Towards a contingent approach to firm strategy on the lowest levels of the hierarchy of the defence industry

Purpose – This paper aims to provide a strategic analysis of firms at the lowest hierarchical levels of the defence industry.

Design/methodology/approach – This paper presents the main results of an exploratory, multiple-case study that analyses the current strategy drivers and their views about the future ones, and their impact at the lowest hierarchical levels of the defence industry in Spain.

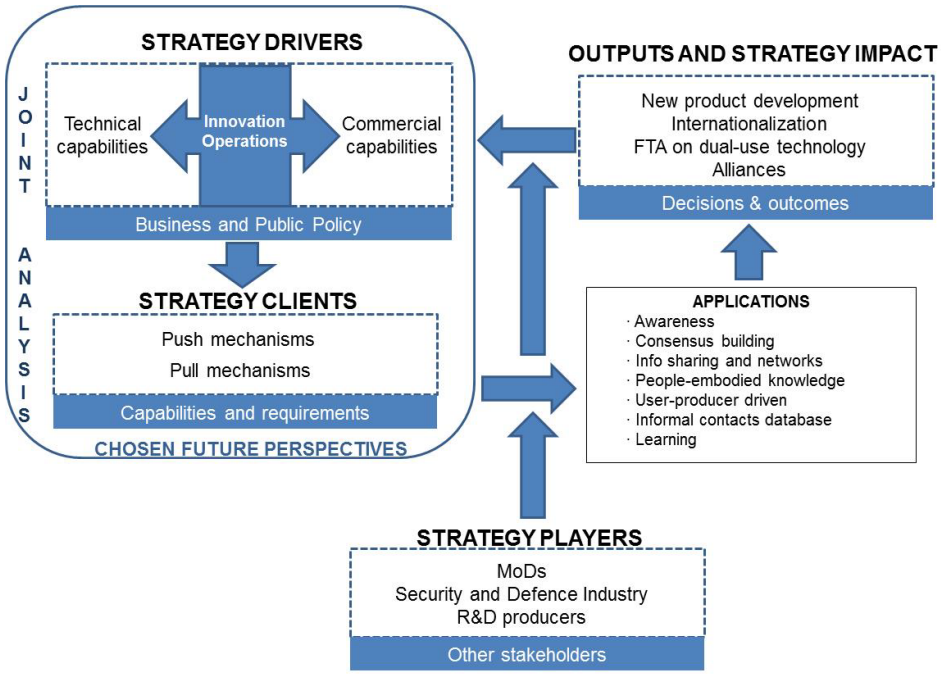
Findings – Our investigation develops and analyses a contingency model regarding the strategy impact and effects of firms' drivers and clients, both mediated by the strategy players because of their huge impact on the defence industry. The research model focuses on the internal relations between technical and commercial activities due to the cause and effect of their capabilities. Simultaneously, pull and push mechanisms boost firms' capabilities and requirements to provide strategic foresight.

Practical implications- MoDs and prime contractors will remain mediating players in the near future which will have further implications for the competition of DTIB firms. It implies that firms and MoDs must maintain a close relation and implement more flexible practices, such as open innovation, property rights or new commercialization schemes.

Originality/value – This study offers insights related to the specific applications and the necessity of commercial and technological areas alignment of these firms for the future.

Paper type – Research paper

Keywords—Defence Technological and Industrial Base (DTIB); commercial capabilities; security and defence industry; strategic management; technical capabilities



1. Introduction

In the defence industry, major contractors act as system integrators that provide defence agencies and the armed forces with complete systemic solutions. The top defence companies in Europe –BAE Systems, EADS, Finmeccanica, Thales- are global players, and concentrate 2/3 of the industry turnover (Directorate General for External Policies of the Union 2013). They act as gatekeepers while the military acts as end-users (Zervos and Swann 2009) and the Departments/Ministries of Defence (MoDs) define the customer requirements.

The hierarchical structure, the economic issues are sometimes less relevant than the cutting-edge technological capabilities of manufacturers and suppliers, and the paradox of openness in the defence industry (Laursen and Salter 2014), the mediating role of the MoD and government agencies, among other characteristics make the defence industry something unique where traditional strategic analysis must be adapted.

The analysis is based on firms at the lowest hierarchical level of defence industry (LH), all of them with excellent technological capabilities in spite of being small and medium

enterprises (SMEs). For the purposes of this paper, the lowest hierarchical echelons in the defence industry include four levels from the bottom up, defined by Walker et al (1988)[1]. Our qualitative, multiple-case study of five Spanish defence firms was conducted in order to identify the main characteristics of the in-house strategic process. The research question is: How do the firms at the lowest levels of the hierarchy of the defence industry (LH) design their strategy? The findings confirm that the strategy drivers and clients are jointly defined in these firms, and the strategy players[2] have a mediating role, especially for internationalization activities and alliance establishment. The and, consequently, the dependence of these firms for developing their own strategy is an important characteristic of defence sector found in this study.

2. Literature Review

The characteristics and evolution of the military technologies (Saritas and Burmaoglu 2016) are been supported by MoDs (auto citation) in prior decades. The impact of public investments in national economies are been studied by several research works. Hence, the following literature review draws on developments in the economy of defence, with a microeconomic focus on industrial economics as well as on strategic management related to the Defence Technological and Industrial Base (DTIB).

Fig. 1 shows a graphical résumé of the theories that ground the current review based on (Aguirre et al. 2000) and our own analysis. The dynamic capabilities perspective (Teece, Pisano, and Shuen 1997; Kathleen M. Eisenhardt and Martin 2000) is perhaps the most

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[1] The highest levels of firms fits with the major weapon platforms (2) and integrated weapon and information systems (1), and they are not included in the current analysis. On the lowest levels, firms design and produce complete weapons and communication kits (3), sub-systems (4), components (5), and materials (6).

[2] Thereafter, whenever reference is made to the "strategy players" should be considered as MoDs, the security and defence industry and R&D producers.

suitable theory to root the theoretical background of this paper, and the specific area where our contribution is made. Firms have to develop competencies to open to stakeholders and must be supported by all concerned actors (Castiaux 2012): the strategy players. Both technological and commercial capabilities are designed to face the current and future firms' challenges in order to satisfy their present and potential customers. However, the defence sector has some especial characteristics due to the influence of strategic players as the MoDs, prime contractors, etc. Therefore, international organisations have involved in foresight studies backing to the discussion of future security challenges (James and Teichler 2014), and also the MoDs (auto citation). These strategic defence players are big enough to develop strategies of their own and influence the future defence market but regarding firms at the lowest levels of the hierarchy in the defence industry the literature offers limited insights about how they design their strategy.

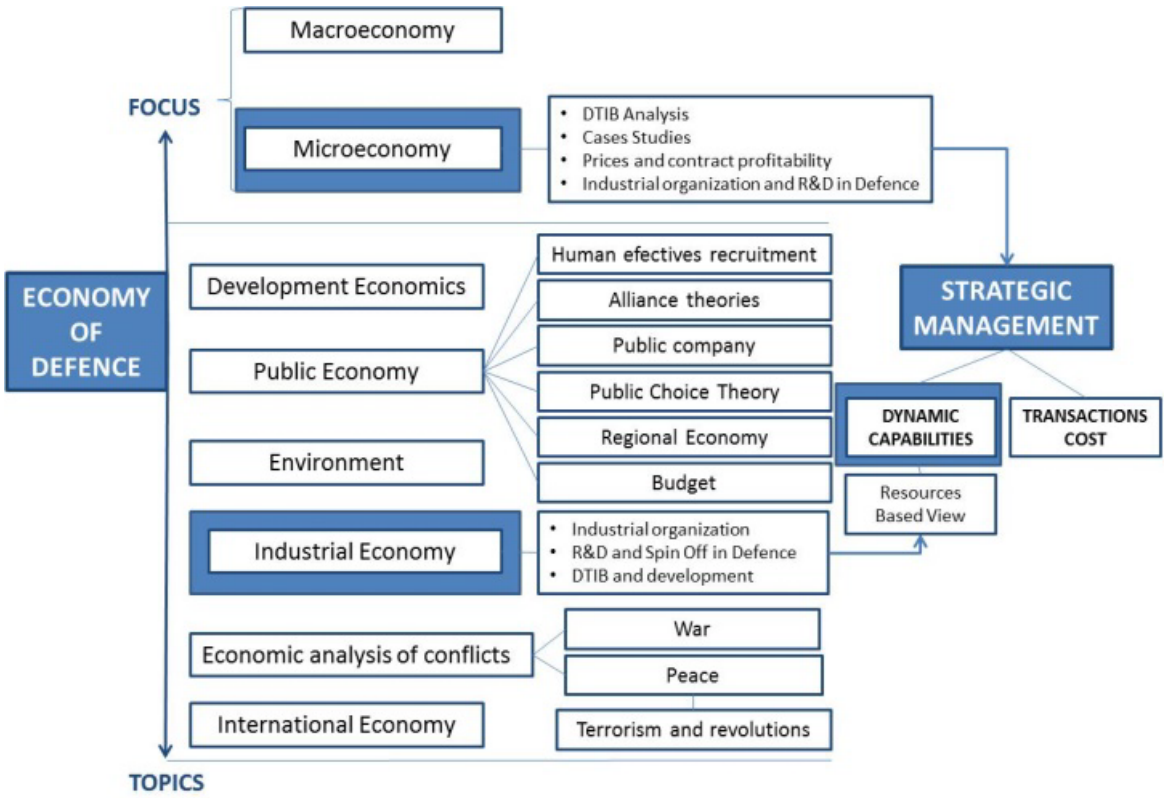


Figure 1 Literature review framework

2.1 Technological Capabilities of Defence Firms

The capabilities of the national science and technology innovation system, together with the accumulation of military power, are becoming an increasingly critical factor in the survival of the defence industry (Jae-ok 2010). In comparison with the twentieth century, the current defence environment is less competitive for major systems and platforms and more competitive for other smaller components, which have become part of the "information warrior" on the modern battlefield (Hartley and Sandler 2003). Moreover, the dual-use technologies –those potentially used for civilian and military purposes- would enable firms to extend their client base to include MoDs and defence integrators only if the technologies are technically relevant and adaptable for use in the defence environment.

New technologies have an impact on defence products both from their adoption and from their insertion into existing products (Kerr, Phaal, and Probert 2008). These technologies can be applied to a relevant problem in a manner that radically alters the symmetry of military power between competitors. The use of game-changing technologies immediately outdates the policies, doctrines and organizations of all the actors because "the technology of today is the past of the future battlefield" (Brimley, Fitzgerald, and Sayler 2013, 4).

According to Fonfría and Duch-Brown (2014), technological capabilities are one of the key factors in the ability to penetrate international defence markets. Exporter firms tend to be capital-intensive, diversified and show a high level of R&D effort. Therefore, technological capabilities are needed to configure a successful strategy to maintain the competitive advantage of defence firms, but those capabilities are not enough to innovate and sell goods for DTIB firms according to the changing requirements of the industry.

2.2. Commercial Capabilities of Defence Firms

The marketing strategy literature posits that market orientation provides a firm with market-sensing and customer-linking capabilities that lead to superior organizational performance (Kirca, Jayachandran, and Bearden 2005). Customer integration into product development occurs even more frequently in the defence context than in civilian industries, and is acknowledged as a factor of project success (Peled and Dvir 2012). Cross-functional teams are used to improve customer integration (Lagrosen 2005) and prime contractors are familiar with this modus operandi. However, since the integration of users into the developing process applies to all the suppliers of the chain, LH firms may receive specification requests from their direct clients when several firms work together in a major programme. So, they should depend on the success and production trajectories of the upper tiers (Directorate General for External Policies of the Union 2013), and have also to meet the customer´s full requirements (pre-competitive offers, project management documentation, product certifications, etc.), although their resources can be more limited.

Defence projects commonly crystallize as a public tender with detailed requirements for every technical feature included in the contract. In this way, the State's procurements trigger greater innovation impulses in more areas than R&D subsidies and are capable of stimulating innovation (Edler and Georghiou 2007). With the State's intervention, several governmental and related agencies (i.e. the RAND Corporation in USA or KADDB in Jordan) had the purpose of stimulating the creation and provisioning of innovative materials and products adapted to defence use. The demand-pull hypothesis works in the defence industry due to contracting with MoDs implying relevant efforts in R&D, although for prime contractors and big contracts part of these efforts are substituted by public investments (García-Estévez and Trujillo-Baute 2014). The requirements of knowledge flows affect the innovation activities and push the technology perspective of

the firm, while pull mechanisms have an impact on the operations and the commercial perspective of the firm and are focused on its capabilities.

2.3. Capabilities and Requirements for the Future

The complexity and the relevance of issues concerning firms' technological and commercial capabilities, the current necessity to address them and the inevitable association with the economic and political uncertainty of the environment require a complementary approach to the traditional analysis of internal capabilities and external possibilities to compete through strategic planning.

MoDs' tendency to establish open systems to increase the technology independence (Kerr, Phaal, and Probert 2008) involves planning to insert new technologies, to outline future capability requirements and to determine product development options. The future lies at the intersection of changes in technology, lifestyles, regulation, demography and geopolitics (Hamel and Prahalad 1994), and firms consider emerging technologies, market research and foresight units are the best possible tools to analyse their economic potential (Malanowski and Zweck 2007). However, at the LH the limited resources make them optimize investment portfolios by focusing on a few business fields (Filippini, Güttel, and Nosella 2012). These firms can hardly accomplish foresight exercises, although Corporate Foresight is capable of launch the market perspective (Daheim and Uerz 2008), and they should design their future capabilities through the joint analysis of industry drivers and client requirements.

2.4 Strategy players

The interrelation between technological and commercial capabilities is greatly dependent on the influence of strategy clients in the market. The research question: *How do firms at the lowest hierarchical levels design their future strategy?* It could be more specific:

W*hat is the role that each aforementioned element (strategy clients, capabilities) plays in the strategic future process?*

The development of global defence markets cannot rely exclusively on large international defence providers, but also require the agile involvement of smaller local firms with proactive future strategies that contribute to reduce the time-to-market development of defence goods and services. The defence market is already changing to the "*think global act locally*" paradigm. National defence "champion" firms keep supported by national governments, but regional governments are supporting nowadays the development of defence-related SMEs because these firms offer good opportunities to diversify the industrial tissue of each region and contribute to create high qualified jobs.

On the one hand we need to know the differences as well as the factors that influence the firm´s performance in such areas as new product development, internationalization, dual-use technology involvement or alliances. On the other hand LH firms may be more dependent of MoDs due to their lower level of resources or limited visibility within the defence market. We know that MoDs diffuse technology scenarios to different firms (self-citation) but we do not know if the mediated role of MoDs is helping firms at lower hierarchical levels to compensate enough their deficits. These are the main reasons to explain why we cannot use the usual knowledge to design strategy of LH firms.

3. Research Method

Firms that make up the technological and industrial DTIB operate in different productive sectors; thus, the analysis is conducted in a heterogeneous industry (Aguirre et al. 2000). The study was designed according to Eisenhardt and Graebner (2007) and Stake (1995), and the unit of analysis was the providers of the Spanish MoD with their own patents and technology developments (Ministerio de Defensa 2013). This enabled representative cases studies to be conducted on five firms LH with activities in land, naval, aeronautics,

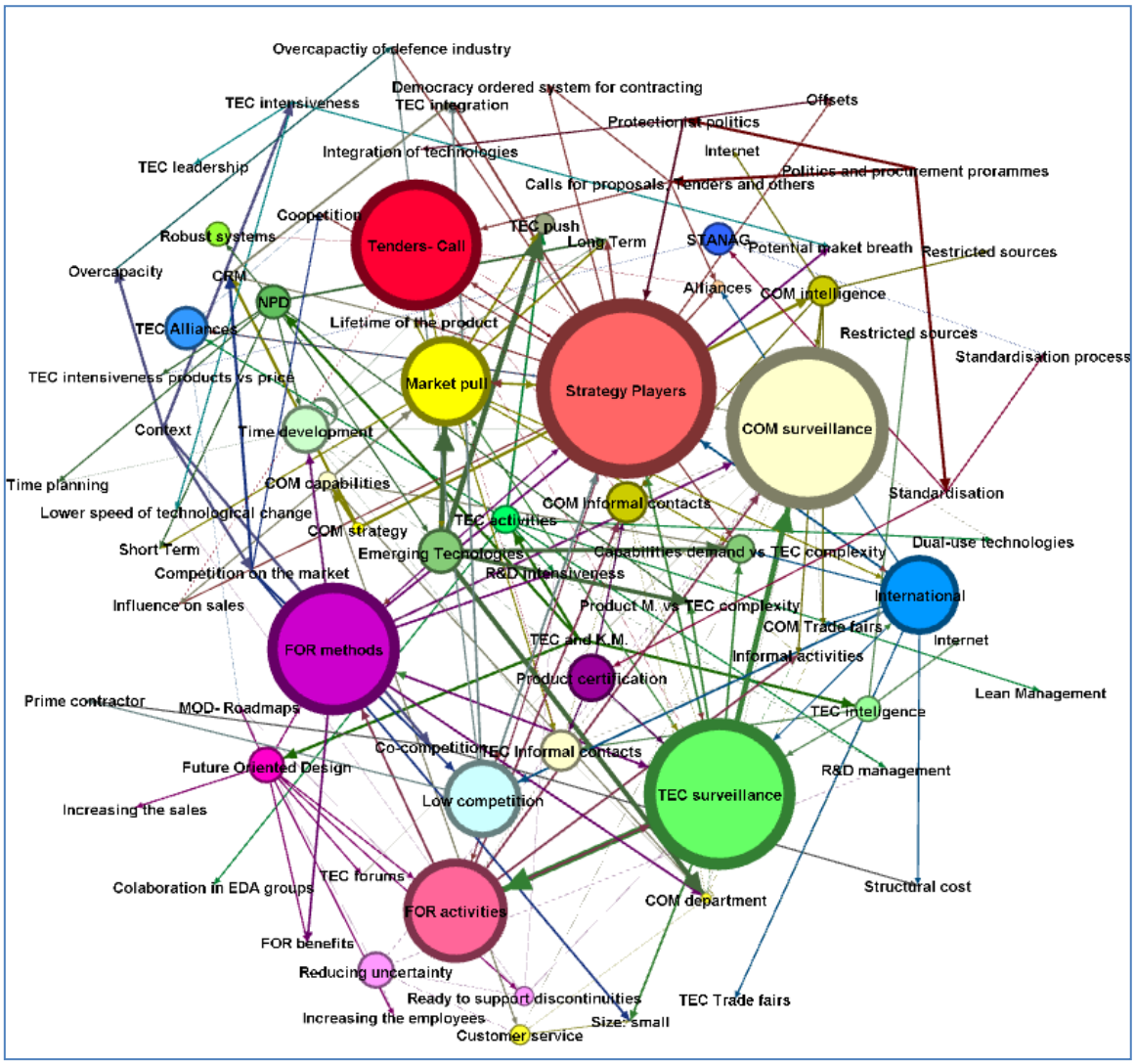
space vehicles, weapons, missiles, electronic and computer, and general services, although some of them have divisions, goods and services that are included in more than one category. Three of them are SMEs and two are large firms, privately owned and MoD providers. The average firm size is 373 employees, €97,090 million in capital stock and €157,028 million in assets. The firms' average age is 43.6 years.

Multiple interviews with technicians, marketing staff and strategy and innovation managers were conducted during the period March–June 2014. The script was validated by experts in strategy, technology foresight and defence economy of Mexico, Colombia and Spain belonging to civilian and military organizations. The length of the recorded interviews to managers and technicians was between 60 and 125 minutes for each person. The words in the data collection –included interviews, patents and commercial information- were structured in logic units (codes and concepts) and grouped to conform to categories of logic meaning (1,329 text units in the Nudist software). According to the grounded theory (Strauss and Corbin 2014), the linkages between the text units were more than a listing of propositions and they had conceptual density (Annex 1 shows the cross analysis from a parsing and data included in the 1,329 text units). Simultaneously, the Gephi software enabled the modelling of every code and target with its frequency weight, based on the cross text analysis. The relations were forced with a multidimensional scale (MDS) in accordance with Fruchterman and Reingold (1991), allowing the vertices connected by an edge to be approximated and not drawn too close together. Therefore, the concepts can be reviewed in their appropriate context of the defence market.

4. Research Findings

The study findings may elicit further the joint analysis of the strategy drivers and the strategy to pay attention to the customers' needs as well as to the way in which the future

strategy is managed in the firms in LH. The complete diagram founded on the relations among variables that shows the complete network of the qualitative study is depicted in figure 2. The starting relations of every relevant node, as well as those originating in the same node, were extracted to improve the analysis and are available under request to the corresponding author.



TEC: Technology; ;COM- Commercial; MOD-Ministry of Defence; FOR-Foresight; EDA-European Defence Agency; NPD- New Product Development; Product M. – Product Management

Figure 2. Complete Network

4.1. The Joint Analysis of Strategy Drivers and Strategy Clients

Dual-use technologies are highly influenced by the technological activities of the firms, but commercial surveillance has a low impact on them. However, other activities that should have an impact on the firm, such as NPD, do not show any kind of relationship. At one end of the scale, most of the interviewed firms produce dual-use goods, although not one exceed 20% of its sales. At the other end, only one firm delivers exclusively to the defence market, and that is because of the kind of product in its category and firm specialization. However, the market trends lead to diversification in products and markets.

> "Currently all products could be used by the defence sector. Maybe in a few years we will have something that does not fit in the defence industry. It has seen a possible diversification."

Our study shows that the strategy impacts identified as international performance and alliances established to design, manufacture and/or export products and systems in the defence market are very closely related. They are highly linked to strategy players. However, technological surveillance performed by the firms and their capabilities to deal with the customer requests (taking into account the technological complexity) are necessary to support the alliances and the structural cost of the firms. The international environment is highly relevant to maintaining technology surveillance, although the firms consider that there is really a low level of competition among the knowledge competitors:

> "In order to be viable, we have to sell worldwide. We cover a range of products and we try to be the best, as a small range is difficult because it has a cost and there are not many contests and many commercial operations that we can add. In return, having everything vertically integrated gives us much more flexibility and lets us avoid risks, mainly not having the key technology and manufacturing. To sell many customers is vital because it gives us flexibility in terms of time, offsets, co-manufacturing..."

The international environment has expanded the range of alliances among industries; thus, the defence sector reflects these changes and new ways to support new product development.

> "We also make some programmes at risk with other manufacturers with whom we have already collaborated, and we had a good experience. Each of us has invested money in

> their developments and then we can sell units in agreement to the amount proportionally invested."
>
> "We also have other competitive products [...] but the challenge is to jump the barriers."

There are other research findings related to the decisions and outcomes that have influenced the firms' strategy. Some of them mentioned the intricate plans to afford new products and markets, political contacts with governments outside the North Atlantic Treaty Organization (NATO) area, joint ventures to develop new technologies, agreements in an early stage with firms that have technology complementarities and so on.

Technological and commercial capabilities

The market as a determinant of the capabilities and requirements of firms (market-pull and pull mechanisms of the strategy clients) was frequently mentioned by all the participants in the study. The relationship between the lifetime of most defence products and the long-term planning is linked to market-pull in defence contracts. Either short-term or long-term, the market orientation has a direct relationship; this is not related to technology-push.

The strategy players have a great influence on market-pull as primary and secondary contractors of the defence industry. The relation is mediated by instruments like the calls for any kind of tenders and public systems for contracting by the MoDs. The life cycle of defence systems tends to be long, but it has to be in accordance with the public tender published by the MoD more than the fixation of term frames, even though in practice the delays are well known and considered when the project is launched. Market-pull has an international impact due to firms having increased their export ratios. The knowledge about the current market expectations is transferred through technological informal contacts, even in the short term.

Technology-push is a minor mechanism to redirect the strategy drivers of these firms, because technology development – inside the firm or in collaboration with partners – is influenced by the client's requirements, particularly for emerging technologies and technological activities. An important relationship that should be noticed in this sector is that technology surveillance has an impact on market-pull and therefore the firms have recently considered its strategic relevance:

> "Engineers visit the fairs since 4–5–6 years ago, because we understood that it was essential. Historically only the sales department and management attended. Now, we consider that what you can see as an engineer does not compare from a commercial perspective and otherwise, both figures are basic."

Future-oriented design

Firms design their strategy as a mix of many elements, although managers and visionaries of the organizational sciences increasingly consider that today decisions have a great impact on the future essential capabilities and requirements. The technology and knowledge managed by the firms have a direct impact on how they face the future and the managerial response to future challenges, mostly in technological areas. The foresight methods used by firms are informal, as well as the activities related to this issue. However, most of them agree that their future strategy should be based on technology and knowledge management (in the figure TEC and K.M.). In this study, commercial issues seem to be less important for the future design of the strategy than the technology-related ones.

> "We design through a mixture between top-down, especially in the most strategic vision; but the input is bottom-up and based on technology development, product and customer. And there are also flow initiatives in order to be strengthened within the vision."

However, the firms considered especially the sales growth and risk reduction or whether the technology transferred from other sectors will be adequate for their potential technological performance.

> "It is difficult to incorporate some very sophisticated issues into the product types because the batch sizes are not large, etc. Technologies should be mature in other fields if you incorporate them."

Although the firms showed complete agreement about the usefulness of the foresight benefits and most of them knew some methods, none of them had a formal methodology or system to process the internal initiatives or the external impacts. A well-known benefit of foresight activities is its support in facing technological discontinuities. However, the firms can achieve this goal without mutual communication in technological areas, even though they have an affordable size with a low number of locations.

> "Each department makes its own previsions, but we still have not organized the integration of all thematic areas."

The general benefits of future-oriented design carried out in these firms are the securing of new investments and their future performance, as well as the enabling of organizational learning.

> "It would reduce the risk of investing heavily in something that does not make sense then, or that is not what customers were looking for, and be more aware of what is needed to identify more opportunities. It would increase the turnover and the number of employees as a result."

4.2. Strategy Players and Applications

MoDs are the most relevant players in the defence context because they act as legislators, entrepreneurs and customers all at once. That explains the direct impacts of the strategy players to the "protectionist politics" of the MoD and Ministry of Industry (in Spain) and the "offsets" agreements. Therefore, the "overcapacity" of the DTIB is well known as a strategic reason for every country to support its own industry to secure the basic capabilities within its borders; finally, there has been a recent tendency of "coopetition" even among firms in the same country.

> "We have understood that we need to cooperate. Before we just competed for a piece of the cake against each other but now perhaps the spirit of competition has changed and it is time to look forward, finding the best inside the other players. And, in my opinion, the financial crisis may have had an influence on this."

The analysis carried out took into account the effect of every strategy driver and client on the strategy players and its impact. In the defence market, due to its special characteristics, MoDs and prime contractors as huge integrators of systems have an important mediating role and a direct impact on sales, as well as the capabilities demanded due to the technological complexity.

> "The industrial policy of the MoD is very decisive for a firm like ours. When you compete in the international market, it is on equal terms. In France, you compete against the French firms … in Europe it depends on the country. Some of them follow the European regulation for an open market in defence products and each firm presents its better strong points on technology and commercialization."

The following items receive impacts from the strategy players and vice versa: international performance, technology surveillance, low competition, foresight methods and activities, and market-pull.

4.3. Managing the Future Strategy

The joint identification of new customers and emerging technologies responds to the commercial and technological intelligence that the firms possess, so those activities are intensively related to the surveillance and processing of external information. However, the capabilities of the firms have to match the technological complexity required by the defence market. Additionally, the integration of emerging technologies and customer needs into ongoing projects has its own casuistry in this market.

> "In our firm, I am not sure if strategy is before foresight, because in strategy we devise for the medium and long term, which makes you reach the technology for positioning on the market. First of all, the firm's vision; after that, technology, product and confirmation about business feasibility …"

The commercial and the technological intelligence receive information from similar sources, although the interviewed firms pay more attention to monitor the market and the technologies than to process this information. The strongest impact on commercial intelligence comes from informal contacts; meanwhile, the most important one on technology intelligence is the way in which the firm manages technology and knowledge.

The restricted sources and informal activities undertaken to obtain information are relevant in the commercial area but not in the technological one. Information provided by informal contacts, trade fairs and web searches is relevant in both.

Technology surveillance is fed by the international environment, the strategy players and their call for contracts, as well as by the foresight activities and methods. Product certification has a relevant impact on it and that is a particular characteristic for regulated markets because it generates signals for future developments.

> "Although we are focused on Spain, we also work with agents all over the world. They send information about the work lines for the next five years in the countries that we consider strategic."

The NPD has an impact on the emerging technologies that firms consider in designing their strategy. Emerging technologies influence technical issues such as product management versus technological complexity and technology-push as well as the commercial area as a way to feed the surveillance system.

> "Our product is also used in situations of armed conflicts. The typology of the conflict emerged over the past few years produced a great pressure to adapt our products for use in the field. It is completely different from the product that it was ten years ago for a mission or the product that it will be in the future."

4.4. Strategy Impact and development of research propositions from the multiple-case study

Our research drills-down on the outputs of the strategic process and their impact considering the effect of other strategy players in these firms on the LH firms.

Technical capabilities may improve the flow of communication between users and producers and this is even important for the involvement of LH firms in the development of dual-use technologies. Product developers are able to foresee alternative uses for a purpose-developed defence technology. However, to adapt those uses to non-defence purposes, commercial capabilities are strategically important to combine different technologies that can be diffused and utilized in other non-defence industries.

Following these arguments, we develop the two following more detailed research propositions as suggestions from our multiple-case study that are tested within the information provided by the surveyed firms at the LH firms:

> *P1A. The technical capabilities of a defence firm at the lowest level of the hierarchy in this industry have a positive impact on its NPD, internationalization, dual-use technology involvement and alliances with the mediated role of the MoD.*
>
> *P1B. The commercial capabilities of a defence firm at the lowest level of the hierarchy in this industry have a positive impact on dual-use technology involvement, and internationalization and alliances with the mediated role of the MoD.*

Defence companies should not focus on pull-mechanisms alone, but this even more important for LH because they lack the capabilities to own or control the required resources. The demand-pull hypothesis usually works in the defence industry because contracting with MoDs implies relevant efforts in R&D, although prime contractors and big contracts substitute part of these efforts with public investments. The defence industry is R&D-intensive for large strategic players but also for small LH firms. Such investments require long-term paybacks; thus, firms at the LH industry are sometimes unable to obtain good returns based only on demand-pull innovations and products. These firms must then look beyond the defence industry to commercialize their own outputs but those that integrate pull and push mechanisms could be able to attract collaborators to develop highly R&D-intensive innovations, internationalize and diversify their activities.
These findings and arguments from the multiple-case study suggest the following research propositions:

> *P2A. Push mechanisms in a defence firm at the lowest level of the hierarchy in this industry have a positive effect on its NPD, internationalization, dual-use technology involvement and alliances.*
>
> *P2B. Pull mechanisms in a defence firm at the lowest level of the hierarchy in this industry have a positive effect on its NPD, internationalization, dual-use technology involvement and alliances.*
>
> *P2C. Future-oriented design in a defence firm at the lowest level of the hierarchy in this industry has a positive effect on internationalization, dual-use technology involvement and alliances.*

Third, defence firms in general may exhibit particular ways to manage the innovation process or use some innovation management tools, their response to emerging business

fields, and the necessity to form international alliances. Finally, surveyed managers also suggested the importance of integrating emerging technologies and customer needs. Defence firms face longer innovation development times to make robust applications and adapt to hostile environments. In some cases, technologies advance even faster than their applications in products needing a certification, such as in the aeronautic field, in which milestones are the norm. This uncertainty is common along the entire defence industry but LH firms face especial difficulties due to, again, their more limited resources but also sometimes because of their lack of visibility. These firms must very careful to focus themselves in the best possible strategic position. Rohrbeck and Gemünden (2011) proposed three roles of corporate foresight in enhancing the innovation management of a firm: the initiator role, which supports the identification of new customer needs and emerging technologies; the strategist role, which identifies emerging technologies; and, finally, the opponent role, which ensures that innovation initiatives are continuously benchmarked against the emerging technologies and confronted with the current customer needs. These findings and arguments lead us to the final three research propositions:

> *P3A. For defence firms at the lowest hierarchical levels, the identification of new customers and emerging technologies has a positive effect on internationalization, dual-use technology involvement and alliances.*
>
> *P3B. For defence firms at the lowest hierarchical levels, their repositioning efforts in response to emerging business fields have a positive effect on internationalization, dual-use technology involvement and alliances.*
>
> *P3C. For defence firms at the lowest hierarchical levels, the integration of emerging technologies and customer needs into ongoing projects has a positive effect on NPD, internationalization, dual-use technology involvement and alliances.*

In the defence environment, the products can be used for safety purposes (e.g. aviation security), for interfacing standards (e.g. standardization agreements[3] in NATO) or for

[3] Standardization agreements (STANAG) define the processes, procedures and conditions for common military products or equipment of the member countries of the NATO alliance.

other reasons that underlie strategic and military purposes. Our article studies the mediating role of defence strategy players in the strategy impact focused on innovation operations of LH firms because these may have more in need of mediating support. Its mediator function represents the generative mechanism through which the independent variable considered in every proposition is able to influence the dependent variable of interest, the "strategy impact".

The results indicate that technical capabilities seem to be more important than commercial capabilities for new product development (NPD) but both capabilities are needed for dual-use technology involvement. Strategic players such as MoDs mediate the impact of both capabilities to establish alliances for LH firms. Similarly both push and pull mechanisms have positive effects on these firms´ NPD, internationalization, dual-use technology involvement and alliances. Finally regarding the roles of corporate foresight, the opponent role seems to be the more significant on LH firms for NPD, internationalization, dual-use technology involvement and alliances.

	Firms in which they have been obtained			
	NPD	International	Dual-Use Technologies	Alliances
1. WHAT ARE THE DRIVERS				
1A Technical capabilities	✓	✓	✓	M
1B Commercial capabilities	x	M	✓	M
2. HOW ATTEND TO THE CUSTOMERS NEEDS				
2A Push mechanisms	✓	✓	✓	✓
2B Pull mechanisms	✓	✓	✓	✓
2C Future-oriented design	x	✓	✓	✓
3. WHO MANAGES THE FUTURE STRATEGY?				
3A Initiator role	x	✓	✓	✓
3B Strategist role	x	✓	✓	✓
3C Opponent role	✓	✓	✓	✓

✓: Positive relation supported
X: Positive relation not supported
M: Mediator effect – Strategy Players

Table 1 Examination of research propositions

5. Discussion and Conclusions

The findings of this exploratory study are in line with the existing theory and prior research on strategy management in the defence industry in general, although it makes a contribution regarding firms at lower hierarchical levels of the defence procurement. The transformations happened in the past years in the defence industry have not only redefined the skills and the organization of production; they have also given a more strategic place to knowledge management practices (Guillou et al. 2009). Our findings are also consistent with some recent studies of strategic foresight that have emphasized the importance of its study as a social practice (Sarpong, Maclean, and Davies 2013). Therefore this study has been an opportunity to obtain information about the strategic process of defence firms at lower hierarchical levels that cannot be addressed elsewhere and makes some important contributions for both the defence industry and for the competition of DTIB firms.

First it shows that DTIB firms are more active in scanning the technology and the market than in tasks related to intelligence issues. This constitutes a weak spot because the commercial and technical gatekeepers use informal methods to put the information together. At the same time, more important information is provided by informal sources before formal ones (which benefits the firms with the most qualified contacts). Although Lager, Tano, and Anastasijevic (2015) showed that collaboration during the "innovation stage" was determined to be an interesting avenue to follow for both parties, the internationalization and alliances in LH have the MoD as mediator player, and these firms design a not future-oriented strategy. Therefore, the studied DTIB firms have no formal systems to produce their particular vision of the future or the required changes for shaping the future technologies and market evolution. The informal ways to work in strategic areas are linked with the size and low level of complexity of the firms, but they

encompass a weakness in relation with growth, the expansion in the international market and diversification of their products, or generational renewal in the case of family firms.

Secondly, our findings contribute to the competition of DTIB firms because they show that LH firms –i.e., with no high market power- basically trust too much in the public intervention of MoD. The resources and the risk entailed in adopting an international open innovation approach might be higher in the LH firms without the support of prime contractors or the MoDs. DTIB firms in our study are mostly adapting their current technological strategy instead of designing new strategies for the future. However, the results also show that DTIB firms are finding new ways to assure their competitiveness, based on the capability to maintain a strengthened "opponent role": they know very well their customer needs and have good mechanisms to satisfy them thanks to the industrial organization of the defence sector, that includes international alliances.

The international openness is a recent strategic movement for this kind of firms, and it is produced by something more than the tight budget in the last years. The global competition is already a reality for every single firm in the market, although SMEs in defence industry were very dependent from the MoD. Firstly, for historical reasons: some firms were "Royal factories" in their remote origin, or they were founded by public administration until fifteen years ago. Secondly, there is a strategic motivation: every country would like to own military capabilities provided by local firms. As far as we can see, this is the main reason of the differences between DTIB and the rest of the world. Therefore the DTIB is smaller and fragmented, and provide some duplicate capabilities at once it suffers from lack of many other technologies and final products.

Besides our study shows that MoDs and prime contractors will remain mediating players in the near future which will have further implications for the competition of DTIB firms. It implies that firms and MoDs must maintain a close relation and implement more

flexible practices, such as open innovation, property rights or new commercialization schemes.

The results of our study also suggest some managerial implications for DTIB firms and public policy. First, DTIB firms need to understand the potential implications of emerging technological trajectories and overcome the limits on their ability to prepare for an unknown future. The disruptive and emergent technologies are cross-cutting technological areas but also economic, political and legal issues in the defence industry (Kadtke and Wells III 2014).

Secondly, the recent transition from traditional procurement contracts –through life cost reduction– could affect more the SMEs due to the increasing level of technical capabilities and resources needed to win contracts directly with the MoDs. Therefore, collaboration is a path that all DTIB firms are taking to develop projects that exploit their core competencies. Transactional cost are extremely high for studied firms to apply some public tenders, because they are complex (documentation, bonds and guaranties), long contractual payments, the necessity to collaborate with prime contractors… etc. In addition, access to resources is one of the main drivers of research and development's internationalization (Gassmann, Enkel, and Chesbrough 2010) by firms that are capable of appropriating them.

Finally, DTIB firms in our study do not have a formal foresight strategy in spite of the opportunities to implement it. They have informal approaches to foresight but a formal system is important to link technical and commercial capabilities in order to remain in the market and access new niches. Therefore DTIB firms should redefine the traditional roles of R&D staff and even create new ones for the effective scouting and integration of external knowledge and technologies. Moreover, as this study shows, the implementation of corporate foresight has various objectives and may be oriented towards diversification

through dual-use technologies; it may increase the internationalization of firms, even though the defence industry is a highly regulated market and it may improve the firms' participation in alliances to access technology or market knowledge.

As a conclusion, what is original in terms of future strategy from this study? A general conclusion is that informal systems which feed and manage the firms´ strategy are limiting the future of DTIB firms: for instance, their opportunities to grow will be narrowed in the long-term and very restricted to in-house employees and managers in the short-term. LH Defence contractors need a high diversification in products and markets, more competitors and collaborators thanks to dual-use technologies and the growing internationalization, and less dependence of MoDs in order to gain future capabilities. Therefore the strategic process for these firms must still pay nowadays more attention to environmental factors and integrate as well as develop technical and commercial capabilities with the moderator role of MoDs in mind. But in the short and medium-term of these firms, future strategy should be less dependence of MoDs which would introduce changes in the strategic process. Given the paradox that regional policies view defence firms as very strategic in terms of industry development and qualified jobs creation, firms at the lower hierarchical levels should not trust permanently on the mediator role of MoDs to gain independence and market share.

The conclusions of our multiple-case study should be analysed regarding their limitations: the structure of the small and advanced economies (in terms of gross national income and military expenditure), firms with technological capacity for developments until complete weapons and communication kits, internal practices for strategy design and activities to achieve it. We have tried to overcome the limitations to generalize conclusions from a multiple-case study following the recommendations of Strauss and Corbin (2014): the research team did and/or reviewed every interview in pairs, and during

the process of coding, the interrelations between each pair of scholars produced a unique vision. The background of the researchers from different knowledge areas and with different professional experience produced a high-quality research process and empirical grounding for the findings, although the theoretical findings could not be sustained when extended far beyond the European region.

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Annex 1. Cross analysis

		FIRMS					
ID	Label	A	B	C	D	E	Cross analysis
1	**CONTEXT**						
11	***SIZE AND COMPETITIVENESS***						
1130	Prime contractor		x	x		x	
1140	Structural cost		x				
12	***COMPETITION ON THE MARKET***						
121	Size: small						
1259	Coopetition						
126	High competition						
128	Low competition	**x**	**x**	**x**	**x**	**x**	235, 339, 1353, 1233, 1130
1233	International	**x**	**x**	**x**	**x**	**x**	1140, 235, 2243, 128, 3212, 4118, 4138, 3137
13	***OVERCAPACITY, TEC AND COM***						
1353	Overcapacity of defence industry			x			
14	Technology intensiveness						
1422	Lower speed of technological change	x					
1436	Potential market breath	x	x				
1460	Technological leadership				x	x	
2	**STRATEGY PLAYERS**						
21	***DEFENCE STANDARDS***						
2110	Standardisation	x			x		
2139	Product certification	**x**	**x**	**x**	**x**	**x**	3124, 4118, 4124
2146	STANAG	x	x		x	x	1436, 4345, 2110
22	***CALLS FOR PROPOSALS AND TENDERS***						
2213	Democracy ordered system for contracting	x	x	x			
2217	Tenders - Call	x	x	x	x		4325, 3124, 4118, 4124, 235, 3211, 2243, 3135
2243	International		x	x	x		
23	***PROTECTIONIST POLICIES***						
235	Policy	**x**	**x**	**x**	**x**	**x**	3211, 2217, 2243, 4419, 4434, 2213, 1353, 339, 128, 4428, 3135, 3332, 437, 3332, 437, 323, 3212, 4118, 1233, 4251, 4428, 1259, 4428, 2329
2329	Offsets		x			x	
2341	Integration of technologies	x	x				
3	**COM STRATEGY**						
31	***COM INTELLIGENCE***						
3120	Informal activities	x		x	x		
3123	Internet	x					
3124	Informal contacts (COM)	x	x	x	x		2217, 4118, 4124, 3227, 3135, 3120
3135	COM surveillance		x	x	x	x	3212, 4118, 3244, 4247, 4321, 4419, 3124, 3135, 4124, 4434,235, 3135, 4252, 3227, 3137, 4242, 4463
3137	Trade fairs -(COM)	x	x		x		
3162	Restricted sources					x	
32	***COM CAPABILITIES***						
323	Market pull	**x**	**x**	**x**	**x**	**x**	323, 4316, 2217, 422,4118, 4124, 4321, 4321, 332, 437,3332, 235, 1233, 3212
3211	Influence on sales	x		x			
3212	Capabilities demand vs technology complexity	x	x		x		
3227	Commercial department	x	x		x	x	3227, 4118, 4124, 4434, 3244, 3137, 3227
3244	Customer service		x	x	x	x	3244, 4449, 3244, 121
33	***CRM***						
339	Technology integration	x		x			
3332	Lifetime of the product	x		x		x	
4	**TEC & KM STRATEGY**						
41	***TEC INTELLIGENCE***						

		FIRMS					
ID	**Label**	**A**	**B**	**C**	**D**	**E**	**Cross analysis**
4118	Technology surveillance	**x**	**x**	**x**	**x**	**x**	4419, 121, 3135, 3212, 4314, 4434, 1233, 323, 235
4124	Informal contacts (TEC)	x	x	x	x		3124, 2217, 3124, 3227, 3135, 3120, 4419, 4431
4123	Internet	x					
4138	Trade fairs -TEC	x	x		x		
4162	Restricted sources					x	
42	***TEC CAPABILITIES***						
422	Technology push		x	x	x		
4242	Dual-use technologies	x		x	x		
4247	R&D intensiveness		x	x	x		
4251	Alliances		x	x	x	x	1259, 235, 4428
4252	R&D management		x	x		x	
4254	Collaboration in EDA groups			x		x	
4261	Lean Management					x	
43	***NPD***						
437	Long Term	x	x	x			
4314	Product M. vs tech complexity	x	x	x			
4316	Short Term	x	x				
4321	Cutting Edge Technologies	x	x	x		x	3227, 3212, 4314, 422, 323
4325	Robust systems	x					
4326	Time planning	x				x	
4331	Time development	x	x	x		x	4326, 437, 4247, 3135, 4434, 4118, 4124, 2124, 4252, 4326,3332, 4331
4345	TEC intensiveness products vs price		x				
44	***FUTURE-ORIENTED DESIGN***						
4415	Foresight benefits	x			x	x	
4419	Foresight activities	**x**	**x**	**x**	**x**	**x**	3120, 235, 4118, 3135, 4434, 3124
4428	MOD- Roadmaps	x		x	x	x	
4434	Foresight methods	**x**	**x**	**x**	**x**	**x**	1436, 3227, 235, 3135, 4247, 4331, 4118, 4419, 4415
4449	Reducing uncertainty		x	x	x	x	3244, 3135, 4456, 4252, 4455, 4428
4450	Ready to support discontinuities	x	x	x		x	1422, 4247, 4118, 4428, 4449
4455	Increasing the sales			x			
4456	Increasing the employees			x			
4463	Technical forums					x	