

The Chief Research and Development (R&D) Officer's Contribution to Innovation: A Study in Consumer Packaged Goods Multinationals

by

Javier Rodriguez Hefferan

B. Eng., Chemical Engineering
Universidad Iberoamericana, Mexico, 2009

Submitted to the System Design and Management Program in Partial Fulfillment of the Requirements for the Degree of

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Signature redacted

Signature of Author: _____
Javier Rodriguez Hefferan
System Design and Management Program
August 5, 2016

Signature redacted

Certified by: _____
David Niño, Ph. D.
Senior Lecturer, Gordon-MIT Engineering Leadership Program
Thesis Supervisor

Signature redacted

Accepted by: _____
Warren Seering
Weber-Shaughness Professor of Mechanical Engineering

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Abstract

The Consumer Packaged Goods (CPG) industry faces challenges that are making it increasingly harder for CPG multinational companies to compete. The lack of differentiation in CPG, evolving consumer preferences, and the need to offer the consumer a unique and valuable experience is requiring CPG multinational companies to continuously innovate. The Research and Development (R&D) function helps to overcome the pressing challenges that the CPG industry faces by contributing to the overall innovation that a firm can deliver. The underlying question is how R&D creates innovation in the context of a CPG multinational. Such innovation, in the form of new products and processes, would seemingly require a central R&D executive, defined in this thesis as the Chief R&D Officer, the person who is accountable for creating innovation for the firm in the R&D context. To contribute to innovation, the Chief R&D Officer must not only set the direction for R&D, but also execute this direction in terms of formulating the R&D strategy, and then managing the R&D organizational structure and leading the R&D organizational culture. The proposition is that the evolving role of the Chief R&D Officer is demanding that these senior executives think systematically about these elements to guarantee the short-term and long-term competitiveness of the R&D organization. If the Chief R&D Officer formulates the right strategy but has an inefficient organizational structure or lacks an innovative organizational culture, then the R&D organization will fail in creating innovation for the firm. This thesis also explores how Chief R&D Officers in the CPG multinational companies have coped with these key elements to achieve successful innovation.

Thesis Supervisor: David Niño, Ph. D.
Title: Senior Lecturer, Gordon-MIT Engineering Leadership Program
Massachusetts Institute of Technology
Thesis Advisor

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Dedication

I would like to dedicate this thesis to the central pillars of my life, my mother, Blanca, and my father, Fernando, who have always unconditionally supported and praised the decisions I have made in my life. Their infinite love has always given me the courage and strength to follow my dreams and to fight for them. To my sister, Monica for always providing me counsel in moments of struggle and for always making me feel that fraternal bonds are stronger than anything in this world. Last but not least, I want to thank the love of my life, Rodrigo, for providing the proof that love can move mountains. This last year would have not been the same without you supporting me and encouraging me to always aspire for greater things in life. Your kind, enormous heart and shining light have always been guiding me and supporting me throughout these years. I am forever grateful for having you by my side every day of my life and for always bringing out the best of me.

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List of Acronyms

AGs	Application Groups
BTC	Business Technology Center
CEO	Chief Executive Officer
CFO	Chief Financial Officer
CIO	Chief Innovation Officer
CSO	Chief Scientific Officer
CTO	Chief Technology Officer
C&D	Connect and Develop
CPG	Consumer Packaged Goods
EVP	Executive Vice President
FMCG	Fast moving consumer goods
HR	Human Resources
MIT	Massachusetts Institute of Technology
M&A	Mergers and Acquisitions
NIHS	Nestlé Institute of Health Sciences
NRC	Nestlé Research Center
NIH	Not-Invented-Here
NHW	Nutrition, Health and Wellness
OI	Open Innovation
P&E	Process and Equipment Development
P&G	Procter & Gamble
PD	Product Development
PR	Product Research
PS&R	Product Safety and Regulatory
PTCs	Product Technology Centers
QA	Quality Assurance
RB	Reckitt Benckiser
R&D	Research and Development
SVP	Senior Vice President
SiW	Sharing is Winning
SBU	Strategic Business Units
STC	System Technology Center
TTM	Time-to-market
VP	Vice President
WFGM	Want, Find, Get, Manage

Chapter 1 | Introduction

1.1 | Research Motivation and Research Question

The Consumer Packaged Goods (CPG) industry faces challenges that are making it increasingly harder for CPG multinational companies to compete. At a macro level, the CPG industry operates in a mature market. Mature markets are characterized by less market potential and less product differentiation, but higher competitive forces (Kalish, 2007). At the micro level, consumers have become more demanding and selective, and their preferences are evolving faster than ever before. As a consequence, product lifecycles have been reduced. This leads to a higher number of available offerings to the consumers in the marketplace, and therefore, a higher risk of substitution (Noordman & Meijer, 2010). In addition, there has been an increasing awareness in consumers regarding health and wellness. Consumers are demanding healthier and environmentally sustainable products. This high-pressure environment is challenging CPG companies to introduce highly successful and differentiated new products in the marketplace at faster rates. At the same time, these products need to offer a unique and valuable experience to the consumer. If the consumer dislikes the product, the repurchase cycle ends. To cope with these challenges, CPG multinational companies need to continuously create *innovation*.

This research focuses on how the Research and Development (R&D) function in the CPG industry creates innovation for the firm. In fact, the R&D function is at the forefront of the innovation process and is responsible for discovering new knowledge and ideas in scientific and technological areas and materializing these ideas into new products, processes or services (Carleton, Cockayne & Sawatani, 2015). Moreover, innovation can be viewed as *holistic* as it can generate value for the consumer in multiple dimensions. Innovation can be created by a firm through four main dimensions: (1) the form of the products it produces, (2) the customers it serves, (3) the processes it utilizes and (4) the markets where its offerings are available (Sawhney, Wolcott & Arroniz, 2007). This thesis proposes that R&D acts as a key contributor in three of the four main dimensions. Therefore, R&D acts as a key contributor to create innovation for the firm.

Furthermore, new products and process innovations vary along two different degrees of innovation: incremental and radical. Incremental innovation refers to making slight modifications to the existing products. Radical innovation refers to new products delivered in entirely new ways,

therefore, offering the consumer an entirely new value proposition (Davila, Epstein & Sheldon, 2006). The CPG industry generally creates incremental innovations rather than radical innovations (Grunert et al., 1997). While incremental innovations secure the short-term survival of a company, radical innovations are necessary to sustain the company's long-term growth (Tushman & O'Reilly, 2008). Innovation generated by R&D creates sustainable growth in a company and that R&D brings value to the firm in three dimensions: (1) creating differentiated products, (2) decreasing the time-to-market, and (3) delivering radical innovations (Holtzman, 2008). Thus, the value that the R&D organization creates helps to overcome the pressing challenges that the CPG industry is facing by the delivery of both types of innovation.

However, the delivery of successful innovation by R&D in the context of a CPG multinational company is a complex task. It requires asking strategic questions about: (1) when to make the necessary investments on the technologies that are going to sustain the business of tomorrow, (2) how to globalize the R&D activity, (3) how to balance both short- and long-term R&D strategy, (4) how to structure the R&D organization so that it can be more responsive to the business, and (5) how to change the mindset of the R&D organization by introducing a stronger business focus.

The need to have a central R&D executive who addresses the decisions and trade-offs associated with these strategic questions and who leads and manages the R&D organization is the core of what is explored in this research paper. More specifically, this research examines the role of the central R&D executive, defined in this thesis as *Chief Research and Development (R&D) Officer*, the person who is accountable for generating innovation in the R&D context.

The Chief R&D Officer must not only set the direction for R&D, but also execute this direction in terms of formulating the R&D strategy, and then managing the R&D organizational structure and leading the R&D organizational culture. In this thesis, the proposal is that the Chief R&D Officer needs to approach these elements from a holistic perspective so that the R&D organization can contribute positively to innovation. Consequently, this thesis explores the following question:

In the context of the CPG industry, how does the Chief R&D Officer contribute to innovation by taking a systematic approach in terms of formulating R&D strategy, managing the R&D organizational structure and leading the R&D organizational culture?

The system to be explored in this is portrayed in Figure 1.

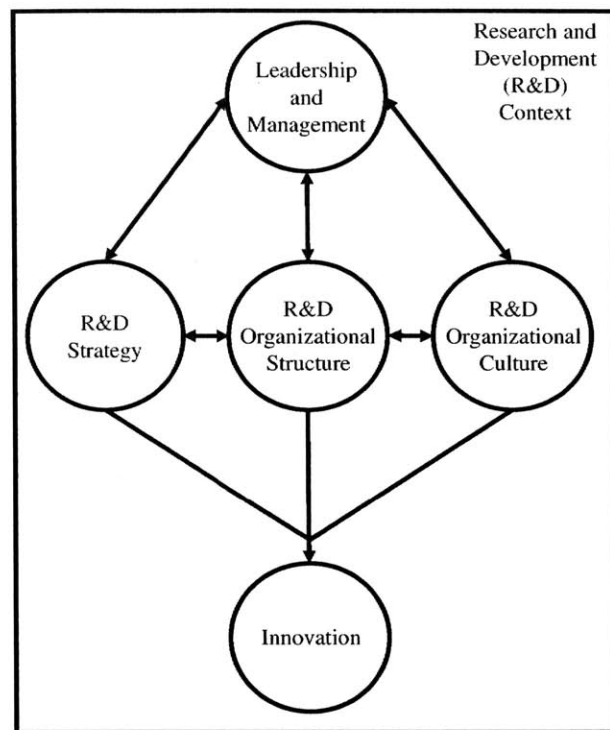


Figure 1. Thesis topics in the Research and Development (R&D) context.

This thesis will cover the following topics to help answer the central question of this research paper. First, it is necessary to clarify that leadership and management are different but complementary, and they depend on each other to function (Kotter, 2001). Management copes with complexity, which implies planning, providing organizational structure, controlling and problem solving. Leadership copes with change, which implies setting a direction, and aligning, motivating and inspiring people in an organization. Due to the inherent dependency of these two systems of action, this thesis suggests that a great part of the Chief R&D Officer's core responsibilities reside in:

- Formulating the *R&D strategy*. In the corporate context, Crawley, Cameron and Selva (2016) define corporate strategy as the “means by which the firm achieves corporate goals, such as increasing profitability and building competitive shareholder value.” Chiesa (2001) elaborates that that R&D strategy consists of “the definition of set R&D initiatives required to achieve the fixed objectives defined within the overall strategic framework of the firm.”

The Chief R&D Officer not only has to set the direction for R&D, but also has to decide which initiatives are going to be pursued. These initiatives must be closely aligned with the overall firm's strategy.

- Managing the *organizational structure* once the R&D strategy has been decided. This includes decisions regarding the centralization or decentralization to internationalize R&D activities, the allocation of R&D resources, the orientation of the organization (project, function or matrix organization), and the use of external versus internal resources (Galbraith, 2002; Rouseel, Saad & Erickson, 1991).
- Leading the *organizational culture* to nurture the R&D structure and contribute to the R&D strategy. Leading the R&D organizational culture involves transforming the R&D organization by instilling a sense of purpose, direction and focus in all technical departments and changing the mindset in R&D so the R&D organization can be more responsive to business demands. Schein (2010) argues that the impact that leaders have is crucial for establishing or influencing the culture of an organization.

Finally, on a personal note, I worked in an R&D organization for a CPG multinational company before starting my postgraduate degree at the Massachusetts Institute of Technology (MIT) and I was always interested to explore the Chief R&D Officer's role in this dynamic and demanding industry and understand the challenges associated with leading and managing the R&D organization. In fact, managing and leading the R&D organization poses both internal and external challenges if compared with other functions. Internal challenges are associated with: (1) the art of integrating the efforts of many disciplines (Jain, Triandis & Wagner, 2010) due to the diverse internal teams that comprise the R&D organization and the wide array of functions that R&D must interact with (e.g., marketing) to bring new products and processes to the market; (2) the alignment and integration of R&D with the rest of the organization to execute the overall firm's strategy; and (3) the unique culture of the R&D organization, as it is assumed to have highly creative people, with above-average intelligence quotients and advanced graduate training (Roussel, Saad & Erickson, 1991). External challenges are associated with (1) the highly uncertain and unpredictable environment in which the R&D activities generally take place; and (2) the globalization of markets, the diversification of technical and scientific expertise, and the continuous change in technologies (Traill & Grunert, 1997). Exploring these challenges in terms of the central R&D topics this thesis

proposes (R&D strategy, R&D organizational structure, and R&D organizational culture) could provide an initial insight regarding the complexity associated with leading and managing the R&D organization in a CPG multinational company. Thus, this research paper could be a valuable contribution for aspiring R&D leaders *and* managers in the CPG industry as they build their careers in the R&D organization.

1.2 | Thesis Organization

This thesis is organized as follows. First, this research introduces an overview of the CPG industry, the challenges the CPG industry is facing and the necessity of having an R&D function that drives the firm's innovation. Next, it explores the term "innovation" and specifically details how does the R&D function contributes to the firm's innovation. Then, the thesis details the relevance of the Chief R&D Officer's role and the implications for formulating the R&D strategy, managing the R&D organizational structure and leading the R&D organizational culture.

Chapter 2 | Consumer Packaged Goods (CPG): Industry and Product Characteristics

This chapter outlines the general characteristics of the consumer packaged goods (CPG) industry and the scope of CPG multinational companies that are explored in this thesis. It also introduces the challenges and trends this industry is facing and highlights the importance of introducing successful new products to the market to guarantee the firm's competitiveness. The chapter concludes by elucidating the particular challenges in the CPG organization and the impact they have on R&D with regard to strategy, structure and culture.

Chapter 3 | Innovation and Research and Development (R&D)

This chapter provides an overview of the definition of innovation, types of innovation, and classification of new products. It specifies the need of having innovation in the CPG industry to differentiate products and create value for consumers. Moreover, this chapter remarks how specifically R&D contributes to the overall firm's innovation and clarifies the distinction between *Research* and *Development*. It also provides an insight on how the transition is made between *Research* and *Development* in CPG multinational companies.

Chapter 4 | The Role of the Chief Research and Development (R&D) Officer

This chapter provides an overview of the evolution of the Chief R&D Officer's role and the emergence of a senior executive as part of the executive leadership team of a multinational company. The Chief R&D Officer's role evolution has demanded this senior executive to not only lead, but also manage the R&D organization. This chapter explains the role of the Chief R&D Officer in CPG multinational companies as the person who has an oversight of Innovation, Technology and R&D. It also establishes the comparison against other industries (e.g. high-tech) and then provides the Chief R&D Officer's core responsibilities and establishes that this senior executive has to not only set the direction for R&D, but also execute this direction in terms of formulating the R&D strategy, managing the R&D organizational structure and leading the R&D organizational culture.

Additionally, this chapter provides an overview of the functions that can interact with R&D in a CPG Organization and the internal functions that can comprise an R&D CPG organization. This explanation is presented to support Jain et al.'s (2010) point that managing and leading the R&D organization is the art of integrating the efforts of many disciplines. The objective of introducing this overview is to emphasize that the Chief R&D Officer has to establish the strategy, structure and culture to enable the collaboration internally, across the R&D organization as well as externally, with business functions and external partners.

Chapter 5 | Formulating the R&D Strategy

This chapter provides an overview of corporate strategy and the need for alignment of the R&D strategy with the company's strategy. It then addresses the key decisions the Chief R&D Officer has to make when formulating the R&D strategy: deciding the amount to invest in R&D, designing a technology roadmap and selecting on the R&D project portfolio. The chapter includes a case study from the CPG industry to illustrate the Chief R&D Officer's relevance in aligning R&D strategy with corporate strategy.

Chapter 6 | Managing the R&D Organizational Structure

This chapter introduces the dimensions of structural choice distinguished by Rouseel, Saad and Erickson (1991) that need to be addressed by the Chief R&D Officer. This chapter explores these dimensions by introducing the frameworks related to the use of external versus internal resources, centralization or decentralization of R&D, allocation of R&D resources, and the orientation of the organization (project, function or matrix organization). Examples and case studies from Chief R&D Officers from the CPG Industry are included to clarify the frameworks.

Chapter 7 | Leading the R&D Organizational Culture

This chapter explores the implications of leading the R&D organizational culture. The Chief R&D Officer needs to understand the elements that influence R&D organizational culture so he or she can act upon them. In addition, this chapter highlights Schein's (2010) theory about the impact that leaders have in influencing the culture and also explains how the Chief R&D Officer can leverage the organizational culture for fostering innovation. The chapter includes practices and behaviors from Chief R&D Officers in CPG multinational companies that demonstrate the importance of these R&D senior executives in shaping the culture of an R&D organization.

Chapter 8 | Practical and Research Implications

This chapter provides a comprehensive summary of the need for Chief R&D Officers to understand the implications of formulating the R&D strategy, managing the organizational structure and leading the organization culture of an R&D organization to achieve the desired outcome: innovation. The chapter elaborates on theories of the evolving role of the Chief R&D Officer and the potential implications for the CPG companies. The chapter ends with the research implications that are based on, or extensions of, this thesis.

Chapter 9 | Conclusions

This chapter summarizes the research findings of this thesis.

Chapter 2 | Consumer Packaged Goods (CPG): Industry and Product Characteristics

This chapter provides an overview of CPG, the CPG industry and the largest CPG multinational companies. Understanding the CPG characteristics both on a macro level (CPG industry) and micro level (CPG consumer) is important as it sets the stage for showcasing the trends and challenges that CPG multinational companies face nowadays. CPG multinational companies need to react to these trends and challenges in order to guarantee its short- and long-term competitiveness. The R&D function, as part of the CPG organization, is influenced by the firm's strategy. As a consequence, decisions and trade-offs associated with strategy, structure and culture need to be made in the R&D organization.

2.1 | Introduction to CPG

This section provides the context to understand how CPG differ from the broad universe of products. Products can be classified into three groups according to durability and tangibility (Kotler & Keller, 2016):

1. **Nondurable goods** are tangible goods that are normally consumed in one or a few uses. Because these goods are purchased on a frequent basis, the appropriate strategy is to make them readily available in many locations, charge only a small markup, and advertise heavily to induce trial and build preference. Shampoo, beverages, and laundry soaps are examples of nondurable goods.
2. **Durable goods** are tangible goods that normally survive many uses. These require more personal selling and service, have a higher margin, and require more seller guarantees. Refrigerators, clothing, and machine tools are examples of durable goods.
3. **Services** are intangible, inseparable and variable products that generally require more quality control, supplier credibility, and adaptability. Haircuts and legal advice are examples of services.

Therefore, from this classification, consumer packaged goods (CPG) usually refer to nondurable products that are purchased on a frequent basis by consumers with minimal effort (Kotler & Keller, 2016). Since CPG are generally replaced on a more frequent basis, they are sometimes referred to as fast moving consumer goods (FMCG) (Geissel, 2008).

Additionally, these products have a short lifecycle (due to their high demand or their perishability) and sell quickly at relatively low cost. Even though the absolute profit made by these types of products is low, the selling volume is usually very high and the cumulative profit can be significant. Therefore, the CPG industry is classified as a low margin and high volume business (Roshif, 2015).

Majumdar (2007) classifies CPG in four main categories:

1. **Personal Care Products.** Comprises oral care, hair care, personal wash, cosmetics and toiletries, deodorants, perfumes and paper products (e.g. tissues, diapers, sanitary), among others.
2. **Household Care Products.** Includes household cleaners and fabric wash (laundry soaps and detergents), among other products.
3. **Branded Packaged Foods and Beverages.** Includes beverages, carbonated soft drinks, cereals, food snacks, tea, coffee, bottled water, dairy products, processed fruits and vegetables and meat, among other products.
4. **Alcoholic Beverages and Tobacco.**

This research paper mainly studies multinational companies associated with products in the first three categories.

2.2 | General Characteristics of CPG and CPG Industry

Understanding the general characteristics of both CPG from a consumer perspective and the CPG industry is important, as it provides information about the landscape in which CPG companies operate.

From a consumer perspective CPG have the following characteristics:

- Most of the purchasing decisions in CPG are emotional rather than rational (Geissel, 2008). This emotional appeal is generally associated with the approval and social appreciation derived from consuming the product rather than the basic usage of it. Personal motives such as image, prestige, lifestyle or fashion can have a great impact on the buyer's decision.
- CPG are classified as low involvement products (Kotler & Keller, 2016). This implies that purchasing decisions require less effort for these types of products since they are usually less expensive and purchased more frequently than high involvement products (e.g. durable

goods). Additionally, CPG within a specific category can be relatively homogeneous. For example, soft drinks can often be differentiated only by price, brand, packaging and attributes such as flavor or color. To consumers, often these products seem similar and therefore price, brand, differentiation and perceived value are the major drivers that influence in the purchasing decision.

Furthermore, the CPG industry has the following characteristics:

- CPG companies operate in a mature market (Kalish, 2007). Mature markets, as opposed to growth markets, are characterized by less market potential and less product differentiation, but higher competitive forces. Therefore, introducing new products in saturated markets is challenging and also market success might be less probable. Zaltman (2003) mentions that approximately 80% of all new products fail within six months.
- The CPG industry operates in a low-technology sector (Christensen et al., 1996). Low-tech, as opposed to the high-tech sector, might not consider the most advanced technology available for their new products or processes. The Organization for Economic Co-operation and Development (OECD) clarifies that the distinction between high-tech and low-tech resides in the R&D intensity (Hatzichronoglou, 1997). The R&D intensity, in the context of multinational companies, is the R&D spending as a percent of the firm's revenue (Jaruzelski, Schwartz & Staack, 2015). Examples of high-tech industries include pharmaceuticals and computing and electronics. For comparison purposes, Jaruzelski, Schwartz and Staack (2015) in the "*Global Innovation 1000*" *Strategy & Report* indicate that R&D intensity for the healthcare and computing and electronics sector was 21.3% and 24.5% respectively, while for CPG R&D intensity was 3%. This indicates that due to the high amount of investment in the high-tech sector, there are greater possibilities to develop the most advanced technology for new products, processes or services.
- CPG manufacturers normally sell their products through retailers, including brick-and-mortar stores and through e-commerce (e.g. Amazon). Therefore, CPG companies are not in direct contact with the end customer of their product (Geissel, 2008). Information that might be relevant for new product development, such as buying motives, preferences or consumer problems, is generally not collected directly through retailers and, due to this lack of information, CPG companies conduct marketing research to close this gap.

- CPG companies try to achieve wide distribution networks to reach out to as many potential consumers as possible. This increases their presence in the market (Majumdar, 2007).
- The CPG market is highly competitive. Therefore, building customer loyalty through branding is imperative to sustain sales growth (Hlavinka & Gomez, 2007).

2.3 | Largest CPG Multinational Companies

Once having defined the general characteristics of this sector, it is important to explore which are the largest CPG companies, as this thesis explores examples and case studies from these multinationals. Exploring the largest CPG companies also sets the context for understanding the global presence of these organizations. The leading fifteen CPG companies worldwide in 2014 based on net sales in million US dollars can be found in Table 1.

Table 1. Top fifteen leading CPG companies. *Source: OC&C Statista (2014).*

Number	Company	2014 Net Sales (in million US dollars)
1	Nestlé	100,205
2	Procter & Gamble	83,062
3	PepsiCo	66,683
4	Unilever	66,135
5	JBS	49,102
6	AB InBev	47,063
7	The Coca-Cola Company	45,998
8	Tyson Foods	37,580
9	Mondelez	34,244
10	Archer Daniels Midland	31,546
11	L'Oreal	29,945
12	Philip Morris International	29,767
13	Danone	28,100
14	Heineken Holding	25,593
15	British American Tobacco	23,019

The complete list of the fifty largest CPG companies (2014) is found in Figure 2.

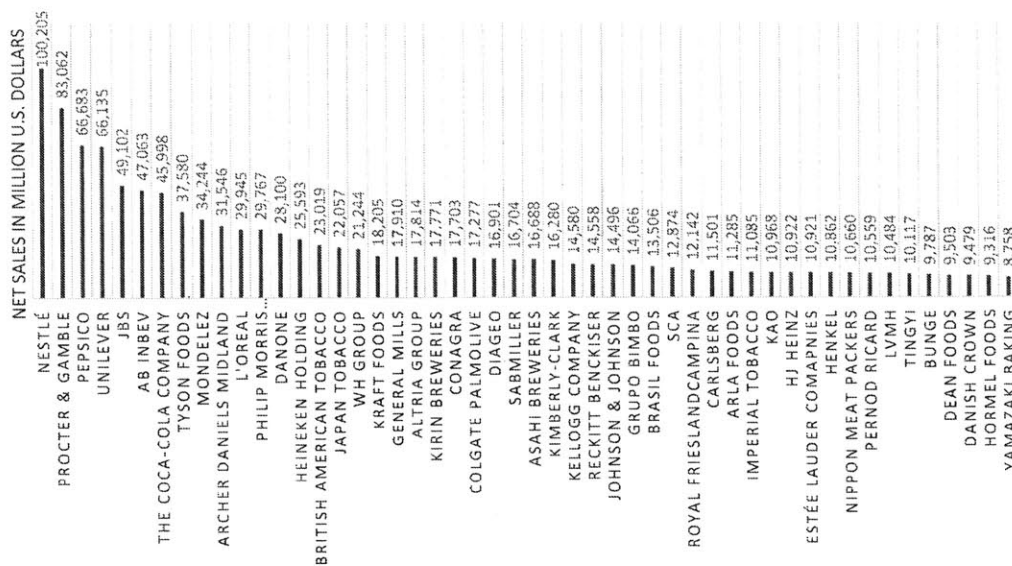


Figure 2. Fifty largest CPG companies based on Net Sales in Million U.S. dollars (2014)
Source: OC&C Statista (2014)

Table 1 and Figure 2 confirm the point made earlier that CPG is a high volume business. The global presence of these CPG companies enables them to have such high net sales. Furthermore, meanwhile Table 1 provides a partial picture of the top 15 players in the CPG industry, Figure 2 provides the complete picture. This is necessary because this thesis explores examples from these multinational companies: Nestlé, Procter & Gamble (P&G), PepsiCo, Unilever, The Coca-Cola Company, L’Oreal, Reckitt Benckiser (RB), General Mills and Mars. This last company is not listed in Figure 2; however, it is still considered a multinational. The reason to study these multinational companies, besides the fact that these are considered the key CPG industry players, is because useful public information and models are available to study them for the purposes of this research.

In addition, it is necessary to understand the magnitude of these multinationals, as it provides the context to start understanding the complexity required to operate these multinationals. These multinational companies have a wide diversification of products. Each product of a particular brand can solely generate billions of dollars of revenue for the company. These companies have

multiple operating segments across the globe, both in emerging and developed markets, to capitalize on opportunities for growth that continue generating profits for the companies.

Moreover, to achieve a broad and globalized product portfolio, CPG multinational companies need to have not only an impeccable execution in the market, but also a robust organizational engine that deeply understands the consumer, discovers new knowledge and applies that knowledge to create new products or processes that delight the consumers.

Furthermore, all these CPG multinational companies have a senior executive who is in charge of leading and managing the R&D function. These senior executives have different titles that generally include Technology and Innovation. In the CPG industry, data suggests that the Chief R&D Officer, as defined in this thesis, is also responsible for Technology and Innovation. Chapter 4 provides further detail about these titles.

Finally, Table 2 provides further information about CPG multinational companies, their product portfolios, their operating segments, general structure and global presence, major brands and products as well as the titles for these top R&D executives.

Table 2. Details of CPG companies: Products and General Structure.

Number	Company	Products	Operating Segments and General Structure	Major Products and Brands	Source	Top R&D Executive
1	Nestlé	Beverages, milk-based products, ice cream, prepared dishes and pharmaceutical products.	Divided in three geographic zones (Europe, Americas, Asia, Oceania and Africa) and four globally managed businesses (Nestle Waters, Nestle Nutrition, other Food and Beverages and Pharma). Has presence in 189 countries.	Nescafé, Nestea, Nesquik, Nespresso, Perrier, Vittell	MarketWatch: Global Round-up. Jul 2010, Vol. 9 Issue 7, p. 60-67	Executive Vice President, Chief Technology Officer (CTO), Head of Innovation, Technology, Research and Development
2	Procter & Gamble	Personal Care products, household care products, and snacks.	Presence in Americas, Europe, Middle East and Africa (EMEA) and Asia. Classified into six divisions: beauty, grooming, healthcare, snacks and pet care, fabric care and home care, and baby care and family care. Comprised of four divisions: Global Business Units (GBUs), Global Operations, Global Business Services (GBS), and Corporate Functions (CF). Has presence in over 180 countries.	Braun, Gillette, Oral B, Olay, Crest, Pampers	MarketWatch: Personal Care. Oct 2011, Vol. 10 Issue 10, p. 13-20	Chief Technology Officer (CTO)
3	PepsiCo	Salty, sweet and grain based snacks; carbonated and non-carbonated beverages.	Operates through three business units: PepsiCo Americas Foods (PAF) [including Frito-Lay North America (FLNA), Quaker Foods North America (QFNA) and Latin America Foods (LAF)], PepsiCo Americas Beverages (PAB) [including PepsiCo Beverages North America (PBNA) and Latin America Beverages (LAB)] and PepsiCo International (PI) [businesses in UK, Europe, Asia, Middle East, and Africa]. Has presence in nearly 200 countries.	Cheetos, Doritos, Frito-Lay, Gatorade, Lay's, Pepsi, Quaker, SoBe	MarketWatch: Global Round-up. Nov 2009, Vol. 8 Issue 11, p. 50-58	Vice Chairman and Chief Scientific Officer (CSO), Global Research and Development
4	Unilever	Food products, household care products and personal care products.	Operating segment has three geographic regions: Asia-Africa, Central and Eastern Europe, The Americas and Western Europe. Products fall under four categories: savory, dressings and spreads; ice cream and beverages; personal care; and home care. Has presence in over 170 countries.	Dove, Pond's, Vaseline, Rexona, Cornetto	MarketWatch: Global Round-up. Aug 2010, Vol. 9 Issue 8, p. 94-101	Chief Research and Development (R&D) Officer
5	The Coca-Cola Company	Sparkling beverages and still beverages.	Operates through six business segments: North America, Eurasia and Africa, Europe, Latin America, Pacific and Bottling Investments. The company divides its operations into segments based on geographic operations. Has presence in nearly 200 countries.	Coca-Cola, Dasani, Fanta, Minute Maid, Powerade, Sprite	MarketWatch: Global Round-up. Sep 2009, Vol. 8 Issue 9, p. 51-58	Senior Vice President, Chief Technical Officer (CTO)
6	L'Oreal	Perfume, make-up, hair and skin care products.	Operates through three business segments: cosmetics, The Body Shop and dermatology. The cosmetics division functions through four operating segments: professional products, consumer products, luxury products and active cosmetics. The Body Shop is a chain of cosmetic stores. The dermatology segments is comprised of dermatological and pharmaceutical activities. Has presence in over 130 countries.	L'Oreal Paris, Garnier, Maybelline, Kerastase, Redken	MarketWatch: Global Round-up. Feb 2010, Vol. 9 Issue 2, p. 94-100	Executive Vice President, Research and Innovation (R&I)
7	Reckitt Benckiser	Personal Care products, household care products and health products.	Operates through eight business divisions: health and personal care, fabric care, surface care, home care, dishwashing, pharmaceuticals, foods, and other household. Has presence in over 180 countries.	Air Wick, Finish, French's, Harpic, Beut, Calgon	MarketWatch: Global Round-up. Jan 2010, Vol. 9 Issue 1, p. 107-113	Senior Vice President, Head of Global R&D
8	General Mills	Food products.	Operates through three business divisions: US retail, bakeries and foodservice, and international (comprises operations in Canada, Latin America, Europe and the Asia Pacific region). Has presence in over 100 countries outside the US.	Betty Crocker, Green Giant, Haagen Dazs, Pillsbury, Yoplait	MarketWatch: Global Round-up. Mar 2009, Vol. 8 Issue 3, p. 108-118	Executive Vice President, Innovation, Technology and Quality
9	Mars	Snack foods, main meal foods, beverages and pet care products.	Operates through six business segments: chocolate, petcare, gum and confectionary, food, beverages and symbioscience. Has presence in over 75 countries.	Milky Way, Snickers, M&M's, Uncle Ben's, Whiskas	MarketWatch: Global Round-up. Jul 2010, Vol. 9 Issue 7, p. 92-97	Vice President, Supply, Research and Development, and Procurement

2.4 | Trends and Challenges in the CPG Industry

An introduction to the current and future trends and challenges in the CPG industry is also helpful as they influence the overall company's strategy, including the R&D organization. Changes in the business environment in the CPG industry influence the companies' approach and organization with respect to innovation. In addition, since the world is becoming increasingly connected, consumer preferences are evolving faster. As a consequence, product lifecycles have shortened (Noordman & Meijer, 2010).

According to reports from consulting firms issued in 2014 (Accenture) and 2010 (McKinsey & Company), the CPG industry faces the following challenges and trends:

1. **A billion new middle-class consumers in emerging markets.** New consumers have appeared in emerging countries like China and India. CPG companies have to understand these new consumers and meet their needs by creating value-oriented products according to the characteristics of each market.
2. **The rise of the digital consumer.** Technology plays an important role that involves strategic decisions regarding: a) expanding the business base through online retail channels, b) brand building through social media and c) how to understand, connect and communicate better with the consumer through technology.
3. **The shift to value brands.** This involves a consumer's preference to "trade down" to cheaper brands to save money, which imposes difficulty for building brand loyalty among consumers. This trend also includes private labels offered by retailers. Value brands and retailer's private labels increase competition for shelf space and make it harder for CPG companies to differentiate their products.
4. **Consumption patterns induced by the impact of demographic shifts.** The shift to an aging global population increases the need for CPG companies to meet the needs of these potential consumers. This trend also includes the rise of younger consumers in key markets and micro-demographic shifts (e.g. Hispanic segment market in the United States).
5. **The increasing bargaining power of retailers.** The retail landscape has changed significantly over the last years and, as a consequence, retailers have diminished privileges from CPG companies especially in pricing and delivery. CPG companies need to balance

this relationship because it can affect their finished product supply chain and reach of distribution networks.

6. **The rise of alternative stores.** Consumers have started to seek alternative stores for low- as well as high-priced goods. Alternative stores for low-priced goods such as high discounters, have caused the decline in sales for traditional retailers and suppliers. Alternative stores for high-priced goods include specialty stores, which offer alternative categories and brands, such as organic products. The share of consumers that regularly shop at traditional retail stores, to which CPG companies generally supply, has shifted to some extent to these alternative stores.
7. **The need for differentiation.** Since there is a wide selection of consumer products available, it is becoming harder for CPG companies to achieve differentiation and create truly new products that discover unmet consumer needs. CPG companies need to find new ways to capture more meaningful consumer insights and translate them to generate new and transformative products.
8. **Generalized shift in consumers' preferences towards health and wellness.** The consumers' awareness regarding health and wellness has increased over the last years. This shift includes rising health concerns related to human health conditions such as obesity or diabetes. This has caused consumers to have greater awareness about the choices related to their daily consumption patterns, and has also shifted consumer preferences to look for healthier and more nutritious product alternatives. In addition, consumers have become more aware of the environmental impact and demand more environmentally sustainable products in the market.
9. **Increasing government regulation.** Governments have become involved in the health and wellness trend, and there are increasing amounts of regulation and consumer protection. Examples range from taxes on sugared beverages to specifying information on food labels such as allergens and detailed nutritional information.
10. **Shortening of product lifecycle.** Consumer preferences are evolving faster than before and this has shortened the CPG product lifecycle. As a consequence, firms have developed greater advances in scientific and technological development to reduce the time-to-market.

These trends and challenges indicate the evolving landscape of the CPG industry where CPG multinationals operate. Moreover, these trends and challenges occur at a macro level, such as the increasing government regulation, opportunities in emerging markets, and the rise of digital technologies; and at a micro level the consumer is becoming more demanding, more selective, and more health-conscious. These challenges require CPG multinational companies to react and adapt, so they can guarantee their short- and long-term survival.

2.5 | Overview of Challenges in CPG Organizations: Impact on Research and Development (R&D)

The trends and challenges reviewed in the previous sections can influence the CPG companies' strategic choices about introducing new products in the market and opening new markets. Also, they impact the decisions associated with developing the required organizational capabilities and nurturing the culture to survive in this fast-paced and demanding environment.

Neely and Pandrangi (2013) argue that one of the greatest challenge for most CPG companies nowadays is to decide on how to organize for different markets around the world since there are both emerging markets that represent growth opportunities, and mature markets which are large and growing at a slower rate. CPG companies need to balance their choices to deliver what each market requires. Pressures to deliver ongoing profitable growth and the need for introducing differentiated new products in the market that provide value to the consumer adds another challenge that CPG companies have to face. The introduction chapter explains that the R&D function can help to deliver new products and processes (Bone, 2014), be a major source to create growth or the company (Holtzman, 2008), and assist to overcome part of the challenges that the CPG industry faces.

Moreover, CPG companies have to define *where to play* and focus on building their differentiating capabilities. In other words, CPG companies have to design an optimal strategy that guarantees their short- and long-term sources of competitive advantage. Defining this strategy demands the involvement of all the functional areas of a firm, including R&D (Roussel, Saad & Erickson, 1991). Since R&D function is part of the overall firm's strategy, the R&D organization needs to align to this strategy so it can produce value for the firm. Aligning this strategy creates challenges in the R&D organization such as how to globalize R&D activities, how to structure the R&D

organization so that it can be more responsive to the business and how to change the mindset of the R&D organization by introducing a stronger business focus. The underlying challenge is *how* to provide direction to R&D so that it can produce value for the company.

2.6 | Key Takeaways: CPG Industry and Product Characteristics

The CPG industry operates in a mature and low-technology sector, which is characterized by high competition and low differentiation and might not consider cutting edge-technology to develop new products or services. Moreover, CPG are frequently bought by consumers with minimal effort. Consumers' involvement is low when buying the product. This implies there might be a high degree of substitution when similar products are presented to the consumer. The saturated market, along with the high degree of competition, constantly changing consumer trends, and consumer digitalization, make it increasingly harder for CPG companies to achieve differentiation and provide a unique value to consumers.

The last section indicates that the R&D function can be a major source for the company's growth and help to overcome some of the challenges the CPG industry faces. Moreover, it suggests that directing the R&D organization in the context of a CPG multinational is a challenging task. Elements associated with R&D strategy, R&D structure and R&D culture need to be addressed so that the R&D organization can achieve its desired outcome. Finally, the R&D function can help to deliver new products and processes (Bone, 2014) and help to overcome part of the challenges that the CPG industry faces. The following chapter specifies how the R&D function adds value to the firm by creating new products and processes and how R&D contributes to the overall innovation a firm can create for the consumer.

Chapter 3 | Innovation and Research and Development (R&D)

This chapter introduces the definition of innovation and then specifically focuses on how R&D contributes to innovation. Innovation can generate value for the customer in multiple dimensions and be delivered by the company in multiple ways. In the CPG context, firms need to continuously generate innovation to cope with the pressing challenges the industry faces. This chapter explains how R&D serves as a key contributor to create innovation for the firm. Finally, it also clarifies the distinction between the terms "Research" and "Development" and applies this distinction to the CPG context.

3.1 | Definition of Innovation

Innovation is often considered the lifeblood of our global economy (Christensen, Gregersen & Dyer, 2011). In fact, many CEOs view innovation as critical for corporate success (Sawhney, Wolcott & Arroniz, 2007). Davila, Epstein and Sheldon (2006) elaborate on this point and mention that for any organization, innovation represents not only the opportunity to grow and survive but also the opportunity to influence the direction of the industry.

A particular definition of innovation is difficult to obtain as it can vary according to the context in which it is applied. However, generally many of existing definitions for innovation include the terms *new* and *introduction*. This research considers innovation as *holistic*, which implies that it can be delivered in multiple dimensions (Sawhney, Wolcott & Arroniz, 2007). Defining innovation as holistic sets the context to establish how the R&D function contributes to the overall innovation a firm can create.

Schumpeter (1982) offers a now-classic definition of innovation as the implementation of new factor combinations in the following dimensions:

- The introduction of a **new good** - that is, one with which consumers are not yet familiar or a new quality of good (or improved good).
- The introduction of a **new method of production**, which can be based upon a scientific discovery, and can also exist in a new way of handling a commodity commercially.
- The **opening of a new market**, that is, a market into which the particular branch of manufacture of the country in question has not previously entered.

- The conquest of a **new source of supply of raw materials** or half-manufactured goods, independent of whether this source already exists or whether it was first created.
- The carrying out of a **new organization** of any industry, like the creation or breaking up of a monopoly position.

Moreover, Sawhney, Wolcott and Arroniz (2007) build upon Schumpeter’s innovation dimensions and propose the term “business innovation.” Business innovation is defined by these authors as “the creation of substantial new value for customers and the firm by creatively changing one or more dimensions of the business system.” Innovation is relevant only if it creates value for the customers, and therefore for the firm.

Furthermore, these authors suggest that managers should think holistically about innovation by considering all the aspects of a business. By using this systemic view of innovation, Sawhney, Wolcott and Arroniz (2007) developed and validated a new framework called the “Innovation Radar,” which consists of all the dimensions in which a company can innovate for the customers. This innovation radar consists of four key dimensions: (1) the offerings (what) a company produces, (2) the customers (who) it serves, (3) the processes (how) it utilizes and (4) the markets where its offerings are available. Between these four key dimensions, there are eight additional dimensions in which a firm can create innovation. Therefore, this radar contains a total of 12 innovation dimensions. Figure 3 illustrates the “Innovation Radar.”

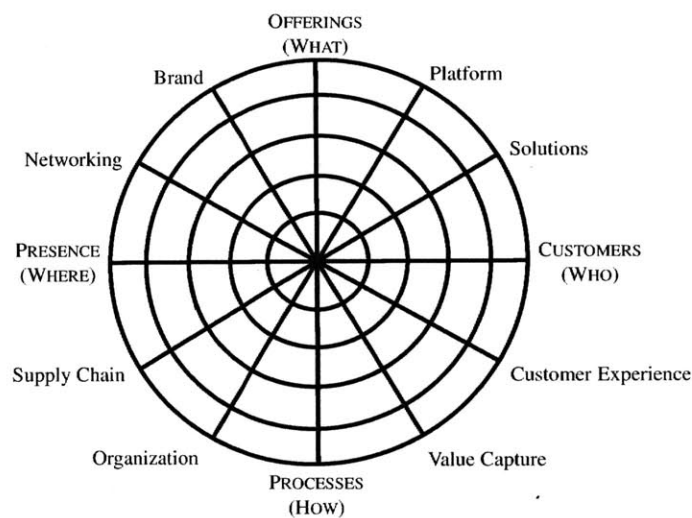


Figure 3. The Innovation Radar.
Adapted from (Sawhney, Wolcott & Arroniz, 2007)

Details of each of these dimensions and examples from these dimensions in the CPG industry can be found in Table 3.

Table 3. The Twelve Dimensions of Business Innovation. *Adapted from* (Sawhney, Wolcott & Arroniz, 2006).

Dimension	Definition and Example in CPG Industry
Offerings	Create new products or services that are valued by customers.
	In the CPG industry an example is the introduction of Procter and Gamble's (P&G) Crest Whitestrips. This is a product that created value for the consumers because the consumers could have a convenient and affordable way to whiten their teeth.
Platform	Use common components or building blocks to create derivative offerings.
	In the CPG industry, an example is how the R&D function has created new ingredients (e.g. artificial and natural sweeteners, natural colors, flavors) that can be applied to different types of beverages.
Solutions	Create integrated and customized solutions that solve end-to-end customer problems
	In the CPG industry, an example is how PepsiCo has established a call center to solve any problems or ask any questions about PepsiCo's products.
Customers	Discover unmet customer needs or identify underserved customer segments.
	In the CPG industry, the Nespresso Machine created a new and unique offering to the consumer and has redefined the concept of personalized coffee. The Nespresso Machine discovered unmet customer needs in the personalized coffee market.
Customer Experience	Redesign customer interactions across all touch points and all moments of contact.
	In the CPG industry, PepsiCo has created a soda dispenser machine that has redefine how the consumer interacts with this machine. For example, live videos or interactive displays allow the consumer to customize the beverage.
Value Capture	Redefine how the company gets paid or create innovative new revenue streams.
	In the CPG industry, CPG companies such as PepsiCo or P&G are selling their products through e-commerce (e.g. Amazon) to increase their revenue streams.
Processes	Redesign core operating processes to improve efficiency and effectiveness.
	In the CPG industry, Unilever created the R&D Operations team to identify areas for improvement in the R&D organization and make all the teams work consistently across the R&D organization with standard operating procedures.

Dimension	Definition and Example in CPG Industry
Organization	Change form, function or activity scope of the firm.
	In the CPG industry, an example is how Procter and Gamble (P&G) was one of the pioneers to leverage external expertise for technology development outside of the R&D organization.
Supply Chain	Think differently about sourcing and fulfillment.
	In the CPG industry, an example is how PepsiCo has created an internal central supply chain organization that delivers raw materials directly to manufacturing sites to produce beverages.
Presence	Create new distribution channels or innovative points of presence, including the places where offerings can be bought or used by customers.
	In the CPG industry, an example was the introduction of vending machines for opening new points of presence for the consumer.
Networking	Create network-centric intelligent and integrated offerings.
	In the CPG industry, an example is how PepsiCo has recently created a restaurant called the Kola House, which provides the consumer an integrated experience.
Brand	Leverage a brand into new domains.
	In the CPG industry, an example is how the Coca-Cola brand has evolved into a lifestyle brand.

As established previously, the firm can generate innovation in many dimensions. This framework is presented to detail how specifically R&D contributes to some of the dimensions from this “Innovation Radar.” The twelve dimensions suggest that R&D is required more intensively in new product offerings (Offerings), process innovation (Processes) and products derived from platforms (Platforms) (Jain, Triandis & Wagner, 2010). Creating new products, processes and platforms requires new knowledge. Precisely, the R&D function is at the forefront of the innovation process and is responsible for discovering and materializing this knowledge into the desired outcome (Carleton, Cockayne & Sawatani, 2015). In addition, R&D also contributes to the Customers dimension, since close consumer interaction with R&D in new product development processes is associated with project success (Salomo et al., 2003). This same argument explains that even though R&D does not generate innovation in all dimensions, R&D acts as a key contributor to three of the four key dimensions. Therefore, the R&D function is a crucial driver to create innovation for the firm.

3.2 | Types of Innovation and New Product Classification

In the CPG context, it is necessary to define the types of innovation and relate these to new product introductions in terms of the degree of novelty associated with the market in which the product is introduced and the degree of newness for the company that is developing the product.

According to the literature, there are mainly two types of innovation, incremental and radical:

- The first type, **incremental innovation**, increases product performance using the existing firm's technological and organizational capabilities (Abernathy & Clark, 1985). These types of products are generally demanded by mainstream customers and therefore firms make better products every generation because this is what customers have valued historically (Christensen, 1994). Davila, Epstein and Sheldon (2006) mention that incremental innovation is the most common form of innovation in most companies, including CPG. While incremental innovation helps to provide protection for maintaining market share or profitability, it can also lead to limited creativity, where only small changes are allowed.
- The second type, **radical innovation**, results in new products or services delivered in entirely new ways, and therefore offers the customer an entirely new value proposition (Davila, Epstein & Sheldon, 2006). These innovations bring important changes to the competitive environment of an industry and can create competitive advantages for a company. However, radical innovations inherently bring risks due to the high degree of novelty they can represent for both the company and the market.

To clarify how these two types of innovation relate to product innovations in the CPG context, first it is important to introduce the classification of new products. This classification helps to clarify whether the new product that a CPG firm introduces to the market is either an incremental or a radical innovation. Booz, Allen and Hamilton (1982) suggest evaluating new product introductions in two principal dimensions: (1) newness to company: How new is the product to the company? and (2) newness to market: How new is the product to the marketplace? This led them to propose six different product classifications:

1. **New-to-World.** These are first of their kind products, which create a new market and are radically different. An example in the CPG industry is the introduction of disposable baby

diapers in the 1970s, which completely redefined the woven cloth traditional diapers and could be bought in retail stores.

2. **New-to-Company.** These are products that represent a new market or category for the company, but not for the marketplace. An example in the CPG industry could be to open a new business unit dedicated to developing a new product for the company, e.g. manufacture Greek yoghurt in a company that used to develop salty snacks.
3. **Line Extensions.** These are products that have incremental innovations added to complement existing product lines and targeted to the current market. An example in the CPG industry could be to launch a new flavor with an older carbonated beverage brand.
4. **Product Improvements.** These are new, improved versions of existing offerings that target the current market and have the objective of replacing existing products. An example in the CPG industry could be to introduce a sugar-reduced beverage formula to replace a full-sugar beverage.
5. **Product Repositioning.** These are existing products that are targeted to new markets or applied to a new purpose. An example in the CPG industry could be to introduce an existing product or brand and sell it in a new market with similar characteristics.
6. **Cost Reductions.** These are reduced price versions of the product for the existing market. An example in the CPG industry could be to reduce the price of a product as part of a promotion or reduce the price due to the discovery of a new technology that decreases the product cost.

The product classifications indicate that radical innovation is related to new-to-world products, while the rest of the product classifications, especially line extensions and product improvements represent incremental innovation. The classification of new products along the newness dimensions can be seen in Figure 4.

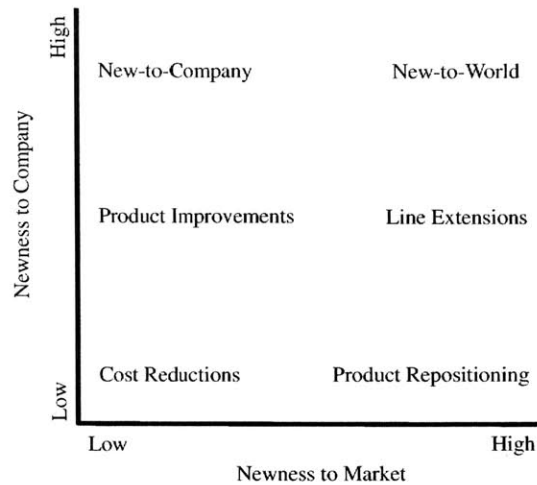


Figure 4. New Product Classification.
Adapted from (Booz, Allen & Hamilton, 1982)

Furthermore, the R&D function can create value through all these product classifications, for example:

1. For creating a **new-to-world** product, the R&D function has to discover new knowledge to deliver value for the consumer. For example, discovering new chemical molecules to help with anti-aging creams.
2. For creating a **new-to-company** product, the R&D function can help to develop the necessary capabilities to manufacture Greek yoghurt with fruit inclusions.
3. For creating a **line extension** product, the R&D function contributes to discover a cherry flavor to diversify the brand of a particular beverage.
4. For creating a **product improvement** product, the R&D function can help to reduce salt content from a potato chip to address the health and wellness consumer trend.
5. For creating a **product-repositioning** product, the R&D function can develop a product that can address the particular needs of a particular market.
6. For creating a **cost reductions** product, the R&D function can help to discover a new ingredient that decreases the product cost.

3.3 | Why Do CPG Companies Need Innovation?

“Consumer insights lead [us] to conclude that consumers have become incredibly educated, they know what they want and they have become more demanding with no compromise on achieving what they want. The innovation not only has to be brilliant, but it also has to be price sensitive, available and widely distributed.” (Cioffe, 2014)

These statements set the stage for why CPG multinational companies need to continuously create innovation for the consumer and the pressure that CPG multinational companies face to deliver this innovation.

Ringel, Taylor and Zablitz (2015) mention that 79% of respondents from Boston Consulting Group’s annual global survey of the state of innovation ranked innovation as either the top-most priority or a top-three priority at their company. In addition, science and technology continue to be seen as important foundations of innovation that enable speed to market and help achieve differentiation against competitors.

The previous chapter suggests that the CPG industry operates in a saturated and highly competitive market, and that the constant change in consumer trends, among other factors, is making it harder for CPG companies to achieve differentiation in their products. Innovation in the CPG sector generally creates incremental innovations rather than radical innovations (Grunert et al., 1997). While incremental innovations ensure short-term strategy, radical innovations are important to ensure long-term strategy and a firm needs to pursue these two types of innovation at the same time to cope with the complexity and fast-paced environment that many organizations face (Tushman & O’Reilly, 2008).

Geissel (2008) conducted a study to highlight the importance of creating radical innovations in CPG companies. The survey conducted for this study revealed that more than 80% of the participants believe that radical innovation is either important or very important for their company’s growth. This author argues that if companies do not introduce new products to the market, they will eventually remain with products that decline in sales, and therefore, generate fewer profits for the company. Even though the cost for developing new products is elevated and the failure rate can be high due to risks associated with uncertainties in the market and consumer adoption, deciding not to bet on radical innovation can result in much higher losses in the long-

term. Schneider and Hall (2015) mention that about 75% of CPG fail to earn the necessary revenues to continue in the market during their first year. According to these authors, several reasons can cause new product introductions to fail at the pre-launch and launch phases. For example, at the pre-launch phase, the company could fail to address the market in which the product is introduced, or the company failed to understand consumer needs or the product was not tested enough with consumers. At the launch phase, examples include launching the product too late in the market, lack of product promotion in the market, or not creating enough engagement with the consumer because the product lacks to deliver in key product attributes (such as taste). This suggests that both R&D and business functions need to work closely together to deliver successful innovation in the market.

Finally, incremental innovations in the form of line extensions do not help with differentiation as opposed to radical innovations, which often redefine markets or create new ones, and therefore it is important for CPG companies to deliver both types of innovation to balance their short- and long-term competitiveness.

3.4 | What is Research and Development (R&D)?

The previous sections provided an overview of innovation and established how the R&D function contributes to the overall innovation that a firm can deliver. They also established the need for innovation for the CPG companies. This section provides a deeper understanding on how R&D specifically contributes to generate innovation for the firm, and makes a distinction between the terms "Research" and "Development" and exemplifies this distinction in CPG multinational companies.

Before proceeding to the definition of Research and Development, first it is important to define *technology*. Roussel, Saad and Erickson (1991) maintain that technology is "often confused with science and engineering on the one hand and with a product and its function on the other." Technology is the application of scientific and engineering knowledge to achieve a practical result. Technology clarifies what the technology does for the business instead of asserting what the technology is. In the CPG Industry, for example, manufacturing milk powder required the development of spray drying technology. Another example, for producing breakfast cereals,

snacks for cereal bars, extrusion technology was developed. Thus, extrusion technology enables the business to manufacture cereal bars (Bauer, 2007).

3.4.1 | Definition of "Research" and "Development"

In defining Research and Development, it is important to understand the differences between the terms "Research" and "Development" and specifically the role of industrial or corporate R&D.

Roussel, Saad and Erickson (1991) make the distinction between *Research*, *Industrial Research* and *Development*.

- **Research** applies to the academician and those who work in research institutes and the main objective is the "revelation of new knowledge about the universe."
- **Industrial research** also looks for new knowledge; however, the research goal is knowledge applicable to "a company's business needs that will enable the company to participate in the forefront of new technology or lay the scientific foundation for the development of new products or processes."

In CPG multinational companies, it is common to make a distinction between **advanced research** and **applied research**. Advanced research teams generally are in charge of discovering new knowledge looking into what is going to sustain the business in the long-term, while applied research is a team that is focused on bridging the gap between **advanced research** and the **development** group. For example, R&D in L'Oréal, has the following entities: (1) *Advanced Research*, which focuses on nurturing scientific knowledge about skin and hair around the world, and discovering new active ingredients, and (2) *Applied Research*, which develops formulation systems so that they can be transferred to different families of products (L'Oréal, 2016). Similarly, Unilever's R&D organization has the following entities: (1) *Strategic Science Group*, which focuses on emerging science and technologies and capitalizes on major developments, especially in the areas of biological and physical sciences. This area generally forecasts within a three-to five-year timeframe; and (2) *Discover Group*, which enables bridging the gap between the ideas generated by the Strategic Science Group and the vision of Unilever's brands. This creates a path to introduce new technologies in Unilever's innovations (Unilever, 2016).

- **Development** applies scientific or engineering knowledge to expand it or connect knowledge in one field. In other words, development “seeks to move product or process concepts through a series of definite stages to prove, refine, and ready them for commercial application.” In CPG companies, for example, L’Oréal has the *Development* entity, which provides the brands with formulas customized to their respective identities and to consumer needs according to local, regional and global markets (L’Oréal, 2016). Likewise, Unilever has the *Design Group and Deploy Group*, whose responsibility is to turn a great idea into a great product and to ensure that new products are launched on time and get the most out of their introduction to the market (Unilever, 2016).

Regardless of the individual composition of the R&D organization in a CPG multinational, the definitions suggest that **Research** is at the forefront of discovering new knowledge, while **Development** applies that new knowledge for commercialization processes. This thesis evaluates the R&D function as the same entity or function that has a leader that represents both Research and Development functions.

3.4.2 | Types of R&D

Once clarified the distinction between the terms "Research" and "Development" and providing an overview of how this distinction applies in the CPG context, it is important to understand the different types of R&D, as they can lead to different outcomes in the innovation dimension.

Roussel, Saad and Erickson (1991) argue that there are three basic types of R&D: incremental, radical, and fundamental. These are described as the following:

- **Incremental R&D: Small “r” and Big “D.”** The goal is to achieve small advances in technology based on an established foundation of scientific and engineering knowledge. This type of R&D applies existing knowledge rather than discovering or applying new knowledge, and therefore, the technical risks involved are low. In the CPG industry, an example is to make small modifications to an existing flavor (small “r”) and use this flavor to develop a new carbonated product for several markets at the same time (Big “D”).
- **Radical R&D: Large “R” and often Large “D.”** The goal of this type of R&D is to discover new knowledge with the purpose of applying that knowledge to a useful purpose. Since discovery implies learning things not already known, it involves considerable

technical risk, cost and time. There is no certainty that R&D will get all the technical success needed for commercial success. For this situation, the business must see the potential of a substantial reward because if R&D succeeds, the business will have a know-how that no competitor has, and therefore be a source for competitive advantage. Risks can be mitigated by first conducting research feasibility projects to reduce the uncertainty to levels that are acceptable for the business to proceed to the development phase. This definition indicates that radical innovation is generated when this type of R&D is followed. In the CPG industry, an example was the creation of Nespresso, a personalized coffee system that provides the customer a completely new experience to consume coffee. The creation of the Nespresso machine and coffee capsules required both a large “R,” to discover the knowledge required to conceptualize the machine and capsules, and large “D,” to apply that knowledge to create the complete functional system (Deschamps & Nelson, 2014).

- **Fundamental R&D: Large “R” and No “D.”** Fundamental R&D is a scientific/technological reach into the unknown. This type of R&D mainly has two goals: (1) to develop a depth of research competence in fields of potential future technology that the company forecasts to have a considerable strategic impact in the long term (5 to 10 years out), and (2) to prepare for future commercial exploitation of these fields. This involves making strategic decisions involving a considerable amount of uncertainties to deal with in the following contexts: scientific, competitive, social, and governmental. This definition indicates that fundamental R&D would act as the Advanced Research function that belongs to the R&D organization. In the CPG industry, an example is how Nestlé created the Nestlé Institute of Health Sciences “to deepen research into products that could prevent or treat chronic ailments, including diabetes, obesity, cardiovascular disease, and Alzheimer’s disease.” (Henderson & Johnson, 2012).

These different types of R&D indicate that the intensity between “R” and “D” can vary within a firm according to the particular goals that the firm wants to achieve. Ideally, a CPG multinational company has to have the three types of R&D to guarantee its short- and long-term competitiveness. However, regardless of the different types of R&D the firm chooses to pursue, it is necessary to

understand how the R&D function creates value for the firm. The following section explores this value in terms of the R&D function's contribution to innovation.

3.4.3 | Strategic Role of R&D: Contribution to Innovation

This section specifically elaborates on how R&D contributes to a part of the overall innovation that a firm can deliver and remarks the importance of the R&D function within a firm.

Holtzman (2008) maintains that innovation generated by R&D can be a strategic weapon that can create sustainable growth in a company and help to enhance the firm's competitive advantage. In fact, the author mentions that building and maintaining innovation created by R&D is key for the company's success. Specifically, innovation created by R&D brings value to the firm in the following three dimensions: (1) differentiation, (2) fast time-to-market (TTM), and (3) radical innovations. These dimensions are further explained in the following paragraphs:

1. **Differentiation.** R&D contributes to differentiation by creating products that provide unique or superior performance from the customer's perspective, generating a premium value to the customer who is willing to pay for the product. Differentiation can also involve the delivery of high quality and lower cost products at a faster rate than competitors.
2. **Fast time-to-market (TTM).** By introducing products to the market faster than competitors, high margins can be achieved by these differentiated offerings because the products are introduced to the market first.
3. **Radical innovations.** R&D contributes in this dimension by developing products that create new and unique offerings to customers that completely redefine the marketplace. As reviewed previously, this type of innovation increases the value of a product in one or multiple key attributes and therefore new value is created for customers.

Roussel, Saad and Erickson (1991) elaborate on this point and argue that corporate R&D specifically contributes to the firm's innovation by:

- **Defending, supporting, and expanding existing business.** This includes modifying products to improve customer acceptance or adapting them to different market standards or regulations, using different or new raw materials or improvements in manufacturing processes, and dealing with activities related to safety considerations and environmental compliance. Supporting existing business also includes developing new products and

manufacturing processes to improve the competitive position within the existing business structure.

- **Driving new business.** This involves providing opportunities for new businesses using existing or new technologies. These new businesses might be new to the company or new to the world. This also applies to new technologies and products, which might be new-to-company or new-to-world.
- **Broadening and deepening the company's technological capabilities.** This might address existing or new business, depending on the perceived opportunity and the company's competitive position.

The previous definitions indicate that R&D is a strategic partner that contributes to create value for the firm, and more importantly, the R&D function adds value by continuously creating innovation for the firm.

3.5 | Key Takeaways: Innovation and R&D

This chapter provides an overview of innovation and degrees of innovation in terms of new product classification. It also establishes the importance of the need for innovation for CPG companies in order for them to achieve differentiation and consumer engagement and balance their short- and long-term competitiveness in a high-pressure and dynamic environment characteristic of the CPG industry.

The R&D function is an important element that contributes to the firm's innovation, as it is responsible for discovering new knowledge and applying that knowledge to create new products, among other key important activities. In fact, R&D should be envisioned as a strategic partner that acts as a key contributor to innovation in a company. In the CPG industry, R&D needs to be very close to the business as it can produce the desired outcome for innovation. As this chapter establishes, R&D can help to overcome the challenges that the CPG industry faces by introducing products faster to the market, achieving differentiation and creating radical innovation.

However, for R&D to be able to produce this desired outcome in innovation, it needs to have someone who sets the direction and balances the short- and the long-term by maximizing the value of today, but also making sure that the R&D organization is looking into the future. The person who sets the direction for R&D is named in this thesis the Chief Research and Development (R&D)

Officer. The Chief R&D Officer must not only have a foresight into the future, but also execute this vision by continuously aligning the company's strategy with the R&D strategy. In addition, the Chief R&D officer needs to cope with the implications associated with managing and leading the R&D organization. This point is further explored in the following chapter.

Chapter 4 | The Role of the Chief Research and Development (R&D) Officer

This chapter provides an overview of the evolution of the Chief R&D Officer's role and the emergence of a senior executive as part of the executive leadership team of a multinational company. This same evolving role has demanded that this senior executive not only lead, but also manage the R&D organization. This chapter also explains the role of the Chief R&D Officer in CPG multinational companies as the person who has the oversight of Innovation, Technology and R&D, and establishes the comparison against other industries (e.g. high-tech). It then provides the Chief R&D Officer's core responsibilities and establishes that this senior executive has to not only set the direction for R&D, but also execute this direction in terms of formulating the R&D strategy, managing the R&D organizational structure and leading the R&D organizational culture. The chapter concludes by providing an overview of the internal teams that can compose an R&D CPG organization and of the functions that R&D has to interact with, both inside and outside of the firm's boundaries. The objective of this overview is to emphasize that the Chief R&D Officer has to establish the strategy, structure and culture to enable this collaboration.

4.1 | The Evolution of the Chief R&D Officer's Role

This section provides an overview of the emergence of the Chief R&D Officer and clarifies the general distinction between the responsibilities associated with the Chief R&D Officer, as these are generally associated with Innovation, Technology and R&D. This section also discusses that in the sample of CPG multinational companies this research paper studies, the Chief R&D Officer has the oversight for Technology, Innovation and Research and Development (R&D). Finally, this section mentions that due to the evolving role of the Chief R&D Officer in the context of a CPG multinational, this senior executive must not only manage, but also lead the R&D organization.

4.1.1 | The Emergence of the Chief R&D Officer's Role

Deschamps (2008) explains that the role of the Chief R&D Officer has become increasingly important. In fact, the nine CPG multinational companies studied in this research paper indicate that the Chief R&D Officer is part of the executive leadership team. This author mentions that the emergence of this senior executive is mainly attributed to two factors. The first factor is associated with the diversification of products, businesses and technologies handled by a single firm since the 1970s. The second factor is related to the critical importance that technology has in securing

the firm's long-term competitiveness. These two drivers caused two major changes in the Chief R&D Officer's function.

Furthermore, this author mentions that the first change in the Chief R&D Officer's function originated from the evolution of multinational firms as they changed from a functional hierarchy to a business unit approach. This change caused central R&D organizations to be broken down to create distributed R&D sites located according to the firm's strategic business units. Even though this decentralization caused the R&D function to be more responsive to business needs, having autonomous and fragmented R&D sites created the duplication of competencies and the loss of shared knowledge among the R&D organization. The need for a central leader who could coordinate and maximize the efficiency of the global R&D organization was imperative. The second change of the Chief R&D Officer's function was the increased appearance of new technologies in the 1980s and 1990s, which forced companies to diversify their technology portfolio. In the CPG industry, for example, biotechnology has been an important factor for developing and producing new food products, such as the development of new ingredients (e.g. natural sweeteners), which can replace sugar content in beverages (Taeymans, 2000). The emergence of these new technologies caused companies to have a central leader who could assess the firm's technology strategy and build new competencies to develop or adapt these new technologies to create new products and processes.

All of these factors contributed to the emergence and evolution of the Chief R&D Officer as the central leader for the R&D organization. Part of this evolution demanded that the Chief R&D Officer assume responsibilities associated with Innovation and Technology. The next section provides an overview of the Chief Innovation Officer (CIO) and Chief Technology (CTO) roles and explains how for the nine CPG multinational companies studied in this research paper, the Chief R&D Officer assumes both responsibilities in addition to the R&D responsibility, based on the data gathered for this study.

4.1.2 | Chief R&D Officer in CPG: Innovation, Technology and R&D

Deschamps (2008) mentions that the main differences between the Chief Technology Officer (CTO) and the Chief Innovation Officer (CIO) depends on the background and functional origin of the person and the responsibilities associated with each role. On the one hand, CIOs typically

supervise and facilitate innovation (e.g. new product and process innovations) across all functions within a firm. CIOs search for and support ideas, both inside and outside of the organization's boundaries and are expected to influence the company's innovation culture (Deschamps, 2008). CTOs, on the other hand, represent the technical community in their companies and come from a scientific or engineering background. CTOs are the head of the R&D organization and they typically reach top management after successfully managing projects of increasing importance and leading, first, different R&D teams through regional or global R&D sites and then, the entire corporate R&D organization. When these senior executives rise above their traditional R&D management responsibilities, they tend to focus on new technology-based products, processes and service (Deschamps, 2008).

Furthermore, Deschamps (2008) mentions that the decision of whether the company entrusts the responsibility for innovation to a CIO or CTO depends on two factors:

1. **The nature of the industrial environment.** The competitive environment, especially if companies compete directly or indirectly on technology, tends to entrust the innovation responsibility to the person with the highest rank in the scientific and technological community.
2. **The breadth of experience of the CTO.** The CTO's technical training, R&D experience and technology focus can help him or her to consider all aspects of innovation, from innovation culture to process and technology development and deployment. In fact, many companies have appointed their Chief R&D Officer as their prime "innovation tsar" (Deschamps, 2008).

The data gathered for this study suggests that for the nine CPG multinational companies, the highest ranked executive in the scientific and technological community has the responsibility for Technology, Innovation and R&D, and that these companies do not have a senior executive as part of the senior leadership team who has the title Chief Innovation Officer (CIO). In fact, some of their titles explicitly include the following terms: Technology, Innovation and R&D. For example, these titles are the following: Chief Technology Officer (CTO), Head of Innovation, Technology, Research and Development (Nestlé); Chief Technology Officer (P&G); Vice Chairman and Chief Scientific Officer (CSO), Global R&D (PepsiCo); Chief R&D Officer (Unilever); Senior Vice President, Chief Technical Officer (CTO) (The Coca-Cola Company); Executive Vice President

Research and Innovation (L'Oréal); Vice President, Supply, R&D, and Procurement (Mars); Senior Vice President, Head of Global R&D (Reckitt Benckiser); Executive Vice President Innovation, Technology and Quality (General Mills). For simplicity, the term Chief R&D Officer is adopted as a *generic form* to represent all these titles.

The fact that these nine CPG companies designate the accountability for innovation, R&D and technology to the Chief R&D Officer does not imply that this is applicable to other industries or that the emergence of the CIO can take place at any time as the industries keep evolving. Johnson (2010) suggests that the CIO should be responsible for building a common language of innovation across the organization, be responsible for organizational learning and generate innovation across all company dimensions.

Moreover, Deschamps (2008) makes the distinction that in high-tech industries there are generally two types of titles. In pharmaceuticals or medical technology, there is a Chief Research Officer (CRO), who is more science-driven and focused on the research and discovery process, while in electronics and information technology industries, the title of CTO is more common because of the technological and applied science nature of this industry. Deschamps (2008) argues that the boundary between these titles in most of the cases is blurry, as many executives have overlaps between the accountabilities for innovation and technology. The data from this study supports this assertion.

Regardless of their individual responsibilities, the Chief R&D Officer, behind their Chief Executive Officer (CEO) or Chief Financial Officer (CFO), strongly influence the crucial technology and innovation choices on which these companies bet their future. They also educate top management colleagues in scientific and technological issues and help them understand the strategic implications of technology choices and the impact of technology on the bottom line (Deschamps, 2008). This leads to the conclusion that the role of the Chief R&D Officer has become increasingly relevant in the industry, including CPG. In fact, the evolution of the Chief R&D Officer's role suggests that this senior executive is not only responsible for managing but also for leading the R&D organization. This is further explored in the following section.

4.2 | Chief R&D Officer's Core Responsibilities

This section explains the relevance of the Chief R&D Officer as the person who is responsible for setting the direction for R&D and executing it in terms of formulating the R&D strategy and managing and leading the R&D organization.

Furthermore, this section provides an introduction to answer the question about how the Chief R&D Officer needs to have a systematic approach towards R&D strategy, R&D organizational structure and R&D organizational culture when he or she is leading and managing the R&D organization. This introduction explains the distinction between managing and leading and identifies the Chief R&D Officers core responsibilities: setting the direction for R&D and Chief R&D Officer's responsibilities in the context of managing and leading.

4.2.1 | Difference between Managing and Leading

Kotter (2001) proposes that leadership and management are different but complementary, and that one cannot function without the other. Managing involves coping with complexity and good management enables a degree of order and consistency, which is essential especially in large organizations. Leading involves coping with change and this has become very necessary for organizations to survive and compete in today's environment. The main differences between the characteristic activities of managing and leading are summarized in Table 4.

Table 4. Key functions involved for creating new products. *Adapted from (Kotter, 2001).*

Managing	Leading
Planning and budgeting. Setting targets or goals for the near future, establishing detailed steps for achieving those targets and then allocating resources to accomplish those plans.	Setting a direction. Developing a vision of the distant future along with strategies for producing the changes needed to achieve that vision.
Organizing and Staffing. Creating an organizational structure and set of jobs for achieving plan requirements, staffing the jobs with qualified individuals, communicating the plan, delegating responsibility for carrying out the plan, and developing systems to monitor the implementation.	Aligning People. Communicating the new direction to those who can create coalitions that understand the vision and are committed to achieving it.
Controlling and problem solving. Monitoring versus the plan, both formally and informally, by reports and meetings, among other tools; identifying deviations and then planning and organizing to solve the problems.	Motivating and Inspiring. Keeping people moving in the right direction despite major obstacles to change by appealing to basic values and emotions.

As demonstrated in the table above, both managing and leading reinforce each other, and in this particular case, the Chief R&D Officer must be able to integrate both systems of action to guarantee success for the R&D organization in today’s complex and volatile environment.

4.2.2 | Setting the direction for R&D

This research suggests that the Chief R&D Officer is viewed as the "architect" of the R&D organization as he or she sets the direction for R&D, which implies that the Chief R&D Officer needs to have a vision, ambition and faith regarding technology. This vision, called the Technology Vision, is composed of two interconnected facets (Deschamps, 2008):

- **A picture of the "envisaged future" regarding technology (hard side).** The Chief R&D Officer needs to envisage a future regarding technology and this implies defining the scope of the technology reach and identifying the core competencies that are critical for the company to master. This also includes defining where to investigate and develop and how to achieve it.
- **A "core ideology" regarding technology (soft side).** The Chief R&D Officer needs to develop a core ideology, which includes promoting policies and embedding desirable

behaviors, beliefs and values to support the technology vision. In other words, it includes influencing the mindset of the R&D organization.

The Chief R&D Officer needs to make a close alignment between the business vision and the technology vision when he or she formulates this technology vision. Having this close connection with the business vision enables the R&D function to balance the short-term, by maximizing the value of current product and process offerings, and the long-term, by ensuring company's technological competitiveness in the long run. The key questions covering both business vision and technology vision, and the interconnectedness between them are shown in Figure 5.

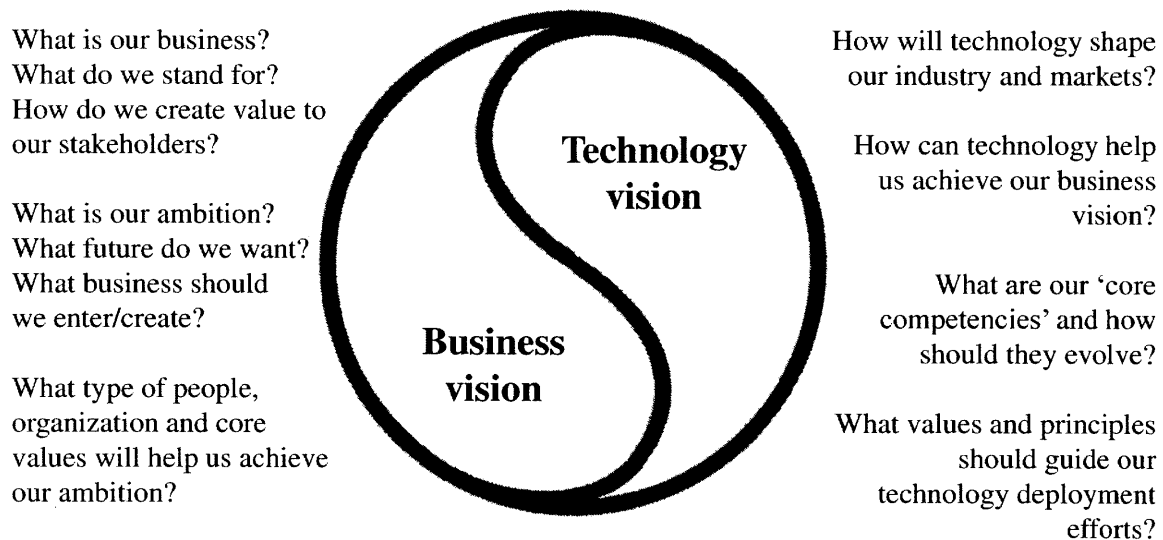


Figure 5. The interdependence of technology and business visions.
Adapted from (Deschamps, 2008)

At this point, it is critical to mention that the Chief R&D Officer must not only have this vision for setting the direction for R&D, but must also execute it in terms of *formulating the R&D strategy*. Just as the business vision must be closely linked to the technology vision, the R&D strategy must be closely aligned with the business strategy so that R&D can maximize its contribution to innovation. This strategy helps to define the scope of the company's technology coverage and identify competencies that are critical to master (Deschamps, 2008). This strategy should also provide direction and focus towards achieving the desired outcomes regarding innovation, by balancing both incremental and radical types of innovation. Formulating the R&D strategy will drive the decisions regarding the organizational structure and organizational culture

of the R&D organization, and therefore dictate different responsibilities associated with managing and leading the R&D organization.

4.2.3 | Chief R&D Officer's Managing and Leading Responsibilities

Within the context of managing and leading, it is important to highlight the Chief R&D Officer's core responsibilities to set the context for the three following chapters. The Chief R&D Officer's responsibilities are classified according to Kotter's theory about managing and leading and complemented with Deschamps' descriptions of duties extracted from *Innovation Leaders: How Senior Executives Stimulate, Steer and Sustain Innovation (2008)*.

4.2.3.1 | Chief R&D Officer's Managing Responsibilities

The Chief R&D Officer's managing responsibilities are the following (Deschamps, 2008):

- Hiring highly qualified staff and overseeing the allocation of senior R&D personnel. Therefore, the Chief R&D Officer is often seen by the top executive team as the high-level human resource officer of the scientific and technical staff.
- Allocating corporate funds to strategic R&D programs. The Chief R&D Officer generally decides whether to pursue high-impact R&D programs, which aim to develop a new technology, catch up with competitors or launch a new technical activity between or across divisions or business units.
- Monitoring whether funds are being used effectively and cultivating strategic projects until they come to fruition. Part of this responsibility includes influencing the R&D project portfolio, which basically determines the company's priorities regarding R&D strategy.
- Organizing R&D for a global world, for example, optimizing R&D resources to operate in all parts of the world.
- Considering short-term results by introducing competitive new products to increase shareholder value and tracking of long-term projects to ensure their profitability.
- Organizing the R&D staff by functions, project or matrix organizations so the R&D organization can be more responsive to the business environment and aligned with the business strategy.

- Deciding on how to leverage the best technological resources regardless of the source (e.g. license or acquire a new technology rather than developing it in-house) and tapping into scientific and technical expertise outside of the R&D organization's boundaries.

4.2.3.2 | Chief R&D Officer's Leading Responsibilities

The Chief R&D Officer's leading responsibilities are the following (Deschamps, 2008):

- Leading the transformation of the R&D organization by instilling a sense of purpose, direction and focus in all technical departments. Aligning scientists and engineers with the company's strategic direction enables cohesion in the organization and therefore increases the probability of the company's success.
- Formulating the technology vision, which includes both a hard side, which implies setting the technology research priorities and identifying the core competencies that are critical for the company to master; and soft side, which includes embedding desirable behaviors, beliefs and value to support the technology vision.
- Inculcating a sense of purpose in the role of science and technology. In other words, to raise a sense of purpose within their staff, and continuously remind them that they are responsible for contributing to the future growth of their company through the creation of successful new products in the market.
- Enhancing knowledge and competencies, for example, focus on creating, using, sharing and protecting knowledge among the R&D organization.
- Building a unified innovation process, which includes communicating and working more effectively with other key critical functions such as marketing and manufacturing.
- Changing the mindset in R&D, for example, introducing a stronger business focus and a more critical sense of urgency among the scientific and technical community. This allows the R&D organization to be more responsive to business demands.
- Enforcing a sense of focus on technology. This involves ensuring that the R&D organization focus on core differentiating technologies while encouraging its members to be open and accept external resources in order to build more competencies.
- Establishing and building a consensus of beliefs and values within the company's scientific and technical community. This includes running a program of change to infuse the new behaviors into day-to-day reality among the R&D organization.

A great part of the Chief R&D Officer's key responsibilities reside in formulating the R&D strategy, managing the organizational structure and leading the organizational culture. The proposal is that the Chief R&D Officer needs to have a systematic approach towards these elements to achieve the desired innovation in the CPG multinational company context. Chapter 1 mentions that managing and leading the R&D organization is the art of integrating the efforts of many disciplines (Jain, Triandis & Wagner, 2010), because the R&D function is comprised of diverse internal functions, and also can interact with functions and entities both inside and outside of the organization. The following section explores the relevance of the Chief R&D Officer in contributing to this alignment in a CPG multinational.

4.3 | Integration of Diverse Functions: R&D CPG Organization

"The R&D function is a core player that shares responsibility with marketing, manufacturing, supply chain, sales, finance, regulatory affairs and human resources, among other functions."
(Bauer, 2007, p. 12)

R&D is viewed as a core function that can interact with a wide array of entities and functions, both inside and outside of the organization. In fact, R&D does not work in isolation. The Chief R&D Officer needs to ensure that the R&D function is closely aligned with the business so that it can play as a strategic partner that adds value to the organization. However, ensuring this alignment can be a challenging task, as the R&D organization in a CPG multinational company comprises different functions, for example, the following (Hurtado, 2013):

- **Advanced Research:** This group is in charge of discovering new knowledge and develop the next generation of foundational technologies necessary to sustain the business in the long term.
- **Applied Research:** This group is in charge of making the transition between the Advanced Research Group and the Product Development Group by proofing the technologies the Advanced Research creates and facilitating the technology-transfer so that the Product Development group can apply it for creating new products.
- **Product Development:** This group is responsible for new product development based on consumer needs.
- **Process and Equipment Development (P&E):** This team design the processes needed for making the product.

- **Packaging Development:** This group is responsible for developing the package that is in direct contact with the product.
- **Quality Assurance (QA):** This group establishes, maintains and audits internal R&D processes to ensure that new products are compliant with corporate and government regulations.
- **Product Safety and Regulatory (PS&R):** This group ensures product compliance according to local government regulations and assures that labeling information meets packaging regulations.
- **Analytical Development:** This group develops the measurement methods and equipment to ensure the product's quality.
- **Product Research (PR):** This group translates key consumer needs into technical product requirements for facilitating the product development process.

Besides setting the direction for the R&D organization, the Chief R&D Officer has to ensure that R&D is closely aligned with the business, so that the R&D organization can be responsive to business needs, and also ensure that the R&D organization is willing to cooperate with external innovation partners to capitalize in greater sources for creating innovation. The Chief R&D Officer has to establish the organizational structure and organizational culture to enable this alignment.

In the CPG context, the R&D organization can interact with the following functions and entities, both inside and outside of the firm's boundaries. This interaction is necessary because creating new products is a multidisciplinary effort that involves many functional departments (Urban & Hauser, 1993). The functions that can interface with R&D inside the organization are the following (Hurtado, 2013):

- **Marketing:** This function is responsible for the entire commercial business proposition. Marketing defines "what" to do and R&D drives "how" to do it.
- **Manufacturing:** The R&D interaction with Manufacturing is critical to ensure production feasibility and development of new manufacturing processes and capabilities (Brettel, Heinemann, Engelen & Neubauer, 2011).
- **Finance:** The interaction between R&D and Finance is necessary to ensure that the products being developed are affordable and also are able to make the desired margins to remain in business.

- **Product Supply or Logistics:** R&D works closely with this function to test the product along the supply chain to determine any potential flaws in product design.
- **Legal or Regulatory Affairs:** R&D interfaces with Regulatory Affairs to make sure the product claims are verified meanwhile the product is in development.
- **Sales:** The R&D and Sales interaction can help to access specific customer information or facilitate consumer testing with a specific customer audience (Ernst, Hoyer & Rübsaamen, 2010).
- **Human Resources (HR):** R&D works with Human Resources to ensure that the right people are being recruited and taken care of in terms of training and development.

In addition, outside of the firm’s boundaries, the Chief R&D Officer has to make sure that the R&D organization interfaces with other entities, as this can increase the probabilities to create sources for innovation. This is further discussed in the following chapters. As an overview, the term Open Innovation (OI) is associated with opening up the company boundaries to let valuable knowledge in from the outside so that new opportunities can be created (Chesbrough, 2003; Gassmann & Enkel 2004). This valuable knowledge can come from different sources, such as: (1) universities and research institutes, (2) industrial partnerships in joint ventures, (3) start-up companies for innovative technologies and Venture Capital (VC), (4) suppliers (e.g. industrial equipment, raw materials), (5) technology owners in unrelated businesses, and (6) consumers.

The link that the Chief R&D Officer has to make between R&D and the rest of the functions and entities outside of R&D is portrayed in Figure 6.

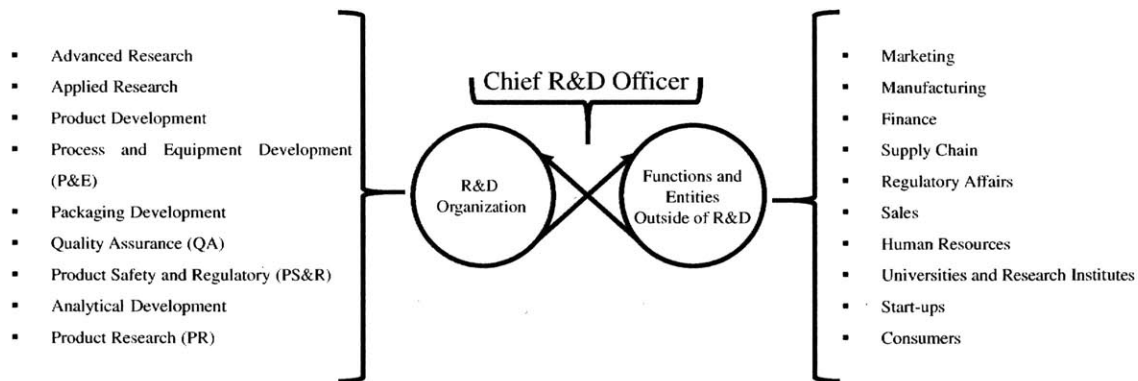


Figure 6. The Chief R&D Officer Relevance: Integration of Diverse Functions.

Finally, an important part that allows the alignment of R&D with the rest of the organization as well as the ensuring the collaboration of R&D both internally and externally (business and external partners) resides in the Chief R&D Officer's responsibility for setting the direction for R&D and executing this direction in terms of strategy, structure and culture. This is further explored in the following chapters.

4.4 | Key Takeaways: Role of the Chief R&D Officer

This chapter provides an overview of the evolution of the Chief R&D Officer's role and how it has emerged within the industry and become increasingly relevant, especially for CPG multinationals. It discusses how the Chief R&D Officer in the sample of nine multinational companies studied in this research paper has the responsibility for technology, innovation and R&D, and that this role might differ if compared with other industries (e.g. high-tech).

Moreover, this chapter establishes that the Chief R&D Officer sets the direction for R&D so that it can generate value by creating innovation for the firm. It also indicates that a great part of the Chief R&D Officer's key responsibilities resides in formulating the R&D strategy, managing the organizational structure and leading the organizational culture. The Chief R&D Officer needs to have a systematic approach towards these aspects if he or she wants to create value for the firm. In addition, this chapter provides an overview complexity associated with leading and managing an R&D organization in the context of a CPG multinational company. The R&D function needs to interact with a wide array of entities both inside and outside of the R&D organization. Generating innovation is not an isolated effort. It requires the integration of many functions within a firm. The Chief R&D Officer needs to establish the strategy, structure and culture to enable this close alignment and interaction, both inside and outside of the R&D organization's boundaries.

Finally, the Chief R&D Officer needs to be visionary and have a technology vision that drives the R&D organization, closely linked with the business, towards the desired state. However, the critical part resides in executing this vision, and this is where the Chief R&D Officer needs to formulate the R&D strategy to generate the choices and trade-offs to establish R&D priorities. These priorities lead to decisions regarding the organizational structure and organizational culture for the R&D organization that supports this strategy. The following chapter explores this aspect in further detail.

Chapter 5 | Formulating the R&D Strategy

This chapter provides an overview of the definition of corporate strategy and explains how the R&D strategy is derived from the corporate strategy. The Chief R&D Officer has to formulate an R&D strategy that is closely aligned with the business to generate value and innovation for the firm. The R&D strategy sets the direction for the R&D organization, both in the short-term and in the long-term. This chapter suggests that when the Chief R&D Officer is formulating the R&D strategy, three key decisions have to be made: designing a technology roadmap, selecting on the R&D project portfolio and deciding the amount to invest in R&D. These decisions trigger choices regarding the R&D organizational structure and the R&D organizational culture that align and enhance this R&D strategy.

The chapter ends with a case study from a CPG multinational company that explains how its former Chief R&D Officer successfully aligned corporate strategy with R&D strategy to make the R&D organization more efficient and responsive to business needs. This case study provides further detail regarding the key decisions that the Chief R&D Officer has to make when he or she formulates the R&D strategy and shows how its execution necessarily involves the elements of the R&D organizational structure and culture. This introduction sets the context for the following two chapters.

5.1 | Alignment of Corporate Strategy and R&D Strategy: An overview

Roussel, Saad and Erickson (1991) argue that R&D must be connected with the firm's corporate strategy and that R&D needs to be integrated with the rest of the organization in the execution of this strategy in order to enhance the firm's strategic position and maintain its competitive advantage. The role of the Chief R&D Officer is crucial because this senior executive needs to perform the alignment of R&D strategy with corporate strategy so that the R&D function can contribute positively to the firm. This section provides the definition of corporate strategy to understand how R&D is involved in the design and execution of a company's plan.

5.1.1 | Definition of Corporate Strategy

Crawley, Cameron and Selva (2016) define corporate strategy as the “means by which the firm achieves corporate goals, such as increasing profitability and building competitive shareholder value.” Corporate strategy addresses the following:

- Defines the specific activities of the organization, including the mission of the firm, the scope of the activities, the short-, medium- and long-term goals, resource allocation and anticipated activities.
- Provides the decisions of the products or services that the firm delivers, the markets in which the company serves and the value that is offered to the consumer.
- Assesses the opportunities and threats in the competitive environment and weighs the firm’s strengths and weaknesses.
- Dictates the firm’s differentiation and therefore, the sources of competitive advantage.
- Defines the businesses the firm is or should be in, and then establishes the path to develop these capabilities to achieve sustainable competitive advantage. Developing the capabilities involves deciding on the firm’s priorities and what to exclude.

Crawley, Cameron and Selva (2016) mention that in multinational companies there exists a *business unit strategy* that derives from the corporate strategy. This business unit strategy is targeted towards the sector, market, geography that defines the business unit. Within a business unit, and sometimes across, there are *functional strategies* that are responsible for deploying the firm’s goals with regard to the firm functions. These functions can either serve a corporate goal (e.g. what actions need to take place so that the firm can be the first in the market with a particular technology?) or they can serve to deploy improvement plans related to increasing the firm’s profitability. These key functions are: Marketing, R&D and Manufacturing. This indicates that corporate strategy drives R&D strategy, and that the R&D function is a part of the overall firm’s strategy. This also suggests that R&D needs to be aligned with the business in the execution of the R&D strategy.

5.1.2 | Corporate Strategy and R&D Strategy

This section provides an introduction for the need of aligning R&D with corporate strategy and also connecting R&D with the priorities of the rest of the organization. First, it is important to

define R&D strategy. Chiesa (2001) mentions that R&D strategy consists of “the definition of set R&D initiatives required to achieve the fixed objectives defined within the overall strategic framework of the firm.” This definition confirms that R&D strategy derives from corporate strategy.

Roussel, Saad and Erickson (1991) argue that corporate, business and R&D need to work as partners to establish an overall R&D strategy that is closely linked with corporate strategy and that also focus on providing value to customers and shareholders. If corporate, business and R&D fail to act in partnership, the probability of success to achieve the company’s strategic goals is diminished.

Furthermore, Wilkinson (1987) mentions that the R&D function should not be isolated from planning and executing its own strategy independent of other functions; instead it should be integrated with the rest of the functions to define in conjunction the R&D strategy as well as help contributing to the strategy of other functions within a firm. Braunstein and Salsamendi (1994) elaborate on this point, indicating that the integration of corporate R&D with other functions is needed to maintain and grow technical capabilities to ensure the support of programs related to long-term corporate objectives. These authors also argue that R&D must integrate its strategy with that of the firm and that an effective planning process agreed upon by the major functional units for the firm enables the alignment of corporate strategy with R&D strategy.

The cascading effect of corporate strategy in R&D strategy is depicted in Figure 7.

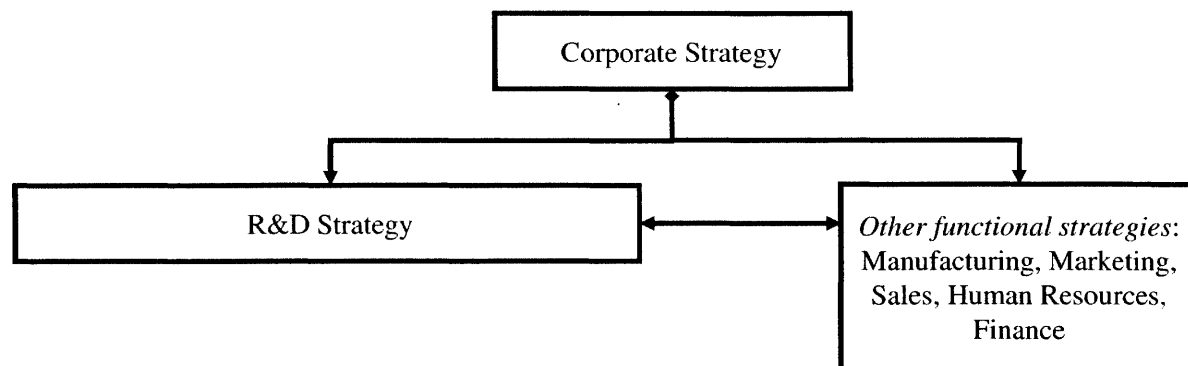


Figure 7. Corporate strategy and R&D strategy.

Finally, it is worth mentioning that the executive senior management, including the Chief R&D Officer, is crucial for designing the overall firm's strategy, because only they can ensure the integration of all plans into one cohesive plan that leads to an enhanced firm's competitive position. Building on this point, the next section explores how the Chief R&D Officer has to formulate an R&D strategy that is closely aligned with the business to generate value and innovation for the firm.

5.2 | Formulating the R&D Strategy: Chief R&D Officer Key Decisions

“Innovation must be closely tied to the business strategy and growth agenda; with clear engagement by the businesses that will ultimately launch these initiatives. Innovation must also be delivered on time and with clear business value.” (Quan, 2015, p. 42)

As an executive of the top management team, the Chief R&D Officer has an influence on the corporate strategy, which in turn drives R&D strategy. As mentioned previously, the Chief R&D Officer is in charge of setting the direction of R&D, and materializing this direction in terms of formulating an R&D strategy that is closely linked with the corporate strategy and that reflects the business priorities. Once the R&D strategy has been formulated, executing this strategy triggers decisions regarding the R&D organizational structure and the R&D organizational culture that need to be in place to support this R&D strategy. If the Chief R&D Officer systematically thinks about these three elements, innovation is created.

The summary of this argument is portrayed in Figure 8.

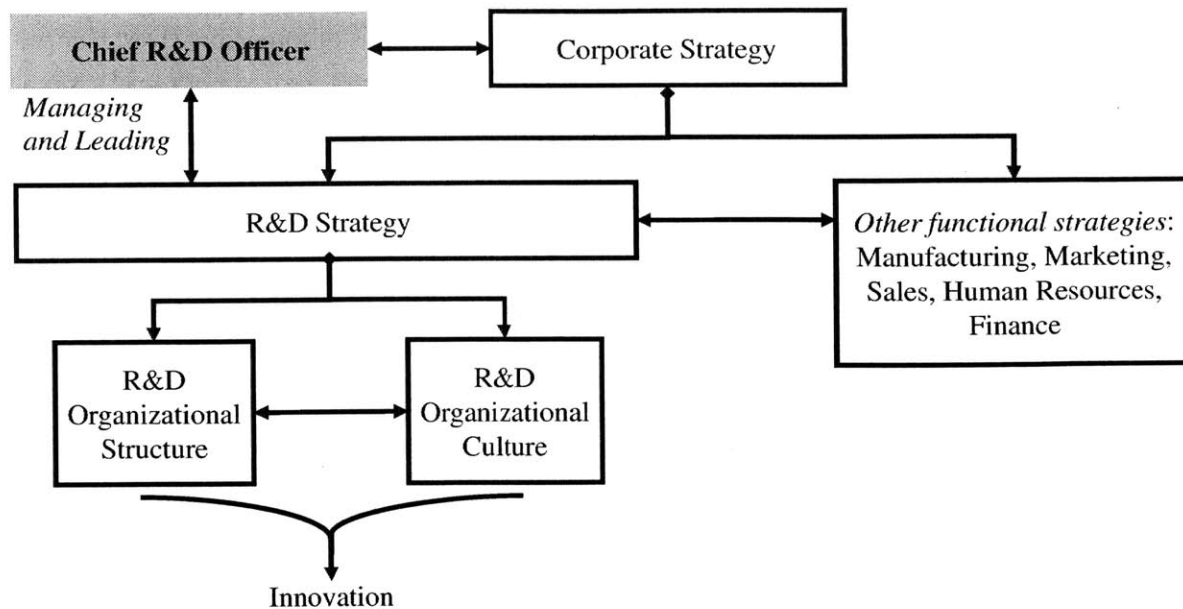


Figure 8. The Chief R&D Officer as the 'architect' of the R&D organization.

Additionally, the Chief R&D Officer needs to formulate an *optimal* R&D strategy, that is, a strategy that applies according to the particular context of a CPG multinational. The objective of formulating an *optimal* R&D strategy is to deploy R&D investments strategically and more efficiently to better address pressures in the competitive environment and urgency of lead-time reduction in product development cycles for achieving fast time-to-market (Roussel, Saad & Erickson, 1991). Likewise, an *optimal* R&D strategy can lead to achieve product differentiation and create new value for the consumer, because radical innovations can be planned along the product development pipeline. Planning allows development of the capabilities required to create this type of innovation.

The Chief R&D Officer has to consider the following for achieving this *optimal* R&D strategy:

- Decide on how to manage technology more strategically in the long-term; this implies linking technology and business more effectively (Deschamps, 2008). In the CPG industry, this consideration could be related to direct the efforts of the Advanced Research Group towards the discovery of new ingredients with the premise of having a potential application in mind for a diverse set of products.

- Identify critical new technologies that will sustain the business of tomorrow (Deschamps, 2008). In the CPG industry, a new technology could be to identify non-caloric, natural sweeteners to replace sugar content in beverages.
- Identify competencies that are critical for the company to master in order to develop or continue developing those core capabilities (Deschamps, 2008). In the CPG industry, there might be the case that the CPG multinational company is interested in developing targeted and customized personalized nutritional products for a certain audience. Therefore, the Chief R&D Officer needs to make sure to develop the necessary capabilities to develop these types of products.
- Evaluate decisions of developing the technology in-house or looking externally for that technology (Deschamps, 2008). In the CPG industry, this consideration leads the R&D organization to leverage external technologies from suppliers, commercial partners or even start-ups for accelerating the development process.
- Recommend which areas of R&D should be investigated, developed and grown (or phased-out) (Deschamps, 2008). In the CPG industry, this might be related to looking into technologies from apparently unrelated fields and seeing how to apply them in the current field (e.g. Nestlé developed extrusion technology for breakfast cereals, snacks and cereal food from technology used in the plastics industry). Recommending which areas should be investigated also includes prioritizing which technologies should be selected to investigate according to the firm's priorities. For example, due to the increased health and wellness trend in the CPG industry, this might involve prioritizing investigating new technologies to deliver more nutritious products.
- Identify technologies that have the highest competitive impact on the company's business in the present and identify technologies that might replace the existing technologies and be radical for the business or the industry (Deschamps, 2008). In the CPG industry, this might be related to developing new ingredients for substituting sugar, fat or salt content in products because of the increased trend of health and wellness in this industry.
- Analyze opportunities and threats that might arise from major technological shifts in the industry (Deschamps, 2008). In the CPG industry, there might be an opportunity to leverage on the digitalization trend to better understand consumer needs and therefore deliver better solutions for them.

- Invest in new critical technologies ahead of time but not too early. This might involve decisions on how to drive ambiguity out of new and radical technologies to reduce the risk of investment (Deschamps, 2008). In the CPG industry, this might be related to invest in a radical technology to understand the efficient uptake in the body of nutrients for health.
- Help to ensure the long-term technological competitiveness of the firm (Deschamps, 2008). In the CPG industry this might involve creating R&D centers in strategic positions around the world to leverage knowledge and technology that is locally generated and then applying that knowledge on a global scale.

These considerations suggest that the Chief R&D Officer has to decide when and how much to invest in technology, plan on how to achieve the desired results and prioritize among multiple initiatives according to the firm's priorities. Thus, this research paper suggests that the Chief R&D makes three key decisions when formulating the R&D strategy to create the desired value for the firm:

1. **Designing a Technology Roadmap.** The Chief R&D Officer, in conjunction with his or her senior management team and business functions, has to decide on how to get where to go or achieve the desired objective (Cooper, Edgett & Kleinschmidt, 2001).
2. **Planning the R&D Project Portfolio.** Once the Technology Roadmap has been established, the Chief R&D Officer, in conjunction with his or her key staff, needs to decide in which projects to invest and how to manage them. This includes balancing both short- and long-term projects (Cooper, Edgett & Kleinschmidt, 2001).
3. **Investment in Corporate R&D.** The Chief R&D Officer needs to decide the total amount to invest in R&D based on the outcome from the Technology Roadmap and R&D Project Portfolio (Deschamps, 2008).

The following sections elaborate on these three key decisions and provide general definitions that apply to CPG multinational companies. Moreover, the Chief R&D Officer has to execute the R&D strategy after formulating it. Executing the R&D strategy involves choices regarding how to organize R&D and how to shape the culture that aligns with the R&D strategy and R&D structure. The final section of this chapter introduces a case study of how Nestlé's former Chief R&D Officer executed these decisions in terms of aligning the R&D strategy with corporate strategy and provides an overview of how executing the R&D strategy necessarily requires having the R&D

organizational structure and organizational culture support this R&D strategy. This overview provides the context for the following two chapters. First, it is necessary to explore these three key decisions.

5.2.1 | Decision 1: Technology Roadmap

Cooper, Edgett and Kleinschmidt (2001) mention that roadmaps are an effective way to map out a series of assaults in an attack plan. The Chief R&D Officer, in conjunction with his or her senior management team and business functions, needs to decide on how to get where they want to go to achieve the desired objective. The roadmap is a valuable tool that helps a group make sure that the capabilities to achieve their desired objective are in place when needed. Kostoff and Schaller (2002) mention that a roadmap provides a consensus view or vision of the future landscape available to decision makers. The roadmapping process provides a way to systematically identify, evaluate and select strategic alternatives that satisfy a desired objective.

According to Cooper, Edgett and Kleinschmidt (2001) there are two different types of roadmaps:

- **Product Roadmap.** Defines the product and product releases along a timeline, how the product line will evolve over time and what the next generations will be. Basically, it answers the question: “*what products?*” This roadmap is mainly driven by business functions; however, the Chief R&D Officer and his or her senior management team need to provide input to determine the initial technical feasibility for the portfolio of products planned in this roadmap.
- **Technology Roadmap.** This roadmap is derived from the product roadmap and specifies *how* the company will get there. It determines the technologies and technological competencies that are needed in order to implement, either by means of developing or acquiring, the products included in the product roadmap. This technology roadmap is an extension of the product roadmap and it is inherently linked to it. The input of the Chief R&D Officer is critical to design this roadmap.

In this sense, roadmaps typically contain a timeline of items such as markets, products, technologies, and R&D projects along the link between those items (Kostoff & Schaller, 2002) as shown in Figure 9.

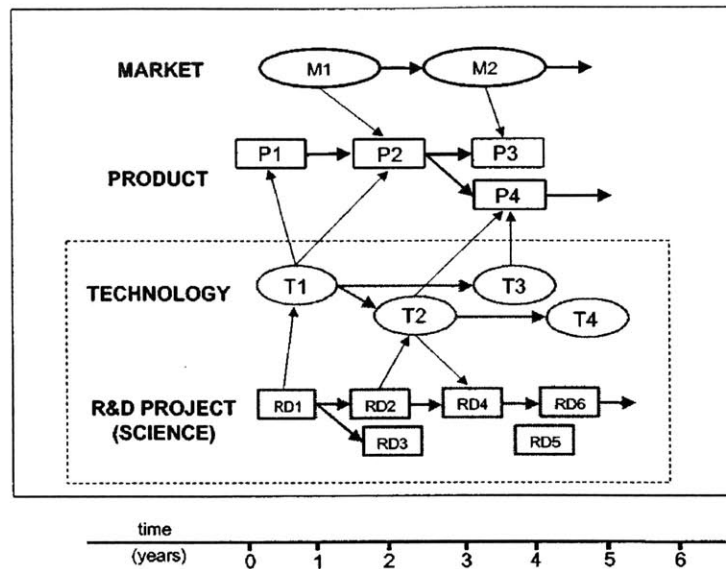


Figure 9. Generic example of a technology roadmap.
Retrieved from (Kostoff & Schaller, 2002)

The roadmaps benefit the R&D organization and the overall organization in the following ways (Kostoff & Schaller, 2002): (1) they develop a consensus among decision makers about what the firm’s technologies needs are, (2) they provide a mechanism to forecast technology developments, (3) they create an agenda for what technology to pursue at what time, and (4) they ensure a set of mutually supporting and synergistic activities.

5.2.2 | Decision 2: R&D Project Portfolio

Based on the technology roadmap, the Chief R&D Officer proceeds to the planning process, which implies selecting the R&D project portfolio. The R&D project portfolio basically considers which projects to invest in and how to manage them (Cooper, Edgett & Kleinschmidt, 2001). Roussel, Saad and Erickson (1991) mention that the objective of the R&D project portfolio is to reach the optimum point between risk and reward, stability and growth.

The Chief R&D Officer needs to ensure three key goals when planning the R&D project portfolio (Cooper, Edgett & Kleinschmidt, 2001):

1. Ensure the R&D portfolio is properly balanced.
2. Align the R&D portfolio with the corporate strategy.
3. Select the proper number of R&D projects within the portfolio.

These key goals are briefly explained in the following paragraphs.

5.2.2.1 | Balance the R&D portfolio

The Chief R&D Officer has to decide the criteria to properly assess the balance the projects. For example, this criteria applies to short-term versus long-term, high-risk versus low-risk, and project type, among other criteria. Kandybin (2009) suggests having a balance of projects that includes different project sizes, segments, categories, risks and launch times.

The Chief R&D Officer has to have a mix of both incremental innovation projects and radical innovation projects to guarantee the introduction of new products both in short-term and long-term horizons. Incremental innovation projects help to sustain the business in the short-term and are generally low-risk projects, while radical innovation projects need greater investment, have greater risks and require more time to develop due to their degree of novelty. Radical innovations also secure the long-term competitiveness of a firm. (Davila, Epstein & Sheldon, 2006). Thus, the Chief R&D Officer has to champion the radical innovation projects and make sure that they have enough time to grow, even though they do not generate profits in the first years due to increased costs related to product development. This is a challenge that the Chief R&D Officer has to deal with, because most of the time the business is pressured to maximize shareholders' profits in the short-term, which can compromise investments in radical innovation.

5.2.2.2 | Strategic alignment

The Chief R&D Officer must keep in mind at all times that aligning the R&D portfolio to corporate strategy is an important factor in project portfolio management. The main goal of this alignment is first, to ensure that each project is a strategic fit with the goals of the company, and second, to choose a portfolio of project that not only fits the firm's strategy but also reflects the strategic priorities.

5.2.2.3 | Proper selection of R&D projects

The proper selection of R&D projects is critical, because choosing a portfolio of too many projects can result in a bottleneck where none of the projects can move forward because of the lack of clarity associated with the priority of each project. Resources such as budget, number of employees, required employee skill-set, facilities and capital expenditures should all be taken into

consideration. Summing up all the projects is extremely important as it allows prioritization of projects, helps identify resource bottlenecks, determines which projects can be eliminated and estimates the amount of resources needed. It also helps to determine resource and budget allocation for the projects.

5.2.3 | Decision 3: Investment in Corporate R&D

Once the Technology Roadmap and R&D Project Portfolio has been selected, the Chief R&D Officer has to provide the executive management team the directions on where and how much to invest in R&D (Deschamps, 2008). Therefore, the Chief R&D Officer has to decide the R&D intensity, which is the R&D spending as a percent of the firm's revenue.

The R&D intensity in the CPG Industry was 3% in 2015 (Jaruzelski, Schwartz & Staack, "*Global Innovation 1000*" *Strategy & Report*). For the four largest CPG multinationals, R&D costs according to their *2015 Annual Reports and Financial Statements* were US\$1,678 million for Nestlé, US\$2,047 million for Procter and Gamble (P&G), US\$754 million for PepsiCo and US\$1,120 million for Unilever. To this point, PepsiCo's Chief R&D Officer mentions the following: "The only way you can change is invest back in innovation. You cannot grow yourself out of the challenges the food industry faces by efficiency alone. Yes, this grows the bottom line, but cannot grow the top line without innovation." (Khan, 2015)

Furthermore, how the Chief R&D Officer decides the investment allocation in R&D will reflect the following (Deschamps, 2008):

- A vision of where and how technology will shape the future of the business and create opportunities;
- The position management is willing to take related to risks associated with introducing new products and technologies;
- Faith in the power of science and technology to outperform competitors.

5.2.4 | Consequences of the R&D strategy

When the Chief R&D Officer makes the three key decisions involved in formulating the R&D strategy (designing a technology roadmap, planning the R&D project portfolio, and investment in corporate R&D), they trigger different needs associated with how to globalize the R&D activity, how to make R&D more responsive to the business, how to develop the necessary skill-set and competencies in the R&D organization, how to establish this close alliance with the business side to make the innovation more efficient, and how to instill a sense of purpose in the R&D organization. In other words, once the R&D strategy has been formulated, the Chief R&D Officer's responsibility resides on how to organize R&D for results (managing the R&D organizational structure) and how to build the culture (leading the organizational culture) that emerges and nurtures both the R&D strategy and the R&D organizational structure. The next section provides an example of how a Chief R&D Officer accomplished executing the R&D strategy in a CPG multinational company.

5.3 | Case study from Nestlé's former Chief R&D Officer

This section provides a case study from a CPG multinational company (Nestlé) that explains how its former Chief R&D Officer (Werner Bauer) successfully executed the three key decisions in terms of aligning the R&D strategy with corporate strategy to make the R&D organization more efficient and responsive to business needs. In fact, this alignment helped Nestlé to continuously generate innovation for consumers and create the shift to become the leading Nutrition, Health and Wellness (NHW) Company.

This case study is based on a public Nestlé R&D report *Innovating the Future* (2007), Deschamps and Nelson (2014) *Innovation Governance: How Top Management Organizes and Mobilizes for Innovation*, and Henderson and Johnson (2012) Harvard Business School Case *Nestlé SA: Nutrition, Health and Wellness Strategy*. This section provides a company overview to understand the magnitude of this CPG multinational company and then provides further detail on Nestlé's strategy, how the Chief R&D Officer created key pillars to execute this strategy and how the execution involves elements of R&D organizational structure and R&D organizational culture.

5.3.1 | Nestlé: Company Overview

Nestlé is one of Europe's oldest food companies and has more than 80 global and regional brands with presence in a large number of product categories. Nestlé's product portfolio ranges from bottled water, cereals, chocolate and confectionery, coffee, culinary specialties, chilled and frozen foods, dairy, drinks, ice cream, to baby food, sports nutrition, and weight management products. The company is also strongly positioned in food service and healthcare nutrition.

For most of its businesses, Nestlé combines a highly decentralized market organization with a relatively centralized approach to strategic innovation, operations and R&D (Deschamps & Nelson, 2014). Each geographical market head has a high degree of autonomy in product portfolio and local market operations under the supervision of his or her Zone Director. Chapter 2 explains that Nestlé is divided into three geographic zones: Europe; the Americas and Caribbean; and Asia, Oceania, Africa, and the Middle East. In terms of structure:

- Product strategies are controlled by a number of centrally located Strategic Business Units (SBUs) Leaders, who report to an Executive Vice President that oversees all SBUs as well as the strategic aspects of marketing and sales.
- All operations are centrally managed under the control of an Executive Vice President for Operations and "Globe" (Nestlé's Resource Planning System).
- All the R&D and innovation activities are supervised by the Chief R&D Officer (or CTO), who is the head of Innovation, Technology and R&D. The Chief R&D Officer is a member of Nestlé's 13-member executive board and is officially responsible for overall innovation governance within Nestlé.

Besides its geographically based businesses, Nestlé operates a number of globally managed businesses: Nestlé Nutrition, Nespresso, Nestlé Health Science and the Nestlé Institute of Health Sciences (NIHS). These organizations have a greater degree of autonomy in their operations and resources compared to other Nestlé businesses. This company has also established key partnerships with other companies by joint ventures such as Cereal Partners Worldwide (with General Mills), Beverage Partners Worldwide (with Coca-Cola), and Dairy Partners of America (with Fonterra), and with L'Oréal in the pharmaceutical business.

Deschamps and Nelson (2014) argue that Nestlé is one of the most innovative companies in the CPG industry, as demonstrated by the great success of its Nespresso coffee system and the progress it is making into the emerging market of science-based, personalized nutritional solutions. Under the guidance of its Chief R&D Officer, the R&D function has been a key player to drive these innovations.

5.3.2 | Chief R&D Officer's Key Pillars for aligning R&D strategy with corporate strategy

Nestlé's strategic vision to become the leading Nutrition, Health and Wellness (NHW) Company began in 1997 when Peter Brabeck, former CEO and current Chairman, envisioned that this strategy would build for Nestlé a source of differentiation with consumers and be a driver for higher profit margins. This vision was triggered by shifts that were taking place in the consumer market, such as rising health concerns and changing preferences about food towards more nutritious alternatives (Henderson and Johnson, 2012).

Deschamps and Nelson (2014) mention that Nestlé was able to redefine itself as a NHW Company by leveraging its powerful R&D capabilities and meeting new societal demands. The following extracts from Nestlé's R&D report "*Innovating the Future*" (2007) explain R&D's relevance to achieve this transformation:

"At the beginning of this century, Nestlé made the strategic decision to transform itself from a successful, technology-driven foods and beverages company into an R&D- and marketing-driven Nutrition, Health and Wellness Group. Turning this strategic vision into reality requires a re-orientation of our R&D efforts towards life science and an open collaboration environment that constantly delivers bigger, bolder and better innovations... R&D's role is one of creating bridges not only outside the Company but also across the Company. That way we are building a wide base from which to drive our Nutrition, Health and Wellness transformation and further business growth... For Nestlé to achieve all of this, R&D takes on even more importance. It forms the scientific base and creates the proprietary technology platforms in order to be leader in Nutrition, Health and Wellness." (Brabeck, 2007, p. 3)

“R&D is one of Nestlé’s strengths. It always has been. We constantly leverage our scale to new and more challenging heights. Innovation is the first pillar of our corporate strategy with Nutrition, Health and Wellness as a core value... Our “innovating the future” strategy is based on: (1) continuous improvement in consumer insights and their translation to innovative products build on superior science and technology; (2) harnessing the vast expertise in our unmatched research and development network; (3) working closely with leading universities and outside partners on cutting-edge science and technology; (4) recruitment of open-minded and passionate innovators who can bridge science, technology and business needs; (4) bigger pioneering innovation that hit the “innovation sweet-spot” – where best-in-class science and technology combine to deliver precisely targeted Nutrition, Health and Wellness benefits that lead to significant business success.” (Bauer, 2007, p. 5)

These extracts indicate how the Chief R&D Officer strongly believed in the strength of the R&D organization towards this achieving this transformation. The following paragraphs explain how Bauer achieved R&D transformation towards the company’s NHW strategy and established a close alignment between R&D strategy and the company’s strategy. The Chief R&D Officer established the following five key pillars to execute this R&D strategy (Deschamps, 2008):

- Managing a five-generation pipeline.
- Innovation/Renovation Governance Model and R&D structure.
- Investment in R&D.
- Encouraging Innovation Partnerships.
- Developing Competencies and Attitudes to nurture the strategy.

Managing a Five-generation Pipeline

Nestlé classifies innovation according to two types: (1) *renovation*, which is oriented towards incremental product development in existing categories (incremental innovation), and (2) *innovation*, which deals with more radical attempts to create new categories, either within the business boundaries or through the creation of new ventures such as Nespresso (radical innovation).

Bauer provided a sense of direction in science and technology by introducing a five-generation pipeline to map these renovation and innovation activities (or respectively, incremental and radical innovation). This pipeline helps to map out the capabilities needed for R&D to develop over the

next years to continue driving the innovation according to the business strategy and to define the Technology Roadmap and R&D project portfolio. The five-generation pipeline is at the intersection between the business and R&D and helps balance and determine the renovation and innovation activities within a certain timeframe. Renovation, or incremental innovations, generally have less risk and require less time to develop, while innovation, or radical innovations, require more investment and more time to develop (Davila, Epstein & Sheldon, 2006). Therefore, renovation activities are generally located within the first three years of the cycle, while innovation (or radical innovation) are located at longer horizons, four to five years in the future. Generating the five-generation pipeline addresses three questions:

- What is needed for the consumer? SBUs, markets and R&D provide this response.
- What is technically possible? R&D and technical operations provide this response.
- What is economically achievable? SBUs, markets, R&D and technical operations provide this response.

The five-generation pipeline is shown in Figure 10.

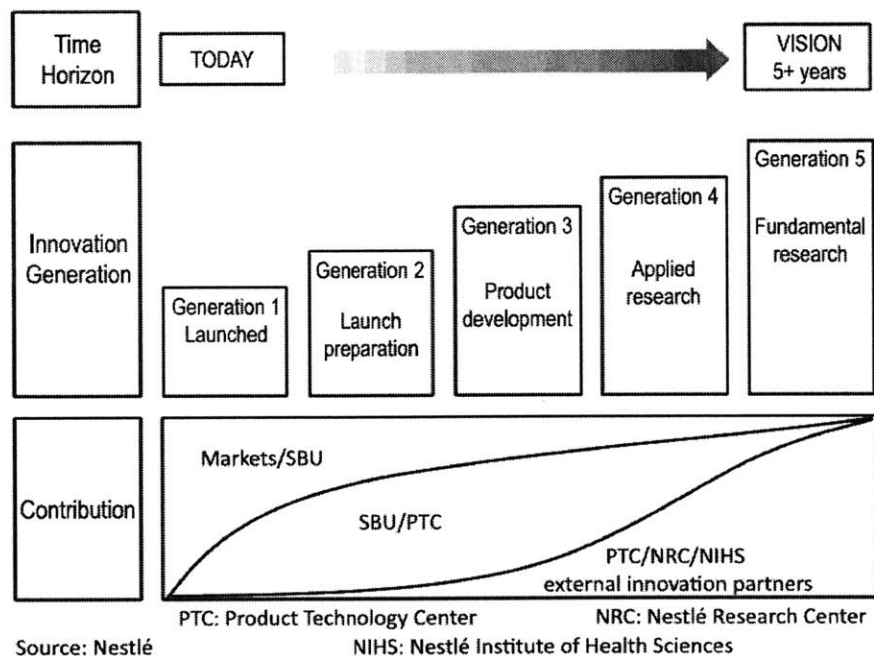


Figure 10. Innovation/Renovation Five-generation Pipeline.
Retrieved from (Deschamps & Nelson, 2014)

Figure 10 confirms that executing this five-generation pipeline requires the contribution of both business and R&D, so that new products can be introduced in the short- and long-term horizons. Creating the right innovations requires having an R&D organizational structure that is responsive to the business and efficient to generate value through the creation of new products and processes.

Innovation/Renovation Governance Model and R&D Structure

The five-generation pipeline allows visibility of the types of projects that are pursued and keeps the balance in the short-term and the long-term. The challenge, however, is how to establish the priorities across the organization that combine both R&D and the business.

To overcome this challenge, Bauer contributed to establish a symmetrical structure and process between the mechanisms for business governance and those belonging to R&D. A global business strategy is agreed at the executive board, then a market strategy is set for the zone and cluster levels and then finally for the individual market level. On the R&D side, an annual R&D strategy conference supports the global business strategy. At the zone level, aggregate R&D project portfolio is discussed and then specific projects are detailed at the individual market level.

To close the gap between the technical and business functions, R&D interfaces with the SBUs for strategic alignment and for driving and governing innovation. The SBUs coordinate strategies within the individual Nestlé business categories and are responsible for all globally managed brands and all product categories. Deschamps and Nelson (2014) mention that Nestlé's former Chief R&D Officer shared the following perspective towards making this parallel alignment between R&D and the SBUs:

"The head of the SBUs is my counterpart in the strategy process taking place through our R&D conferences. He decides on the "what" of innovation. The how is the CTO's job! But we sometimes help the businesses decide on the "what" by indicating to them what is scientifically or technologically feasible." (Bauer, 2014, p. 211)

New product development projects result in the combined effort of three players: SBUs, Product Technology Centers (PTCs), and zone and market management. The Nestlé Research Center (NRC) also plays a role when radical new technologies or new ingredients need to be developed for the new product. The SBUs and zone and market management establish the Product Roadmap;

meanwhile the Chief R&D Officer and the key technical team establish the Technology Roadmap. From here, the Innovation/Renovation priorities and projects are set for the company.

Investment in R&D

By deciding where the R&D resources were allocated, Bauer influenced how the different labs, research centers, excellence centers and PTCs worked, so that the innovation and renovation projects could be executed by the R&D organization. Due to the high involvement that R&D had with the business in Nestlé, Bauer, in conjunction with the executive management team, decided to specify the following rules regarding spending decisions (Deschamps & Nelson, 2014):

- 50% of the overall R&D budget is decided by the business units,
- 25% is decided by geographic zones and key markets, and
- 25% is decided by the Chief R&D Officer.

In this matter, the Chief R&D Officer had autonomy and freedom on where and what to spend. Therefore, Bauer, could champion strategic projects that could lead to radical innovations.

Encouraging Innovation Partnerships

Part of Nestlé's R&D strategy was to leverage on external innovation partners for creating new products and technologies. Supporting this strategy involves building the organizational culture to support this change. Bauer was key to encourage innovation partnerships with entities outside of the R&D organization and build a network of collaboration with universities, research institutes, small-startup companies, industrial partners and suppliers to cope with the increased expansion of new scientific and technological development in the CPG industry and the firm's ambition to tap into new fields such as nutrition. Bauer, in conjunction with the executive management team, launched and promoted the "*Sharing is Winning*" (SiW) model to change internal and external attitudes towards Open Innovation. Encouraging Open Innovation also included changing the mindset of the R&D organization to embrace this initiative.

Developing Competencies and Attitudes to Nurture the Strategy

Bauer helped to lead the transformation of the R&D organization by instilling a sense of purpose, direction and focus in all technical departments. He also inculcated a sense of teamwork between the technical and business organizations to maximize the potential for success in new products and

processes and make everyone accountable for innovation. Making R&D closer to the business included the implementation and promotion of Nestlé's MicroMBA Program, which is explored in Chapter 6. Deschamps and Nelson (2014) mention that Nestlé's former Chief R&D Officer shared the following opinion towards making R&D more business oriented:

"The CTO's mission is the continuous improvement of innovation. This means working on strategic alignment, processes, competencies and attitudes. We started ten years ago by trying to make R&D more business-centric. Besides providing extensive training, we work on R&D career management." (Bauer, 2014, p. 217)

In addition, Bauer instilled the innovation mindset with his conviction that management attitudes must support it and this is why he naturally chose to be a mentor to his key R&D staff. Bauer mentions that attitudes within R&D must change to support ongoing efforts and this is achieved in part through training.

To conclude, these key pillars establish the importance of the Chief R&D Officer's role to achieve the R&D transformation and align R&D strategy with the organization's strategy. It also indicates that executing the R&D strategy necessarily involves decisions regarding the R&D organizational structure and R&D organizational culture to support this strategy.

Finally, Nestlé continues to strive its mission to become the leading NHW Company and drive the frontier towards addressing global issues such as aging population and obesity and other chronic diseases. In this scientific and technological food and beverage revolution, it is clear that Nestlé is betting that R&D plays as a key strategic partner to enable this revolution.

5.4 | Key Takeaways: Formulating the R&D Strategy

This chapter provides the definition for corporate strategy. The need for having an R&D strategy that is closely linked to the business increases the probability of success in terms of bringing innovation to the market and developing the necessary capabilities to address these market needs. The central role of the Chief R&D Officer in formulating the R&D strategy is critical, as he or she needs to not only decide the amount needed to invest in R&D, but also forecast the technological future, which in turn can create an impact on the company's direction. The Chief R&D Officer also has to select the right projects and strive to balance the short and long-term competitiveness of the R&D organization.

The case study presented in this chapter suggests that the corporate strategy has a strong influence on the R&D strategy. After formulating the R&D strategy, the Chief R&D Officer has to decide on how to organize R&D effectively and how to develop competencies and attitudes in the R&D organization. This implies that the Chief R&D Officer has to decide how to organize R&D by managing the R&D organizational structure and how to develop the competencies and attitudes by leading the R&D organizational culture. These decisions are supported by the case this chapter explores. The two following chapters provide further detail of these two aspects.

Chapter 6 | Managing the R&D Organizational Structure

The previous chapter suggests that executing the R&D strategy requires the elements of R&D organizational structure and culture. This chapter provides further detail on the structural elements that the Chief R&D Officer has to evaluate when he or she is organizing R&D. These elements address organizational aspects related to R&D organizational structure such as the orientation of the organization (project, function or matrix organization), centralization or decentralization of R&D, allocation of R&D resources, and the use of external versus internal resources. The choices that each Chief R&D Officer makes need to align with the R&D strategy and corporate strategy of a particular CPG organization. These choices influence the structure of the R&D organization and therefore can allow R&D to be more effective and more responsive to the business. The R&D structure also enables the R&D organization to create value for the firm, because if the R&D structure is more effective and responsive, new products can be introduced to the market faster. Therefore, continuous innovation is generated.

Furthermore, in CPG multinational companies, the Chief R&D Officer has to consider these structural elements in the context of a global R&D organization. Chapter 2 establishes that CPG multinational companies operate in multiple countries and markets which requires having an R&D organization that is globally distributed so that scientific and technological knowledge can be leveraged across the global R&D network. Consequently, this component is considered in the analysis. This chapter includes examples from Chief R&D Officers in the CPG Industry to clarify the analysis of each of the structural decisions.

6.1 | Five structural elements of the R&D Organization: Chief R&D Officer Choices

Once the Chief R&D Officer has formulated the R&D strategy, the responsibility is focused on execution. That is, how to organize R&D to achieve the desired results. The Chief R&D Officer needs to understand the implications for managing the R&D organizational structure with the purpose of considering the necessary trade-offs involved in organizing R&D according to the particular R&D strategy and overall firm's strategy. The Chief R&D Officer has to consider organizational questions such as how to distribute R&D resources around the globe or how to change the R&D organization so that the product development lead time can be reduced. The underlying strategic intent for these organizational questions resides on how achieve an

appropriate R&D structure that is aligned according to the firm’s strategic intentions. More information regarding the organizational questions and underlying strategic issues are summarized in Figure 11.

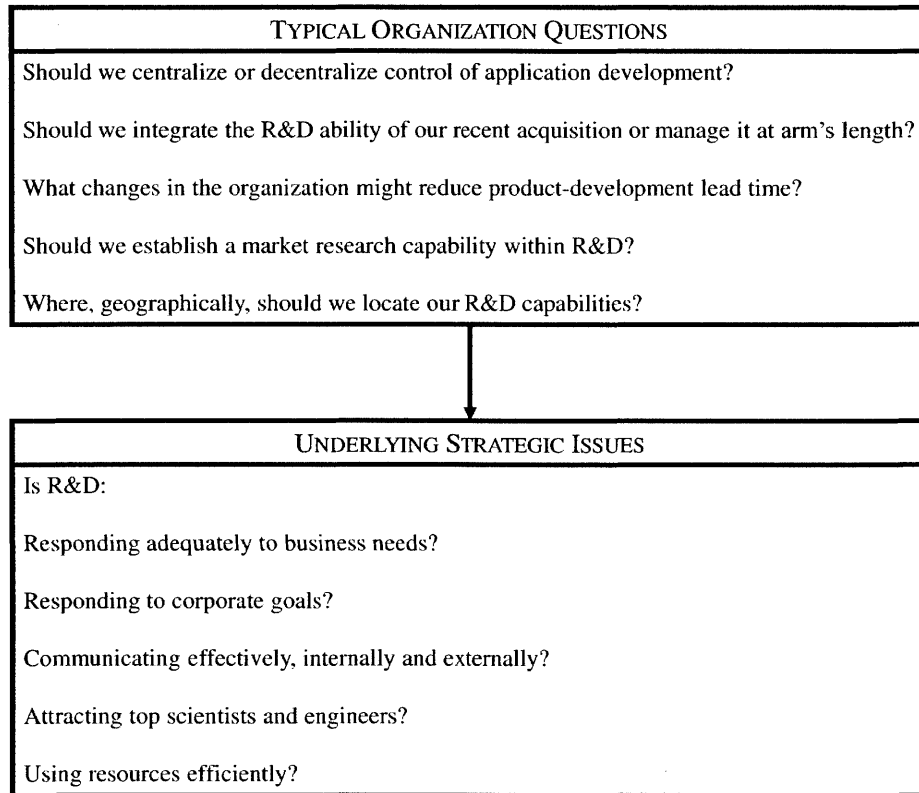


Figure 11. Typical Organization issues in R&D.
Adapted from (Roussel, Saad & Erickson, 1991)

Roussel, Saad and Erickson (1991) explain that the way R&D is organized has a significant impact on its effectiveness and efficiency. An unsuitable organizational structure can impede the deployment of R&D talent, increase the cost of output, and delay results. Additionally, an ineffective organization can lead to poor performance and create barriers both within the R&D organization and with the rest of the functions and entities the R&D organization interfaces with. These authors propose that the organization is the “catalyst that facilitates the implementation of both tactics and strategy. Like a catalyst, the optimum organization is one that fits the combination of input conditions and the desired end state.”

Furthermore, these authors mention that there is no best way to structure R&D since there will be conflicting interests and objectives. These consist of making the R&D structure responsive and flexible enough to support existing and new businesses, have the necessary human and capital resources, and ensure that the R&D organization can be appropriately controlled.

The Chief R&D Officer has to consider the following factors when deciding the *optimal* R&D structure: (1) the growth of technologies that a company needs to master, (2) the expansion of the R&D capabilities, (3) the increasing need to support businesses in a global context, (4) the increasing customer demands that demand responsiveness from R&D, and (5) the increasing landscape of Information and Communications Technology (ICT) which allows new degrees of organizational freedom. These factors suggest that the Chief R&D Officer needs to evaluate explicitly and simultaneously the following five structural elements of an R&D organization (Roussel, Saad and Erickson, 1991):

1. **An input orientation versus an output orientation.** Implies organizing by function (input-oriented) or by projects (output-oriented).
2. **The balance between line and project management.** Involves who controls the decisions. In a pure line (or functional) form there is a functional manager; in a pure project form there is a project manager. The matrix organization couples features of both the functional and the project forms.
3. **Centralized versus decentralized control and funding of R&D.** Involves the relative autonomy that R&D organizations can have in decision-making processes.
4. **Concentrated versus distributed R&D resources.** Implies whether to have one central R&D organization or a distributed R&D structure that is closer to markets.
5. **The use of external versus internal R&D resources.** Evaluates whether to use internal R&D resources to develop certain expertise, technologies or products, or whether to look outside of a firm's R&D boundaries.

This chapter explores these five structural elements as follows:

- Section 6.2 explores structural elements 1 and 2 by providing further explanation of these elements. It also introduces an example that explains the Chief R&D Officer's rationale for adopting a matrix R&D organization to capitalize on its R&D capabilities based on the

decision of this particular R&D strategy and corporate strategy for this CPG multinational company.

- Section 6.3 explains structural elements 3 and 4. Roussel, Saad and Erickson (1991) argue that structural elements 3 and 4 often dominate the discussions about the organization of R&D. In the context of a CPG multinational company, the Chief R&D Officer has to manage the global R&D organization. The Chief R&D Officer can globalize the R&D activity through different organizational models, realizing the strengths and weaknesses of each model so that they can be assessed according to the particular R&D strategy and firm's strategy. This section presents an example of how a Chief R&D Officer accomplished an R&D organizational model to increase the efficiency of the global R&D organization.
- Section 6.4 explores structural element 5. The Chief R&D Officer has to decide whether to use exclusively internal R&D resources or whether to allow external resources to assist the R&D organization in its scientific and technological developments. Essentially, this section provides an overview of Open Innovation (OI) versus Closed Innovation. Furthermore, this section explains how the role of the Chief R&D Officer is crucial for establishing an organizational structure that supports this practice and introduces an example of a CPG company that successfully implemented this model.

6.2 | Structural Elements 1 and 2: Functional versus Project versus Matrix R&D Organization

This section explores structural elements 1 and 2. The Chief R&D Officer needs to assess what organizational structure allows R&D to be more responsive to business needs and collaborates efficiently with the rest of the organization. For a CPG multinational company, responsiveness to business needs and collaboration are crucial for creating new products and being responsive to the market needs. This section provides an overview of the different organizational structures so that the Chief R&D Officer can understand the strengths and weaknesses associated with each structural element and select the one that is aligned to both corporate strategy and R&D strategy of a particular CPG multinational company.

6.2.1 | Input-Oriented (Functional) versus Output-Oriented (Project) Structure

The Chief R&D Officer has to realize that the decision of whether the organizational structure should be input-oriented (functional organization) or output-oriented (project organization) resides in the ability of the R&D organization to accomplish two conflicting goals (Roussel, Saad & Erickson, 1991):

1. A particular product development project needs to have the latest information and knowledge about technology. Having this latest information and knowledge is best accomplished by an input-oriented organization because units are organized by scientific or engineering specialties and disciplines. This information and knowledge are more readily available because these scientific and engineering disciplines interact more closely.
2. The activities of the different disciplines and specialties must be coordinated in order to accomplish the work of multidisciplinary projects. When units are organized by products or customer groups, this coordination works more effectively. In other words, this type of organization is commonly referred as output-oriented.

The Chief R&D Officer needs to understand the implications associated with these two conflicting goals as well as the strengths and weaknesses of each type of organization:

- **Input-oriented or functional organization.** Since the principal input of the R&D organization is technical and scientific knowledge, the input-oriented or functional structure is organized around scientific disciplines, technologies or technical specialties. One of the strengths of this type of organization is that it helps to develop in-depth knowledge and skill development among the employees within a particular function (Ulrich & Eppinger, 2012). One of the weaknesses of the input-oriented or functional structure organization is that focusing so strongly on the input side can create difficulties on the output side, because the output of an R&D project is influenced by the integration of many technical skills required to commercialize a successful new product (Roussel, Saad & Erickson, 1991).
- **Output-oriented or project organization.** In this type of organization, scientists and engineers are removed from their functional departments and organized by the structure of the client base they seek to satisfy: either by customer or product group (Roussel, Saad &

Erickson, 1991). This output-oriented or project organization can work on a single project, or most commonly, work on multiple projects. Having different disciplines can create coordination problems, which can be solved by having a project manager to whom the different groups of people from several different functions report. In this sense, the technical skills are brought together in one organization whose purpose is to achieve the goal of the project. One of the strengths of the output-oriented or project organization is that resources can be optimally allocated within the project team and that technical and market trade-offs can be evaluated faster. One of the weaknesses of this type of organization is that individuals may have difficulty maintaining cutting-edge functional capabilities because being in a project organization might hinder specialization in a specific function. This is especially applicable in engineering and scientific knowledge (Ulrich & Eppinger, 2012).

The structure of the R&D organization in the CPG industry suggests that the Advanced Research Group is more input-oriented, while the Applied Research Group and Development Group are more output-oriented. The Chief R&D Officer needs to ensure that there is close collaboration between these groups to maximize their synergy. The Advanced Research Group is in charge of the discovery of new scientific knowledge and the Applied Research Group and Development Group needs to capitalize on this so that new products can be developed and commercialized in the market. Section 6.3 explores this aspect and provides an example of how the Chief R&D Officer of a CPG multinational accomplished establishing a global R&D organization that enabled the collaboration between these three groups: Advanced Research, Applied Research and Development.

The analysis of these structural elements indicate that if the Chief R&D Officer decides on an input-oriented functional organization, it conduces R&D to isolate from the rest of the organization and therefore, causes R&D to be unresponsive to business needs; while the output-oriented or project organization leads R&D to a potential loss in specialization in scientific and technical knowledge. The Chief R&D Officer has to realize that the matrix organization offers a solution to balance these aspects. The following section explores this aspect.

6.2.2 | Line versus Matrix versus Project Organization

This structural element is related to the day-to-day management of an R&D organization and how the issue of *project management* allows the execution of the projects contemplated in the R&D Project Portfolio (Roussel, Saad & Erickson, 1991). Since the R&D organization in the CPG industry has to be responsive to business needs, the Chief R&D Officer has to realize that the matrix organization solves the problem between the input-oriented or functional organization and the output-oriented of project organization.

First, it is relevant to understand the concept of the matrix organization. In the pure line, or functional, form projects are assigned to a functional manager to coordinate. In a pure project form, each project is a unit that contains most of the skills required to execute the project and these groups are coordinated by a line or project manager. The matrix organization is conceived as a hybrid of functional and project organizations. The objective of the matrix organization is to introduce flexibility into rigid organizations by linking individuals to each other according to both the project they work on and their function. Typically, each individual has two supervisors: a project manager and a functional manager (Ulrich & Eppinger, 2012).

The Chief R&D Officer must consider the balance of influence and control held by the project manager and the line manager and the clarity with which scientists and engineers are assigned to their respective responsibilities. The trade-offs that the Chief R&D must consider in designing the R&D structure according to the firm's strategy and R&D strategy are shown in Table 5.

Table 5. Advantages of different types of R&D organizations. *Adapted from* (Roussel, Saad & Erickson, 1991).

Dimension	Line/Input Organization	Matrix Organization	Output/Project Organization
Resource efficiency	Medium	High	Medium
Resource flexibility	Medium	High	Low
Essential information flow	Medium	High	Medium
Clarity of relationships	High	Low	Medium
R&D/Business integration	Weak	Moderate	Strong
Customer focus	Weak	Moderate	Strong

Furthermore, for selecting the appropriate structure, the Chief R&D Officer needs to consider the following:

- **Maturity of Critical R&D Technologies.** Implies the degree of novelty associated with a particular technology that is considered for a particular project.
- **Technology Rate of Change.** Involves how fast the pace of technology change is in the particular sector of the industry.
- **Market Rate of Change.** Involves how fast the market changes within a defined period of time or horizon.

By considering these three factors, the Chief R&D Officer can select the most appropriate structure. The suggestion for adopting a particular structure is shown in Figure 12.

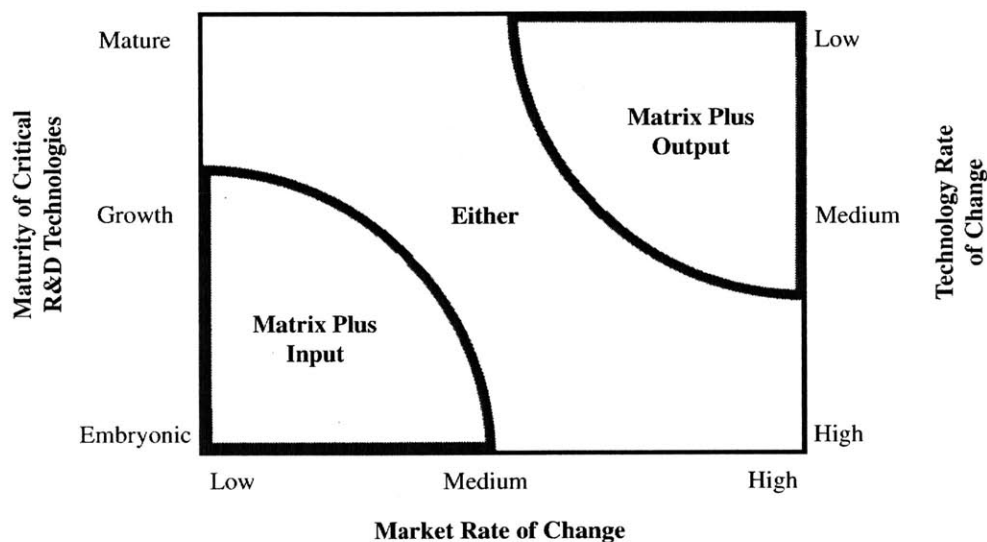


Figure 12. Selecting appropriate R&D structures.
Adapted from (Roussel, Saad & Erickson, 1991)

The CPG industry operates in the upper-right corner of Figure 14 in most cases. This indicates that in CPG multinational companies, it is common to have a matrix plus output type of organization because of the need to have faster time-to-market priorities and the close need to integrate between cross-functional groups in the development efforts for new products.

One key challenge that the Chief R&D Officer has to overcome is how to delegate some degree of control to the project managers, which is generally controlled by the business functions, without

compromising the degree of freedom that R&D employees can have in the R&D organization. The previous chapter established that Nestlé's former Chief R&D Officer had the autonomy to decide on how the different labs, research centers and excellence centers should work based on how their resources are allocated. This indicates that the Chief R&D Officer established a balance between this input-oriented or functional and output-oriented or project tension.

6.2.3 | Nestlé's Matrix Organization: Leveraging R&D Capabilities

This section builds upon the final section of the previous chapter, which explained that the Nestlé's former Chief R&D Officer established key pillars to align the R&D strategy with the corporate strategy. One of the pillars was to create a symmetrical process between the business and R&D to establish the project priorities across the organization in terms of innovation.

To establish the project priorities the technical and business functions, the previous section mentions that the Strategic Business Units (SBUs) (*line or project management*) interfaces with R&D (*functional management*) for strategic alignment. Therefore, SBUs and R&D need to work as strategic partners for deciding new product development plans for the firm across different zones, regions and individual markets.

Furthermore, as Figure 13 portrays, in this type of matrix, Nestlé employees have two bosses. For example, the R&D director reports to both the General Country Manager, who acts as the project manager and Senior Director or Vice President who is in the Chief R&D Officer's key team and acts as the functional manager. Another aspects is that the General Country Manager has the same corporate functions, technical functions and business units reporting to him or her as the CEO.

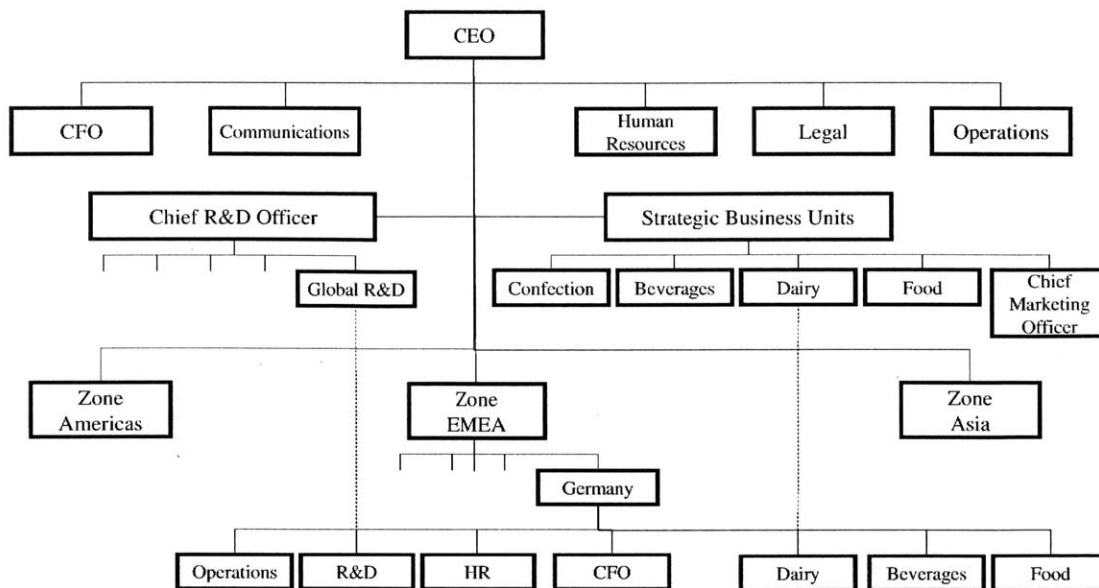


Figure 13. Nestlé Matrix Organization, including R&D.
Adapted from (Galbraith, 2009)

This type of structure makes R&D more responsive to business needs and breaks R&D from isolation, as it allows R&D to interface in a collaborative environment with business functions to commercialize new products. Besides these benefits, the implementation of this structure allowed the R&D organization to contribute to Nestlé’s Nutrition Health and Wellness Strategy by (Galbraith, 2009):

- **Having access to heterogeneous markets and develop unique products.** Nestlé R&D helped to develop nutritious products according to the characteristics of each market.
- **Having access to local consumers, competitors and suppliers.** Each market had its own diverse set of different consumer needs and competitors. Therefore, Nestlé R&D created new nutritious products that fulfilled those particular needs and help differentiate products in the local markets.
- **Coping with the challenges associated with an active and demanding government.** Local regulations applicable to food and beverages changed from one country to another. Therefore, Nestlé R&D developed new nutritious products according to local regulations.

Finally, this suggests that the Chief R&D Officer in a CPG multinational has to consider how to make R&D more responsive to the business and to the markets on a global scale. The next section explores this aspect in more detail.

6.3 | Structural Elements 3 and 4: The Global R&D Organization

As mentioned before, the Chief R&D Officer has to manage the global R&D organization because of the presence that CPG multinationals have in multiple countries around the world. To globalize the R&D activity, the Chief R&D Officer has to consider simultaneously the trade-offs and implications of choosing a centralized versus decentralized control and funding of R&D and concentrated versus distributed R&D resources that align to a particular R&D strategy. Additionally, the Chief R&D Officer has to consider the following aspects to achieve a global R&D organization (Roussel, Saad & Erickson, 1991):

- The need to make R&D resources responsible to individual businesses,
- The quality of communication and cooperation between R&D centers,
- The increasing globalization,
- The balance between the number of R&D centers concentrating on longer-term and serving multiple divisions and businesses versus the number of divisional or business unit laboratories focusing on incremental R&D,
- The desire to be closer to the customer and local suppliers,
- The strategic location of R&D centers to access key resources, and
- The possible cost savings through lower wages.

6.3.1 | Factors driving Global R&D

The factors that influence the Chief R&D Officer's decision and the overall firm's decision to internationalize R&D are the following:

- Mergers and acquisitions (M&A), shorter product development cycles, global competition, increased customer expectations and technological risks (Bouteiller, Gassmann & von Zedtwitz, 2008). Chapter 2 establishes that CPG multinational companies have to face all of these aspects. The Chief R&D Officer has to integrate or leverage R&D resources from a M&A activity as it can help to increase the scientific and technological knowledge base for new products and processes
- The development of local products requires the early involvement of market and customer application know-how, and this is more likely to be found in regional business units. Development of local products is also influenced by local regulations (such as content

requirements and fulfillment of standards) (Bouteiller, Gassmann & von Zedtwitz, 2008). The previous section establishes how the Chief R&D Officer met these needs by establishing an R&D organization that was close to market and customer requirements.

- The creation of a new R&D strategic site may play a decisive role for creating potential synergies with local production facilities, enabling the creation of new technologies, transferring know-how into the company and attracting high-potential technical talent (Bouteiller, Gassmann & von Zedtwitz, 2008). In the CPG industry, having R&D sites in both developed and emerging markets is crucial as it can allow the knowledge creation and transfer across R&D sites for the creation of new products for particular markets.
- The need to fulfill three key purposes: (1) to detect and internationalize new creative potential sources of science and technology, (2) to capitalize on these new sources for the development of new products concepts, and (3) to adapt these new product concepts according to markets which have different preferences (Filippaios, Papanastassiou, Pearce & Rama, 2009). In the CPG industry, fulfilling these three purposes is important as this allows development of products according to the needs of heterogeneous markets and local consumers.

These factors lead the Chief R&D Officer to decide on different organizational forms to internationalize the R&D organization. This is further explored in the following section.

6.3.2 | Five typical forms of international R&D organizations

The factors that drive the Global R&D Organization require the Chief R&D Officer to carefully consider how to globalize R&D activity. The Chief R&D Officer can globalize the R&D activity through different organizational models, assessing the strengths and weaknesses of each model according to the particular R&D strategy and firm's strategy, so as to make the most appropriate decision according to the particular context of a firm.

Gassmann and von Zedtwitz (1999) proposed a typology of organizational concepts of international R&D and looked at different structural and organizational approaches to organizing R&D on a global scale based on 195 semi-structured research interviews in 33 multinational companies between 1994 and 1998. These authors maintain that international R&D represents an opportunity for achieving competitive advantage, but that their optimal utilization depends on the

appropriate organizational setting. Keeping this in mind, Gassmann and von Zedtwitz (1999) classify international R&D into five organizational concepts:

1. Ethnocentric Centralized R&D
2. Geocentric Centralized R&D
3. Polycentric Decentralized R&D
4. R&D Hub Model
5. Integrated R&D Network

The concepts differ in the distribution of internal competencies and knowledge bases and the degree of cooperation between R&D sites. These general differences can be observed in Figure 14 and Table 6. Detailed differences between these concepts are explored in the following subsections.

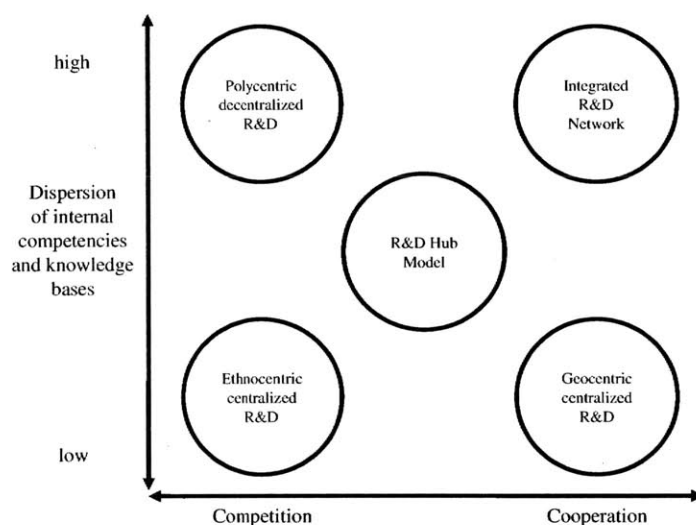


Figure 14. Five concepts of R&D organizational design.
Adapted from (Bouteiller, Gassmann & von Zedtwitz, 2008)

Table 6. Five ideal forms of international R&D organization. *Adapted from* (Bouteiller, Gassmann & von Zedtwitz, 2008).

Configuration	Organizational Structure	Behavioral Orientation
<i>Ethnocentric centralized R&D</i>	Centralized R&D	National inward orientation
<i>Geocentric centralized R&D</i>	Centralized R&D	International external orientation
<i>Polycentric centralized R&D</i>	Highly dispersed R&D, weak center	Competition among independent R&D units
<i>R&D hub model</i>	Dispersed R&D, strong center	Supportive role of foreign R&D units
<i>Integrated R&D network</i>	Highly dispersed R&D, several competence centers	Synergetic integration of international R&D units

6.3.2.1 | Ethnocentric Centralized R&D

In this organizational concept, all R&D activities are concentrated in one home country. Central R&D is the protected “think tank” of the company that creates new products, which are manufactured in other locations and distributed worldwide. The core technologies are guarded as a “national treasure” in the home country base. This concept protects against uncontrolled technology transfer and has high efficiency due to scale and specialization effects. This organizational form therefore achieves low R&D costs and short development times (Bouteiller, Gassmann & von Zedtwitz, 2008).

The Chief R&D Officer has to realize that this centralization enables creation of a homogeneous R&D culture that promotes the flow of information between scientists at the R&D center and facilitates the control of R&D activities. Weaknesses related to the ethnocentric centralized R&D are lack of sensitivity for local markets, danger of missing external technology, insufficient consideration of local market demands and tendency towards a rigid organization.

The Chief R&D Officer has to suggest that the R&D organization should adopt this structure only if part of its strategy considers global products and does not consider differentiation between regional markets. In the CPG industry, differentiation in products between regional markets is crucial, as each market has its own particular characteristics. The company must have solid fundamentals if they want to locate R&D outside their range of operations, especially if the market (global or domestic) has been served from a central location.

The summary of the ethnocentric centralized R&D is shown in Figure 15.

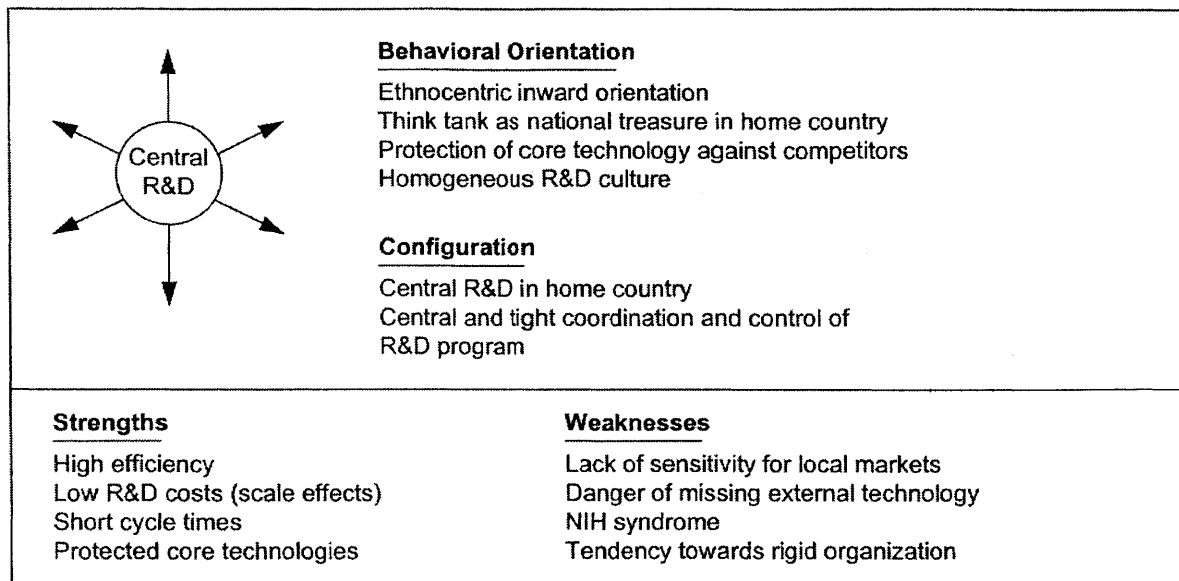


Figure 15. Ethnocentric Centralized R&D.
Retrieved from (Bouteiller, Gassmann & von Zedtwitz, 2008)

6.3.2.2 | Geocentric Centralized R&D

The geocentric centralized R&D model is more appropriate when a company becomes more dependent on foreign markets and local competencies. This organizational concept incorporates a multicultural and multinational workforce while retaining the efficiency advantage of centralization. At the central R&D site, knowledge of worldwide external technologies is collected and the sensitivity of R&D employees for international markets is increased due to collaboration and engagement with local manufacturers, suppliers and lead customers (Bouteiller, Gassmann & von Zedtwitz, 2008).

The Chief R&D Officer should realize that this model requires investment in training personnel to increase international awareness and potentially recruiting foreign scientists or engineers with work experience in foreign cultures. This configuration requires have changing agents within top management to enable the internationalization of employees. Strengths in this organizational concept include keeping efficiency due to centralization, high sensitivity for local markets and technology trends and cost-efficient R&D internationalization. Weaknesses of this model are associated with lack of visibility to consider local content restrictions and local market specifications. Therefore, R&D might not be aware of the particular requirements that a local

market has. In the CPG industry, having access to local market requirements is key, and therefore, the Chief R&D Officer has to make the R&D organization responsive to those local market needs.

The summary of the geocentric centralized R&D is shown in Figure 16.

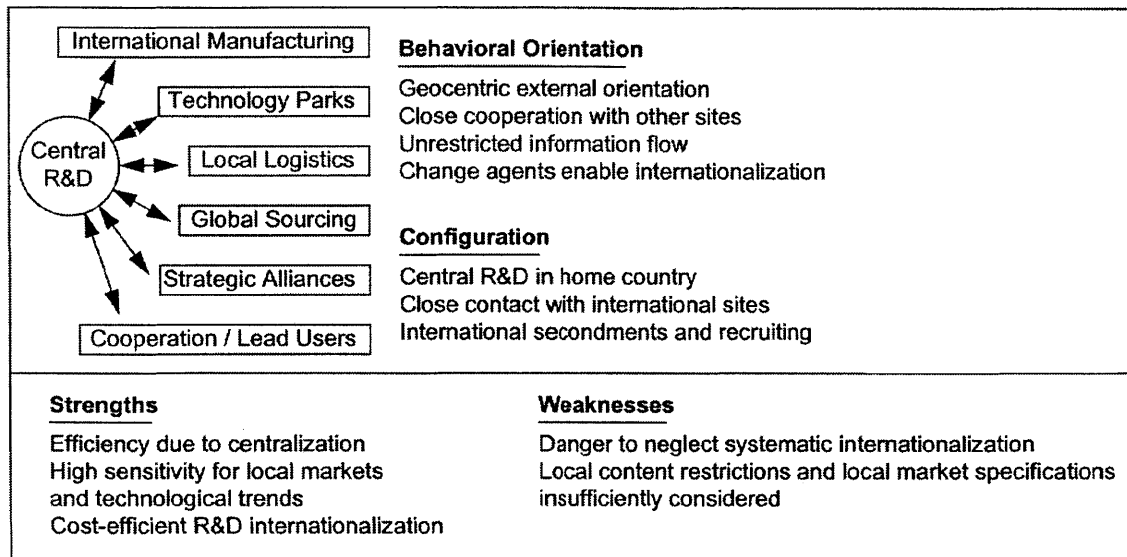


Figure 16. Geocentric Centralized R&D.
Retrieved from (Bouteiller, Gassmann & von Zedtwitz, 2008)

6.3.2.3 | Polycentric Decentralized R&D

The polycentric decentralized R&D model helps to facilitate the recognition of crucial local requirements such as local codes and market requirements that the two previous models fail to address. This model is dominant for companies that have strong orientations towards regional markets and in fact, many European multinationals adopted this model in the 1970s and 1980s. Local R&D laboratories have been established by local distribution and manufacturing units to respond to customer product adaptation requests (Bouteiller, Gassmann & von Zedtwitz, 2008).

The Chief R&D Officer has to consider that this R&D organizational structure results in decentralized R&D sites with no supervising corporate R&D center that manages the internationalization effort and weak information flow between foreign sites and the home base.

Furthermore, the Chief R&D Officer has to contemplate that this structure has high autonomy and limited collaboration between R&D sites, which leads to inefficiency on a corporate level and duplicate R&D activities. Some firms have this type of structure because they have been formed by merger and acquisition activities and fostering collaboration where there had not been historical

collaboration might be difficult to achieve. This configuration is the “*dying model*” among the given forms of international R&D organization because of the pressure for multinationals to reduce R&D costs. This model caused multinational companies to incur higher R&D costs due to redundant development activities and to develop distinct capabilities without a proper technology plan. Strengths of this structure include strong sensitivity for local markets, adaptation to local environment and usage of local resources. Weaknesses of this organization are related to inefficiency and parallel development and the lack of technological focus. In the CPG industry, having this decentralized model can lead to the lack of coordination among R&D teams which can lead to the overall loss of local knowledge across global sites, and therefore, the potential to create product innovations leveraging knowledge or technology created in one R&D site and transferred to another.

The summary of the polycentric decentralized R&D is shown in Figure 17.

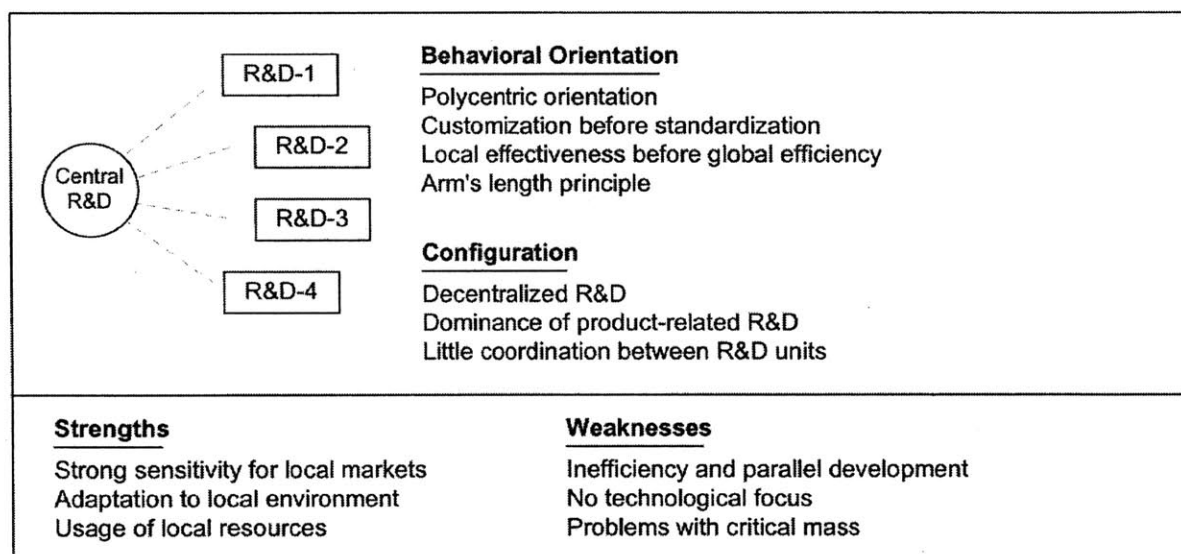


Figure 17. Polycentric Decentralized R&D.
 Retrieved from (Bouteiller, Gassmann and von Zedtwitz, 2008)

6.3.2.4 | R&D Hub Model

The R&D hub model consists of a central R&D in the home location, which is the main laboratory for all research and advanced technological activities and foreign R&D sites limited to designated technological areas. Thereby, R&D duplication activities are reduced. The R&D center tightly coordinates decentralized R&D activities by establishing an R&D framework program that enables

efficient technology transfer and making decisions regarding resource allocation (Bouteiller, Gassmann & von Zedtwitz, 2008).

The Chief R&D Officer has to consider that the success of this model depends on the R&D center maintaining the lead on technological competence and coordinating worldwide activities in an effective manner. Furthermore, the advantages of this structure are related to the fast recognition of local demands, the integration of global R&D input for fostering innovation, the exploitation of all available strengths and the capitalization of potential synergies among R&D sites. Weaknesses of this model are related to the rising costs of coordination and time as well as the danger of potentially having less flexibility due to central directives imposed on decentralized R&D sites. In the CPG industry, this organizational concept can lead to leveraging scientific and technological sites across R&D sites and therefore increasing the efficiency for creating new products and processes across different markets.

The summary of the R&D hub model is shown in Figure 18.

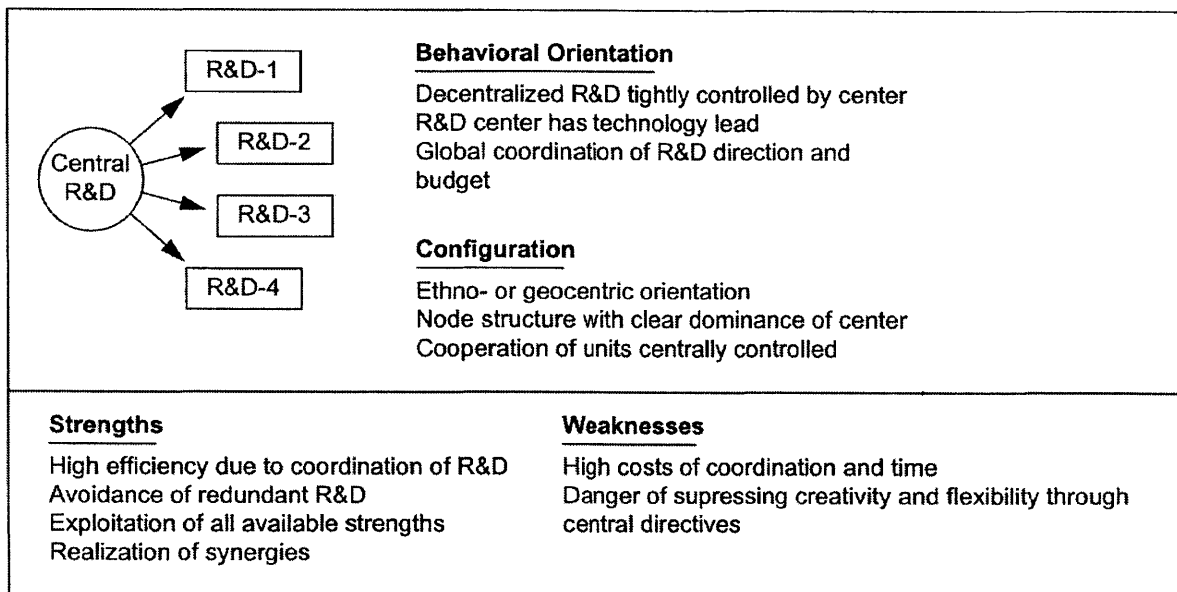


Figure 18. R&D Hub Model.
 Retrieved from (Bouteiller, Gassmann & von Zedtwitz, 2008)

6.3.2.5 | Integrated R&D Network

In this organizational model, domestic R&D is no longer the center of control for all R&D activities. Instead, the central R&D evolves into a competency center among many interdependent R&D units, which are closely interconnected by flexible coordination mechanisms that constitute a network. Under this structure, each unit in the network specializes in a particular product, component or technology area and even a set of core capabilities. In this way, each unit has functions that affect the entire company and each center of competence develops the knowledge about potential markets and applications of a particular product, thereby defining appropriate strategies and new business development. Multinational companies that had polycentric or hub configurations tended to evolve to this type of network organization.

The Chief R&D Officer has to consider that the strengths of this type of model include increasing the global efficiency of R&D and creating synergistic effects due to the specialization of knowledge of each unit in the network. This knowledge can be leveraged across multiple markets and adjusted to the particular needs of each market. Weaknesses related to this model result in high coordination costs that guarantee the successful implementation such as introducing project management tools across all R&D departments, institutionalizing standard operating procedures and increasing complexity of institutional rules and decision processes. In the CPG industry, this R&D organizational concept can lead to the efficient transfer of knowledge and technologies across different sites, but also to a higher challenge for setting the priorities for each strategic R&D site across developed and emerging markets.

The summary of the Integrated R&D Network is shown in Figure 19.

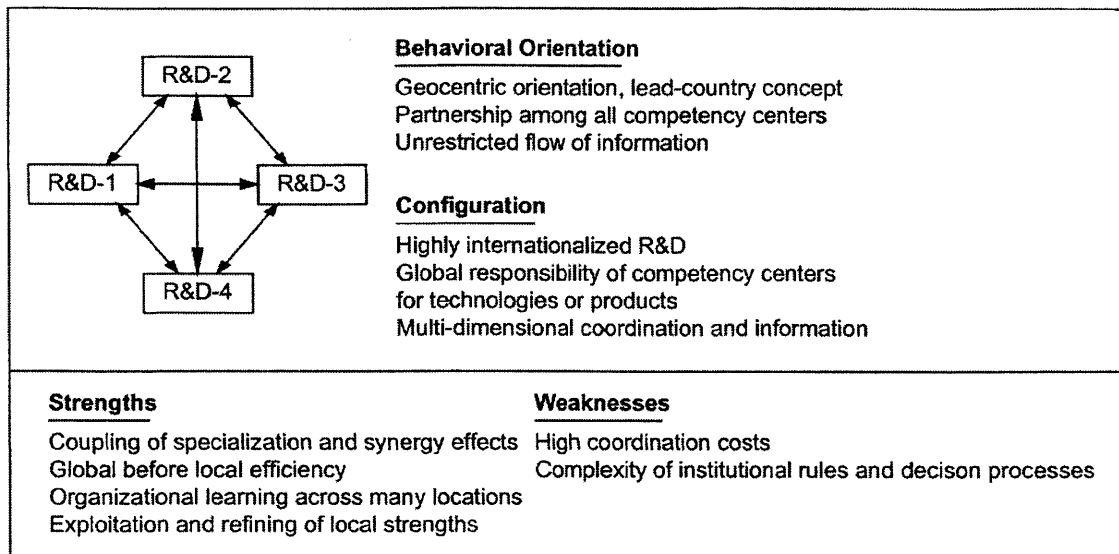


Figure 19. Integrated R&D Network.
 Retrieved from (Bouteiller, Gassmann & von Zedtwitz, 2008)

6.3.3 | Nestlé’s R&D Hub Model

Once reviewed the different R&D organizational concepts, it is necessary to exemplify how Nestlé’s former Chief R&D Officer, accomplished managing the R&D Hub Model. Bauer helped to establish the principle of “*think global-act local.*”

The objective behind this principle is to maximize R&D efficiency while supporting the NHW strategy by leveraging Nestlé’s geographically dispersed, multi-center structure to provide the flexibility for continuous adaptation to the business needs. R&D is structured according to this principle: global product and process development is vertically integrated into all Nestlé core businesses and pushed out locally to the markets through 500 factories in 100 countries worldwide. Proximity to markets allows tapping into a great number of local ideas, which can be used for global implementation. This R&D hub model includes the following:

- *One Nestlé Research Center (NRC).* NRC is the biggest private facility for fundamental research on foods, nutrition and the link to health in the world. This research center provides the scientific knowledge and research base for product innovation. This central R&D location has to coordinate the decentralized R&D activities with the rest of the R&D sites to avoid R&D duplication activities and communicate closely with the rest of the centers to enable the technology transfer between R&D sites. Moreover, as the R&D hub

model indicates, the NRC is in the same country as Nestlé's main headquarters (Switzerland).

- *Eight Product Technology Centers (PTCs)*. Each single location has a critical mass of experts in food technology and engineering that act as a hub for category-specific innovation aligned with one or more of Nestlé's SBUs and Global Businesses. SBUs manage global brands and product lines and are responsible for new product development projects for products that will be sold in multiple countries
- *Nine R&D Centers*. These centers have a dual role, global and local, most often working in joint projects with the PTCs or Application Groups (AGs). Their role is critical at a regional level in two-way flow of knowledge from global R&D out to the local Adaptation Groups and back.
- *Two-hundred-eighty Application Groups (AGs)*. AGs supplement the R&D process at the local level, ensuring that products comply with local regulations and taste preferences. This Application Groups allow Nestlé to rapidly adjust its global R&D development according to the specific needs of consumers worldwide. The groups work with PTCs and R&D Centers to install and test new process lines.
- *One Business Technology Center (BTC)*. This center develops and enhances all of Nestlé's business systems to constantly improve the efficiency of their operations. In other words, it develops the technology behind the way Nestlé does business to identify standard operating procedures and replicate them throughout all of Nestlé's businesses.
- *Global Networks*. These networks are shared by the whole R&D Organization: Quality & Safety, Nutrition, Sensory & Consumer Preference and Food Science & Technology.

The notion of the principle "*think global-act local*" and R&D hub model structure is exemplified in Figure 20.

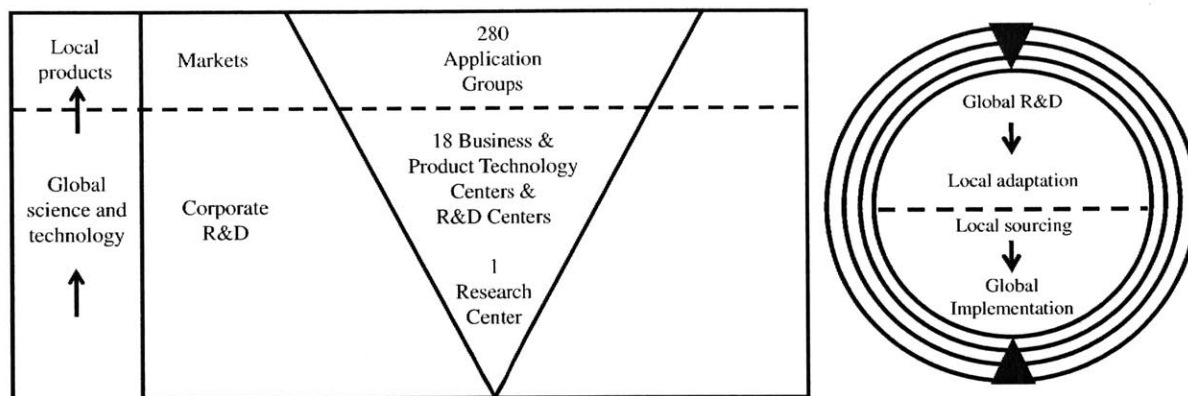


Figure 20. Nestlé R&D Global Strength/Local Development.
Adapted from Innovating the Future (Nestlé, 2007).

This R&D organizational model indicates how the Chief R&D Officer in Nestlé accomplished leveraging local knowledge and applying it on a global scale and vice versa. Leveraging the knowledge across the R&D organization has an additional element the Chief R&D Officer has to consider and that is how to balance the scientific and technological knowledge that can come from outside of the R&D organization to increase the knowledge base and probabilities for innovation. The following section explores this element.

6.4 | Structural Element 5: Open Innovation versus Closed Innovation in R&D

The final structural element the Chief R&D Officer has to consider is whether to use external versus internal R&D resources. Looking for external R&D resources implies looking outside of the R&D organization with the objective of leveraging external expertise in scientific and technological developments.

This section provides the definitions for Open Innovation (OI) versus Closed Innovation (CI) as well as an overview of the Open Innovation Processes. In addition, this section provides an overview to Open Innovation Models in CPG multinational companies and introduces the challenges the Chief R&D Officer has to overcome in the R&D organization for the adoption of these models. The final section explains how the Chief R&D Officer, in conjunction with the key technical team, established OI practices in a CPG multinational company (Procter and Gamble, P&G).

6.4.1 | Overview of Open Innovation versus Closed Innovation

Chesbrough (2003) first coined the term Open Innovation (OI) in his book on *Open Innovation* (2003). Chesbrough defines Open Innovation as “the use of purposive inflows and outflows of knowledge to accelerate internal innovation and expand the markets for external use of innovation, respectively. Open Innovations is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as they look to advance the market.”

West and Gallagher (2006) argue that open innovation is a holistic approach to innovation management as “systematically encouraging and exploring a wide range of internal and external sources for innovation opportunities, consciously integrating that exploration with firm capabilities and resources, and broadly exploiting those opportunities through multiple channels.”

In the Closed Innovation paradigm all the development is kept within the boundaries of the firm. This implies that a company generates, develops and commercializes its own ideas and internal resources and funds are used and the entire value chain from R&D to commercialization is vertically integrated. Chesbrough (2003) maintains that this paradigm of self-reliance dominated the R&D operations of many leading industrial corporations for most of the 20th century. The Closed Innovation paradigm is shown in Figure 21.

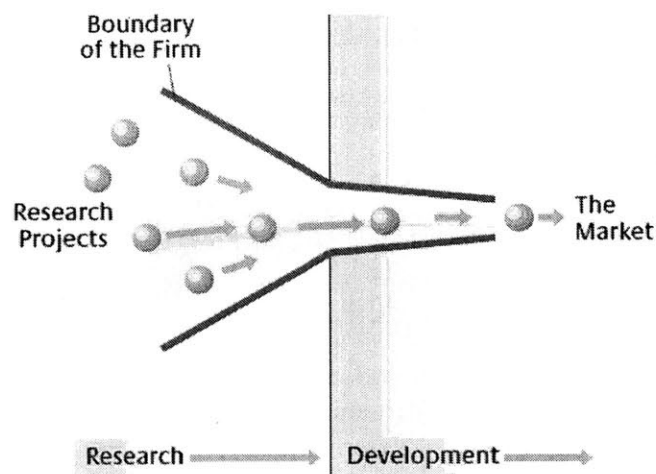


Figure 21. Closed Innovation Paradigm.
Retrieved from (Chesbrough, 2003)

The OI paradigm suggests that innovation nowadays is not confined exclusively to R&D labs in an organization and that a single company cannot innovate in isolation. Actually, innovation is happening at the boundaries of the firm. In the OI model, firms can and should use both internal and external sources to accelerate the innovation process. In addition to the corporate R&D, companies can get access to external knowledge by leveraging universities and research institutes, industrial partnerships, start-up companies, suppliers, technology owners in unrelated businesses and even consumers if they want to guarantee their long-term competitiveness. The OI paradigm is shown in Figure 22.

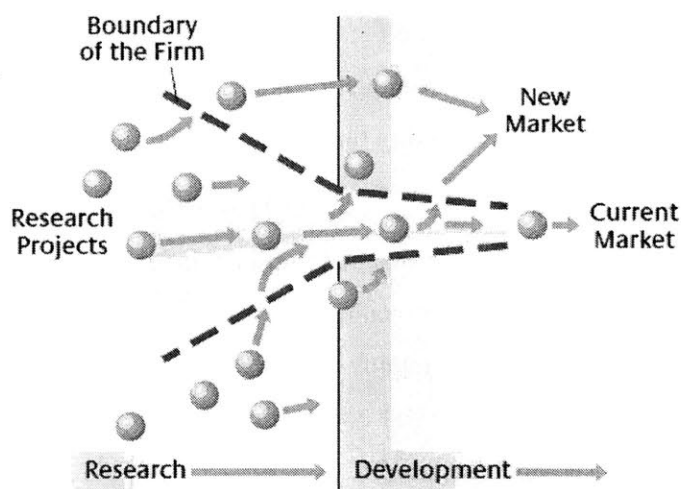


Figure 22. Open Innovation Paradigm.
Retrieved from (Chesbrough, 2003)

Table 7 shows some of the principles of the OI paradigm and contrasts them with the Closed Innovation approach.

Table 7. Contrasting Principles of Closed and Open Innovation. Adapted from (Chesbrough, 2003).

Closed Innovation Principles	Open Innovation Principles
The smart people in our field work for us.	Not all the smart people work for us. We need to work with smart people inside and outside the organization.
To profit from R&D, we must discover it, develop it, and ship it ourselves.	External R&D can create significant value; internal R&D is needed to claim some portion of that value.
If we discover it ourselves, we will get to market first.	We don't have to originate the research to profit from it.
The company that gets an innovation to market first will win.	Building a better business model is better than getting to market first.

If we create the most and the best ideas in the industry, we will win.	If we make the best use of internal and external ideas, we will win.
We should control our Intellectual Property (IP), so that our competitors don't profit from our ideas.	We should profit from others' use of our IP, and we should buy others' IP whenever it advances our own business model.

The previous chapter established how Nestlé launched an OI initiative supported by its former Chief R&D Officer. Table 8 indicates how Bauer supported these principles by mentioning the following: “In Nestlé we cannot achieve our ambitions simply by working internally. We increasingly operate in an Open Innovation mode to enhance our own internal R&D capability by tapping into external resources.”

To adopt OI practices, an R&D company must identify what processes companies have included as part of their operations. To answer this question, Gassmann and Enkel (2004) propose three core OI Processes based in an empirical database of 124 companies:

1. **The Outside-In Process.** This process enriches a company's knowledge base and skills by integrating knowledge from suppliers, customers, and other external sources.
2. **The Inside-Out Process.** The inside-out process looks to procure the maximum benefit of the technology created by the firm by opening it to the public, including competitors. In this way, the company can create additional revenue streams by technology licensing, granting intellectual property rights and commercializing ideas in different industries (cross-industry innovation).
3. **The Coupled Process.** This type of process combines both processes to gain external knowledge as well as bringing their own ideas to market. As a consequence, this model co-creates with complementary partners and leverages their technology to commercialize new products.

Based on their research data by looking into these different processes of OI, Gassmann and Enkel suggest that each company chooses one primary process out of the three, but also integrates some elements of the others. Gassmann, Enkel and Chesbrough (2010) indicate that OI mainly started in the high-tech sector, but it has also started in the low-tech sector to take advantage of the potential of opening up the innovation process. OI in the low-tech sector includes the CPG industry. The following section explores OI in CPG multinational companies.

6.4.2 | Open Innovation Models in the CPG Multinational Companies

Bigliardi and Galati (2013) argue that recent changes in both the nature of consumer products demand and in the supply chain organization, together with the high degree of competitiveness where CPG companies operate, have led companies to adopt innovation as a fundamental contributor for the company's profitability. As reviewed in Chapter 1, challenges in the CPG industry, including consumers' demand for products to be tailored to their individual needs and the health and wellness trend, have led CPG companies to introduce radical products, adopt technological solutions and create new business models to address the consumer's differentiated needs. These considerations seem to indicate that the innovation process should not only reside within the company, but also include multiple external actors that can bring value to the table.

The role of the Chief R&D Officer is critical to promote the adoption of an OI model as reviewed in the previous chapter (Deschamps, 2008). The following paragraphs include two particular models to present the benefits and challenges that the Chief R&D Officer has to address to implement this practice.

6.4.2.1 | "Sharing is Winning" (SiW) Model

Traitler and Saguy (2009) propose the Sharing is Winning model (SiW). This is a model of collaboration based on the co-innovation or co-creation with key partners through alliances, cooperation, and joint ventures.

There are three objectives associated in adopting this model: first, the value creation along the value chain; second, the building of goodwill; and third, the establishment of trust and winning respect. The model represents a paradigm shift to accelerate co-development of sustainable innovation with the alignment of the entire value chain towards creating consumer-centric innovations. The model contemplates three main partners that contribute for co-development: Universities, research institutes and centers; startups and individual inventors; and a selected number of key strategic suppliers. This model is exemplified in Figure 23.

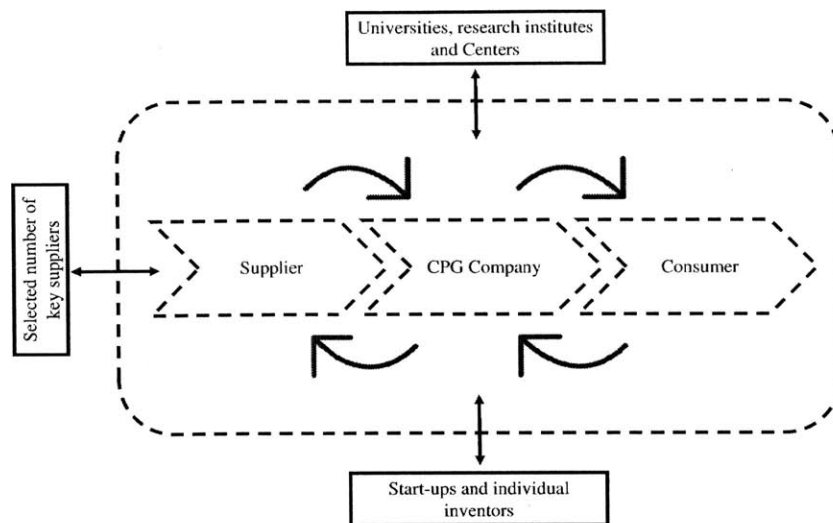


Figure 23. Sharing is Winning (SiW) Model.
Adapted from (Bigliardi & Galati, 2013)

Traitler and Saguy (2009) argue that the fundamental principle to start the collaboration is for the solution seeker to open the precise needs, gaps or requirements to the potential solution provider. These authors propose a roadmap to implement the SiW model: (1) partner selection; (2) co-creation of intellectual properties; (3) joint creative problem-solving teams; (4) implementing best practices; and (5) sustainable and continuous processes affecting people, mindset, metrics, culture and education. These authors reference Nestlé as a company who successfully adopted this model.

Finally, the Chief R&D Officer has to realize that the adoption of the SiW model has some challenges, in particular, the embracement of a more open culture and risk-taking activities, such as sharing intellectual property. These risks can be minimized by implementing confidentiality agreements and joint development agreements once there is progress in the innovation path. To adopt the SiW model requires four paradigm shifts (Traitler & Saguy, 2009): (1) breaking down the walls between academia and industry; (2) revising the intellectual property model; (3) cardinal management's role in driving the innovation process; and (4) increasing social responsibility.

6.4.2.2 | “Want, Find, Get, Manage” Model

Ślowski (2004) proposes the Want, Find, Get, Manage (WFGM) model. This model determines how and when external knowledge is required and used in the innovation process. This model consists of four steps Want, Find, Get, Manage and contemplates the following main partners:

universities and research centers, suppliers, competitors, companies in operating in other industries and innovation intermediaries. This model is exemplified in Figure 24.

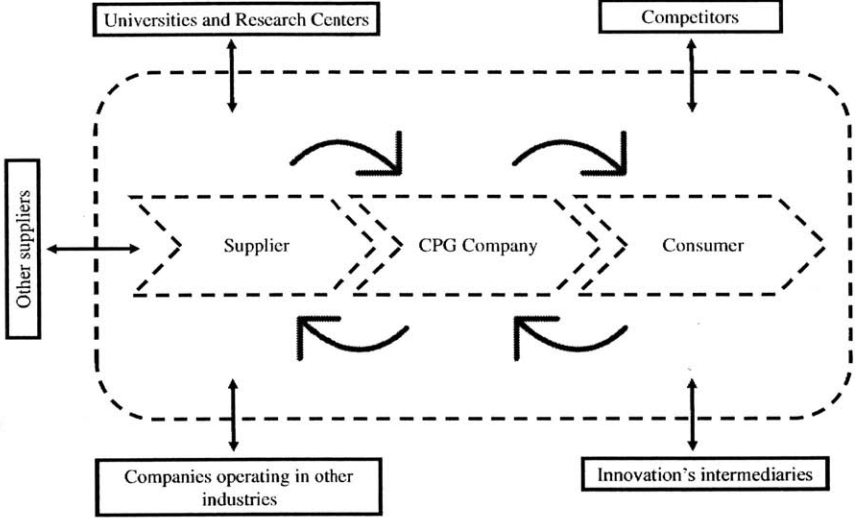


Figure 24. Want, Find, Get, Manage (WFGM) Model.
Adapted from (Bigliardi & Galati, 2013)

In the first step, *Want*, is the necessity for the firm to understand what knowledge it *wants* to access externally. The second step, *Find*, consists in selecting the right partner. The third stage, *Get*, consists of acquiring the knowledge identified in the *Want* step from the partners selected in the *Find* phase. The final stage, *Manage* has the main purpose to coordinate and integrate the partner’s resources to meet their specific objectives and ensure that partners understand their respective responsibilities, how to exchange information and what kind of information must be exchanged.

Slowinski (2004) argues that this OI model could help to reduce the high failure rate of new CPG products due to the new knowledge management methods: knowledge and learning that is acquired in previous OI projects can be transferred and applied to new collaborations. This model could also help to achieve faster time to market, decrease R&D costs and have a better match to consumers’ needs. Mars and Procter & Gamble (P&G) are CPG companies that have successfully adopted this model (Slowinski, Hummel, Gupta & Gilmont, 2009).

Finally, the Chief R&D Officer needs to consider that the adoption of the WFGM model has some common challenges with the SiW, in particular, changing the mindset of the scientific community to adopt open innovation and intellectual property (IP) management. Implementing this model also

requires the conviction and engagement from senior management to enforce the model, a powerful ICT infrastructure to assist in technology seeking and idea capturing and dedicated cross-functional teams that contribute to make the OI process more systematic and embedded in the company's culture, among other recommendations. The following section explores how Procter and Gamble (P&G) established this model, and more importantly, examines the role of the Chief R&D Officer as a key contributor to enforce this model.

6.4.3 | Procter and Gamble's (P&G) "Connect and Develop" Program

To provide an overview, Procter and Gamble (P&G) is a multinational CPG company that is well known for its impressive marketing and brand management, as well as for its innovative products and technological depth. Dyer, Gregersen and Christensen (2011) consider P&G as a top innovating company. With over 110,000 employees and operations in about 80 countries, P&G has presence in more than 180 markets around the world (Procter and Gamble, 2016). The company holds more than 55,000 active patent filings globally and has won many "Product of the Year" recognitions, as voted on by consumers across the globe (P&G Science, 2016).

Huston and Sakkab (2006) mention that P&G was encountering difficulties in 2000: the company's shares had gone down, innovation success rate had stagnated at about 35%, R&D productivity had decreased and there was an increasing pressure to sustain high levels of top-line growth. In addition, their innovation model had not changed since the late 1980s. Recognizing that P&G could not handle all the innovation by itself, this company started looking at the innovation approach of other small and midsize entrepreneurial companies, trying to understand how the new open innovation concept was working in other companies from different industries, such as IBM and Eli Lilly.

In 2000, P&G's former CEO, A.G. Lafley challenged P&G's organization *status quo* to reinvent the company's innovation business model and set a goal to acquire 50% of innovations from outside the company. At that time, Gil Cloyd, former Chief R&D Officer, Larry Hutson, former R&D Vice President of Innovation and Knowledge, and Nabil Sakkab, Senior Vice President for Corporate R&D, realized that they could leverage better the scientific community by making half of the innovations come from their labs and half come through them. They estimated that for every P&G researcher there were 200 scientists or engineers elsewhere in the world who were just as

equally capable. Thereby, P&G could tap into the talents of about 1.5 million people. With this conviction, P&G decided to invest in the *Connect and Develop* program. Leveraging both internal and external capabilities was the core of the *Connect and Develop* program:

“With a clear sense of consumers’ needs, we could identify promising ideas throughout the world and apply our own R&D, manufacturing, marketing and purchasing capabilities to them to create better and cheaper products faster.” (Huston & Sakkab, 2006, p. 61)

P&G’s *Connect and Develop* (C&D) program is about finding good ideas outside and bringing them to enhance and capitalize on internal capabilities. To achieve this, P&G collaborates with organizations and individuals around the world to search for proven technologies, packages and products that P&G can improve, scale-up and commercialize either by themselves or in partnership with other companies.

Implementing the C&D program in P&G required the engagement of the CEO, the Chief R&D Officer and the key technical team. This key staff implemented the following pillars (Huston and Sakkab, 2006):

- **Locating the consumer at the center of all innovation.** P&G engaged the consumer from the beginning, even at early stages of the product development process, such as ideation and prototyping. The company co-creates and co-designs with the eventual users, validating and improving the idea at each stage of the product development process.
- **Deciding ‘Where to Play’.** In order to look for the correct solutions outside of the firm boundaries, the company assessed top-ten-needs list for each of the businesses and one for the company overall. These needs were translated into technology briefs.
- **Building a network.** P&G looked into networks from government, private labs, academia, research institutions, suppliers, retailers, competitors, and venture capital to look for ideas that might help with solving the technology briefs. Open networks like *NineSigma* or *InnoCentive* were used to distribute these technology briefs and to post narrowly scientific problems. P&G also created a C&D website that allows external innovators submit their ideas and solutions. P&G had a team of "technology entrepreneurs" located around the world that facilitated the link the firm and the outside.
- **Technology Prioritizing and Selecting.** P&G had dedicated Innovation Managers that prioritized according to the company’s priorities and made the link to R&D. These

Innovation managers searched by topic or work area and tracked the progress of the technology readiness level in order to make the transition to the product development process faster.

- **Transforming the culture.** The C&D program was established as an explicit company strategy by the CEO and required the constant reinforcement from senior management to make it a reality. This included the active engagement from the Chief R&D Officer since the R&D organization needed to overcome the fear and avoidance of bringing external knowledge into the R&D organization's boundaries. P&G's former Chief R&D Officer shares the following perspective:

"The shift required a major culture change... Moving to open innovation was a challenge because some people, particularly in Research and Development, were worried that we were moving to outsource our innovation entirely. We needed to deal with that very proactively, to articulate that we're not outsourcing Research and Development and that we still needed a very strong internal core capability." (Cloyd, 2012, p. 16)

Finally, Huston and Sakkab (2006) mention that since the implementation of the C&D program, in 2006, more than 35% of the new products in the market had elements that originated outside of P&G, compared to 15% in 2000. R&D productivity increased by nearly 60%, and the innovation success rate more than doubled while the cost of innovation decreased. In two years, P&G launched more than 100 new products that had key elements that were discovered externally.

6.5 | Key Takeaways: Managing the R&D Organizational Structure

This chapter provides an overview of the implications related to managing the R&D organizational structure. The Chief R&D Officer has to evaluate these five structural elements simultaneously to select the *optimal* structure that aligns with R&D strategy and corporate strategy. *Optimal* is defined this way because the R&D structure depends on a company's particular context and there is not a specific recipe for success.

Each of the structural dimensions provides the answers to the underlying strategic issues that arise from the R&D organization. For example, Nestlé's former Chief R&D Officer made the decision for the R&D organization to adopt a matrix organization so that it could be more responsive to business needs and address the requirements of local products. Equally important, this same Chief

R&D Officer established an R&D hub model to increase the overall effectiveness of the R&D organization and therefore, create new innovations for multiple markets. In P&G, the Chief R&D Officer helped to implement the *Connect and Develop* program to increase the innovation rate of the R&D organization.

Moreover, the Chief R&D Officer has to understand and recognize the complexities and trade-offs associated with these structural dimensions. Managing the global R&D organization ensures that R&D objectives can be met and more importantly, it secures the long-term competitiveness of the R&D organization. The analysis for the structural dimensions suggest that for a CPG multinational company, a matrix organization, coupled with an R&D hub model or an R&D integrated network and that embraces Open Innovation seems to represent an *optimal* structural combination generates innovation and R&D competitiveness. This statement is only a suggestion, and once again it is reiterated that the optimal R&D structure depends on the context of a particular company.

Finally, the element of organizational culture emerges as part of the R&D organizational structure through the analysis of all the structural dimensions. For example, the matrix organization requires the collaboration of R&D to interact and synergize with other cross-functional teams in the development of new products. In the organizational concepts for the global R&D organization, a behavioral orientation emerges for the structure. The R&D hub model requires the R&D organization to efficiently transfer the knowledge across R&D sites to capitalize on the opportunities of this decentralized R&D model. Implementing OI practices requires a cultural shift in the R&D organization to embrace this change. The importance of the Chief R&D Officer is crucial and this is why this research suggests that this senior executive has to lead the R&D organizational culture to nurture both the R&D structure and the R&D strategy. The next chapter further explores this topic.

Chapter 7 | Leading the R&D Organizational Culture

This chapter explores the role of the Chief R&D Officer in leading the organizational culture. As the previous chapter mentions, the R&D organizational culture emerges as part of the R&D strategy and the R&D organizational structure. Therefore, the Chief R&D Officer has a crucial role in influencing the culture of the R&D organization and aligning it with the R&D strategy and R&D organizational structure. This chapter explores the elements which the Chief R&D Officer can act upon to influence and shape the R&D organizational culture. Each of these elements present cases from Chief R&D Officers in CPG multinational companies that clarify how these elements come into place for ensuring that the R&D organizational culture fosters innovation in the CPG context.

7.1 | Elements that Influence R&D Organizational Culture: Chief R&D Considerations

This section provides an overview of the considerations that the Chief R&D Officer has to address in order to influence the R&D organizational culture in a CPG multinational company. First, this section introduces an overview of the definition for organizational culture and leadership (Schein, 2010) to justify the importance of leaders in shaping and creating the organizational culture. This section also provides an overview of the levels of organizational culture to explain which levels this research paper explores based on the data gathered for this study. The chapter then introduces the elements that influence the R&D organizational culture to set the context for the following sections of this chapter. The Chief R&D Officer has to leverage these elements to help with creating innovation in the R&D context. The section also includes examples of how Chief R&D Officers in the CPG industry have accomplished leveraging these elements in their respective R&D organizations to create an innovation culture.

7.1.1 | Overview of Organizational Culture and Leadership

The term culture has been used to name a set of characteristics that identify and belong to a certain group of people. The influence that leadership has to create and change an organization's culture is the subject of interest in this research paper, which proposes that the Chief R&D Officer is the leader who influences the R&D organizational culture. Setting the framework to understand the implications of leading the R&D organizational culture requires first, to provide the definition of culture and its levels and second, to define the link between leadership and organizational culture.

Schein (2010) defines culture as “a pattern of basic assumptions, invented, discovered, or developed by a given group, as it learns to cope with its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore is to be taught to new members as the correct way to perceive, think, and feel in relation to those problems.” This definition implies that culture emerges over time and that its strength depends on how deeply embedded these basic assumptions are within a certain group.

Culture can be analyzed at several different levels (Schein, 2010). *Level* is defined as “the degree to which the cultural phenomenon is visible to the observer.” This author mentions that levels range from tangible manifestations that can be seen or felt to the basic and unconscious assumptions that define how an organization acts and defines its personality. These levels are: (1) observable artifacts, (2) values, and (3) basic underlying assumptions. This research paper focuses on the first two levels, observable artifacts and values, since basic underlying assumptions are complex to decipher and beyond the scope of this research paper. Schein (2010) describes these levels as the following:

1. **Observable artifacts.** These include all the phenomena that one observes, feels and hears when encountering an unfamiliar culture. These include the visible products of the group such as physical layout; its language; its style such as clothing or the manner in which people address each other; its myths and stories told about the organization; its published lists of values and permanent archival manifestations such as annual reports.
In this research paper, annual reports and case studies from CPG companies have been referenced and analyzed as a source of information to understand the role of the Chief R&D Officer in influencing an R&D organization's culture.
2. **Espoused Beliefs and Values.** Through interviews, questionnaires, or surveys the culture's espoused and documented values can be studied. Espoused beliefs and values reveal the day-to-day operating principles that guide a certain group to adopt a particular behavior. Espoused beliefs and values become embedded over time, which implies that if a manager convinces a group to act on his or her belief, and the solution works, the group has a shared perception of that success. Gradually, the perceived value becomes transformed into a shared value or belief and ultimately into a shared assumption if the

belief continues to be successful. Espoused beliefs include the ideas, goals, aspirations and ideologies of a particular group.

In this research paper, Chief R&D Officer's beliefs and values are studied by including interviews as the main source of information.

3. **Basic underlying assumptions.** These are the taken-for-granted, underlying and usually unconscious assumptions that determine perceptions, thought processes, feeling and behavior. These basic underlying assumptions constitute the core of the culture and help in deciphering the patterns of behavior and predictions of future behavior.

Furthermore, the definition and levels of organizational culture suggest that leaders have a crucial impact for establishing or influencing the culture of a certain organization. In fact, Schein (2010) maintains that there is a very close relationship between organizational culture and leadership because leaders first start the process of culture creation when they create groups and organizations. Culture is the result of what a leader has imposed on a certain group and has worked out. Therefore, culture is created, embedded, evolved and shaped by leaders. As culture progresses, it provides structure and meaning to what is the acceptable way of leadership. In fact, this author argues that "leadership and culture are two sides of the same coin."

7.1.2 | Overview of the elements that influence R&D Organizational Culture

The previous section establishes the role of the leader in creating and shaping culture. The importance of the Chief R&D Officer resides in embedding his or her espoused beliefs and values so that they can gradually evolve into basic assumptions within the R&D organization. Martins and Terblanche (2003) build upon Schein's work, and argue that the evolution into these basic assumptions depends on four key elements that leadership must address. In addition, these four key elements can also contribute to create innovation within the organization. These key elements are the following: (1) vision and strategy, (2) structure, (3) support mechanisms, and (4) behaviors and practices. In the context of this research, the Chief R&D Officer can leverage the elements associated with the organizational culture of an R&D organization, as these can be a contributing factor for innovation in a CPG multinational company. These four organizational culture elements are briefly defined as the following:

1. **Vision and Strategy.** Tushman and O'Reilly (1997) argue that finding the right strategy, vision and purpose are essential for long-term success, but they also have important motivational elements. They provide the members of the organization with a sense that the work they are doing matters far more than its completion. Motivation and sustainable commitment come from individuals' beliefs that their efforts are contributing to something meaningful. In this matter, the Chief R&D Officer needs to provide a sense of purpose to the scientific and technological community when he or she sets the direction for R&D.
2. **Structure.** The previous chapter introduced the influence of organizational structure on organizational culture. This influence is present along the five structural choices that the Chief R&D Officer needs to consider. For example, a matrix organization fosters the collaboration among functions and projects (Roussel, Saad & Erickson, 1991; Ulrich & Eppinger, 2012). In the global R&D organizational concepts, a behavioral orientation emerges and varies from each organizational concept to another (Gassmann & von Zedtwitz, 1999). Implementing Open Innovation (OI) requires both structural and cultural transformations inside the R&D organization so that it can embrace this model (Chesbrough, 2003). The analysis in this chapter focuses on breaking R&D from isolation because this has been established as one of the Chief R&D Officer's main leading responsibilities in this research paper.

To break R&D from isolation, the Chief R&D Officer needs to consider two aspects associated with creating the desired change in the R&D organizational culture: (1) how to integrate R&D into the larger corporate culture because this can help to build a unified innovation process which enables R&D to communicate and work more effectively with other key critical functions, and (2) how to build an Open Innovation (OI) culture to encourage collaboration with partners outside of the firm and the R&D organization.
3. **Support Mechanisms in R&D.** Martins and Terblanche (2003) mention that support mechanisms should be present in the organizational culture to create an environment that promotes creativity and innovation. These main mechanisms are rewards and recognition. Management or, in this case, the Chief R&D Officer should be sensitive to which methods will inspire employees in the R&D organization to be more creative and innovative (Tushman & O'Reilly, 1997).

4. **Behaviors and Practices in R&D.** Martins and Terblanche (2003) argue that values and norms that encourage innovation manifest themselves in specific behavioral forms that promote or inhibit innovation. In the R&D context, the R&D activities and environment possess unique characteristics that the Chief R&D Officer needs to understand in order to lead the R&D organization (Asmawi & Mohan, 2011). Due to this unique environment, the Chief R&D Officer needs to promote behaviors and values beneficial for R&D and implement practices to foster innovation in the R&D organizational culture.

7.2 | Element 1: Vision and Strategy

As previously mentioned, the right strategy, vision and purpose are indispensable for long-term success, and they also provide a sense of purpose to the employees of a certain organization. A vision offers a reason why members of the organization should feel passion and enthusiasm about executing the strategy. Strategy engages people intellectually, meanwhile a vision engages people emotionally (Tushman & O'Reilly, 1997). Furthermore, a vision explains the “why” behind the strategy and is a source of intrinsic motivation. Visions have the following three characteristics: they are (1) strategic, which provides direction and alignment, (2) meaningful, which implies they are easy to understand, remember and support, and (3) empowering, which means that they provide motivation or inspiration (Niño, D., Class Notes Spring 2016, ESD.S32 Leading Creative Teams, Massachusetts Institute of Technology).

Chapter 4 established that the Chief R&D Officer needs to anticipate the future by identifying critical new technologies that will sustain the business of tomorrow. Setting the direction for R&D towards developing these technologies and building the necessary capabilities in the long-term requires the engagement and conviction from employees in the R&D organization. For achieving this commitment, the Chief R&D Officer needs to formulate a Technology Vision along with an R&D strategy that provides a sense of motivation to the R&D organization (Deschamps, 2008). Chapter 4 explained this Technology Vision has two sides: (1) *a hard side*, which deals with defining the scope of the technology reach and identifying the core competencies that are critical for the company to master, and (2) *a soft side*, which deals with developing a core ideology regarding technology and promoting desirable behaviors, beliefs and values to support this vision. The following paragraphs provide further explanation on the *soft side* of the Technology Vision.

Deschamps (2008) suggests that the following question should be asked when the Chief R&D Officer is developing this core ideology: *What values and principles should guide our technology deployment efforts?* The Chief R&D Officer needs to be conscious that the values and principles embedded in the Technology Vision can help change the working behavior in the organization, and therefore contribute in changing the mindset of R&D. In addition, the Chief R&D Officer should not only communicate clearly and compellingly his or her Technology Vision, but also translate it into a day-to-day reality in the R&D organization and infuse it into the overall organization. An example is how the previous Chief R&D Officers in Nestlé and P&G accomplished building values and principles so that Open Innovation could be embraced in the R&D community. The reason for building this core ideology was to engage the organization to embrace this change so that more sources of innovation could be created for their respective companies. Chapter 5 established that Nestlé's former Chief R&D Officer was key in promoting the *Sharing is Winning* philosophy to encourage the collaboration of the R&D organization with external partners. Chapter 6 established that P&G's former Chief R&D Officer accomplished this transformation in the R&D community by first, explicitly communicating that this strategy could create better innovations for the company, and second, giving confidence to the R&D community that the adoption of OI practices would allow them to be more efficient and provide innovations faster. Building these values and practices in the R&D community engaged R&D employees to gradually start adopting this practice. Additionally, fostering the collaboration with both internal and external partners requires having both structural and cultural dimensions to support it. This is further explored in the following section.

7.3 | Element 2: Structure, Breaking R&D Isolation

This chapter briefly introduced earlier the influence of organizational structure on organizational culture and the importance of breaking R&D from isolation. Roussel, Saad and Erickson (1991) argue that R&D must be broken from isolation for at least the following four reasons:

- To help avoid technology surprises through a sharing of knowledge, experience, and intuition.
- To encourage the R&D organization to identify with business goals and objectives and to make their work more purposeful by allowing them to participate in setting the company's priorities.

- To enhance the contribution of the R&D organization by encouraging them to challenge the business choices.
- To improve the overall quality of management through cross-fertilization between R&D and other company functions.

To address these major reasons, this section further elaborates on the aspects that the Chief R&D Officer needs to consider for breaking R&D from isolation in the CPG context: (1) how to integrate R&D into the larger corporate culture, and (2) how to build an Open Innovation (OI) Culture. To illustrate how Chief R&D Officers in the CPG Industry have accomplished breaking R&D isolation, two cases are introduced:

- 1) The creation of Nestlé's MicroMBA Program by Werner Bauer, previous Chief Technology Officer (CTO) of Innovation, Technology and Research & Development of Nestlé.
- 2) An overview of building a culture of Open Innovation (OI) in CPG Companies. The objective is to provide a framework that indicates the crucial role that R&D senior management has to promote and drive this model throughout the R&D organization.

7.3.1 | Nestlé's R&D MicroMBA Program: Breaking Silos

Werner Bauer, previous Nestlé's Chief R&D Officer, questioned what would happen if the talented and clever R&D professionals who already have outstanding technical skills had greater business savvy. Would this business knowledge help them to perform even better or to establish better conversations with marketing and business experts? Would this help to boost innovation?

Keeping these questions in mind, Bauer, with the help of Raphael H. Cohen, who invented a new process for increasing innovation, and Marc Dreyer, responsible for developing R&D people, designed a program called the Nestlé R&D MicroMBA Program that targeted middle management professionals with high potential in order to break organizational silos and develop their business savvy, agility and ability to seize opportunities, collaboration and peer support, network inside and outside the company, and intrapreneurial and innovation skills. Intrapreneurs are employees within a company who are assigned to a special project and develop it as an entrepreneur would. This program includes three main pillars:

- **Practical training.** This includes learning how to produce a convincing business case and to achieve this it is necessary for R&D professionals to learn how to think like businesspeople and acquire business savvy. This is enabled by learning the fundamentals of business, the vocabulary of business, and the key issues that must be addressed in the business environment. This practical training includes learning hard skills such as marketing, finance, strategy, branding and process management; and also soft skills such as negotiations, dealing with stakeholders, managing virtual teams, change management, caring leadership and embracing cultural diversity. All of these hard and soft skills are necessary to become agents in a complex multinational organization.
- **Providing a model for innovation.** New innovators learn about Cohen's Innovation Model, which provides a roadmap of the key questions that must be addressed to increase the probability of success. These questions include a detailed analysis of how to deal with stakeholders, how to use client decision criteria, how to use inventive business models to build competitive advantage, measurable success factors, and a clear checklist of the remaining unknowns that need to be corroborated, among others. Furthermore, this model helps to communicate to upper management a compelling business case that outlines concrete success factors so engagement can be established for supporting the project.
- **Implementing a real project.** With the practical training and the framework of innovation, professionals are tasked with identifying a real innovation and implementing it. Implementation is not straightforward because it requires convincing decision makers in the organization to support and move forward with the project. Teams are composed of people from different backgrounds to maximize the contribution of different expertise as part of the innovation process.

According to Bauer, results from the implementation of this program helped to capitalize R&D potential because it was discovered that R&D professionals can innovate beyond technology. This program helped these high potential middle managers to become real agents of change and deliver measurable results in areas outside of their area of expertise. The program also demonstrated that horizontal collaboration and breaking down silos, which means collaboration and engagement across functional areas, lead to increasing the success of innovation.

Finally, this program also helped to change the perception of R&D people by business partners of other Nestlé divisions. The business savvy acquired by R&D professionals helps them to be more relevant in discussions with the business side. Now, R&D professionals and businesspeople speak the same language, which helps them to be more effective in their conversations and understand each other better.

Finally, besides collaborating effectively with the business, the Chief R&D Officer has to realize that external collaboration with entities outside of the firm can create greater possibilities for innovation. Fostering collaboration with external entities is a challenge the Chief R&D Officer has to address from a cultural perspective. The following section explores the implications for building the OI culture.

7.3.2 | Overview of Building a Culture of Open Innovation (OI)

The previous chapter mentions that the adoption of Open Innovation requires a shift in the R&D organizational culture to embrace this model. In fact, the change in organizational culture is recognized as one of the major challenges that companies face to adopt Open Innovation practices (Naqshbandi, Kaur & Ma, 2014).

Witzeman et al. (2006) maintain that effective leaders encourage their organization to incorporate external knowledge into the firm. These leaders articulate visionary goals that highlight the importance of leveraging internal and external resources to achieve innovation and growth. Effective leaders create a favorable culture that embraces external innovation. They encourage their employees' thinking beyond their current set of internal resources to consider the possibility of creating new products faster by using available external resources.

The literature review suggests that the Chief R&D Officer and his or her key team need to perform the following to enable this OI mindset and build an OI culture in the CPG industry: (1) get employees to overcome the Not-Invented-Here (NIH) Syndrome (Herzog & Leker, 2010, and (2) embed Open Innovation into the organizational structure (Chesbrough, 2003; Chiaroni, Chiesa & Frattini, 2010; Garcia, 2012). It is important to mention that other mechanisms might be available as well; however, these are regarded as key pillars for building an OI culture.

7.3.2.1 | Not-Invented-Here (NIH) Syndrome

OI focuses a strong emphasis on the use of external technology within the innovation process; therefore, individual employees as well as the overall firm need to be sufficiently open to external technology (Herzog & Leker, 2010). The NIH syndrome represents a negative bias towards externally developed technology, and therefore, hinders the adoption of this external technology that could bring the firm a positive outcome (Katz & Allen, 1982). The Chief R&D Officer and his or her team need to change this mindset in the scientific and technical community so that OI can be gradually embraced within R&D and the larger organization. For example, two of the key members of the Chief R&D Officer's team in P&G mentions the following regarding overcoming the NIH Syndrome in the R&D community:

“One of our challenges was to convince our organization to move its culture from “Not-Invented-Here” to one based on “Proudly-Found-Elsewhere” – and to convince them, and have them understand, that we truly wanted a strong R&D organization with great scientists and facilities, but that we wanted to turbo-charge our R&D operation [...] we wanted to change the culture to reward people who brought things in from elsewhere.” (Huston & Sakkab, 2007, p. 23)

7.3.2.2 | Embedding Open Innovation (OI) into the Company's Culture

Embedding OI implies that the Chief R&D Officer and his or key staff, along with the business functions, establish the following changes to the organizational structure so the adoption in the organizational culture can be gradually achieved (Chiaroni, Chiesa & Frattini, 2010): (1) establishment of independent OI business units or task forces and dedicated cross-functional teams (Huston & Sakkab, 2006), (2) champions who lead the process of transition from Closed to Open Innovation (Chesbrough, 2003), and (3) rewards and incentives (Chesbrough, 2003) which include more open oriented goals and metrics. For example:

- In Mars, the Chief R&D Officer helped to establish a cross-functional team within the R&D community with the purpose to make OI systematic within the company. This team was embedded within the R&D innovation structure to ensure that OI became responsible for all innovation teams. In addition, outside of the R&D organization there are OI Ambassadors at each of Mars' five business segments that provide support to the OI team.

Associates are also trained to increase the understanding of OI and promote the benefits of this practice (Garcia, 2012).

- In P&G, for the "Connect and Develop" Program, a new structure for OI was created under the leadership of Gil Cloyd, former P&G Chief R&D Officer and Larry Huston, former R&D Vice President. They created a cadre of scientists and engineers called the "Technology Entrepreneurs" who were responsible for driving the OI initiative across R&D and the greater organization (Cloyd, 2012). In addition, scientists who followed this ideology were rewarded.
- In General Mills, the Chief R&D Officer helped to implement a dedicated team (called "The X Squad") which was created to facilitate finding external innovation. According to Helser (2014), this team is "charged to catalyze this new thinking; to help people think differently about their overall skills sets. Their philosophy is to think big, start small, experiment often and scale fast on successes. The X Squad travels around the globe looking for potential partners that have a product or technology solution that would fit within our existing businesses."

These elements indicate that enabling the R&D strategy requires having both R&D structure and R&D culture aligned so that innovation can happen. The Chief R&D Officers in the CPG companies studied for this thesis indicate the importance that R&D structure can have in enabling the R&D culture and vice versa. The next section presents more detail on the individual dimension of the R&D community, and how motivation, rewards and recognition play an important role in the R&D community of a CPG organization.

7.4 | Element 3: Support Mechanisms in R&D

The beginning of this chapter mentions that support mechanisms should be present in the organizational culture to create an environment that will promote creativity and innovation. These support mechanisms are rewards and recognition (Martins & Terblanche, 2003). The Chief R&D Officer plays an important role for setting these support mechanisms and this is further explored in this section. However, before proceeding to the analysis pertaining to this section, it is essential to provide an overview of the definitions for rewards and recognition:

- **Rewards.** Schein (1982) mentions that “the main objective of the reward system is to align the goals of the employee with the goals of the organization. It provides motivation and incentive to the employees for the completion of the strategic direction.” Rewards include salaries, promotions, and stock options, among other employee benefits. In addition, there are two types of rewards: (1) extrinsic rewards, which are given by others, including salary, promotions and job assignments, among others; and (2) intrinsic rewards, which are provided from within. These include personal development and growth, enhanced competency, autonomy and self-control and feeling of accomplishment (Niño, D., Class Notes Spring 2016, Leading Creative Teams, Massachusetts Institute of Technology).
- **Recognition.** Davila, Epstein and Sheldon (2006) mention that recognition is a reward that takes place after the outcome of a certain project is available. Recognition is based on the subjective assessments of the value generated.

With these definitions, it is now important to understand the role of the leader within this context. Schein (2010) argues that what the organization values and what the organization punishes is part of what the leaders accomplish by establishing rewards if the behavior is consistent to the leaders’ values, assumptions and priorities. In addition, the process of selecting and promoting new members is a subtle but potent way in which the leader's assumptions get embedded. In this matter, the Chief R&D Officer needs to structure a reward system for the technical community according to his or her values and also in accordance with the values of the overall firm in the CPG context. Setting these rewards and recognition includes considering the following questions: Does the R&D organization reward radical innovation? Does the R&D organization reward having "out-of-the-box" ideas? Does the R&D organization reward risk-taking? For example, Sharon James, Chief R&D Officer in Reckitt Benckiser mentions that RB’s R&D culture rewards people in the scientific and technical community for challenging the status-quo as this represents the opportunity to create bolder innovations for consumers. Fostering these values plays an important role in fostering innovation. The following section further explores these values and provides an overview of these rewards and recognition in the R&D context of a CPG multinational.

Ellis and Honig-Haftel (1992) mention that different types of rewards are used to motivate technical people. These types of rewards consist of intrinsic as well as extrinsic rewards. Positive intrinsic rewards include public recognition of outstanding performers by means of awards or

mementos for patents. Positive extrinsic awards include provision of research time or money to explore new concepts, stock options, grants or salary increases. This indicates that rewards in the technical community present similarities to those within the larger organization; however, there are variations, especially in the provision of research time or money to pursue new projects and this might be due to the creative dimension of the R&D community. Deschamps (2008) elaborates on this point and argues that innovative ideas are hindered when staff are dealing with day-to-day tasks. Innovation requires time to observe, imagine, think and experiment. This has been reinforced in high-tech companies such as Google, where the engineers are encouraged to spend 20% of their time working on personal projects that might not necessarily translate into a commercial utility. In the CPG industry, this measure might also be useful to create more radical innovations in the marketplace. For example, Chapter 5 established that Nestlé's previous Chief R&D Officer has the autonomy to allocate a certain percent of the overall R&D budget. This indicates that the Chief R&D Officer could provide the freedom to champion promising projects that could lead to radical innovations.

In terms of recognition, Moser and Morrisey (1984) mention that due to the high-degree of technical knowledge and intelligence of people within the R&D community, they have a desire to gain acceptance and credit from their peers. Excelling performers can have the opportunity to participate in conferences and symposiums where they can present their achievements to their peers. Employees might also feel rewarded if they perceive themselves as contributors to the overall effectiveness of the R&D organization. For example, in the CPG industry, PepsiCo created the Academy of Sciences Award, which is the highest recognition within PepsiCo for R&D. This award recognizes that the people in the R&D organization play an instrumental role in driving the innovation. PepsiCo's Chief R&D Officer shares the following perspective about this award:

"Our Academy of Sciences Award winners are delivering today's business priorities, as well as the growth opportunities of tomorrow." (Khan, 2015)

Finally, this section suggests that support mechanisms also include Chief R&D Officers embedding values within the R&D community that could serve as a source for innovation. The next section provides more detail regarding these values, and expands also on behaviors and practices that Chief R&D Officers have to promote in the R&D community.

7.5 | Element 4: Behaviors, Values and Practices in R&D

Schein (2010) maintains that cultures emerge from the beliefs, values and assumptions of the leaders of a certain organization. Therefore, this section suggests that the Chief R&D Officer plays an important role to promote behaviors and values that are beneficial for R&D and practices to foster innovation in the R&D organizational culture. The Chief R&D Officer has to be consistent with his or her beliefs and values to reinforce their adoption within the larger R&D organization. In addition, the values that the Chief R&D Officer promotes need to be in alignment with those of the larger organization, or also influence the larger organization to embrace these values and practices.

Due to the uniqueness of the R&D activities and environment, Asmawi and Mohan (2011) propose a set of values, behaviors and practices beneficial for R&D. The objective of introducing this framework is to demonstrate how Chief R&D Officers and his or her key staff support the values, behaviors and practices that are beneficial for R&D in the CPG industry. According to Schein's classification of levels of organizational culture, the examples referenced from R&D leaders in the CPG multinational companies are mainly associated with observable artifacts and espoused values and beliefs.

7.5.1 | Characteristics of R&D activities and R&D environment

The Chief R&D Officer needs to understand the environment in which R&D operates if he or she wants to lead the R&D organization. The characteristics of the R&D environment and its related activities are the following (Asmawi & Mohan, 2011):

1. **Highly uncertain.** In general, R&D activities happen in a highly uncertain and unpredictable environment that is mainly driven by the technological changes within an industry and the constant market changes (Calantone & Dröge, 2003). This situation can lead to the absence of necessary information to predict the outcome of an R&D project. In the CPG industry, there is high uncertainty on the market trends and evolving needs of the consumer.
2. **Highly risky.** Risk is related to the potential failure of an R&D project mainly because of technology risks and market risks. Technology risks are associated with the product not meeting the required specifications, while market risks are associated with the product not

selling in the marketplace (Hartmann & Myers, 2001). In the CPG industry, new product introductions are subject to both technology and market risks. Technology risks are associated with using a certain ingredient in a product that can be ultimately penalized by regulation (e.g. sugar content regulations in beverages in both emerging and developing markets), and market risks are associated with a new product introduction (e.g. new personalized beverage) with a lack of consumer adoption in the marketplace.

3. **Market and customer orientation.** This dimension is related to customers having more knowledge about their needs and an understanding of product requirements than the organization. Therefore, it is important to maintain a close relationship between potential customers and the innovating companies to better understand the consumers and help reduce market risks (Salomo, Steinhoff & Trommsdorff, 2003). In the CPG industry, it is necessary to create that unique experience with the consumer from the first purchase, so that the re-purchase cycle can be sustained in the long-run. The R&D organization needs to place the consumers in the center of all of its developments and understand their met and unmet needs.
4. **Knowledge-intensive.** R&D knowledge and information that is discovered by people is transformed into new capabilities that are delivered as new technologies for customers. Knowledge also helps to create information that reduces uncertainty and/or ambiguity. In the CPG industry, discovering new technologies or leveraging technologies from other industries for the creation of new products is critical, as it can create new sources for innovation.
5. **Creative process.** The R&D process involves the creation of a proof of concept that has not existed before; therefore it requires creativity to materialize an idea into a product or service and involves learning as part of the iterative process. In the CPG industry, for example, Unilever conducts creativity sessions across the organization, and especially in R&D to look for creative solutions to problems, among other objectives (Mostert, 2007).
6. **Collaborative and interactive.** Since R&D is a central function that interfaces with both internal and external stakeholders in an organization, the need for collaboration is key for fostering innovation (Song et al., 1998; Von Hippel, 2005). In the CPG industry, collaboration within and outside of the R&D organization is critical to make R&D more responsive to business needs. This collaborative dimension is made possible by breaking

R&D from isolation, and this chapter establishes how Chief R&D Officers in the CPG industry have accomplished this.

These six characteristics of the R&D environment indicate that the Chief R&D Officer in the CPG industry has to not only be aware of this environment, but also promote certain behaviors, values and practices that support this environment. This is explored in the following section.

7.5.2 | Behaviors, values and practices beneficial for R&D

Due to the nature and characteristics of the R&D activities and environment, Asmawi and Mohan (2011) identified nine behaviors and values that are important for increasing R&D performance in organization: (1) risk-taking and experimenting, (2) team working, (3) autonomy, (4) tolerance of mistakes, (5) employee participation, (6) knowledge sharing, (7) open communication, (8) customer and market orientation, and (9) social networking.

The authors tested these nine values with 45 R&D organizations and 198 respondents with positions of leadership in the R&D organization. Their results suggest that these cultural values are beneficial for the R&D organizational culture. Moreover, they suggest these values can be adopted in the form of management practices and established as a baseline foundation for management activities to strive for R&D excellence. The following paragraphs provide further detail of these nine behaviors, values and practices and include examples from R&D leaders in CPG companies that indicate they adopt these behaviors, values and practices.

First, encouraging risk-taking and experimenting. To inspire creativity in R&D, organizations must encourage their people to engage in research efforts that have associated certain risks and at the same time the organization must be prepared to cope with failure (Tushman & O'Reilly, 1997). Management needs to clearly communicate that radical innovations can only be achieved when people challenge the *status quo* and introduce 'out-of-the-box' ideas. For example, Sharon James, R&D Senior Vice President of Reckitt Benckiser (2012), mentions that: "it comes down to attitude as well, you know you need that good science foundation but in Reckitt Benckiser, you really need to be entrepreneurial. If you got an idea, you have got to speak about it, you have got to speak up, you know, think 'out-of-the-box'. Take those challenges on, that what success is in R&D."

Second, teamwork. This value is necessary to promote group synergies. Teamwork flows more efficiently when members communicate effectively, share common goals and understand each

other. Cross-functional collaboration among R&D, manufacturing and marketing fosters creativity by bringing in diverse viewpoints. To this point, Jim Kirkwood, Chief Science and Technology Development Officer of General Mills (2014), maintains the following: “R&D in the past used to be where innovation came from. But we’ve learned that innovation is actually a team sport, and that it needs to be not only R&D, who has a great understanding of some of the technical needs, but it needs to be a broad connection with consumer insights, with marketing, with finance for business models.”

Third, autonomy. Having this value allows a team to develop responsive actions and encourages having initiative. This value can be nurtured by an organic organizational structure, where professionals are given the independence to pursue new ideas and are supported by resources to develop the project. There should be opportunities to develop radical innovation. Autonomy allows the organization to adapt to changing circumstances in the environment and provides challenges to employee. In relation to this point, Meyer and Marion (2010) suggest that R&D executives should include some degree of flexibility in structured processes, especially for projects that involve radical innovation. This involves operating outside of regular gated corporate development processes for these types of projects.

A clear example to convey these behaviors and practices is from Nestlé and the emergence of Nespresso. Nespresso is one of the leading brands in portion coffee within the world coffee market. The product consists of premium quality coffee packed in aluminum capsules for exclusive use in Nespresso machines. The unique offering to the consumer is a customized and high-quality cup of espresso coffee delivered in a convenient and efficient way. Nowadays, Nespresso operates independently and in fact, management, including the Chief R&D Officer, decided to physically separate Nespresso so that it could have greater flexibility from Nestlé’s company rules and standard procedures. Seifert, Leleux, and Tucci, C. (2008) interviewed the current head of Nespresso’s System Technology Center (STC), Alfred Yoakim. In this interview, Yoakim points out that: “Nespresso was successful because Nestlé’s management let the team go to the end of their ideas and fully championed the project.” Yoakim also mentions that Nespresso operating independently allowed them to have a certain degree of freedom for managing the project.

Fourth, tolerance of mistakes or failures and celebrating success. Mistakes are permitted if these are based on the opportunity that these will provide for continuous learning (Tushman &

O'Reilly, 2002). There must be support for those who try and do not succeed, and mistakes should be openly discussed and learn from them. Kirkwood (2014) elaborates on this by sustaining the following: "In the past, if you had a failure, it was over. But now, what we've done is actually built it into our process. That iteration is something you need to do on the product path [...] when your risk is high, we've learned and really created this process that says we are continually iteration on the small scale until we get large enough that we have most of these questions answered [...] failure is part of that process. As a matter of fact, if you don't fail, you probably didn't test enough."

Fifth, employee participation and empowerment. Employee participation enables authority and decision responsibility, which in turn creates empowerment. Particularly, decision making, when pushed at the project level, increases employee engagement. Khan (2015) builds on this and mentions that: "Administrative and executive duties notwithstanding, my job at PepsiCo, fundamentally, is to mentor. My job is to create a framework in which nearly 2,000 R&D associates can flourish, to unleash talent by providing guidance and counsel when requested (or required), to give people the tools they need to succeed, and most importantly, to create a culture in which the PepsiCo R&D team feels empowered to create solutions to problems conventional wisdom said were insoluble."

Sixth, knowledge sharing. Tushman and O'Reilly (2002) argue that employees must be encouraged to exchange information and share knowledge for R&D activities to be successful. Knowledge sharing includes having the necessary infrastructure for sharing knowledge, from physical spaces to ICT for enabling the connection of virtual teams. Meyer and Marion (2010) add another perspective by suggesting building communities of practice across flat organizations. This consists of breaking down internal silos and restructuring organizations around communities of practice that represent major growth opportunities for the company. More collaboration across silos is needed for allowing the emergence of new ideas. Sakkab (2007) argues that: "Communities of Practice are a major element in moving knowledge within P&G. They have kept us at the forefront of emerging technologies. At the same time, they have allowed us to communicate what is going on within P&G in various categories so that we can leverage our knowledge across all of our product brands and new ideas."

Seventh, open communication. This value includes the open diffusion of information, which enhances common understanding and motivation and also facilitates trust between the firm and the

employee. To this point, Dr. Stella Peace, R&D Vice President (VP) of Unilever (2015), mentions the following: “my team is thinking about very complex science, new technology and how we can bring those to bear in new products. Being able to communicate so that everybody can understand what we are talking about is really critical. So for me probably ninety percent of my communication I do is standing up on my feet speaking to my team, speaking to senior leaders who are making decisions about where to make investments. Also for me, as a leader, the way I judge many of my people is when I see the standing up and giving those presentations as well.”

Eighth, customer and market orientation. As mentioned before, coordinating the understanding between marketing and R&D to have more knowledge about customer needs can lead to reduced market risks. In addition, if the organizational culture has customer and market orientation it will create the necessary behaviors for the creation of superior value for potential buyers (Von Hippel, 2005). Meyer and Marion (2010) elaborate on this point and mention that true innovation emerges from a deep understanding of the user and that entering the world of the target user can help to understand holistically the user’s context and have good quality and create better and more valuable innovations for the consumer. Sakkab (2007) deeply promotes this value in the R&D organization and proposes the following: “The R&D leader must really internalize and understand the realities of consumers’ lives if he or she is to see new opportunities for innovation. You don’t discover an unarticulated need by talking to a consumer—you discover it by observing a consumer. When you observe, you gain insights and those insights lead you to unarticulated needs. They are the ones that are valuable and insightful [...] you don’t learn that by sitting in the lab and asking questions. You learn that by being part of it [...] At P&G we started by developing a deep understanding of what the consumer wants and then delivering that experience. That is extremely important. I am not talking about innovation as only the tangible stuff that comes out of the lab—innovation is about creating something that is a terrific experience for the consumer [...] Our products are different from, say, golf clubs or cars, because ours are on a much shorter repurchase cycle; you buy our products today, but next week you come back to buy again. And if you’re not satisfied, you don’t return. Consequently, we must ensure that consumers have a great experience or otherwise they won’t come back.”

Ninth, the importance of social networks. This value includes encouraging R&D professionals to socialize and network with their peers outside the organization to exchange knowledge and

develop potential future collaborations. The R&D organization should also foster networking with other stakeholders outside of the research community, such as clients, product and equipment vendors and business consultants so they can develop the sensibility to detect new opportunities (Von Hippel, 2005). Helser (2015) maintains this point in the context of OI by saying: “when launching an open innovation strategy, it’s tremendously exciting as you discover new technologies and partners that can drive your business forward. It’s equally challenging as you push against a culture that was built doing things internally. The cultural shift is really about encouraging, supporting and rewarding our teams to become more connected, both internally and externally.” Sakkab (2007) adds another perspective: “Sometimes you need to use the networks, sometimes it’s just a phone call to somebody on the other side of the pond or the street who can help you. Sometimes it’s knowing somebody who knows somebody. Knowing who becomes more important than knowing how.”

These nine values, behaviors and practices indicate the relevance that R&D leaders have in promoting and communicating them, but more importantly, they need to ensure that these become into a day-to-day reality in the R&D organization. The different postures of the Chief R&D Officers and key staff within the R&D community in CPG companies seem to indicate the importance of making these values a normal practice in the R&D organization, as it can increase the possibility to continue generating both types of innovation, incremental and radical. As indicated previously, radical innovations are crucial as they sustain the firm’s long-term competitiveness by presenting to the consumer increased and unique value propositions. In addition, the Chief R&D Officer also needs to promote and defend these values, behaviors and practices outside the R&D organization, as R&D can shape corporate practice and set the tone for change for the rest of the enterprise (Carleton, Cockayne & Sawatani, 2015).

7.6 | Key Takeaways: Leading R&D Organizational Culture

This chapter defines the importance of how leaders create and shape the organizational culture in the context of a CPG multinational company. The Chief R&D Officer has the responsibility for setting the environment so that a positive and innovative R&D organizational culture can emerge by influencing the different elements characteristic of the R&D organizational structure. The Chief R&D Officer needs to recognize the value that people can create in the R&D organization and ignite that intrinsic motivation so that creativity and innovation can happen. In this process of

change, the Chief R&D Officer also needs to engage both his or her key technical team and the business functions to promote, defend and integrate this culture within the larger organization. By understanding the implications of managing the organizational culture, the Chief R&D Officer can act and influence the outcome for innovation. As established previously, formulating the R&D strategy and managing the organizational culture can also impact the outcome for innovation. The Chief R&D Officer secures both the short- and long-term contribution to innovation by understanding how these elements influence each other. The following chapter provides the practical implications of this research paper by summarizing the implications of formulating the R&D strategy, managing the organizational structure and leading the organization culture of an R&D organization to achieve the innovation for the CPG multinational company. It also provides theories about the evolving role of the Chief R&D Officer as well as the potential implications for CPG multinationals.

Chapter 8 | Practical and Research Implications

8.1 | Practical Implications for Chief R&D Officers

The CPG industry is facing an important transition. This transition is taking place both at a macro level as the market continues to evolve and is making it increasingly harder for CPG companies to compete, and at a micro level as consumers have become more demanding in terms of how they relate to CPG products. This has forced CPG companies to continuously create innovation. This research paper suggests that innovation can be created by a firm in four key dimensions and that R&D function in the CPG context creates innovation in three of the four key dimensions based on the “Innovation Radar” framework (Sawhney, Wolcott & Arroniz, 2006). These dimensions are: (1) new products, (2) processes, and (3) customers. These first two dimensions are related to R&D being responsible for discovering new knowledge and applying that knowledge to create new products and processes, while the customer dimension involves understanding the consumer deeply to deliver the desired innovation. The fourth dimension, which implies the markets where products are available, is more related to the business functions defining the business proposition. This research paper establishes that the challenge resides in *how* to create this innovation, and the Chief R&D Officer is the central leader who accomplishes this.

This research paper proposes the Chief R&D Officer not only should set the direction for the R&D organization, but also execute this direction by systematically considering the elements of R&D strategy, R&D organizational structure and R&D organizational culture to achieve the desired innovation to contribute to innovation in a CPG multinational company. This systematic approach is crucial, because executing the desired R&D strategy has to align with both the R&D organizational structure and R&D organizational culture. Instead of considering these elements in isolation, the Chief R&D Officer needs to exploit the synergies that emerge by connecting these elements with each other. If the Chief R&D Officer formulates what he or she considers the right strategy but has an inefficient organizational structure or lacks an innovative organizational culture, then the R&D organization will fail in creating value for the firm. Chapter 5 established that Nestlé’s previous Chief R&D Officer accomplished not only working with the business to establish a close alignment, but also formulating an R&D strategy that was supported by the R&D organizational structure and the R&D organizational culture. Nestlé’s previous Chief R&D Officer helped to implement innovation to move Nestlé towards achieving the transformation to introduce

healthier products. For example, the R&D structural element that drove the R&D organization to interact very closely with the business and the markets (matrix organization) required having the R&D organizational culture behind that understand how the business dynamics worked, and this is why Nestlé's previous Chief R&D Officer established the MicroMBA Program in the R&D organization to create more awareness in R&D regarding business needs. Another aspect derived from the R&D strategy was how to leverage the R&D global network to create innovation opportunities for different markets, leveraging the knowledge from the widely distributed R&D centers (R&D organizational structure) required to nurture Nestlé's R&D organizational culture so that knowledge could be efficiently transferred from one location to another. Nestlé's previous Chief R&D Officer promoted sharing knowledge with the R&D organization to allow efficient technology transfer, avoid R&D duplication effects, capitalize cross-learning and create synergies between different teams.

An additional example from another CPG multinational company is how P&G's former Chief R&D Officer required having both the R&D organizational structure and the R&D organizational culture in place to align the OI model, which was triggered by the R&D strategy that recognized that R&D organization could be more effective and generate more innovation if the "R&D walls" became more porous. The R&D organizational structure element that helped to drive the cultural change was the "Technology Entrepreneurs" team within the R&D organization that worked to achieve the cultural shift in the R&D organization for embracing OI practices and promoting the benefits that OI could create for the R&D organization, such as being more efficient to produce innovation by better leveraging the connection with external partners. These examples indicate that as the CPG multinational company evolves, the Chief R&D Officer has to have the foresight to continuously adjust the elements of R&D structure and R&D culture according to what the business and R&D strategy require or will require to survive in the fast and high-pressure CPG environment. Aligning these elements will enable the R&D organization to continuously generate innovation for the firm, both in the short-term and in the long-term.

Securing innovation both in the short-term and in the long-term implies the Chief R&D Officer has to advocate for both types of innovation, incremental and radical. For example, Nestlé's previous Chief R&D Officer developed the Innovation/Renovation model to make sure that the R&D organization focuses in the short-term priorities, but also has the direction towards

developing the necessary technologies for the products five to ten years ahead. While incremental innovations maximize value of the company in the short-term, radical innovations can sustain the growth in the long-term of a CPG organization. As this research paper establishes, radical innovations are crucial to achieve product differentiation and create new value for consumers in the CPG space. The Chief R&D Officer has to include radical innovations as part of the R&D strategy, and the Chief R&D Officer has to champion these types of products until they come to fruition. Creating radical innovations requires the support and alignment in R&D organizational structure and R&D organizational culture. For example, the Chief R&D Officer at Nestlé championed letting the Nespresso business operate independently so that this radical innovation could create value for the firm. Creating this independent operation also promoted an R&D organizational culture of autonomy within the R&D organization, and therefore, more flexibility to create new ways to deliver personalized beverages for the consumer. To build this cultural dimension in the R&D community, the Chief R&D Officer needs to foster a culture that tolerates mistakes and learns from them and to stimulate the freedom and empowerment to experiment. Chapter 7 provided examples from Chief R&D Officers that support these values in RB, General Mills and Nestlé. Furthermore, another cultural dimension that allows building radical innovations is deeply understanding the consumer. Chapter 7 established how P&G created the culture in the R&D organization for locating the consumer in the center when new products were being created. The Chief R&D Officer has to instill the idea that the consumer is at the center of every initiative and development and that creating this unique connection with the consumer will allow creating this unique experience and value that the customer is looking for. This unique connection with the consumer continues to evolve as other industries (e.g. high-tech) influence the CPG industry. For example, Nestlé has been leading the connection between food and the pharmaceutical industry.

Finally, the previous argument indicates that the future is headed towards convergence, which is the cross-fertilization of fields. This cross-fertilization is going to become a norm in the following years. The Chief R&D Officer has to be aware of this change because the knowledge generated in one apparently unrelated field can generate the desired solutions in the field of interest. The Chief R&D Officer has to be able to "connect the dots" across different fields as it can create opportunities for generating innovation or increasing the efficiency of a certain process. Additionally, this convergence is demanding Chief R&D Officers to think more holistically about

innovation. Chief R&D Officers need to start thinking about the R&D organization as a system, which implies considering the influence that one entity might have on another as well as the relationship between the entities within a system. This is why this research suggests that the Chief R&D Officer needs to have a systematic approach towards formulating the R&D strategy, managing the R&D structure and leading the R&D organization.

8.2 | Research Implications

This research suggests a framework so that Chief R&D Officers can think holistically to generate innovation for the firm in the CPG industry; however, there might be other additional elements that are also necessary to consider for leading and managing the R&D organization. Therefore, this research suggests the following areas for future research:

- Evaluate the role of Chief R&D Officers in other industries and determine how the elements of R&D strategy, R&D structure and R&D culture differ or present similarities across different industries, especially comparing and contrasting high-tech versus low-tech industries. How do the Chief R&D Officer's responsibilities differ in the pharmaceutical industry or the electronics and information technology industries?
- Test the proposed system by formulating a survey and quantify the interrelationships between these elements. In this expansion, it would be necessary to conduct the survey with senior executives in the CPG industry.
- Study the role of the Chief R&D Officer when the R&D organization is scaled down into small and medium enterprises in the CPG industry or expand the sample of CPG multinational companies to answer the following questions: Is the Chief R&D Officer part of the leadership team? How does this affect the outcomes for innovation opportunities and sustained growth in the long-term?
- Assess how the role of the Chief R&D Officer is going to change with the convergence trend this chapter suggests. Is the Chief R&D Officer's role going to be more related to knowledge-management? How does this affect the elements of strategy, structure and culture in the R&D organization?

Chapter 9 | Conclusions

The role of the Chief R&D Officer in the CPG industry has evolved. The sample of CPG multinational companies this research studies indicates that this senior executive is part of the executive management team. Including the Chief R&D Officer as part of this team has created the opportunity for the scientific and technological community to exert greater influence on the company's direction, and also has enabled the closer alignment between the business and R&D. Another related consequence of this evolution in the CPG industry is that the Chief R&D Officer must not only manage, but also lead the transformation of the R&D organization so that it can continuously generate innovation for the firm and maintain its short-term and long-term competitiveness.

Managing and leading the R&D organization requires the Chief R&D Officer to set and execute the vision and direction for the R&D function. This research paper proposes that the first element the Chief R&D Officer has to address to execute this direction is formulating the R&D strategy. The Chief R&D Officer has to integrate technological evolution and business dynamics as central components of the R&D strategy to ensure the close alignment with the overall firm's corporate strategy. Enabling the R&D strategy requires having the elements of R&D organizational structure and R&D organizational culture enhance and nurture the particular R&D strategy that the Chief R&D Officer has decided according to the overall firm's strategy. This suggests that R&D strategy, R&D organizational structure and R&D organizational culture are interwoven elements. Therefore, the Chief R&D Officer has to systematically consider these key elements to create innovation.

The case studies presented throughout this research paper suggest these elements reinforce each other for creating innovation, and also indicate how Chief R&D Officers leveraged these elements in the R&D organization of CPG multinational companies. The R&D strategy for making R&D more responsive to the business and for making R&D more efficient to create innovation for a CPG company led the Chief R&D Officer to establish a matrix organization that enabled R&D to closely interact with the business, a global R&D network of employees dispersed throughout different sites that created knowledge and shared this knowledge across the different R&D sites so that new products and processes could be created, and the launch of Open Innovation practices inside the company that fostered the collaboration of R&D with external innovation partners. This

in turn, required a cultural change inside the R&D organization to embrace this practice. The impact of this R&D strategy led the R&D organization to produce faster and more valuable innovations for the consumer.

Finally, this research paper provides the context to suggest that the Chief R&D Officer in the CPG organization has to systematically consider the elements of R&D strategy, R&D organizational structure and R&D organizational culture to contribute to the overall firm's innovation. Deciding on the optimal R&D strategy depends on the particular context of a CPG firm and creates unique implications with respect to the R&D organizational structure and the R&D organizational culture. The Chief R&D Officer has to be visionary and consider that the transformation of the global R&D organization will evolve over time and require the necessary adjustments to align the R&D organization towards the desired future state.

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