



Antonio Juan Briones Peñalver

Department of Business Economics. Faculty of Business Studies. Technical University of Cartagena (UPCT). Calle Real 3, 30201, Cartagena (Murcia), (e-mail: aj.briones@upct.es).

THE ECONOMICS OF SECURITY AND DEFENCE. TRANSFER OF KNOWLEDGE AND INNOVATION RELATED TO THE DEFENCE INDUSTRY

The objective of this paper is to provide a definition of the economics of security and defence and its basis within the framework of a research study in companies belonging to the defence industry. It will analyse the security and defence economy and cooperation relationships among organisations, which were the subject of our doctoral thesis. One of the key points addressed in the article highlights defence's role as an agent of Research, Development and Innovation (R&D&I). Emphasis is placed on the transfer of technology from defence to civil applications, known as dual-use technology. We believe that pooling the knowledge of organisations by means of strategic alliances is vital for the transfer of technology from the defence sector. European Union security and defence strategies are other aspects that the paper examines. Our aim is to highlight the importance of collaboration between defence and civilian society through closer economic ties and the knowledge transfer that results from R&D&I. On the other

hand, we stress the dynamic role played by companies that gain a competitive edge from the economic value of defence and thereby render the civilian use of such technology possible. In essence, the innovation that stems from national defence is extremely important for business performance.

Defence economy, Cooperation relationships, R&D&I (Innovation), National defence, Defence industry, Knowledge, Civil technology, Dual-use technology, Strategic alliances, Strategy, Competitive advantage, Business performance

THE ECONOMICS OF SECURITY AND DEFENCE. TRANSFER OF KNOWLEDGE AND INNOVATION RELATED TO THE DEFENCE INDUSTRY

I: INTRODUCTION

Today, “knowledge transfer” is seen to be the vertex of the defence sector’s organisational pyramid, revealing the strategic management of the companies with which it interacts. In this respect, General Ballesteros¹ affirms that knowledge transfer explains capacity-based strategic planning and the pre-eminence of effective decision-making within the defence function. Academic research regards knowledge management as “the art of creating value with the intangible assets of an organisation”². This is all based on a model where a competitive advantage derives from the creation, acquirement, storage and dissemination of knowledge emerging from organisations where this represents the central basis for managing intangible assets.

The outcome of this relationship consists in processing information using new knowledge of greater added value. It thus follows that firms, aware of the importance of the management of the intangible assets, have placed their bets on the evaluation of intellectual capital as an appropriate organisational response to achieve better results and lasting competitive advantages over time.³

To achieve this, organisations require all knowledge to be externalised through business-to-business cooperation relationships whereby people disseminate the knowledge they have beyond their company, sharing their know-how and expertise. Today, with a view to technological development, it has been pro-

1 BALLESTEROS, M.A. “La transferencia mutua de conocimiento Defensa-Sociedad. El proceso estratégico”, Ciclo de Conferencias “*El papel de desarrollo y transferencia tecnológica de la Defensa y las Fuerzas Armadas en el Sistema de I+D+I*”, Autonomous University of Madrid, Spanish Institute for Strategic Studies, Madrid, 2010.

2 MARTÍNEZ, A.; CEGARRA, J.G. AND SÁNCHEZ, M.T. “*Managing Environmental Knowledge as a Way to Improve Business Performance*”, Managing Services in the Knowledge Economy (MSKE), Universidad Lusíada de Famalicão, Portugal, 2009.

3 BUENO, E.; JERICÓ, P. AND SALMADOR, M.P. Experiencias en Medición del Capital Intelectual en España: El Modelo Intelec. In Bueno y Salmador (eds.). *Perspectivas sobre Dirección del Conocimiento y Capital Intelectual*. Instituto Universitario Euroforum Escorial, 2010 pp. 111-121.

ven that the sharing of knowledge between organisations by means of alliances is a successful way of fostering a communication interface with the outside world and is key to business success since it allows unique skills to be acquired⁴.

These business relations that give rise to network organisations may be established by means of contractual relations, whether formal or informal. On the basis of this model, it is reasonable to believe that new cycles of learning and knowledge cycles will commence, in which interrelationships enable the procurement and distribution stages to also generate new knowledge⁵ as this is disseminated among the agents of an “R&D&I defence system”. It is thus envisaged, when processes lead to situations of economic downturn, as is currently the case, that the “knowledge society” be developed as a more advanced stage vis-à-vis the information society.⁶

This would also encompass business development with the aim of achieving a National Defence Knowledge and Innovation System with a focus on certain technological, social and economic aspects in order to overcome the “challenges that remain”⁷.

By means of introduction, the paper shall provide a definition of the economics of security and defence, and what underpins it, as a preliminary outline, since academic, scientific, and university literature on the matter is scant. The concept of the economics of defence in the context of business economics, which in turn relates to defence or the defence industry, has affinity with the cooperation relationships that exist between organisations, strategic alliances, management of knowledge and the economic value of innovation and the R&D linked to dual-use technology associated with the security and defence industry. There is a vacuum of literature devoted to this area of economic thinking and its sources, as regards what is understood as “the economics of security and defence” and the economically valuable knowledge generated by national defence R&D activities that merits our attention and further research.

At an initial stage, we consider that the economic decision -of what to produce

4 BRIONES, A.J. “Determinantes estratégicos en el modelo de modernización de las fuerzas armadas y sistemas de defensa. Análisis de los procesos de cooperación con organizaciones externas”, *Doctoral Thesis*, Technical University of Cartagena (UPCT), 2007.

5 CEGARRA, J.G. AND RODRIGO, B. “Influencia de los Componentes del Capital Humano en el Proceso de Aprendizaje Relacional”, *European Research on Management and Business Economics (IEDEE)*, Vol. 9 (3), 2003, pp. 187-210.

6 BUENO, E. AND SALMADOR, M. P. “Análisis Interdisciplinar de la Función y Proceso de Innovación en un Modelo Económico Evolutivo y Sostenible”, *AECA documents*, (2010).

7 BUENO, E. “La urgente evolución de la sociedad de la información a la sociedad del conocimiento: El reto de la innovación”, *Boletín Intellectus*, (electronic version www.iade.org), 16, April 2010a, pp. 17-25.

and for whom- may be taken, either by the market or by an agent responsible for economic planning. Effectiveness, accountability and transparency form the essential foundation of any institutional planning and management of public funds. In particular, the public defence sector, given its importance within Europe, both due to its economic bearing and the number of people it comprises, as well as the diverse range of goods and services that it entails, requires a planning and information system providing quality and accountability with a view to ensuring good governance. Therefore, the realities of national defence necessitate examination of the “*economics of security and defence*” to account for the costs it implicitly bears, as well as additional analysis of the efficiency of resource management and the major technological advances related to the defence industry.

In light of the above, and bearing other factors in mind, companies with links to the public defence sector deserve to be considered a dynamic business sector and as agents of “R&D&I” in the context of the wider economy. That is to say, a major catalyst for business innovation activities in the pursuit of improvement to the goods and services offered by the companies that interact with the defence sector across the whole of industry.

Finally, as a consequence of collaboration between military and civil R&D, technological innovation specific to the defence sector has developed that in turn facilitates development and social well-being for the system within the economy as a whole⁸.

Therefore, in this article, by introducing the concept of “economics of security and defence”, and the areas in which this new economic concept plays a role, we stress the importance of the defence sector’s collaboration with society and civil demands. In this regard, through the economic approach of the national defence sector and the knowledge transferred to industry, innovation and excellence are considered to be economic strategies that entail business R&D&I results. Likewise, technological knowledge from R&D activities within defence may be of great economic and social value if applied to civil use.

2. DEFINITION OF THE ECONOMICS OF SECURITY AND DEFENCE.

The *modernisation* of the armed forces arises from the new notion of defence as a state function that benefits society, where its continued evolution is indispensable; both with respect to its structures and to the resources needed for it to carry out its

8 BUENO, E. “El Papel del Desarrollo y Transferencia Tecnológica de la Defensa y las Fuerzas Armadas en el Sistema de I+D+I”, in Briones, A.J. (Dr): *Aula Abierta y Foro de Estudio de Seguridad y Defensa*. Technical University of Cartagena (UPCT), 2011.

activities adequately⁹

This modernisation process leads to the continued socio-economic development of the organisation itself in such a way as to:

- a) maximise *defence logistics*, thereby establishing certain criteria for the effectiveness of this organisation in terms of staffing;
- b) provide support for *defence system procurement* (resources, equipment and infrastructure);
- c) promote higher quality over quantity (fewer soldiers and more technical experts);
- d) boost specialisation as compared to diversity;
- e) promote rationalisation and restructuring, which will make increased material resources available; and
- f) increase budgetary resources.

These overtones to the modernisation of the armed forces give rise to reflection on what we understand by the “*economics of security and defence*” today. Application of the economic discipline within the defence sector is riddled with challenges. Along the way towards this, it becomes clear that “at the outset of modernity, the field of economics was based on the values provided by land and labour”¹⁰

The authors reiterate that “production and wealth are linked to these values” and to “political economy”. Likewise, these Portuguese academics¹¹ underline that “the economy, dematerialised by new technologies, widens the distance separating human beings and disassociates the concept that they had of human nature and other humans”; namely, the grandeur associated with political economy.

On that account, if one considers political economy -or “economic science”- to be the relationships between people, values and the factors associated with the labour that generates wealth, the “*economics of security and defence*”, should also be deemed a discipline. It can thus be defined as “*the result of partnership between the security and defence means and resources that find their origin in the state, whereby they are made available to society and serve to benefit a region’s well-being*”.

⁹ BRIONES, A.J., 2007, op.cit.

¹⁰ COVAS, A., AND COVAS, M.DAS M. *Modernização Ecológica, Serviços Ecosistémicos e Riscos Globais. Ruralidades V*. Universidade do Algarve, Portugal, 2010, pp. 17.

¹¹ COVAS, A Y COVAS, M.DAS.M, 2010, op.cit

The outcome of this vision of the “economics of security and defence” requires that the modernisation of the armed forces be considered as the aspect that improves the efficacy of the use of the resources allocated to defence services. The Strategic Defence Review means that this ministry has augmented its command and control capacity, thereby reaching a high level of technology. In parallel, it has enhanced armed forces intelligence. All of this serves to guarantee national and international security and defence, allowing Spain to participate in joint military operations.

3. THE BASIS OF THE ECONOMICS OF SECURITY AND DEFENCE.

The art of *management*, in reference to both the public sector and the defence sector, has two more explicit objectives:

- (1) upholding citizens’ fundamental rights
- and (2) facilitating the provision of basic services to a welfare society¹².

On the other hand, for management within an institution such as the armed forces, the Ministry of Defence follows the economic guidelines below, drawing a distinction between the “*modernisation of logistics*” and the “*rationalisation of defence*”. The following section shall describe the different domains of this organisational model associated with the economics of security and defence.

Firstly. The *modernisation of logistics* during the life cycle of system acquisitions (arms systems, infrastructure, and information and telecommunication systems) calls for the optimisation of capabilities within their joint action, encompassing the following general principles:

- 1) addressing the logistical process in its respective phases (planning, programming, budgeting and implementation);
- 2) organising defence around joint action, coordinated by the Ministry, without distinguishing between its three armed forces;
- 3) exploiting the huge potential that exists for the negotiation of contracts with different companies, with a view to achieving the status of preferential client;
- and 4) undertaking system maintenance, using an overall approach by means of the organisation of logistics activity and the examination of the different aspects of armament programmes –operational, technological, industrial, economic or others–

12 GONZÁLEZ, M.; HUERTA, J.; LÁZARO, J.F., AND MUÑOZ, A. *Eficiencia en la gestión de recursos, proyectos y contratos de la Administración Pública. Especial referencia al ámbito de la Defensa*. Instituto Universitario General Gutiérrez Mellado-UNED, 2008, pp. 111.

with the involvement of multidisciplinary teams of experts.

Secondly. As regards the *principle of rationalisation of defence* and the reorganisation of material resources, it is essential to account for the large amount of fixed assets that the armed forces possess and the wide-ranging and demanding maintenance requirements thereof. Optimisation of their use and their proper organisation can lead to reduced costs and, consequently, boosts resources for other activities such as peacekeeping.

Against this background, the concepts of security and defence currently warrant complex management remedies in favour of good governance of the assets held by a defence organisation, with efforts made in various areas of its economic management, *inter alia*, human resources, investment, procurement, outsourcing, regulation of the industrial sector and of movable assets. This leads one to believe that Adam Smith was correct when he stated that military institutions governed economic growth¹³

In this regard, the first contemporary economist justifies the need to examine the *economics of security and defence* in greater depth, alluding to the fact that the institutions created to work towards the aim of the betterment and well-being of nations, require an industry to support them to emerge.

Recently, it has become evident that security, economic development and human freedom are inseparably entwined¹⁴. The perils of insecurity are directly ascribed to environmental deterioration, underdevelopment, overpopulation and the violation of rights in general. The four areas that are closely connected to military security are politics, economics, social aspects and environmental aspects¹⁵. Professor Bueno¹⁶ highlights the role of the armed forces in the knowledge society, as they act as a key agent for the development of R&D, the generation of innovation and the transfer of technological assets to the companies with which they have links. As a result, military defence is directly related to the economy in terms of human, economic and social development. It thus merits the attention of researchers and academics, as well as of civil and military strategists.

4. DEFENCE AS AN AGENT OF R&D&I.

13 HACKER, B.C. "Regularity order, and prompt obedience. On military institutions in enlightenment thought", *Actas del XVII Conferencia Internacional de Ciencias Históricas*, Vol. I, 1990, pp. 159-167, Madrid.

14 TOMÉ, L. "Segurança e complexo de segurança: conceitos operacionais", *JANUS.NET, e-Journal of International Relations*, Vol. 1 (1), Autumn, 2010, pp. 33-49.

15 BUZAN, B. *People, States and Fear: An Agenda for the International Security Studies in the Post-Cold War Era*. Boulder, Colorado: Lynner Rienner, 1991, pp. 19-20.

16 BUENO, E., 2011, op.cit.

The twenty-first century presents a myriad of challenges in the field of international defence where research relating to a culture of national defence is a priority in order to improve citizens' knowledge and the dissemination of information about the “*challenges of the strategic transformation and modernisation of the armed forces and the role of defence as an agent of R&D&I*”.

Faced with this backdrop of transformations to national defence, the main areas of activity for intelligence and knowledge are as follows:

- (1) training, professionalism and voluntarism of armed forces staff;
 - (2) the nature of risks, threats and global conflicts;
 - (3) restructuring, rationalisation and modern, sustainable technology;
 - (4) joint international missions;
 - (5) military intervention as part of international networks;
 - (6) humanitarian aid and military stabilisation;
 - (7) European security and defence policy;
- and (8) civil and military international cooperation.

All this is necessary to raise awareness of and publicise the role of the armed forces and armies as part of a multidisciplinary model for security and defence.

The analysis of the modernisation and professionalisation process of the armed forces undertaken over the last twenty years, the establishment of a European Common Security and Defence Policy, the National Defence Directives and the Strategic Defence Review are some of the aspects that justify broadening knowledge of the key factors at play in the change process within the defence sector, also known as the defence industry. With this purpose in mind, a study was undertaken to link the field of national defence with civilian and military industry.

Collaboration between industry and the defence sector and the various R&D programmes of the agents involved, both military and civil, illustrates the new focus on society. As well as being a techno - scientific alliance, put into practice by means of knowledge transfer and R&D cooperation, it is worth highlighting the role of the armed forces in economic transformation and value creation as well as the exchange of knowledge between agents¹⁷. Nonetheless, there continues to be little academic literature addressing modernisation and professionalisation determinants

17 BUENO, E. “*Conocimiento e innovación para dirigir situaciones complejas de cambio y crisis*”: Hacia un modelo económico evolutivo-sostenible”. In Micheli, J.; Medellín, E.; Hidalgo, A. and Jassó, J. (Coordinators). *Conocimiento e innovación: un reto ante el cambio y la crisis*, Plaza y Valdés, Mexico (forthcoming publication), 2010b.

for the armed forces and defence systems. There are also very few academic texts dealing with the underlying strategic driving forces as grounds for concluding that national defence is a real R&D&I agent.

This situation makes reliance on firms related to the defence industry necessary, incorporating the armed forces and defence systems into the knowledge and innovation society, wherein the defence industry is committed to innovation and business excellence measures; i.e. quality and corporate social responsibility. The national defence sector will be able to reach its military modernisation and professionalisation targets by means of these interorganisational relations, cooperation and the establishment of strategic alliances.¹⁸

Based on the elements considered as part of an analysis of “the cooperation processes of companies relating to the defence industry¹⁹”, a research study (doctoral thesis) sets out innovation and excellence measures (corporate social responsibility and quality). These provide results on the basis of organisational variables, which make up a business landscape that is significant to an industry that has adapted itself to the changes brought about by the modernisation and professionalisation of the defence sector.

This study outlines the new Approach for Defence Organisation (EOD), addressing the socio-economic and military results that institutional change within the armed forces and defence systems gives rise to as a result of the modernisation policy of the Ministry of Defence. The repercussions of these measures are apparent in different areas (technological, social and economic fields) and thus concern all of society.^{20 21}

Some of the considerations outlined in the research study call attention to various aspects of a strategic and economic nature such as “success and good performance, outstanding practice, culture, conscience, ethics, innovation” etc. These serve to formulate factors and components to denote indices for innovation and business

18 BRIONES, A.J. AND LABORDA, F. “Capacidades de innovación tecnológica en empresas relacionadas con la Industria de Defensa”, *Revista de Economía Industrial, Ministry of Industry, Tourism and Trade*, Vol. 378, 2010, pp. 135-146.

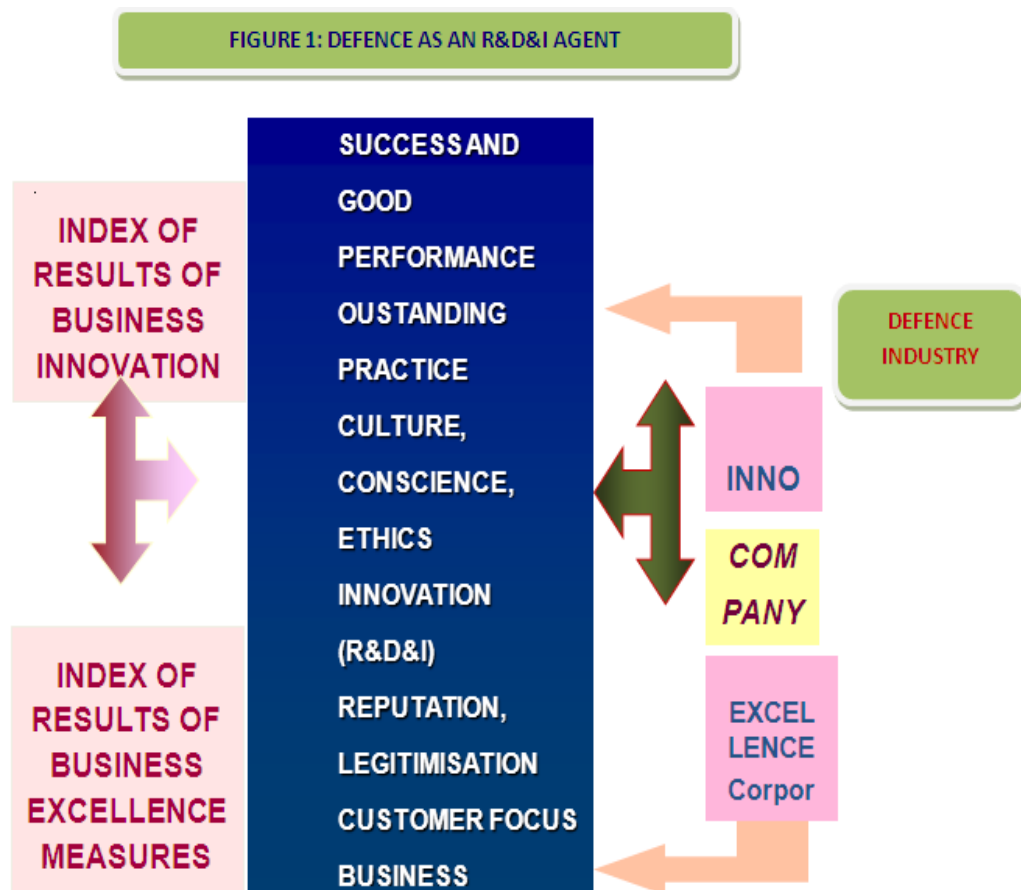
19 BRIONES, A.J. *Gobierno en la Industria de Defensa. Estudio de Investigación de los Procesos de Cooperación entre Organizaciones*. Diego Marín, L.E. Murcia, 2009a.

20 BRIONES, A.J. “El Nuevo Modelo de Fuerzas Armadas y la Industria de Defensa”, pp. 25-39. In Briones, A.J. (Dr): *Gobierno en la Industria de Defensa. Aula Abierta y Foro de Estudio de Seguridad y Defensa*. Diego Marín, L.E. Murcia, 2009b.

21 BUENO, E. “Ciencia, Defensa y Sociedad. Una reflexión sobre estrategia, I+D, y Buen Gobierno”; pp. 15-24. In Briones, A.J. Coordinator, “Gobierno en la Industria de Defensa. Aula Abierta y Foro de Estudio de Seguridad y Defensa. Spanish Ministry of Defence and Technical University of Cartagena (UPCT), D.M. Librero Editor, 2009.

excellence, measured by the importance of the variables used in the doctoral thesis research questionnaire, and which result in findings that are significant and characteristic of the firms that have contractual relations with the Ministry of Defence (see Figure 1).

In this case, defence as an agent of R&D&I provides companies active within the industries of the sector with a strategic vision in terms of innovation and excellence (social responsibility and quality), which are reflected in improved business performance and in their competitiveness or competitive edge. These are the factors that determine the armed forces' modernisation policy.



Source: Prepared by the author

5. ECONOMIC INTERORGANSIATIONAL RELATIONS

Interorganisational relations improve the link-up between science and technology, foster the emergence of science-based industries and encourage companies to utilise science to gain a competitive edge. They can be understood as a system of aspects that maximises economic revenues and the assets of corporate groups. Strategic management considers interorganisational relations to be highly significant since a

company carries out its activities in open systems that depend on their environment for survival and to meet objectives.

The armed forces use interorganisational relations due to the benefits that these deliver, and due to the need to engage with firms in the industry, just as the destinations of economic resources within defence budget demonstrate. Accordingly, these may be formed to carry out any activity along the value chain of the organisation of the armed forces, such as their supply operations in times of war. The military companies sector is of great interest for international security, both in terms of geographical extension as well as diversification of products/services and turnover²². In this case, the use of interorganisational relations is warranted on the grounds of economic logistics for military supply chains.

On the other hand, the recompenses associated with the procurement of foreign material have evolved into a system of industrial cooperation and economic business relations. This transformation has its origin in experience; and close cooperation with the Ministry of Defence in a network with suppliers²³, as well as the setting up of strategic “joint ventures”²⁴.

This text shall draw up a handful of proposals and recommendations for establishing interorganisational relations and strategic alliances that are the result of the research study chosen as a reference point. These are set out below:

- Inter-company cooperation is a valid strategic option with respect to other growth possibilities and is invaluable to 21st century organisations.
- Cooperation determinants are confidence, commitment, flexibility, communication, coordination and control in the light of potential conflict situations.
- A network is an organisational structure that responds to a new style of management, as well as to new ways of organising relations between companies.
- ICTs have become the main tools for the implementation of processes for inter-company cooperation and for the development of interorganisational networks.
- Interorganisational relations take place with a view to cutting costs, boosting

22 POZO, P. “La privatización de la formación militar y policial en programas internacionales de Reforma del sector de la seguridad”. In *Fernández, J.J.; Jordán, J., and Sansó-Rubert, D.: Seguridad y Defensa Hoy*. Plaza y Valdés Editores, Mexico, 2008, pp. 178.

23 BUENO, E., 2009, op.cit.

24 NAVARRO, E.G. *Externalización y financiación privada en el sector defensa (EPR)*, Executive Report, Información de Defensa y Seguridad (IDS), Madrid, 2003.

technological progress and enhancing shareholder prospects by the use of collaborative ICT tools.

- Willingness to cooperate with the Ministry of Defence depends on prior experience, the creation and exploitation of synergies and the potential to boost business performance.
- The business attitude demonstrated in relations with the defence organisation depends on the streamlining of activities as part of the new armed forces model and a lack of difficulties connected with Ministry of Defence public procurement.
- The innovation strategy and excellence measures produce business results as part of the Defence Organisation Approach (EOD)
- Business specialisation is positively associated with performance, interorganisational relations and the enhancement of cooperation agreements.
- Specialisation has an impact on the degree of innovation, social responsibility measures, total quality management and continuous quality improvement.

6. EU STRATEGY ON ECONOMICS OF SECURITY AND DEFENCE

The *strategic shift* makes it necessary to advance the view that our security is inextricably linked to that of neighbouring countries and of other countries located in areas of high economic and strategic interest. Today, the joint action strategy finds expression in the political project of the construction of a European defence and security area. The conflicts that now arise exhibit specific characteristics that call for solidarity and the creation of an external force to resolve them, usually a multinational one. In order to achieve this, national defence necessitates the participation of all activities suitable for cooperation²⁵, together with an economic and organisational structure that accounts for its three major components: military defence, economic defence and civil defence (civil protection). These, once coordinated, constitute a body of measures and resources tailored to the specificities of the country and its cooperation possibilities²⁶.

25 ALONSO-BAQUER, M.; GARCÍA, J.; VERGARA, J.A., AND BLESÁ, P. “Aspectos de la seguridad y defensa en el Mediterráneo: información, globalización y conflictos”, VI Ciclo de Cultura de Defensa, *Aula de Cultura e Historia Militar Comandante Villamartín, Fundación Emma Egea*, June, Cartagena, 2003.

26 MATEO, L. (1996): “Relaciones de causalidad entre economía y defensa nacional en España. Análisis de dependencias y vulnerabilidades económicas. In *Dependencias y Vulnerabilidades de la Eco-*

The issue of financing always constitutes a major economic hindrance, as does the problem that arises from the technical capacity demonstrated by the troops made available by the forces involved in conflicts. In order to tackle both of these concerns, it is advisable to promote international agreements and to establish fora for expression such as “*international cooperation development*” between the coastal countries of the Mediterranean and neighbouring states, who in this way express the continuing concern of their governments about defence industry firms and EU defence systems²⁷.

García-Pérez²⁸ analyses the process of linking security and defence policy on a European stage (ESDP) and identifies particular concern about clarifying several socio-political factors that will shape the results achieved as part of the institutionalisation of European defence policy with a view to integrating the countries of Europe and providing them with collective powers through European Union efforts. The definition of European security encompasses first of all European states, as well as countries outside of Europe including, undeniably, the United States and intergovernmental organisations that require economic security.

In this respect, EU Member States endorse the progressive improvement of their military capabilities in the treaties of the European Union. Likewise, in order to carry out their missions, they may establish “*Permanent Structured Cooperation*” within the EU framework. The important decision to create a European Defence Agency was to contribute significantly to achieving these goals²⁹. Research into the economic reactions and behaviour of organisations is thus relevant, as are the effects of these institutions on corporate structures, which may be bound to the aforementioned structure for cooperation among the defence systems of the EU. The White Paper and government decisions on the military capabilities necessary to guarantee security defence determine, with due regard to international commitments, the main focal points in terms of security and the financial resources that defence policy necessitates.

Military capabilities are developed through an operational command structure, which is composed of integrated systems involving the army, navy and air force. These complement one another and, since their joint use is envisaged, they have the means at their disposal required for close coordination of their respective activities. The three forces will carry out the missions that may be assigned to each armed force and shall enable specific missions to be undertaken in times of peace. The preparation of these

nomía Española: Su Relación con la Defensa Nacional. Strategy Dossiers. Spanish Institute for Strategic Studies. Second Section: Medios para la Defensa. CESEDEN (Spain). No. 80, 1996, pp. 57-78.

27 CANALES, A. “La seguridad colectiva como factor determinante del cambio estratégico”. *En Dependencias y Vulnerabilidades de la Economía Española: Su Relación con la Defensa Nacional. Strategy Dossiers*. Spanish Institute for Strategic Studies. Second Section: Medios para la Defensa. CESEDEN (Spain). No. 80, 1996, pp. 15-36.

28 GARCÍA-PÉREZ, R. *Política de Seguridad y Defensa de la Unión Europea*. Ed. UNED and Instituto Universitario General Gutiérrez-Mellado, 1st Edition, Madrid, 2003.

29 GARCIA-PEREZ. R., 2003, op.cit.

missions falls under the remit of the respective chiefs of staff: the Army Chief of Staff (JEME), the Navy Chief of Staff (AJEMA) and the Air Force Chief of Staff (JEMA), under the supervision of the Chief of Defence Staff (JEMAD). The three forces constitute a single System of Spanish Defence (SDE), which is structured around their specific doctrines and fields of action, in order to meet *security and defence* needs by means of a joint economic strategy, with strength pooled and community action undertaken among EU member states with their respective military capabilities.

7. INNOVATION STEMMING FROM KNOWLEDGE AND RESEARCH

Bueno³⁰ states that “in the new international geopolitical order, the process of innovation is what allows a dynamic to be created for the evolving nature thereof and enables sustainable development to be achieved in the coming decades”. Innovation is advancement applied to technological development as a result of research. A company will remain faithful to this principle as it seeks to improve through innovation, since the life cycles of products are getting shorter, clients more demanding and competition fiercer and these very same technological advances speed up the improvement process³¹. The “act of innovating” accelerates the construction of a new economic model based on a sequence of knowledge connections between the scientific world, technology and society or between agents and institutions³².

The Defence Technology and Innovation Strategy (ETID) contributes to the centralisation of knowledge management for research and development (R&D) activities, the prioritisation of strategic technological capacities, and the planning of R&D activities. The most relevant objectives pursued are: (1) research and technology (R&T) activities and technological innovation; and, (2) coordination and cooperation between agents for defence R&T activities. These considerations point to challenges and give certain bodies of the Ministry of Defence, such as the Directorate-General of Armament and Equipment (DGAM), the role of agents within the National System of Technological Innovation. In the same vein, scientific development is guaranteed by knowledge and research, promoting the participation of SMEs, universities and research institutes in defence R&T.

The Directorate-General of Armament and Equipment³³ defines six Functional Areas of Action (FAA) that link Research and Technology (R&T) to military needs,

30 BUENO, E., 2011, pp. 175, op.cit.

31 BRIONES, A.J. AND LABORDA, F., 2010, op.cit.

32 BUENO, E. “La Sociedad del Conocimiento: Una realidad inacabada”, in Micheli, J.; Medellín, E.; Hidalgo, A. and Jassó, J. (Coordinators). *Conocimiento e Innovación: Retos de la Gestión Empresarial*, Plaza y Valdés, Mexico, 2008, pp. 25-55.

33 DGAM, *Estrategia de Tecnología e Innovación para la Defensa ETID-2010*, Technical Secretariat General, Ministry of Defence; <http://www.o6o.es>, 2010, pp. 72.

and which cover the spectrum of technologies that are of interest to defence: armament, ISTAR (intelligence, surveillance, target acquisition, and reconnaissance), platforms, personal protection, protection of platforms and facilities, ICTs and simulation. What is more, this foresight activity seeks to identify threats and determine which technologies could be implemented to respond to them. Business-to-business cooperation and coordination with the civil sector facilitated by the Ministry of Defence will allow for the optimisation of available resources, thereby fostering technological advances and exploiting synergies. This forward-looking vision defines military technological capabilities and solutions arising from defence R&T and innovation linked to the challenges of tomorrow. The international cooperation programmes implemented by various industrial sectors are mirrored in the European Defence Agency (EDA), which enhances the international competitiveness of economic agents operating within a European Defence Equipment Market. A European security and defence consensus therefore exists and is put into practice by means of inter-company cooperation and strategic alliances in order to ensure military capabilities within the defence sector in the European Union and its member states.

8. THE IMPORTANCE OF THE TRANSFER OF TECHNOLOGY FROM DEFENCE R&D ACTIVITIES TO CIVIL APPLICATIONS

The national defence sector, in its role as an agent of R&D&I, has launched many different initiatives within an aerial, naval or ground context that have led to an *Integrated International Security Area* (hereafter IISA) that elicits technology transfer from defence R&D activities to civil applications. Spanish firms now participate in activities or studies relating to the integration of security systems, given the characteristics of technological innovation processes, by means of participation in international consortia or in the different European Commission framework programmes.

In Spain, the European Aviation Safety Agency (EASA) is responsible for the specific tasks of regulation and implementation in the field of aviation safety. Given the complexity and the breadth of the areas affected by the IISA's alignment today, for example, and for airborne platforms, the issue of Unmanned Aircraft Systems (hereafter, UAS) operating in non-segregated airspaces as integrated security systems has not yet been addressed. There are many initiatives that have been carried out, or that are currently in the development stage, within military and civilian organisations together with private sector collaboration; nevertheless, until the present day, these have not succeeded in making safe operation of UAS possible inside airspace shared with conventional aviation. The absence of a pilot or crew on board these aircraft makes them key elements of a successful IISA where missions are carried out from airports to conflict zones with the risk to staff at a bare minimum. In this way, and as

a compensating factor, these *international joint defence* initiatives are fostering aggregated research efforts in parallel with civil research, with the involvement of all technical actors. In addition, this establishes an international framework of knowledge and industrial capacity building, as well as some extremely favourable profitability prospects.

By the same token, technological advances in the fields of communication, in navigation and positioning, as well as an increase in processing capacity and reliability, have led to the development of an unmanned airborne platform system for civil use, not merely in a commercial sense, but also since this is open to other governmental bodies, such as security, border control and civil protection bodies.

The Technology Watch and Foresight System (hereafter SOPT) of the Sub-Directorate for Technology and Centres, which falls under the Directorate-General of Armament and Equipment, offers a general overview in one of its monographs of the development brought about by Electronic Warfare (EW) in Spain. This presents itself as the organisation that carries out the following activities:

1. continuous and systematic technology monitoring;
2. technology foresight, prioritisation of technologies and areas of interest for the defence sector;
3. support for R&D&I activity planning;
4. knowledge management;
5. technical assistance for the procurement of technology-based systems.

This system (SOPT) is currently a network organisation formed by nodes known as Technological Observatories. These are set up within specific fields relating to, *inter alia*, weapons systems, electronics, information technology and robotics, in addition to a managing node pertaining to the Ministry of Defence, which carries out technology watch activities and leads joint efforts in international organisations.

The SOPT describes multifunctional intelligence systems using programmes that constitute the future trends of Electronic Warfare (EW), taking a time horizon close to the year 2030 as a reference point. These have been supplied by companies such as, *inter alia*, INDRA, EADS-CASA, GMV, IECISA, TELEFÓNICA SOLUCIONES and TECNOBIT, and Spanish universities. All this results in the generation of a real R&D&I system, where the defence sector acts as a catalyst for inventions and the companies that make up the industry and participating institutions constitute the research, development and innovation poles whose EW projects will eventually give rise to a safer defence system in which the following exist:

1. faster localisation of risks;
2. threat detection capacity enhancement; and,

3. greater precision for said localisation and area of surveillance.

9. CONCLUSIONS

Over the course of the last few decades, a series of developments in the field of defence have substantially altered the operational framework of the armed forces. The *European Security and Defence Policy*, the objectives set in the National Defence Directives and the Strategic Defence Review are courses of action relating to defence, and discussed in this text, which have had an impact on the transfer of knowledge and innovation associated with the defence industry.

In this respect, in order to respond to the challenges that they faced, and where new commitments and operational requirements arose, all agents involved, defence industry firms, institutions, universities and research institutes, readied themselves for R&D&I activities coupled with technology goals that would open international borders to them and boost their socio-economic activity. This text considers that the defence sector forms its own economic structure as regards the allocation of resources and agents with which it interacts, knowledge transfer processes and the technological research that it itself generates.

For this reason, and since academic literature has neglected to conceptualise the *economics of security and defence*, the author has endeavoured to propose a definition of this. The paper outlines this using the *Knowledge-Innovation System* and indicates that this “is an economy of revenue generated by the restructuring taking place within the armed forces and by collaboration between military and civil R&D, based on the *coupling of innovation and technology* in the defence sector, which facilitates this discipline of “*socio-economic well-being*”.

Moreover, we conceptualise the “*economics of security and defence*” as “*the result of partnership between the security and defence means and resources that find their origin in the state, whereby they are made available to society and serve to benefit a region’s well-being*”.

Tied into this consideration of “science”, the defence sector strategy is intended to underpin research and innovation and the creation of inter-company cooperation networks. General Ballesteros³⁴ prompts one to view the role of the *economics of security and defence* as one, which, as part of its forward-looking capacity-based strategy, generates knowledge of a high economic and scientific value, with remarkable application in the defence industry. This brings us closer to the initial definitions used

34 BALLESTEROS, M.A., 2010, *op.cit.*

in the text and the economic foundations set out below.

On this front, the *defence innovation system* is considered to be an *R&D&I agent* that helps subsequent positioning within the business landscape. A company must thus *constantly innovate*, since the life cycles of products are getting shorter, clients more demanding and competition fiercer and rapid technological change is underway. All of this entails *defence innovation as progress applied to the technological development of companies*, involving a new product or service, new processes and technology related to armed forces equipment. Given this backdrop, innovation can be understood as a *business strategy arising from collaboration between companies*, as a result of interorganisational relations within the defence sector. Moreover, it is innovation and these techno-scientific alliances that have a decisive impact on the business performance of firms in the defence industry.

Bibliography

- ALONSO-BAQUER, M.; GARCÍA, J.; VERGARA, J.A., AND BLESA, P. “Aspectos de la seguridad y defensa en el Mediterráneo: información, globalización y conflictos”, *VI Ciclo de Cultura de Defensa, Aula de Cultura e Historia Militar Comandante Villamartín, Fundación Emma Egea*, June, Cartagena, 2003.
- BALLESTEROS, M.A. “La transferencia mutua de conocimiento Defensa-Sociedad. El proceso estratégico”, *Ciclo de Conferencias “El papel de desarrollo y transferencia tecnológica de la Defensa y las Fuerzas Armadas en el Sistema de I+D+I”*, Autonomous University of Madrid, Spanish Institute for Strategic Studies, Madrid, 2010.
- BRIONES, A.J. “Determinantes estratégicos en el modelo de modernización de las fuerzas armadas y sistemas de defensa. Análisis de los procesos de cooperación con organizaciones externas”, *Doctoral Thesis*, Technical University of Cartagena (UPCT), 2007.
- BRIONES, A.J. *Gobierno en la Industria de Defensa. Estudio de Investigación de los Procesos de Cooperación entre Organizaciones*. Diego Marín, L.E. Murcia, 2009a.
- BRIONES, A.J. “El Nuevo Modelo de Fuerzas Armadas y la Industria de Defensa”, pp. 25-39, 2009b. In Briones, A.J. (Dr): *Gobierno en la Industria de Defensa. Aula Abierta y Foro de Estudio de Seguridad y Defensa*. Diego Marín, L.E. Murcia, 2009.
- BRIONES, A.J. AND LABORDA, F. “Capacidades de innovación tecnológica en empresas relacionadas con la Industria de Defensa”, *Revista de Economía Industrial, Ministry of Industry, Tourism and Trade*, Vol. 378, pp. 135-146, 2010.
- BUENO, E. “La Sociedad del Conocimiento: Una realidad inacabada”, in Micheli, J.; Medellín, E.; Hidalgo, A. and Jassó, J. (Coordinators). *Conocimiento e Innovación: Retos de la Gestión Empresarial*, Plaza y Valdés, Mexico, pp. 25-55, 2008.
- BUENO, E. “Ciencia, Defensa y Sociedad. Una reflexión sobre estrategia, I+D, y Buen Gobierno”; pp. 15-24. In Briones, A.J. *Coordinator Gobierno en la Industria de Defensa. Aula Abierta y Foro de Estudio de Seguridad y Defensa*. Spanish Ministry of Defence and Technical University of Cartagena (UPCT), D.M. Librero Editor, 2009.
- BUENO, E. “La urgente evolución de la sociedad de la información a la sociedad del conocimiento: El reto de la innovación”, *Boletín Intellectus*, (electronic version www.iade.org), 16, April, 17-25, 2010a.
- BUENO, E. “Conocimiento e innovación para dirigir situaciones complejas de cambio y crisis”: Hacia un modelo económico evolutivo-sostenible”. En Micheli,

- J.; Medellín, E.; Hidalgo, A. and Jassó, J. (Coords.). *Conocimiento e innovación: un reto ante el cambio y la crisis*, Plaza y Valdés, Mexico, 2010b.
- BUENO, E. “El Papel de Desarrollo y Transferencia Tecnológica de la Defensa y las Fuerzas Armadas en el Sistema de I+D+I”, in Briones, A.J. (2011) (Dr): *Aula Abierta y Foro de Estudio de Seguridad y Defensa*. Technical University of Cartagena (UPCT), 2011.
- BUENO, E. AND SALMADOR, M. P. “Análisis Interdisciplinar de la Función y Proceso de Innovación en un Modelo Económico Evolutivo y Sostenible”, *AECA Documents*, 2010.
- BUENO, E.; JERICÓ, P. AND SALMADOR, M.P. Experiencias en Medición del Capital Intelectual en España: El Modelo Intelec. In Bueno y Salmador (eds.). *Perspectivas sobre Dirección del Conocimiento y Capital Intelectual*. Instituto Universitario Euroforum Escorial, pp. 111-121, 2000.
- BUZAN, B. *People, States and Fear: An Agenda for the International Security Studies in the Post-Cold War Era*. Boulder, Colorado: Lynner Rienner, 1991.
- CANALES, A. “La seguridad colectiva como factor determinante del cambio estratégico”. *In Dependencias y Vulnerabilidades de la Economía Española: Su Relación con la Defensa Nacional. Strategy Dossiers*. Spanish Institute for Strategic Studies. Second Section: Medios para la Defensa. CESEDEN (Spain). Nº 80, pp. 15-36, 1996, Spanish Ministry of Defence.
- CEGARRA, J.G. AND RODRIGO, B. “Influencia de los Componentes del Capital Humano en el Proceso de Aprendizaje Relacional”, *European Research on Management and Business Economics (IEDEE)*, Vol. 9 (3), pp. 187-210, 2003.
- COVAS, A., AND COVAS, M.DAS M. *Modernização Ecológica, Serviços Ecosistémicos e Riscos Globais. Ruralidades V*. Universidade do Algarve, Portugal, 2010.
- DGAM. *Estrategia de Tecnología e Innovación para la Defensa ETID*, Technical Secretariat General, Ministry of Defence; <http://www.o6o.es>, 2010.
- GARCÍA-PÉREZ, R. *Política de Seguridad y Defensa de la Unión Europea*. Ed. UNED and Instituto Universitario General Gutiérrez-Mellado, 1st edition, Madrid, 2003.
- GONZÁLEZ, M.; HUERTA, J.; LÁZARO, J.F., AND MUÑOZ, A. *Eficiencia en la gestión de recursos, proyectos y contratos de la Administración Pública. Especial referencia al ámbito de la Defensa*. Instituto Universitario General Gutiérrez Mellado-UNED, 2008.
- HACKER, B.C. “Regularity order, and prompt obedience. On military institutions in enlightenment thought”, *Actas del XVII Conferencia Internacional de Ciencias Históricas*, Vol. I, pp. 59-167, Madrid, 1990.

- MARTÍNEZ, A.; CEGARRA, J.G. AND SÁNCHEZ, M.T. “Managing Environmental Knowledge as a Way to Improve Business Performance”, *Managing Services in the Knowledge Economy (MSKE, 2009)*, Universidad Lusíada de Famalicão, Portugal, 2009.
- MATEO, L. “Relaciones de causalidad entre economía y defensa nacional en España. Análisis de dependencias y vulnerabilidades económicas. *In Dependencias y Vulnerabilidades de la Economía Española: Su Relación con la Defensa Nacional. Strategy Dossiers*. Spanish Institute for Strategic Studies. Second Section: Medios para la Defensa. CESEDEN (Spain). No. 80, pp. 57-78. Spanish Ministry of Defence, 1996.
- NAVARRO, E.G. *Externalización y financiación privada en el sector defensa (EPR)*, Executive Report, Información de Defensa y Seguridad (IDS), Madrid, 2003.
- POZO, P. “La privatización de la formación militar y policial en programas internacionales de Reforma del sector de la seguridad”. In *Fernández, J.J; Jordán, J., and Sansó-Rubert, D.: Seguridad y Defensa Hoy*. Plaza y Valdés Editores, Mexico, 2008.
- TOMÉ, L. “Segurança e complexo de segurança: conceitos operacionais”, *JANUS. NET, e-Journal of International Relations*, No. 1 (1), Autumn, pp. 33-49, 2010.