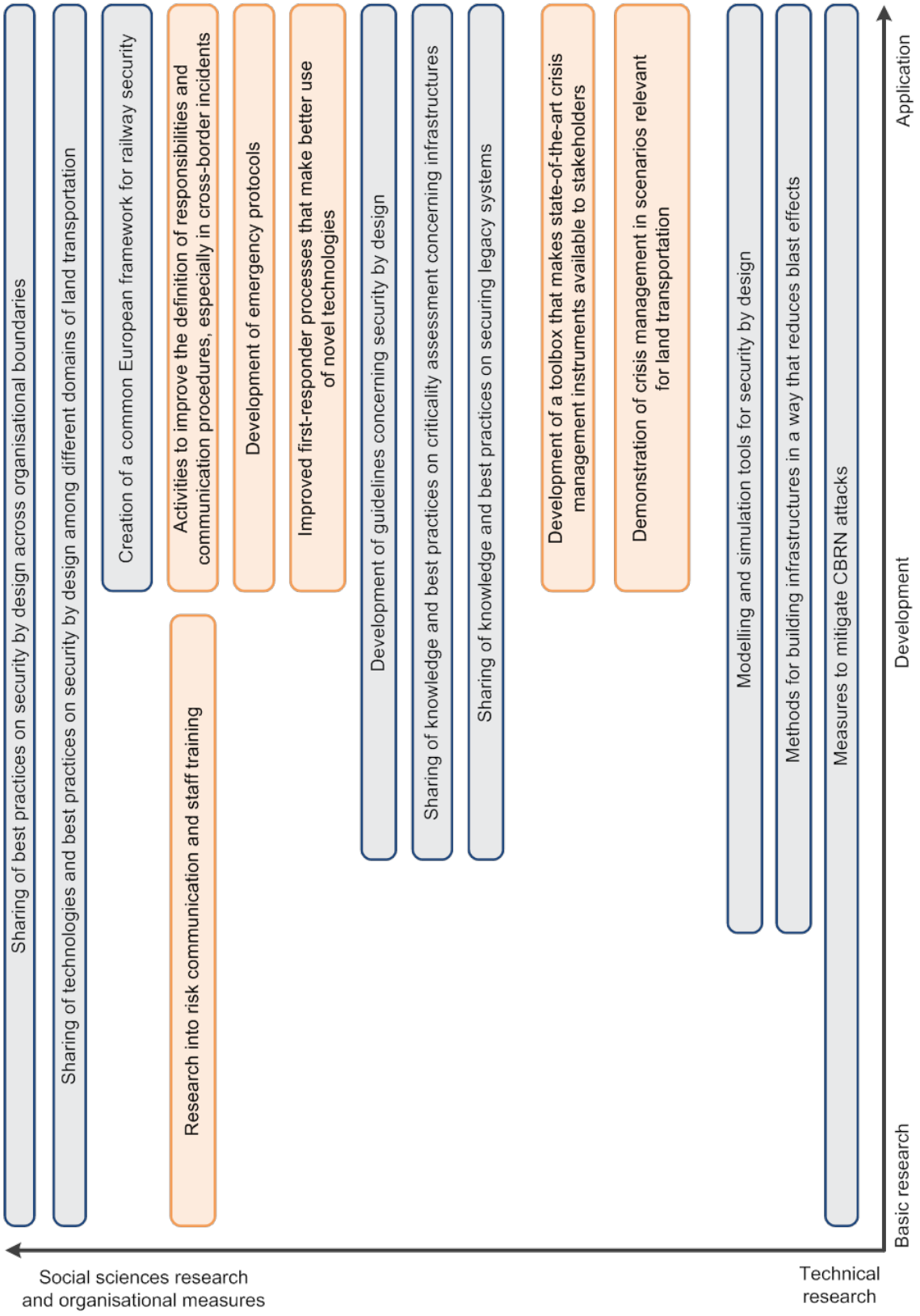

Figure 4: Tentative roadmap for “Critical Infrastructure Protection” (CIP) and “Disaster-resilience: safeguarding and security society” (DRS) (the blue items relate to incident prevention and threat mitigation, the orange items relate to crisis management)

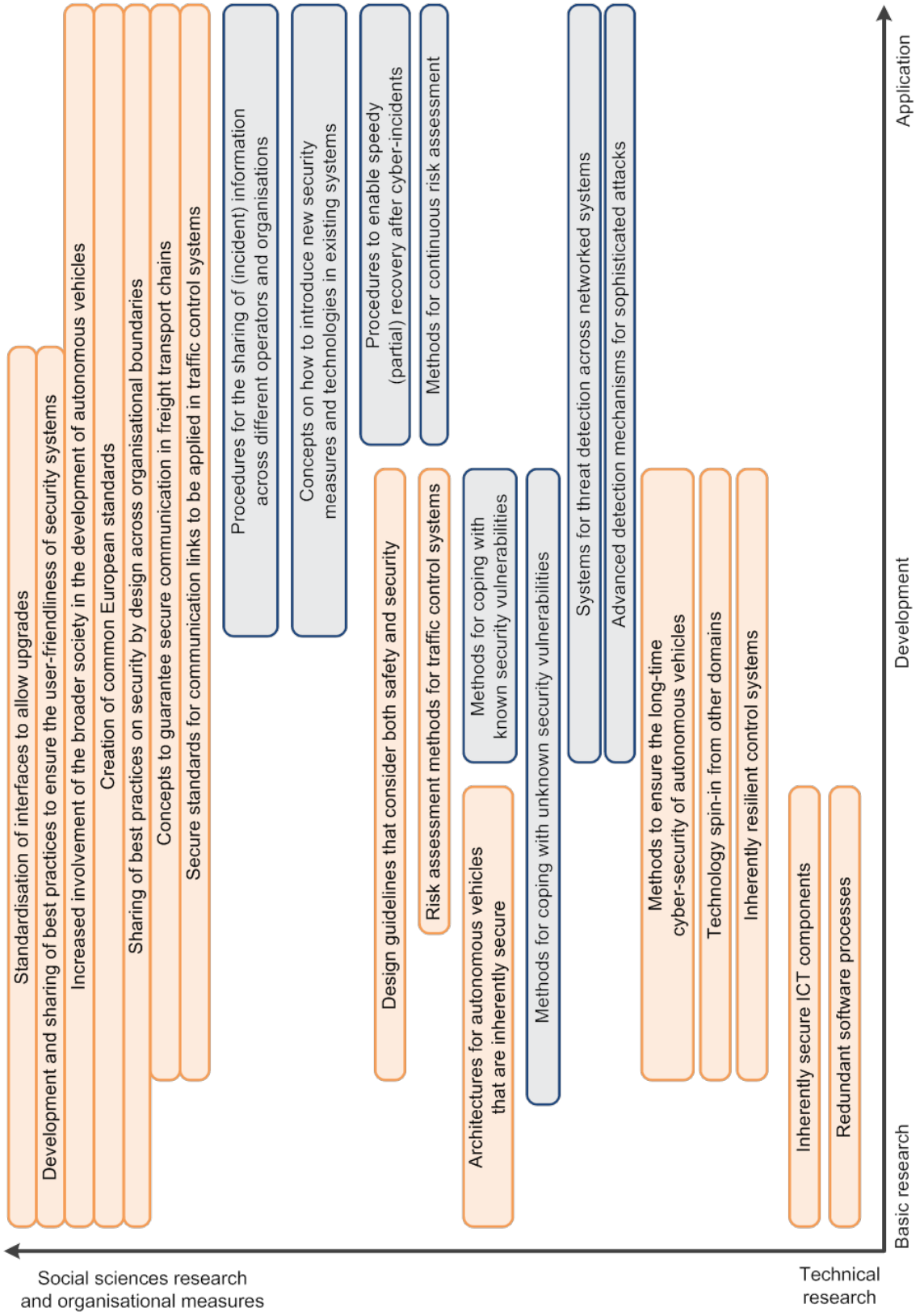

Figure 5: Tentative roadmap for the “Digital Security Focus Area” (the blue items aim at securing existing systems, the orange items aim at securing future systems)