WWW.EFMN.EU The European Foresight Monitoring Network

Opportunities in Innovation for the Dutch Defence Industry

Foresight Brief No. 120

Authors: Joost Hoogendoorn, Arjan Rensma, Maurits Butter & Annelieke van der Giessen
email address: joost.hoogendoorn@tno.nl
Sponsors: Dutch Ministry of Economic Affairs and Dutch Ministry of Defence
Type: Single foresight exercise on defence industry
Organizer: TNO
Duration: Jan. – July 2006 **Budget:** € 150,000 **Time Horizon:** 2015 **Date of Brief:** Oct. 2007

Purpose

Under the influence of (inter)national technological, political and economic developments, the defence industry is increasingly intertwined with and developing towards a civil industry. Consequently, the political responsibilities, attitude and measurements are changing for both the Ministry of Defence and the Ministry of Economic Affairs. An analysis of the Dutch defence industry helped to determine the main innovative opportunities of the industry and to identify the complementary technological competences needed to make the most of these opportunities. Also strategic vision, including options for innovation policy, was developed.

Transition of Defence

Historically, "defence" supports national strategy, in which nations have built their own forces, defence industry and knowledge infrastructure. Consequently, within nations there arose a demand driven chain with a solid and confidential relationship between the parties in a closed chain, also discerning the industry from 'civil' industries. However, technological, political and economic developments in the last twenty years are changing defence radically. Issues such as the end of the Cold War, decreasing budgets, international cooperation, international organization of forces, industries and knowledge infrastructure, growing use of civil technologies, civil industries and civil markets, 'the war on terrorism', and homeland defence have entered the stage. Consequently, the political responsibilities, attitudes and measurements are changing for both the Ministry of Defence and the Ministry of Economic Affairs, while the defence industry and knowledge infrastructure is increasingly intertwined and developing towards a civil industry and knowledge infrastructure. This critical transition of the defence chain demands timely strategic information and a vision to anticipate effectively. For ministries this means a clear view on responsibilities, effective investment strategies for a capable future force and an effective industry and innovation policy. The defence industry increasingly has to determine their most favourable innovative possibilities.

Developing a New Strategic Vision

As a result, the ministries wanted to assess four issues/developments and formed working groups to prepare the strategy. Four groups were formed to

- inventory the relevant international developments,
- determine success factors of international cooperation in procurement,
- determine priority technological areas for the defence industry which are for interest for the domestic market, and
- policy instruments to strengthen the strategic vision.

The EFMN is financed by the European Commission DG Research. It is part of a series of initiatives intended to provide a 'Knowledge Sharing Platform' for policy makers in the European Union. More information on the EFMN and on the Knowledge Sharing Platform is provided at WWW.EFMN.EU

The third question concerning the identification of priority technological areas was the core issue in this project and divided into four sub questions:

1. What are the current **strengths** of the Dutch defence industry?
2. What are international **opportunities** for innovation in the defence market?
3. Which technologies and innovations meet the future **needs** of the Dutch Ministry of Defence?
4. What are opportunities for the **civil market**?

In this approach foresight was embedded into a policy process and used as a tool to provide information for the development of an innovation policy for the defence industry.

Structural Approach Based on Clusters

The challenge of the exercise was to systematically translate the four sub questions into perspectives on technological clusters or innovation opportunities. This makes the outcomes comparable. Every perspective was analysed and then translated into a codified taxonomy of technologies developed by the Western European Armaments Group (WEAG); this WEAG-classification on defence technologies is generally accepted within the defence sector. This taxonomy includes technology, products and intelligence or as they are called 'underpinning technologies', 'systems-related technologies' and 'military assessments, equipment and functions'.

Additionally, the WEAG-classes were checked for interrelation such that priority clusters are formed and interpreted, which seem to combine specific technologies with products and intelligence. Finally, these priority clusters are compared such that a final reflection is made from the four different perspectives (see figure 1).

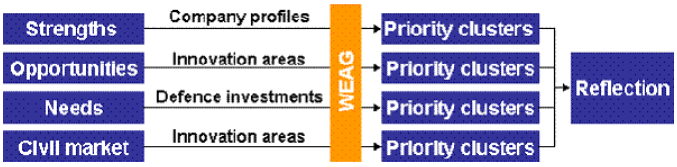

Figure 1: Approach of the study

For determining the **strengths** of the defence industry, companies were analysed and a computer aided workshop including the industry was organized (Group Decision Room). The innovative **opportunities** were inventoried based on desk research and interviews with leading parties. Future **needs** of the military forces were inventoried and weighted based on already planned investments by the Ministry of Defence. Finally, the **civil market** was assessed by experts based on most relevant societal challenges.

Below the analysis on current strengths is elaborated. For foresight purposes, the results on innovative opportunities are also included.

Defence Industry Increasingly Focuses on Intelligence

The defence industry in the Netherlands is relatively small. `With approximately 250 firms, 12,000 employees and 1.5-2.0 billion turnover it represents approximately 0.5% of the Dutch GDP. However, e.g. based on R&D expenditures, it was concluded that the industry was a quite innovative sector. The shift towards a traditional civilian sector is already apparent with a large number of ICT firms within the sector and a substantial turnover in civil markets. Partly this shift is inevitable as defence budgets decline, while the internationalisation of the defence market still appears to be hampered by offsets, "Rules of Engagement" and export controls. Consequently, a nation's defence industry covers all roles in the value chain: research & development, design, engineering, procurement, construction (EPC), subsystem integration, system integration, maintenance, repair and overhaul (MRO) and disposal. However, based on company profiles and questionnaires on WEAG technologies, there is a prioritization (figure 2).

These classes are interrelated; by clustering these classes, technology clusters can be identified. For example, table 2 below shows the classes 'A08 Computing technologies and Mathematical Techniques', 'A09 Information and Signal Processing Technologies', 'B09 Integrated Systems Technology', 'B10 Communication and CIS Related Technologies' and 'C07 battlespace Information' form one cluster.

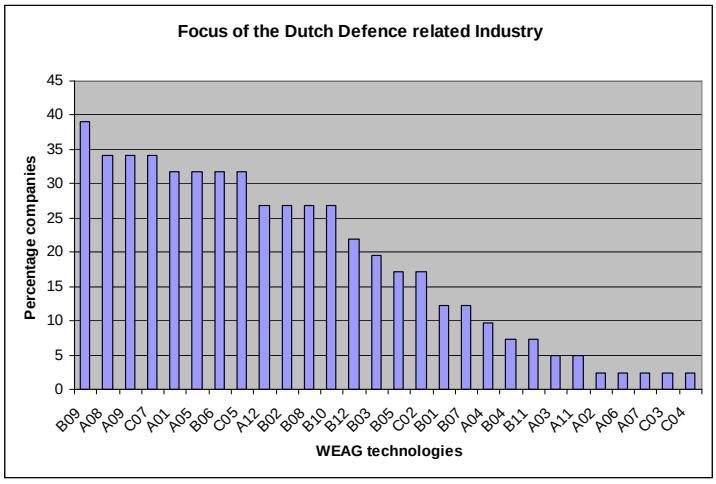

Figure 2: Focus of the Dutch defence industry

Table 1: Most important WEAG classes

1	B09 Integrated Systems Technology
2	A08 Computing Technologies & Mathematical Techniques
3	A09 Information and Signal Processing Technology
4	C07 Battlespace Information
5	A01 Structural & Smart Materials and Structural Mechanics
6	A05 Electronic, Electrical & Electromechanical Device Technology
7	B06 Sensor Systems
8	C05 Equipped Personnel
9	A12 Mechanical, Thermal & Fluid-Related Technologies & Devices
10	B02 Propulsion & Powerplants
11	B08 Simulators, Trainers and Synthetic Environments
12	B10 Communications and CIS Related Technologies

Table 2: Interrelated classes

	A01	A05	A08	A09	A12	B02	B06	B08	B09	B10	B12	C05	C07
A01	13												
A05		13											
A08			14						+	+			+
A09				14						+			+
A12					11								
B02						11							
B06							13						
B08								11				+	
B09			+						16				
B10										11			
B12											9		
C05								+				13	
C07			+	+						+			14

Examining the linkages between these classes shows that this cluster is about information processing and analysis. In defence terminology: command, control, communication, computers and intelligence (C4I).

The identified clusters are:

- command, control, communication, computers and intelligence (C4I)
- sensor systems
- integrated system design and development
- simulation, training and artificial environments
- propulsion and energy systems
- mechanics and hydraulics
- advanced materials
- electronics and mechatronics

New Paradigm of Effectiveness

Military operations are increasingly operations other than war, such as peace operations, foreign humanitarian assistance and other military support to civil authorities. Consequently, governments turned their focus on the ultimate goal of 'effect-based [security] operations'. In practice, effect-based operations imply a joint and combined cooperation between different armies and forces resulting in a transformation of a platform-centric force into a network-centric force. The term "network-centric warfare" or "network enabled operations" broadly describes the combination of emerging tactics, techniques, and procedures that a fully or even partially networked force can employ to create a decisive advantage. On the whole, the defence sector still innovates on platforms, weaponry and increasingly on intelligence. Figure 3 below shows all innovation themes which are on the agenda of the defence sector.

Figure 3: Innovation radar of the (global) defence industry

Innovation themes are divided into underlying innovative opportunities, translated in the WEAG-classification and finally clusters are identified. The main clusters are C4I, sensor systems and integrated system design and development.

Information Based Services

The clusters arising from the four perspectives are compared with each other to identify the main clusters. Table 3 below shows the synthesis.

Type 1 clusters can be regarded as broad, strong clusters, with a good industry base and market potential in domestic, international and civil markets. This first type of cluster represents information based services for the Dutch industry. Type 2 clusters cover a couple of interesting niche markets. Finally, type 3 clusters are fragmented but might have some niches.

		Perspective			
	Technology clusters	Strengths	Opportunities	Needs	Civil market
Type 1	C4I	++	++	++	++
	Sensor systems	+	++	++	++
Type 2	Integrated system design and development	+	+	+	+
	Simulation, training and artificial environments	+	(+)	+	+
	Electronics and mechatronics	(+)	(+)	+	+
	Advanced materials	(+)	(+)	+	+
Type 3	Propulsion and energy systems	+	=	(+)	=
	Mechanics and hydraulics	+	=	=	=
	Protection and weaponry	=	=	+	=

++	A broadly represented technology cluster
+	Strong cluster on niches
(+)	Potential of cluster is viewed differently
=	Less important, fragmented cluster

Table 3: Evaluation of the technology clusters

High Impact on Future Defence Innovation Policy

The project was on a highly political trajectory, where the interests of industry and the ministries of Defence and Economic Affairs were intertwined. Also being a part of a broader process and the project delivering the content for just one of four working groups led to intensive discussions within the interdepartmental group before the results could be used as input to the national strategy for the defence industry. This, together with the change of government, considerably prolonged the finalization of the strategy.

About one year after the finalization of the project, the ministries determined their Defence industry strategy. The results of the project were largely integrated into the strategy and therefore had a high impact. The technological priorities stated were fully accepted and provided the backbone to the suggested defence innovation policy. The strategy was discussed in Parliament and will be part of the national policy on the defence industry.

Sources and References

Butter, M, J.H.A. Hoogendoorn, A. Rensma and A. van der Giessen (2006), “The Dutch Defence Outlook”, TNO.