collected in real time. This is an amazingly positive point because it means that everything could be monitored and even replayed on demand to analyze, visualize and exploit the exercise. This should allow on the one hand to improve the exercise but of course, on the other hand, to improve the plan as a whole (including the skills and know-how of the people).

PERSPECTIVES OF THE EGCERSIS RESEARCH PROGRAM

From the point of view of the EGCERSIS research program, the potential results of the program would lead to a revolution in the domain of security and safety of industrial critical sites. Roughly speaking, the *frequency*, *quality*, *realism*, *coverage,* and *exploitability* of exercise could simultaneously be increased. This is definitely a very promising avenue for the improvement of (i) internal/external plans and (ii) efficiency/effectiveness of actors involved in crisis management (first and second aid as well as external responders). Such an improvement of the preparation phase of such critical industrial sites would consequently improve the resilience of the industrial system impacted. This perspective is clearly the most important of the EGCERSIS research program. Besides, it opens a full business market for Virtual Reality companies.

Another interesting avenue of the EGCERSIS research program is the possibility of having the virtual environment used for evaluating, testing, practicing not only plans and processes, but also new tools and new technologies. Actually, the virtual nature of the played exercise allows considering exploiting absolutely any type of data generated by the virtual environment. Thus, it would be of great benefit to check if the indoor geo-location of responders (which is a very trendy expectation that could completely and perfectly be simulated in the context of a virtual exercise) would help considerably or marginally crisis management. Similarly, it could also be very interesting to plug any new technological platform to the virtual environment (through a configuration and filtering tool, as presented in Figure 4, dedicated to simulating which data should actually be transmitted to the evaluated platform). For instance, within the EGCERSIS research program, it is planned to create and evaluate a new version of RIO-Suite. This version of RIO-Suite would be based on a virtual environment as well and would allow the decision makers to move in a virtual environment where the visualization and the decision-making would be easier. In this context, the configuration and filtering tool would be in charge to simulate what kind of data RIO-Suite should actually be fed with. The kind of data that RIO-Suite is able to use is presented in (Benaben et al.). The very interesting point is that all the data could entirely be obtained through the virtual environment.

The last perspective considered in this article concerns the extension to other exercises than the one in critical industrial sites. This first target is mainly due to the fact that these sites are legally obliged to run crisis management exercises and have consequently all the required material (plans, maps, scenarios, etc.) and a lot of interest for the EGCERSIS research program. However, if the process becomes seamless and effective, if the benefits are obvious and if the efficiency of preparation is clearly demonstrated, other sites could be considered: critical infrastructure (airport, train station, etc.), overcrowded site (touristic place, public building, university, etc.) and any place that potential users (responders but also homeland security stakeholders) would like to study.

CONCLUSION

The EGCERSIS research program is dedicated to creating a breakthrough in the way crisis management exercises are conducted. This domain of the *preparation* phase definitely suffers from a lack of effectiveness and efficiency. For years now, the classical yearly exercises, with simulated imaginary damages and casualties, have shown how disappointing they can be. These exercises, even if most of the time mandatory, are really far from the results they should bring. As a consequence, the *response* phase which is supposed to be a combination of a majority "implementation of the results of the preparation phase" and a minority "improvisation due to the specificity of the faced situation", can often be considered as a majority "improvisation" and a minority "implementation". Virtual Reality opens completely new perspectives: allowing, on the one hand, to replicate the real world to perform experiments in real size without any barriers, and on the other hand to forget about the real world in order to create completely free interfaces benefiting from the realistic physical environment but independent from the constraints of the real world. This new world of VR should be investigated with both these visions.

REFERENCES

Ardila, L., Perez-Llopis, I., Palau, C., Esteve, M. (2013) LVC Training Environment for Strategic and Tactical Emergency Operations, *Proceedings of the Tenth International Conference on Information System for Crisis Response and Management*, Baden-Baden, Germany.

Atlay, N., Green, W. (2005) OR/MS research in disaster operations management, *European Journal of*

WiPe Paper – Protecting Critical Infrastructures in Crisis Situations
Proceedings of the 16th ISCRAM Conference – València, Spain May 2019
Zeno Franco, José J. González and José H. Canós, eds.   1267