The Effects of Organizational Structure on Innovation within Large Defense Contractors

Kelsey E. Scott

kescott@andrew.cmu.edu

Carnegie Mellon University

The aerospace and defense industry have historically had the reputation for being at the forefront of technology development. From the internet to nuclear weapons, groundbreaking innovations have defined the industry and the United States technical prowess at large. In recent years, however, there is growing scrutiny on the industry for employing the "faster higher cheaper" approach to innovation - which is to say it focuses on mass producing platforms that are incrementally better than their ancestors - when the future expects and demands systems that revolutionize the technology on a much more fundamental level. With growing innovation in private technology companies, there is growing pressure on defense contractors to streamline and improve their innovation, however, the large organizations are characterized by clunky inefficiency. Thus, the way defense contractors structure themselves to foster innovation through leveraging interdisciplinary connections while maintaining operational efficiency within functional disciplines will position them to succeed or fail in an increasingly dynamic market.

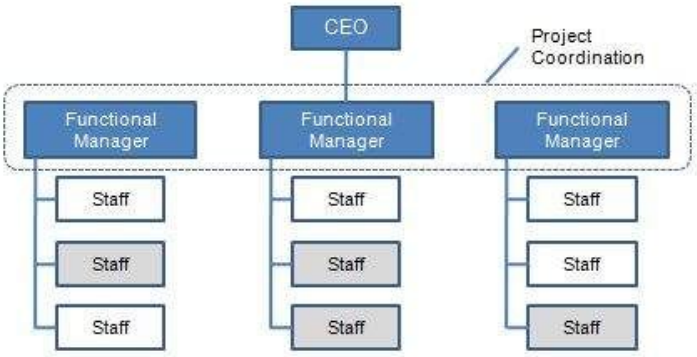
Method

This paper examines the organizational structure of three leading United States defense contractors. Interviews with recruiters and managers at each of the companies were performed to collect insights on how each company believes it has structured itself to succeed long term. The interviewees include the following:

- Hemant Patel, Senior Systems Engineer at the Lockheed Martin Corporation
- Dr. Dianne Chong, VP of Assembly, Factory, and Support Technologies at the Boeing Company
- Carl R. Martin, Program Manager at the Northrop Grumman Corporation

Organizational Structures

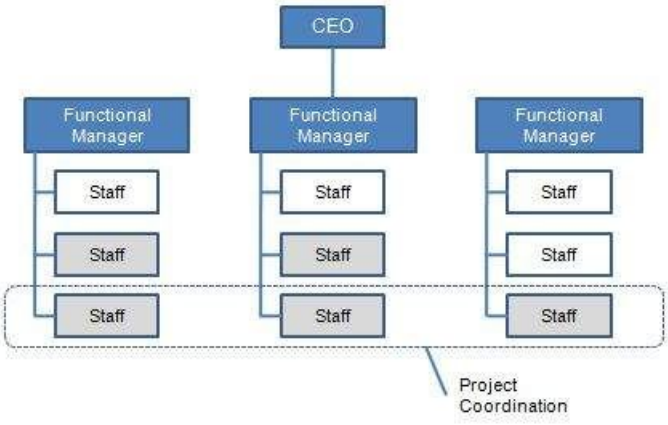
Functional



(Tutorialspoint)

One of the most common organizational structures is known as functional organization. A functional organization is generally considered to be highly effective in large companies that produce high volumes of products with low costs. The functional separation segments employees within the group that affects them, minimizing the distractions or superfluous meetings other structures could require. Communication across different functional divisions is difficult, however. This limits the ideas of This, it is generally characterized by high efficiency, but low interconnectivity and communication.

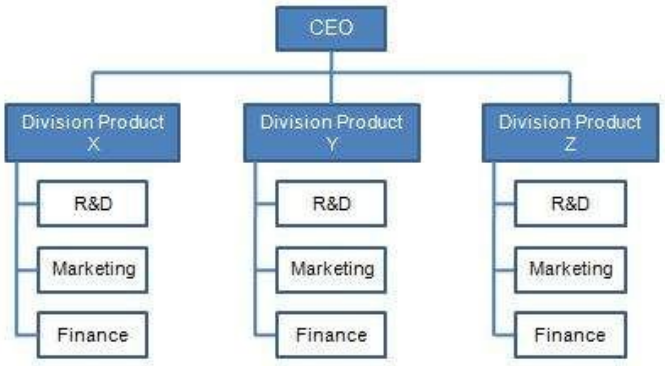
Matrix



(Tutorialspoint)

The Matrix organizational structure has a functional breakdown with additional linkages across the functions. This facilitates the communication between functional managers and functional staffs, which can lead to improved innovation and collaboration. These additional linkages, however, when not properly managed can become highly inefficient and confusing. Individual employees could end up directly reporting to more than one superior and can end up having their schedules inundated with irrelevant meetings.

Others



(Tutorialspoint)

Beyond functional and matrix, organizations can structure around many other components: products, programs, markets, etc. The figure above shows a division structure, in which the functional components are distributed into different divisions corresponding to distinct products. Most organizational structures, however, share ideas, advantages, and disadvantages with either or both the matrix and functional organizational structures.

Defense Industry Case Studies

Boeing

Boeing is commonly recognized as a leading producer of commercial airlines, however, they are also the second largest defense contractor in the United States (Defense News). Boeing

employs a centralized, hierarchical matrix structure (Boeing Organizational Structure). The matrix structure allows Boeing to leverage the creative, innovative nature of their employees who are exposed and connected more widely due to the organizational structure (Chong). The matrix, however, isn't applicable or enforced in all business areas, given some have a very distinct function within the company that must be effectively streamlined (ibid). The company serves a diversity of geographic and industry customers, which requires a flexible and well-managed matrix structure (ibid).

Boeing also has a division, Phantom Works, within the defense and security business unit that focuses on advanced development projects. Phantom Works functions similarly to Lockheed Martin's Skunk Works (described below) and is charged with prototyping the early stage ideas that come out of Boeing's research groups (ibid).

Lockheed Martin

Lockheed Martin is the United State's leading defense contractor (Defense News), with nearly 100,000 employees across the world (Who We Are). Lockheed Martin underwent a restructuring for improved integration in 2013, creating a divisional matrix structure (Calderon et al). This structure divides Lockheed Martin into divisions such as Aeronautics, Missile and Fire Control, and Space Systems, and establishes a matrix within each of these groups. This allows for interdisciplinary connections among different functional groups working on the same project and similar functional groups working on different projects.

Beyond the typical matrix structure, Lockheed Martin is known for its advanced research lab, Skunk Works. Skunkworks is part of the Aeronautics division and focuses on bringing together highly innovative doers to generate revolutionary aircraft (Skunk Works).

Northrop Grumman

Northrop Grumman Corporation, a publicly traded US-based defense contractor, is the fifth largest defense contractor in the Unites States (Defense News). The company as a whole restructured in 2016, transitioning from four sectors to three (Belote). Prior to this restructuring, each sector has a distinct organizational structure, however now the sector matrix structure is the company standard (Martin). Given the transition, it is evident that the corporate leadership believes leveraging the networks and connections of the employees are essential for long-term growth and success, however, the effectiveness of the new structure within the context of Northrop Grumman will be verified within the coming term.

Northrop Grumman has also a dedicated advanced research group in the Advanced Capabilities Development Center (ACDC), known to some as their "black cat" facility, to emulate the Skunk Works and Phantom Works advanced development labs that their competitors boast (ibid). The work and structure of this segment of Northrop Grumman are clouded in much more secrecy than those of its counterparts.

Conclusion

Through speaking with representatives at each of the companies described above, and exploring overall market trends, the following conclusions seem justified:

Innovation Requires Interdisciplinary Teams

Whether it is formally perpetuated through a matrix structure or informally pushed for, interdisciplinarity is recognized as one of the most crucial elements in creating groundbreaking, reliable, and innovative defense solutions (Patel, Martin, Chong). Each organization focused on diversity and interdisciplinarity in their employees, considering factors such as race, gender,

technical training, education level, amongst others. Generally, these companies believe in fostering and promoting connectivity through formal organizational networking events, employee activities, conferences and seminars, and many other corporate culture efforts (ibid).

Systems Engineering is Becoming More Essential

Especially at Lockheed Martin and Northrop Grumman, systems engineering and systems thinking are being pushed as a means of creating roles specifically designed to serve as the go-betweens to connect business people and highly technical engineers. Early career training in the systems engineering field is growing, and exposure to systems thinking is becoming more of a requisite than a competitive edge for prospective employees (Patel, Martin).

Organizations Must Function Efficiently to Compete with Private Tech Companies

Given the growing rate of technological development at large, commercial technology companies (Google, Facebook, Tesla, etc.), the defense industry has been under scrutiny for delivering over budget, under-featured products. Policy and lobbying have pushed for more inclusion of small businesses and non-traditional defense players to get involved in revolutionizing the way military technology and intelligence are handled today (Repenning). Ultimately, large defense players must maintain structures that are streamlined enough to not cause cost overruns and functional inefficiencies, without sacrificing the interdisciplinary connections that allow them to be innovative.

Discussion

Ultimately, a very carefully managed matrix structure appears to be not only the industry standard but also a viable way of balancing the competing priorities of leveraging networks to foster innovation and streamlining operations for functional efficiency. The sheer size of the

projects the companies work on and the number of personnel required by each assignment result in a complicated planning schematic, making management crucial to the success. However, functional or divisional structures that would simplify this management, lack the network benefits that are critical to the development of innovative technologies. By having a dedicated group focused on advanced development and prototyping (such as Skunk Works, Phantom Works or the ACDC), the companies can leverage the innovative thinkers and can-do attitudes of many of their technical employees without slowing down progress and development company-wide. Ultimately, balance is the key to the continued success and improvement of large defense contractors in the United States.

References

Blasius, Ann, Jolene Cabazos, Julie Comeau, Ryan Scalmanini, and Nora Trombley. "Organization Structure." *Slideshare*. Dr. Darin Jones, 23 Aug. 2009. Web. 1 Dec. 2016. <http://www.slideshare.net/rscalmo/teamdweek3alltogether>.

Belote, Randy. "Northrop Grumman Announces Organization and Leadership Changes." *Northrop Grumman Corporation Investors*. Northrop Grumman Corporation, n.d. Web. 11 Oct. 2016.

Calderon, Catrina, Andrea Carter, Fazeela Choudhry, Kalleigh Eisley, Emily Girtin, Zach Kloska, Braeden Lipe, Keegan Parker, and Ali Radwani. "Firm Evaluation: Lockheed Martin Space Systems." *Slideshare*. University of Colorado, Denver, 25 Apr. 2016. Web. 8 Dec. 2016. <http://www.slideshare.net/ZachKloska/lockheed-martin-case-studyfinal-draft-61339406>.

Chong, Dianne. "Innovation Management." Engineering Technology and Innovation Management in Practice. Carnegie Mellon University, Pittsburgh. 21 Nov. 2016. Lecture.

"Defense News Top 100 Global Defense Companies (2015)." *FIRE SUPPORT*. N.p., n.d. Web. 13 Dec. 2016. <https://defensecontractormarketing.com/defense-news-top-100-global-companies-2015/>.

Martin, Carl R. "Innovation at Northrop Grumman." Personal interview. 14 Oct. 2016.

"Organizational Structures." *Www.tutorialspoint.com*. N.p., n.d. Web. 06 Dec. 2016. <https://www.tutorialspoint.com/management_concepts/organizational_structures.htm>.

Repenning, Nelson P., and John D. Sterman. "Nobody Ever Gets Credit for Fixing Problems That Never Happened: Creating and Sustaining Process Improvement." *California Management Review* 43.4 (2001): 64-88. Web.

"Skunk Works®." Lockheed Martin, n.d. Web. 11 Dec. 2016. <http://www.lockheedmartin.com/us/aeronautics/skunkworks.html>.

Patel, Hemant. "Innovation at Lockheed Martin." Personal interview. 13 Oct. 2016.

"Who We Are." Lockheed Martin, n.d. Web. 13 Dec. 2016. <http://www.lockheedmartin.com/us/who-we-are.html>.