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L'INNOVATION INVERSE : VERS UN NOUVEAU MODÈLE D'INNOVATION GLOBALE POUR LES ENTREPRISES

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RÉSUMÉ

Les grandes entreprises occidentales ne peuvent plus se limiter à leurs marchés historiques (les États-Unis, le Canada ou encore l'Europe de l'Ouest). Ces derniers, affectés par les récentes crises économiques et le manque de croissance, sont aujourd'hui saturés et ne présentent donc plus un potentiel de développement suffisant. À l'inverse, d'autres marchés sont en plein essor. Les pays émergents tels que le Brésil, la Chine ou l'Inde voient leurs classes moyennes se développer considérablement, créant ainsi de nouveaux marchés très attractifs.

Conscientes de ces enjeux, un grand nombre d'entreprises occidentales se sont alors mises à innover pour ces nouveaux marchés. Les fortes contraintes locales, à savoir le besoin de produits non dispendieux répondant à des critères d'autonomie ou de durabilité élevés, et ce, sans compromis en termes de qualité, ont stimulé l'innovation. Les entreprises occidentales ont alors développé des solutions tout à fait originales et de grande valeur pour ces marchés émergents.

Réalisant que les axes de valeur de ces nouveaux produits pourraient également permettre de créer des marchés ou de répondre à de nouveaux besoins dans les économies développées, ces multinationales se sont alors mises à faire de *l'innovation inverse*. Une innovation est dite inverse si elle est d'abord adoptée dans une économie émergente avant d'être ensuite *ramenée* et commercialisée dans une économie développée.

L'innovation inverse étant un phénomène récent, la thèse de doctorat contribue à la compréhension et au positionnement théorique de ce nouveau modèle d'innovation. Sur le plan pratique, ce travail s'efforce d'identifier les facteurs clés du succès d'une telle stratégie. L'accent est mis sur les multinationales occidentales et plus spécifiquement sur le secteur de la santé.

Une revue systématique de la littérature sur l'innovation inverse permet initialement de faire l'état de l'art et d'identifier les axes de recherche les plus pertinents pour améliorer la connaissance globale de ce nouveau phénomène (article 1). Trois des pistes de recherches établies par cette étude sont ensuite adressées dans la thèse (articles 2, 3 et 4).

Une analyse quantitative et de contenu permet tout d'abord de valider que les entreprises du secteur de la santé pratiquent l'innovation inverse ainsi que l'impact de ce phénomène en termes de transferts technologiques (article 2). Une étude de cas permet ensuite d'identifier les challenges rencontrés par les entreprises qui pratiquent l'innovation inverse. Plusieurs mitigateurs

de risques permettant de surmonter ou de prévenir ces challenges sont proposés (article 3). Finalement, un tout premier cadre théorique de l'innovation inverse est construit. Il permet le repositionnement du concept selon la perspective réseau de la multinationale et ouvre ainsi la voie à de nouvelles études empiriques (article 4).

Pour élargir le débat, une discussion générale résume les principaux travaux de la thèse et ouvre la discussion sur le lien entre innovation inverse, innovation sociale et créativité.

Une conclusion identifie finalement les principales contributions ainsi que les limites de la thèse et donne quelques recommandations pour les futures recherches dans ce domaine.

ABSTRACT

Western multinationals can no longer limit themselves to their historic markets (the United States, Canada or Western Europe). Indeed, these markets, affected by the recent economic crises and lack of growth, are today saturated and therefore no longer have sufficient development potential. Conversely, other markets are booming. The middle class of several emerging economies such as Brazil, China, and India are growing considerably, creating very attractive new markets.

Aware of these issues, a large number of Western companies have then begun to innovate for these new markets. Strong local constraints, i.e. the need for low-priced products meeting high standards of autonomy or sustainability without compromising quality, have stimulated innovation. This has led western companies to develop very original and valuable solutions for these emerging markets.

By realizing that the added value of these new products could also create markets or meet new demands in developed economies these multinationals started to do *reverse innovation*. An innovation is called reverse if it is first adopted in an emerging economy before being trickled up in a developed economy.

Since reverse innovation is a recent phenomenon, the doctoral thesis contributes to the theoretical understanding and positioning of this new innovation model. In practical terms, this work aims at identifying the key factors for successful of such a strategy. The focus is on western multinationals and more specifically on the health sector.

A systematic review of the literature on reverse innovation initially provides a state of the art and identifies the most relevant research focus to improve the overall knowledge of this new phenomenon (Article 1). Three of the research axis established by this study are then addressed in the thesis (Articles 2, 3 and 4).

A quantitative and content analysis first allows verifying the practice of reverse innovation in the health sector industry and its impact in terms of technology transfer (Article 2). Then, using a case study, the challenges encountered by firms that practice reverse innovation are identified and risk mitigators are proposed (Article 3). At last, a very first theoretical framework of reverse innovation is built. It allows the repositioning of the concept according to the network

perspective of the multinational and opens the way to new empirical studies (Article 4).

In order to broaden the debate, a general discussion summarizes the main results of the thesis and opens the discussion on the link between reverse innovation, social innovation and creativity.

A conclusion finally identifies the main contributions and limitations of the thesis and gives some recommendations for future research in this field.

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LISTE DES SIGLES ET ABRÉVIATIONS

CTO	Chief Technology Officer
CVP	Customer value Product
GLORAD	Center for Global R&D and Innovation
HQ	Headquarter
NIH	Not Invented Here
OMPI	Organisation mondiale de la propriété intellectuelle
R&D	Recherche et développement / Research and development
RI	Reverse Innovation
SIPO	State Intellecctual Property Office de la République Populaire de Chine
WIPO	World Intellectual Property Organization

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CHAPITRE 1 INTRODUCTION

1.1 Un monde *renversé*

L'innovation n'a pas toujours été un concept à la mode. Consiréré pendant plus de 500 ans comme un mot à connotation péjorative, le terme innovation, principalement réservé au monde de la politique, était instrumentalisé pour susciter la polémique et attaquer l'opposition (Rosanvallon, 2003). Au 18e siècle, l'innovation était définie comme *un changement important que l'on fait dans le gouvernement politique d'un état, contre l'usage et les règles de sa constitution* (Encyclopédie Française, 1774, Volume 30, art. Innovation). Ce n'est qu'au cours du 20e siècle, sous l'impulsion de grands économistes comme Joseph Schumpeter ou Edwin Mansfield, mais aussi de grands sociologues comme Everett Rogers, qu'une toute nouvelle perception du terme se développe. L'innovation n'est alors plus considérée comme hérétique et subversive à l'ordre social, mais plutôt comme une théorie décrivant un processus collectif, intentionnel et séquentiel dans le temps, de changement et de modernisation (Godin, 2015).

L'innovation devient l'innovation technologique, définie dans le Manuel d'Oslo comme:

> *« (…) la mise au point/commercialisation d'un produit plus performant dans le but de fournir au consommateur des services objectivement nouveaux ou améliorés (…) ou la mise au point/adoption de méthodes de production ou de distribution nouvelles ou notablement améliorées. Elle peut faire intervenir des changements affectant – séparément ou simultanément – les matériels, les ressources humaines ou les méthodes de travail. »* (OCDE, 2005, p.9)

Synonyme de croissance économique et donc de prospérité (Pavitt, 1963), l'innovation devient dès la seconde moitié du 20e siècle un véritable mot à la mode (buzzword) (Graphique 1).

Graph 1-1 : Occurrence (en pourcentage) du mot *innovation* dans le corpus de livres publiés en anglais aux États-Unis entre 1600 et 2008. Source : Google Books, Ngram Viewer https://books.google.com/ngrams).

Il est aujourd'hui généralement accepté que l'innovation joue un rôle primordial quant à la performance des économies et des leurs entreprises (OCDE & Eurostat, 2005). Les nations qui innovent en exploitant et en gérant efficacement leur capital de connaissances sont celles qui affichent les meilleures performances. Les entreprises les plus innovantes obtiennent systématiquement de meilleurs résultats.

Ces entreprises innovantes "championnes de l'innovation" ont, pendant longtemps, eu comme seule origine les marchés de la triade, à savoir les États-Unis, l'Europe et le Japon. Considérées comme les nations où le niveau technologique y était le plus élevé, leurs entreprises représentaient les plus grandes sources d'innovations produits - destinés aux consommateurs à revenu élevé - et d'innovation de processus permettant la substitution du capital à la main d'œuvre (Vernon, 1966, 1979).

Afin d'améliorer encore leur niveau de compétitivité, ces entreprises se sont alors multinationalisées (Bartlett & Ghoshal, 1988). À des fins de diminution des coûts, elles ont dans un premier temps délocalisé les activités non axées sur la connaissance telle que la production (Kogut, 1985). Puis, plus récemment, elles se sont mises à délocaliser leurs activités de recherche et développement (R&D) (Kuemmerle, 1997), non pas dans le but unique de réduire des coûts cette fois, mais avec l'intention d'avoir accès à de nouvelles ressources et ainsi augmenter leurs capacités d'innovation (Cantwell & Mudambi, 2005; Lewin, Massini, & Peeters, 2009).

Principalement opérationnalisée via le développement de filiales ou de partenariats à l'étranger, cette stratégie de délocalisation de la recherche et du développement (R&D) est longtemps restée exclusive aux pays développés (Nations Unies, 2005).

Les récentes crises économiques ont cependant quelque peu changé l'ordre établi. Affectés par un manque important de croissance, les marchés développés sont aujourd'hui largement saturés (Charue-Duboc & Midler, 2016) et ne présentent donc plus un potentiel de développement suffisant pour ces grandes entreprises. À l'inverse, d'autres marchés sont en plein essor. Les pays émergents tels que le Brésil, la Chine ou l'Inde voient leurs classes moyennes se développer considérablement, créant ainsi de nouveaux marchés très attractifs. Avec plus de 200 millions de consommateurs potentiels en Chine (classe moyenne chinoise selon le China General Chamber of Commerce, 2016) – et au moins autant en Inde et au Brésil – ces pays représentent aujourd'hui une opportunité incontournable.

Mais conquérir ces nouveaux marchés et les consommateurs qui les composent n'est cependant pas trivial pour les entreprises occidentales. En effet, les consommateurs des pays émergents sont en demande de produits plus *accessibles* (moins dispendieux, plus facile d'utilisation, etc.), mais répondant à des critères spécifiques différents, et ce, sans compromis en termes de qualité (Prahalad & Mashelkar, 2010). On reconnaît aujourd'hui principalement cinq contraintes majeures qui caractérisent – et différencient – ces marchés émergents et leurs consommateurs (Govindarajan & Ramamurti, 2011): (1) l'exigence de produits moins chers au moins aussi performants, (2) un manque important d'infrastructures, (3) des exigences sévères en termes de durabilité des innovations dans un contexte de forte conscientisation de l'importance de la préservation de l'environnement, (4) des réglementations différentes et finalement (5) des usages ou des préférences culturelles parfois très distinctes. La stratégie, adoptée par certaines entreprises occidentales, qui consistait à transférer des produits en fin de cycle de vie ou dégradés sur ces marchés (pour répondre à une forte contrainte de prix par exemple), s'est donc avérée être inadequate. En d'autres mots:

> *« Developing world customers cannot simply be differentiated from rich world customers because they have less money. They also have unique needs. To win in emerging markets, you have to understand those needs, and innovate to meet them. »* (Trimble, 2012)

Le cas de Logitech, raconté par Trimble (2012) dans un article du Ivey Business Journal et décrivant l'échec de l'entreprise lors de sa première tentative de pénétration du marché des souris d'ordinateur en Chine, illustre bien cet enjeu. Partant du postulat selon lequel les consommateurs sont en général de plus en plus semblables dans le monde, les responsables de l'entreprise ont immédiatement assumé que les clients chinois n'achetaient pas encore de souris Logitech en raison du prix trop élevé de ces produits. La multinationale suisse a alors décidé de mettre en marché des souris moins performantes en attendant une augmentation naturelle des revenus de la classe moyenne émergente. Rapoo, le concurrent chinois de Logitech, a cependant perçu un élément essentiel que l'entreprise occidentale n'avait pas considéré: les Chinois utilisent leur souris différemment. En effet, la télévision par satellite ou par câble étant trop coûteuse pour des millions de consommateurs, ces derniers utilisent l'ordinateur comme relais internet afin de regarder des vidéos ou de jouer à des jeux sur leur téléviseur. Dans un tel contexte, la souris n'est pas seulement une souris, mais aussi une télécommande et il est donc primordial d'augmenter au maximum sa portée. Plutôt que d'imiter son concurrent et de proposer un produit moins performant pour diminuer le prix de vente sur le marché, Rapoo a privilégié une solution technologique supérieure tout en travaillant à la suppression d'autres options non essentielles (en termes esthétiques par exemple). L'entreprise a ainsi pu répondre au besoin spécifique des consommateurs chinois tout en s'assurant que le produit était vendu à un prix abordable. Cette stratégie a permis à Rapoo d'acquérir une grande partie des parts de marché et de mettre à mal le géant suisse sur le territoire chinois.

De plus en plus conscientes de ces enjeux, nombreuses sont les multinationales occidentales qui ont alors ouvert des centres de R&D au sein des marchés émergents. Ainsi, et même si leur taille peut grandement varier, il existait déjà plus de 1500 centres de R&D étrangers en Chine en 2012 (contre seulement 50 en 2000), faisant de ce pays la deuxième destination en termes de R&D étrangère en 2015, derrière les États-Unis (Haour & von Zedtwitz, 2016). Cette stratégie de délocalisation de la R&D présente un triple avantage pour les entreprises occidentales. Elle permet à ces dernières de (1) bénéficier d'une meilleure proximité avec le marché à conquérir, et donc d'une meilleure compréhension de ce marché et de ses contraintes, ainsi que des besoins de ses consommateurs; (2) avoir un accès direct aux talents locaux; (3) avoir la possibilité de collaborer avec des entreprises locales ayant une meilleure compréhension globale du marché.

Le déplacement, par les entreprises occidentales, de leur force d'innovation dans les pays

émergents se reflète déjà sur les indicateurs de développement : en 2014, et pour la première fois de l'histoire contemporaine, les entreprises investissent davantage dans les nouveaux marchés émergents ou en développement que dans les économies traditionnelles de l'innovation, à savoir les États-Unis, l'Europe et le Japon (UNCTAD, 2015). Également pour la première fois de l'histoire contemporaine, la Chine est, depuis 2011, le pays dans lequel le plus grand nombre de brevets est déposé annuellement (WIPO, 2013).

1.2 La naissance de l'innovation inverse

Le fait que les pays émergents soient aujourd'hui considérés par de nombreuses entreprises occidentales comme les nouveaux incubateurs de l'innovation représente un changement de paradigme important. En 2010, un numéro spécial du journal The Economist, sur l'innovation dans les pays émergents, intitulé « The world turned upside down », prédisait déjà que ce changement de paradigme aurait des conséquences majeures pour les marchés locaux, mais aussi et surtout pour le reste du monde (The Economist, 2010). L'innovation inverse est une de ces conséquences.

Tirant parti de leur présence et de leur force de R&D sur le terrain, les entreprises occidentales ont eu l'opportunité d'innover dans un contexte original, dans un cadre de référence différent de celui auquel elles étaient habituées. En prise avec les réalités locales de ces nouveaux marchés, à savoir les contraintes de prix, d'infrastructure, de durabilité, de réglementation ou encore les préférences culturelles des consommateurs, elles ont été poussées hors de leur zone de confort en termes de paradigmes d'innovation et sont ainsi parvenues à proposer des innovations de rupture, des produits de grande valeur, qu'elles auraient difficilement pu développer dans un contexte occidental (Markides, 2012).

C'est ainsi que ces entreprises ont alors, dans un deuxième temps, commencé à faire ce que l'on appelle aujourd'hui de l'innovation inverse. Une innovation est dite inverse si elle est d'abord adoptée dans une économie émergente avant d'être ensuite *ramenée* et commercialisée dans une

économie avancée (Govindarajan & Trimble, 2012b) [1]. Ce concept, initialement introduit en 2009 par Immelt, Govindarajan & Trimble dans un article de la Harvard Business Review, a largement gagné en popularité depuis.

L'innovation inverse est à la fois une ancienne et une nouvelle idée (Burger-Helmchen, Cohendet, & Nebojsa, 2013). Certains ont comparé la pratique de l'innovation inverse à ce qu'avaient vécu le Japon et la Corée du Sud après la Seconde Guerre mondiale, dans la mesure où ces derniers étaient à l'époque des marchés émergents rapidement devenus des leaders en matière d'innovation. À cet argument, les pères du concept répondent que l'écart des revenus entre les États-Unis et ces pays était bien moins important que celui qu'il existe aujourd'hui entre la Chine ou l'Inde et les États-Unis (Govindarajan & Ramamurti, 2011). D'autres ont clamé que certains concepts d'innovation, antérieurs à l'innovation inverse, recoupaient ce dernier de façon plus ou moins importante (Zeschky, Winterhalter, & Gassmann, 2014). Malgré ces chevauchements, l'innovation inverse apporte pourtant des dimensions nouvelles dont les plus notables sont (1) l'inclusion de la dimension *marchés émergents* dans le transfert des innovations et plus particulièrement le fait que ce transfert s'effectue du *Sud vers le Nord*, (2) la dimension de rupture, c'est à dire le fait que ces innovations ne soient pas nécessairement des innovations frugales ou des innovations moins performantes (à cause d'une contrainte de prix par exemple), mais plutôt des innovations originales (parfois même de rupture) ayant émergé dans un contexte nouveau, emprunt de contraintes également nouvelles.

Parmi tous les secteurs industriels, il semblerait que l'industrie de la santé soit particulièrement propice à la pratique de l'innovation inverse (Crisp, 2014). L'exemple le plus célèbre est l'électrocardiographe développé par General Electric pour les zones rurales en Inde. Ayant comme contraintes le prix, l'autonomie, la transportabilité et la simplicité d'utilisation, les équipes de R&D locales ont mis au point un électrocardiographe transportable, facile d'utilisation et fonctionnant avec des batteries, mais surtout 20 fois moins cher que celui proposé en occident. Cette innovation équipe aujourd'hui la majorité des ambulances et des salles d'urgence aux États-

[1] Il est important de préciser que, selon la conception de l'innovation inverse de ces auteurs, une entreprise issue d'un marché émergent peut également faire de l'innovation inverse. La thèse de doctorat se concentre cependant sur le cas des entreprises occidentales.

Unis. Un autre exemple moins connu d'innovation inverse est celui d'un nouvel équipement médical conçu par une équipe canadienne au Botswana pour faciliter le diagnostic rapide des maladies diarrhéiques, notamment chez les enfants, où ces dernières sont particulièrement meurtrières. Cet équipement medical est aujourd'hui également largement utilisé au Canada[2].

1.3 Objectif général et contribution de la thèse

Bien que la littérature sur l'innovation inverse soit grandissante, la majorité des études se limite encore à l'identification d'exemples à succès de cette nouvelle stratégie. Le phénomène étant encore nouveau, très peu de travaux ont été menés afin d'étudier l'innovation inverse plus en profondeur. Touchant directement aux toutes nouvelles stratégies d'innovation à l'international mises en place par les entreprises pour assurer leur compétitivité de demain, l'étude de l'innovation inverse reste en effet difficile. Encore dans une phase d'imitation et d'essai-erreurs, beaucoup d'entreprises sont assez peu enclines à partager leurs expériences d'innovation inverse et l'accès aux données ainsi que la publication des résultats restent laborieux.

La thèse de doctorat proposée contribue à l'avancement des connaissances dans ce domaine en se concentrant principalement sur la pratique de ce nouveau modèle d'innovation à l'international par les multinationales occidentales. Principalement axée sur le secteur de la santé, la thèse est composée de cinq grandes parties. Dans la section suivante, une revue systématique de la littérature sur l'innovation inverse permet de faire l'état de l'art de cette nouvelle stratégie d'innovation et de mesurer sa portée tant au niveau académique que pratique **(article 1)**. Cet exercice, qui constitue le premier article de la thèse, suggère six axes de recherche principaux à développer pour contribuer à l'avancement des connaissances sur l'innovation inverse.

La section 3 présente la démarche de l'ensemble du travail ainsi que l'organisation de la recherche. Plus spécifiquement la question et les objectifs de recherche sont définis puis les différentes méthodologies utilisées dans la thèse sont présentées.

Les sections 4, 5 et 6 de la thèse abordent ensuite respectivement trois des six axes de recherche

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[2] Page consultée le 15 février 2017 : http://www.cbc.ca/news/technology/reverse-innovation-brings-technology-from-developing-nations-to-canada-1.3065052

suggérés dans la revue systématique de la littérature. Chaque section correspond à un article scientifique.

La section 4 **(article 2)** est une étude mixte (quantitative et qualitative) permettant de vérifier le récent positionnement des pays émergents comme nouveaux centres de l'innovation ainsi que la pratique de l'innovation inverse et son impact sur les transferts technologiques dans le secteur de la santé.

L'étude du cas de la multinationale Essilor est ensuite proposée dans la section 5 **(article 3)**. Ce travail, à travers l'analyse de quatre cas d'innovations inverses, permet l'identification de 10 challenges rencontrés par l'entreprise au cours de ses projets d'innovation inverse. Les solutions mises en œuvre par Essilor pour surmonter ces obstacles sont également décrites.

La section 6 de la thèse s'attèle à construire un cadre théorique pour l'innovation inverse **(article 4)**. Cette étude place l'innovation inverse dans la perspective de la firme multinationale et plus particulièrement du réseau qui la constitue. Ce travail, qui force la décomposition de l'innovation inverse en deux étapes subséquentes et indissociables, fait émerger huit propositions quant à l'impact (1) des flux de connaissance (2) de la distribution du pouvoir et (3) de la configuration des ressources à l'intérieur de la firme, sur le potentiel succès de cette stratégie.

Finalement la section 7 est une discussion générale divisée en deux parties. La première résume les principaux résultats de la thèse et la seconde ouvre la discussion sur le lien entre innovation inverse, innovation sociale, innovation radicale et créativité.

La section 8 conclut l'ensemble du travail effectué dans le cadre de la thèse de doctorat. Les principales contributions et limites de la recherche y sont exposées et quelques recommandations quant aux axes de réflexions qui pourraient permettre de continuer à enrichir ce domaine de recherche sont suggérées.

Dans son ensemble, ce doctorat contribue à la théorisation de l'innovation inverse, mais également à l'amélioration de sa pratique.

CHAPITRE 2 ARTICLE 1: REVERSE INNOVATION: A SYSTEMATIC LITERATURE REVIEW

"Reverse innovation is a phenomenon with familiar features as well as new features" - (Govindarajan & Ramamurti, 2009)

Auteurs: Marine Hadengue, Nathalie de Marcellis-Warin et Thierry Warin

2.1 Présentation de l'article

La revue de littérature de la thèse constitue le premier article de celle-ci. L'innovation inverse étant un phénomène nouveau, aucune revue systématique n'avait été publiée auparavant. Il s'agit donc de la première étude faisant l'état de l'art de ce phénomène.

Il est tout d'abord montré que l'idée derrière le concept n'est pas entièrement nouvelle. Puis, à travers l'analyse des documents collectés, cette revue systématique fait un état des lieux de la théorie (définition, typologie, terminologie), de la pratique (contexte organisationnel et environnemental) mais aussi des externalités d'une telle stratégie d'innovation (risques et implications économique et sociale). Finalement, un cadre conceptuel ainsi que plusieurs suggestions pour de futures recherches sur l'innovation inverse sont proposés.

L'article originalement intitulé *Reverse Innovation: A Systematic Literature Review* et coécrit avec Nathalie de Marcellis-Warin et Thierry Warin a été accepté pour publication dans la revue International Journal of Emerging Markets en mai 2016[3].

[3] Hadengue, M., de Marcellis-Warin, N., and Warin, T. (2017). Reverse innovation: A systematic literature review. *International Journal of Emerging Markets*, Vol. 12, No. 2, pp. 142–182.

Abstract

Interest in reverse innovation (RI) is increasing. According to our review, more than 350 reliable sources (scientific publications, academic books and working papers) examine or at least discuss the concept. As RI gains popularity among academic authors, some discrepancies have started to appear. This wealth of publications could impact prior advancements related to understanding of the phenomenon. The purpose of this article is to decrease fragmentation and focus on identifying and understanding RI.

A systematic review of RI was conducted. The review conformed to a rigorous set of core principles: it was systematic (organized according to a method designed to address the review questions), transparent (explicitly stated), reproducible and updatable, and synthesized (summarized the evidence relating to the review question).

This systematic review provides an improved theoretical and practical framework for the concept of RI. In terms of theory, we have demonstrated that the idea behind the concept is not entirely new. A consensus on the definition of RI is not reached in the literature, and descriptions in organizational theory contexts are sometimes misleading. We analyzed all the various definitions provided in the literature. From a practical point of view, we have explained the academic interest in RI in relation to organizational strategy, in particular the context in which strategies are adopted. The concept of RI has significant managerial implications, and we have proposed a conceptual framework to help managers understand and grasp the implications of RI. Finally, we have provided suggestions for future research on RI.

To the best of our knowledge, this is the first exhaustive literature review on RI.

Keywords

Reverse innovation; systematic review; trickle-up innovation; emerging markets; multinational corporations (MNCs); globalization

2.2 Introduction

Innovation has long been a buzzword associated with positive ideas, often representing an improved quality of life. As Schumpeter (1934) described, innovation and creative destruction activities are common methods of overcoming the obstacles induced by the cyclical development of the economy. Intuition suggests that innovators will usually eventually succeed economically, intellectually and socially. For a long time, high-income countries were thought to be the only ones with the right institutions to foster innovation. As Petrick and Juntiwasarakij (2011, p. 24) said, "Conventional wisdom has long held that innovation was the strength of the West and that what gets developed in the West was modified and transferred to 'the Rest'."

But innovation is no longer the prerogative of high-income countries alone (Zeng and Williamson, 2007). Countries such as China and India are now counted among the hotbeds of innovation. In 2012, multinational corporations invested more in emerging markets than in the core economies of the United States, Europe and Japan (UNCTAD, 2015), making large research and development (R&D) investments in low-cost emerging markets such as China and India to access new talent and take advantage of their proximity to target markets (Haour & von Zedtwitz, 2016). Corporations have started to understand the complexity of these new markets and have had to adjust their strategies. Specific products were developed and adapted to local needs and realities in terms of cost constraints, infrastructure, regulatory systems or cultural differences. Soon after, these innovative products flowed back to high-income countries. It was in this context that the concept of reverse innovation (RI) was born.

For the founding fathers of the concept, an innovation is reverse when it is first developed for and adopted in the developing world (or emerging world) before "spreading" to the industrial world (Govindarajan and Ramamurti, 2011; Govindarajan and Trimble, 2012a, 2012b; Immelt, Govindarajan, and Trimble, 2009). Since Immelt, Govindarajan and Trimble first mentioned the concept in their 2009 *Harvard Business Review* article entitled "How GE Is Disrupting Itself," RI has made tremendous gains in popularity. As Burger-Helmchen, Cohendet and Radojevic (2013) predicted, the academic community has largely accepted the conceptualization of RI, and this idea has been promoted through influential channels such as the *Harvard Business Review* and *Bloomberg Businessweek* (Burger-Helmchen et al., 2013).

According to our research, more than 350 reliable sources (academic publications, conference papers, reports, books, working papers and dissertations) examine or at least discuss the concept. However, as RI gains popularity, some subtle differences have appeared that blur the original definition. Sometimes overused, we believe that the oversimplification of the concept could impact prior advancements related to understanding of the phenomenon.

This paper intends to address this issue by systematically reviewing the concept of RI in the existing literature. We will first provide an overview of the contributions to RI research by analyzing all the documents retrieved from our systematic review in order to answer the following review question: how is reverse innovation positioned in the existing literature?

This systematic review provides an improved theoretical and practical framework for the concept of RI. In terms of theory, we have demonstrated that the idea behind the concept is not entirely new, analyzing RI in the context of the various definitions provided in the literature. From a practical point of view, we have explained the academic interest in RI in relation to organizational strategy, in particular the context in which strategies are adopted. Following from this idea, we noted significant managerial implications related to RI and have proposed a conceptual framework to help managers understand and grasp these implications. Finally, we have provided suggestions for future research on RI.

This paper is organized as follows. Section 2 provides some facts on RI. In Section 3, we describe in detail how we conducted our systematic review and the systematic process used in the literature analysis. In Section 4, we analyze the literature content. Section 5 highlights some managerial implications, and Sections 6 and 7 propose an agenda for further research, as well as a conclusion of this study.

2.3 Reverse Innovation: An Old New Idea

In 2009, Immelt, Govindarajan and Trimble first defined RI as a new idea, as opposed to the well-known concept of *glocalization*[4]. However, a global review of the literature reveals that RI is both a new and an old idea; new because it suggests that innovations coming from emerging markets can flow uphill (spread to high-income countries), which has never been formulated before; old because it could also be considered as the natural evolution of already existing concepts.

One of the precursors to conceptualization of the market potential in developing and emerging markets was Prahalad (2004). In 2004, Prahalad highlighted that the over four billion people living on less than $2 per day who make up the bottom of the pyramid market could be recognized as a private sector market. He then suggested that firms had to understand the dynamics of this potential market, as well as the process of innovation therein (Prahalad, 2012) in order to benefit from it. In the case of RI, the requirement is quite similar. Firms, in order to respond to the needs of a developing or emerging market, have to make sure to be fully aware of developing markets needs and constraints (Trimble, 2012).

Building on the *bottom of the pyramid* concept, Prahalad also introduced *Trickle-up innovation*. Trickle-up innovation refers to any innovation developed for the bottom of the pyramid that subsequently trickles up to the high-income countries (Prahalad, 2012). Very similar to RI because it also implies a spread of the innovation to high-income countries, trickle-up innovation, however differs from it. While trickle-up innovation is necessarily destined to meet bottom of the pyramid needs, RI is rather to meet new or different needs proper to developing or emerging markets, regardless of income levels. In other words, RI is driven by constraints specific to developing or emerging markets, which include but are not limited to cost constraints (as for example lack of infrastructure or even cultural differences between developed market customers and developing or emerging market customers).

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[4] Develop great products at home and then distribute them worldwide, with some adaptations to local conditions instead of (in the case of the RI) developing new products more adapted to emerging (or developing) economies' local reality and then distributing them in developed economies (Immelt, Govindarajan, and Trimble, 2009).

Also prior to the birth of the concept of RI, Brown and Hagel (2005) proposed the concept of *blowback innovation* to underline the importance of developed multinational enterprises (DMNEs) not simply adapting their products to emerging market needs but actually rethinking their ways of doing business in those markets. In their article, they explained why it is important for DMNEs to reshape business and management practices in order to gain access to emerging markets and avoid being displaced by emerging countries' own multinational enterprises (EMNEs) (Brown and Hagel, 2005). These ideas are clearly taken up by RI and the fathers of the concept have often recalled that this new innovation strategy was a prerequisite if DMNEs wanted to survive the rise of emerging markets and their local firms[5].

Trying to improve the positionning of the concept in the existing literature, Burger-Helmchen et al. (2013) have described RI as another way to contest the dominant technology-push innovation model put forward by Schumpeter (1911). They have shown how the demand-pull vision (Schmookler, 1966), the concept of lead-users (von Hippel, 1986), the reverse multinational perspective (Kogut and Zander, 1993) and the creative economy (UNCTAD, 2010) were also attempts to conceptualize a form of reverse innovation (Burger-Helmchen et al., 2013). Schmookler's main assumption was that demand played a leading role in determining both the direction and magnitude of inventive activity. RI is influenced by the same idea, as the developing or emerging market's demand pulls innovation.

Finally other authors have positioned RI on a continuum of *disruptive innovation*, first introduced by Bower and Christensen in 1995 (Corsi and Di Minin, 2014). Disruptive innovation is defined as "an innovation that results in worse product performance in mainstream markets" or as a "typically cheaper, simpler, smaller and frequently more convenient to use" version of an existing product (Christensen, 1997; Christensen and Bower, 1995). In 2002, Hart and Christensen linked the concept of disruptive innovation to emerging economies by giving examples of Asian firms that succeeded in creating disruptive innovations in developing countries (Hart and Christensen, 2002). It seems then reasonable to think that some RIs could be disruptive. We develop this aspect later in the article.

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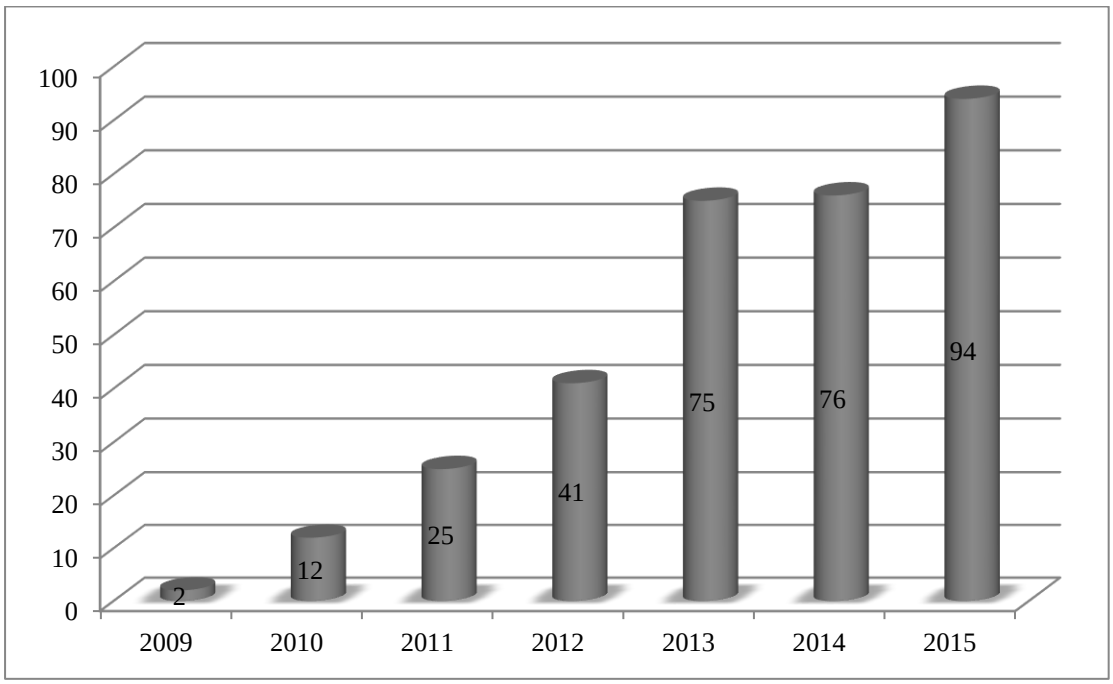
[5] See Govindarajan's TEDx Talk at https://www.youtube.com/watch?v=ztna1lt_LZE.

In sum, although RI seems to cross or be similar to quite a few well-known concepts, it is also a unique concept, especially because it implies innovation for developing or emerging markets. Also, and unlike other similar developing markets innovation concepts, RIs are not necessarily innovations destined to very low-income consumers or innovations of lower quality but rather innovations arising from new contexts. These differences could explain why, since its inception in 2009, RI has tremendously gained in popularity and has been studied all over the world[6].



Graph 2-1 : Evolution of the number of documents addressing or mentioning RI over the last seven years. Note: We chose not to represent the number of documents addressing RI in 2016 (six documents up to March 1) as we believe this number cannot be used to forecast the total number of RI papers in 2016.

[6] The concept of RI was born at Dartmouth College in Hanover, United States.

Figure 2-1: Worldwide places (with a focus on Europe and the United States) where researchers have shown interest in RI. Localization is defined as the location of the university with which the first author of RI documents is affiliated (documents A and B according to our classification, see Appendix)

2.4 Systematic Review: Methodology

To address our questions about RI, we chose to conduct a systematic review using a structured approach to review published and unpublished academic research. This method had the advantage of being extremely specific about the scope of the research and the steps followed to select the articles.

A systematic literature review is neither a formal full-length literature review nor a meta-analysis, as it conforms to a rigorous set of core principles. It has to be systematic (organized according to a method designed to address the review questions), transparent (explicitly stated), reproducible and updatable, and synthesized (summarizes the evidence relating to the review question) (Briner and Denyer, 2012). In other words, it is an essential tool for an evidence-based practice (Briner and Denyer, 2012) that differs from traditional narrative reviews by adopting a replicable, scientific and transparent process (Tranfield, Denyer, and Smart, 2003). Our systematic review followed four major steps: search engine identification, keyword identification for searches in English and French, sorting of papers, and content analysis of papers.

As the concept of RI is relatively new, we did not want to start by restricting our research to specific academic journals. It was important to include all journals in all fields of research to make sure we captured every mention of the concept. For this reason, we started our document collection in academic databases. We selected a large number of databases and repeated our research procedure until we obtained data redundancy. We used popular multidisciplinary databases as well as social and human sciences, engineering, economics and finance databases. The choice of databases was based on their quality and inclusiveness of all relevant outlets for RI research. The coverage was comprehensive, and eight databases were sufficient to cover the field and obtain redundancy in our search results. As RI is a relatively new concept, we wanted to make sure we also captured working papers. Therefore, we also used reliable databases gathering working papers that were not yet published, such as Ideas RePEc and the Social Science Research Network (SSRN). All the databases used are indicated in the following table.

In each database, we searched for “reverse innovation” in all fields (subject, title, abstract, keywords, full text, etc.), for all years. In the French database, we searched for “innovation

inverse"[7]. Although the concept of RI was first introduced as such in 2009, we also checked prior years. Overall, our dataset included the following types of academic works up to March 1, 2016: journal articles, conference articles, conference proceedings, monographs, monograph chapters, monograph reviews, report chapters, report reviews, editorial material, theses, and working papers. The following table gives an overview of the raw data extracted from each database including duplicates, as documents could be retrieved from more than one database.

Table 2-1: Selected databases and results obtained

Databases	**Field**	**Coverage**	**Consultation Date**	**Number of Results**
Cairn.info	Social and Human Sciences	*Over 439 journals (including French journals).*	**March 1st, 2016**	11
Engineering Village: Compendex + INSPEC	Engineering	*Compendex: Over 3,639 journals.* *INSPEC: Over 5,000 journals, plus books, reports, and 2,500 conference proceedings.*		31
Ideas RePEc	Economics and Finance	*Over 2,300 journals and 4,300 working paper.*		11
ProQuest	Multidisciplinary (Research criteria: conference papers+reports+academic publications+working papers+book+masters&thesis)	*90,000 authoritative sources, 6 billion digital pages over six centuries.*		201
ScienceDirect	Multidisciplinary	*Over 13 million publications from nearly 2,500 journals and more than 33,000 books.*		94
SSRN	Social Sciences	*Over 656,400 scholarly working papers and forthcoming papers.*		24
Web of Science	Multidisciplinary	*59 million records and backfiles dating back to 1898.*		55
Wiley Online Library	Multidisciplinary	*Over 1500 journals and 18,000 online books.*		74
TOTAL (duplicates included)				**501**

[7] There is an emerging literature on reverse innovation in France. The authors took advantage of their knowledge of French to look for papers in French. Two important studies were found (see Appendix).

We sorted the results in three successive steps: elimination of duplicates and irrelevant documents[8], verification[9] and elimination of documents mentioning reverse innovation before 2009 and classification of the remaining documents into four distinct categories (A–main subject, B–secondary subject, C–anecdotal reference, D–others). The final sample was composed of 376 pieces to review.

Table 2-2: The four document categories

Category name	**Short designation**	**Attributes**	**Number of documents identified**
Main subject	A	RI is the main topic of the document.	56
Secondary subject	B	RI is not the main topic, but the concept is broadly mentioned and directly related to the topic studied in the document.	29
Anecdotal reference	C	- RI is only mentioned (often as a future research avenue). - Papers addressing RI are listed in the references list at the end of the document.	249
Others	D	- RI is mentioned but not in the sense of the original concept defined by Immelt, Govindarajan, and Trimble in 2009. - Documents are editor's notes, book reviews or no more available.	43
TOTAL			**377**

Although a diverse number of academic journals have published on RI, most of them are specialized in management. RI in health has been particularly researched, as a journal called *Globalization and Health* published a set of articles on the concept and its implications for global health systems.

[8] Editorial, Index, Contents, Review Briefs and documents for which the author was anonymous.

[9] Reverse innovation was always mentioned in another sense than that defined by Immelt, Govindarajan, and Trimble (2009) or was only retrieved in error (for example, in a sentence such as: "[…] reverse. Innovation […]"), leading to the rejection of 12 documents.

2.5 Literature Review Findings: Mapping Reverse Innovation

As Figueiró and Raufflet (2015) argued in their systematic review, building an analytical framework is appropriate to organize the findings of the literature review. To build this framework, we analyzed the 85 articles from the A and B categories (see Appendix) and extracted the key terms associated with RI in each based on a semantic analysis. The following table summarizes this framework. The next section provides an extensive overview of the global literature on RI, examining each item. We first described the style of the documents retrieved, then expanded our analysis to highlight the main challenges related to RI in its current form. Finally, we provided a conceptual map gathering all the theories and concepts associated with RI and their occurrence in the literature.

Table 2-3: Analytical framework organizing the findings of the RI literature review

Types of papers	Conceptual	*Provides a framework for RI.*
	Practical	*Describes the phenomenon usually by using case studies or anecdotes.*
	Conceptual and practical	*Involves both of the above.*
Challenges related to RI theory	Definition of the concept	*Describes the different definitions of RI in the literature.*
	Terminology	*Provides the conceptualization of RI in the fields of organizational theories and innovation theories.*
	Typology	*Provides the different types of RI defined by the literature.*
Challenges related to RI practice	Organizational/ strategy attributes	*Provides factors and strategy associated with RI in the literature.*
	Context and environmental factors	*Describes context and environmental factors commonly associated with RI in the literature.*
RI externalities	Risks and issues	*Provides risks and issues associated with RI in the literature.*
	Economic implications	*Provides economic changes implied by RI practice.*
	Social implications	*Provides social changes implied by RI practice.*

2.5.1 Types of papers

As RI is a relatively new concept, both theoretical and practical documents on the subject were mostly descriptive (about 75% of all the papers), while the other 25% were prescriptive. About 50% of the papers were conceptual and the other 50% were a mix of practical papers such as case studies (only five), both conceptual and practical studies (often more theoretical, with an examination of concrete RI examples) and other studies (for example, interviews conducted by academics).

2.5.2 Challenges related to RI theory

The articles analyzed here (document types A and B) revealed three main challenges related to the definition and the positioning of the RI concept in the literature.

2.5.2.1 Challenge 1: RI definition

The first challenge concerns the definition of RI, since all authors do not use the same one. In the first paper mentioning the concept, Immelt, Govindarajan and Trimble (2009) defined it as the opposite of glocalization, using the example of the multinational company General Electric. Later in the text, they described RI as the defensive action of coming up with innovations in poor countries and taking them global before competitors from the south (Immelt et al., 2009). This definition implied two major RI attributes: (1) RI implies product development in poor countries, and (2) RI is a defensive strategy used more frequently by DMNEs. However, subsequent papers from the authors have nuanced these assumptions. Govindarajan and Ramamurti (2011, p. 193) later defined RI as any innovation adopted—though not necessarily developed—in a poor country before being adopted in rich countries: “Our focus in this article is on where an innovation is first adopted, not where it is developed” (Govindarajan and Ramamurti, 2011). Trimble (2012, p. 2) confirmed this perspective in his 2012 paper: “What makes an innovation a RI has nothing to do with where the innovators are, and it has nothing to do with where the companies are. It has only to do with where the customers are.” Govindarajan and Trimble (2012b, p. 4) reiterated this view in their book, saying that “a RI is any innovation that is adopted first in the developing world […] and flow[s] uphill.”

Despite efforts to adjust the definition, no consensus has been reached in the literature. Although half of the authors defined RI according to the original definition, the other half modified the

definition with additional attributes or even changed the original definition to apply the concept within a different scope. The following table gives an overview of the various definitions found in the literature.

Table 2-4: The various definitions associated with the concept of RI in the literature

RI definitions	Authors using the definition	Typical examples extracted from papers
Original definition	Dakshinamoorthy and Gordon (2010); Hang, Chen, and Subramian (2010); Talaga (2010); Spiridon and Clipa (2010); Govindarajan and Ramamurti (2011); Leavy (2011); Bottles (2012); Dubiel and Ernst (2012); Govindarajan and Trimble (2012a, 2012b); Trimble (2012); Bhatti & Ventresca (2013); Hossain (2013); Jha and Krishnan (2013); Nathan and Sarkar (2013); Radojevic (2013); Borini, Costa, Bezerra, and De Miranda Oliveira (2014); Corsi, Di Minin, and Piccaluga (2014); Zeschky, Winterhalter, and Gassmann (2014); Agnihorti (2015); Corsi, Di Minin, & Piccaluga (2015); Hadengue, De Marcellis-Warin, & Warin, 2015; Radojevic (2015); Simula Hossain, and Halme (2015).	*"(…) any innovation that is adopted first in the developing world (…) and flow uphill.*" *"Innovations adopted first in poor (developing) countries before being adopted in advanced economies."* *"What makes an innovation a RI has nothing to do with where the innovators are, and it has nothing to do with where the companies are. It has only to do with where the customers are."*
Theoretically grounded definition	Burger-Helmchen et al. (2013).	*"(…) innovation qui se diffuse selon un processus inverse à celui énoncé par la théorie traditionnelle du cycle international de vie des produits (International Product Life Cycle), formulée à l'origine par Vernon (1966)."*
New Product Development definition	Brem & Wolfram (2014)	*"RI represents the development of new products in and for emerging countries by DMFs or EMF which will be introduced equally in developed markets if the demand in developed markets is identified."*
Refined definition	von Zedtwitz, Corsi, Soberg, and Frega (2015).	*"(…) any type of global innovation that, at some stage during the innovation process, is characterized by a reversal of the flow of innovation from a developing country to an advanced country, and that is eventually introduced to an advanced country's market."*
Reconceptualised definition	Radojevic (2015)	*"Reconceptualised RI is a template employable by any enterprise that responses to the shift in stimuli by switching its primary innovation effort to a foreign market or market segment emerging to the enterprise in question as the new primary one."*
Definition with a notion of adaptation	Timane (2012); Adriaens, De Lange, and Zielinski (2013); Esko, Zeromskis, and Hsuan (2013); Judge et al. (2015); Ostraszewska and Tylec (2015).	*"(…) where products are first designed for poor countries and then adapted for wealthier countries (…)."*

Table 2-4: The various definitions associated with the concept of RI in the literature (cont'd and end)

Definition with a notion of development location	Laperche, Lefebvre, and Langlet (2011); Petrick and Juntiwasarakij (2011); Laperche and Lefebvre (2012); Timane (2012); Huet, de Pompignan, Noé, and Oster (2013); Leavy, 2014; Corsi and Di Minin (2014); Zeschky, Widenmayer, and Gassmann (2014); Bhadauria (2014); Ostraszewska and Tylec (2015); Xu & Xu (2016).	*"(…) being developed in emerging countries and subsequently taken to developed countries (…)."* *"(…) created locally in Less Developed Countries, tested in local markets, and, if successful, then upgraded for sale and delivery in the developed world."*
Definition with a notion of timing	Agarwal and Brem (2012); Brem and Ivens (2013).	*"(…) market-oriented products (developed) in emerging economies through globalized innovation teams, which are meant to be sold worldwide from the beginning."*
Definition with a notion of step	Furue and Washida (2014).	*"RI entails at least three stages. The first is adopting an innovation in one emerging market, such as China or India. The second is the transferring of this innovation to the other emerging markets. The third and final step is transferring it selectively to developed-country markets."*
Definition with a notion of customer type	Kamp (2012).	*"(…) where new products from emerging economies can be trickled up to satisfy the needs of more demanding customers, be they from emerging countries as well as from developed companies."*
Definition with a notion of probability	Yelkikalan & Aydin (2015).	*"(…) a term referring to an innovation which is likely to be adopted first in the developing world."*
Definition adopted by Global Health	DePasse and Lee (2013); Harris, Weisberger, Silver, & Macinko (2015); Snowdon et al. (2015).	*"(…) the process of first identifying and/or fostering a successful innovation in a low-income country that addresses an unmet need in a high-income country, then adapting and spreading the innovation from the low-income country to the high-income country."*
Reverse knowledge transfer definition	Borini, de Miranda Oliveira, Silveira, and de Oliveira Concer (2012); Li, Zhang, and Lyles (2013); Schmid, Dzedek, and Lehrer (2014); Bezerra, Costa, Borini, & de Miranda Oliveira Junior (2013).	*"(…) innovations designed in subsidiaries and ideally absorbed by the parent company."*
No clear definition	Crainer (2010); Syed et al. (2012); Armanios and Li (2013); Crisp (2014); Costa, Bruno, Vasconcellos, & Da Silveira (2015) among others	-

No matter how RI is defined, it is generally acknowledged as a strategy that can be implemented by DMNEs and EMNEs, as well as by small and medium enterprises (SMEs) (papers discussing RI in SMEs include Burger-Helmchen et al., 2013; Corsi, Di Minin, and Piccaluga, 2014).

2.5.2.2 Challenge 2: RI terminology

RI and other innovation concepts overlap. Some scholars have tried to clarify this intertwining, but a common agreement in the literature has not yet been achieved. The second challenge was then related to RI's positioning in relation to other innovation concepts that already exist in the literature.

As previously mentioned, RI has sometimes been associated with Prahalad's idea of trickle-up innovation (see Ostraszewska and Tylec, 2015; Zeschky, Winterhalter, and Gassmann, 2014). Many other distinct innovation concepts are evolving in relation to RI. The most important of these may be *frugal innovation*. Burger-Helmchen et al. (2013) defined frugal innovation as sharing many similar features with RI (innovation developed for emerging markets, low price, etc.), except that frugal innovations do not necessarily have to spread to high-income countries (Burger-Helmchen et al., 2013). Huet et al. (2013) stipulated that RI goes further than frugal innovation by presupposing a feedback loop from emerging countries to high-income countries. In order to differentiate these concepts, a recent and thorough work by Zeschky, Winterhalter and Gassmann (2014) defined RI as frugal innovation (also cost or good-enough innovations) that is "transferred from the emerging-market environment to the developed-country markets." Other concepts, including catalytic, grassroots, indigenous, good enough, value, Gandhian, Jugaad, resource constrained, bottom of the pyramid, cost or Shanzhai innovation are sometimes mixed together with RI. Table 5 presents the different innovation concepts and the papers connecting them to RI in one way or another, sometimes even in opposition.

Building on the work of Zeschky, Winterhalter and Gassmann (2014), Ostraszewska and Tylec (2015) and von Zedtwitz et al. (2015), we attempted to create a conceptual framework to de-construct all these concepts (see the following figure). Most of them seem to be first steps prior to a potential reversal of the innovation. More precisely, RI occurs when these innovations trickle up to a developed market. To distinguish between all these innovation concepts and based on Mashelkar's presentation (2015), we have described each of them according to five particularities that are often associated with innovations for or from emerging markets: quality, affordability,

accessibility, scalability and sustainability (QAASS). Bold letters in the acronym indicate that these characteristics actually represent critical factors in the innovation definition.

Figure 2-2: Innovation types that could be reverse. Hierarchy of innovation theories and classification according to Mashelkar (2015). Own elaboration based on Zeschky, Winterhalter and Gassmann (2014) and Ostraszewsk and Tylec (2015) and von Zedtwitz et al. (2015). Note: for Shanzhai innovation, the quality has to be lower.

Table 2-5: Various innovation concepts associated with RI in the literature and the papers mentioning them

INNOVATION CONCEPTS (INNOVATION IN/FOR DEVELOPING/EMERGING MARKET CONTEXT)	PAPERS LINKING RI AND THESE CONCEPTS
FRUGAL INNOVATION (Marco Zeschky, Widenmayer, & Gassmann, 2011)	Kamp (2012); Adriaens et al., 2013; Agarwal and Brem, 2012; Brem and Ivens, 2013; Burger-Helmchen et al., 2013; Crisp, 2014; Hossain, 2013; Huet et al., 2013; Jha and Krishnan, 2013; Ostraszewska and Tylec, 2015; Petrick and Juntiwasarakij, 2011; Radojevic, 2013; Simula, Hossain, and Halme, 2015; Zeschky, Winterhalter, and Gassmann, 2014; Zeschky et al., 2014; Agnihotri (2015); Corsi, Di Minin, & Piccaluga, (2015); Hossain, Simula, & Halme (2015)
GRASSROOTS INNOVATION (Gupta, 2008)	Brem & Wolfram (2014)
CATALYTIC INNOVATION (Christensen, Baumann, & Sadtler, 2006)	Brem & Wolfram (2014)
INDIGENOUS INNOVATION (Lazonick, 2004; Lu, 2000)	von Zedtwitz, Corsi, Soberg, & Frega, 2015
GOOD ENOUGH INNOVATION (Christensen, 1997)	Govindarajan and Ramamurti, 2011; Simula et al., 2015; Zeschky et al., 2014
VALUE INNOVATION (Kim & Mauborgne, 2005)	Agnihotri, 2015
GANDHIAN INNOVATION (Prahalad & Mashelkar, 2010)	Brem and Ivens, 2013; Crisp, 2014; Dubiel and Ernst, 2012; Hossain, 2013; Huet et al., 2013; Jha and Krishnan, 2013; Leavy, 2014; Ostraszewska and Tylec, 2015; von Zedtwitz et al., 2015; Zeschky et al., 2014; Agnihotri (2015)
JUGAAD INNOVATION (Radjou, Prabhu, & Ahuja, 2012)	
RESSOURCE CONSTRAINED INNOVATION (Ray & Ray, 2011)	Petrick and Juntiwasarakij, 2011; von Zedtwitz et al., 2015; Zeschky et al., 2014
BOTTOM OF THE PYRAMID INNOVATION (London & Hart, 2004; Prahalad, 2004)	Corsi and Di Minin, 2014; Dakshinamoorthy and Gordon, 2010; Esko et al., 2013; Govindarajan and Euchner, 2012; Ostraszewska and Tylec, 2015; Radojevic, 2013; Corsi, Di Minin, & Piccaluga (2015); von Zedtwitz et al., 2015
COST INNOVATION (Zeng & Williamson, 2007)	Adriaens et al., 2013; Corsi and Di Minin, 2014; Ostraszewska and Tylec, 2015; von Zedtwitz, Corsi, Soberg, and Frega, 2015; Zeschky et al., 2014
SHANZHAI INNOVATION (Peng, Xu, & Lin, 2009)	von Zedtwitz et al., 2015

Disruptive innovation in the RI literature is more ambiguous. Some authors have tried to better define the overlap between reverse and disruptive innovation (see Corsi and Di Minin, 2014;

Govindarajan and Euchner, 2012; Hang, Chen, and Subramian, 2010; Immelt et al., 2009; Judge et al., 2015; Ostraszewska and Tylec, 2015; Spiridon and Clipa, 2010; von Zedtwitz et al., 2015). The confusion has likely existed from the beginning, as the title of the first document mentioning RI ("How GE Is Disrupting Itself" [Immelt et al., 2009]) was suggestive. In his interview with Euchner (2012, p. 15), Govindarajan reported that disruptive innovation was only an example of reverse innovation: "You don't have to have disruptive technologies to enable RI." Following from this idea, Corsi and Di Minin's article (2014) is an intriguing work, disentangling both concepts. They introduced the concept of disruptive innovation in reverse for innovations "resting not only on cost advantage […] but also on new characteristics and features of the disruptive product originated and tested in a developing country and appreciated in advanced countries" (Corsi and Di Minin, 2014, p. 78). For them, disruptive innovation theory is a rich tool for interpreting a subset of RIs.

The concepts of *breakthrough innovation* (see Burger-Helmchen et al., 2013) and *open innovation* (see Burger-Helmchen et al., 2013; Corsi and Di Minin, 2014; Hossain, 2013; Talaga, 2010) are also sometimes linked to RI but could not yet be defined as a first step for it. However, it seems reasonable that open innovation involving organizations from both emerging and high-income countries could potentially lead to RI. More studies should pursue this matter further.

The concept of RI has also been associated with various organizational theories. The most common is von Hippel's (1986) lead-users theory (see Burger-Helmchen et al., 2013; Huet et al., 2013; Judge et al., 2015; Nathan and Sarkar, 2013; Radojevic, 2013). The concept of lead-users, which designates technology users as major actors in the innovation (Burger-Helmchen et al., 2013), is linked to the RI concept when the requirements of users in developing countries (cost constraints, particular needs, resource-constrained environment, etc.) drive the innovation (Judge et al., 2015). The concept of demand-pull (Schmookler, 1966), contrary to Schumpeter's technology-push vision (1911), states that innovation is led by existing demands. This concept then characterizes the inversion process embedded in RI (Burger-Helmchen et al., 2013; Huet et al., 2013; Radojevic, 2013). Vernon's international product life cycle (Vernon, 1966) is also mentioned as reversed to describe the RI process (see Burger-Helmchen et al., 2013; Corsi, Di Minin, and Piccaluga, 2015; Kamp, 2012; Radojevic, 2015). Finally, the reverse multinational perspective proposed by Kogut and Zander (1993) may be seen as a precursor to RI (see Burger-Helmchen et al., 2013). Other theories, such as Rogers' (1962) innovation flow and diffusion of

innovation theories, Berwick's (2003) innovation spread theory and others, such as global production networks or value chains, are also useful in understanding the RI concept (see Burger-Helmchen et al., 2013; DePasse and Lee, 2013; Leavy, 2014; Nathan and Sarkar, 2013; von Zedtwitz et al., 2015).

2.5.2.3 Challenge 3: RI typology

The third challenge identified relates to RI typology. Until recently, RI was a linear concept. However, two papers (one published paper and one conference paper) have offered a more multidimensional view of RI.

In a significant work, von Zedtwitz et al. (2015) proposed emphasizing the spatial patterns of innovation by adding two steps to the innovation flow: development-based and ideation-based RI. They categorized innovation flow in four steps: concept location, development location, primary market location and secondary market location. They identified five types of strong RI and five types of weak RI, partially addressing the development location ambiguity raised in the definition challenge [6]. According to their new definition, an innovation does not necessarily need to be first adopted in a developing or emerging market before spreading to the developed world to be qualified as an RI.

Another work is Furue and Washida's (2014) conference paper, which defined two different types of RI according to the intention of the innovation. An RI that a company strategically plans in advance (an enterprise chose and targeted one or more emerging countries in which to establish R&D facilities, expecting innovations to occur and then spread to developed markets) is defined as an inductive reverse innovation (IRI), while an RI that occurs unexpectedly is a coincidental reverse innovation (CRI) (Furue and Washida, 2014). It is interesting to note that this typology does not contradict that developed by von Zedtwitz et al. (2015).

2.5.3 Challenges related to RI practices in organizations

2.5.3.1 Strategies and organizational attributes associated with RI

RI is actually more of a practical way for companies to design and develop innovations than a theoretical concept. Some multinationals have succeeded, but the majority still have significant difficulties to overcome (Winter and Govindarajan, 2015). It is therefore crucial to examine

strategy, organizational factors and risks in organizations practicing RI in order to enrich the field and give these firms the practical tools they need. This section provides an overview of the work that has already been done in that area.

A key strategy for enterprises practicing RI is to implement new business models with new management strategies. For example, R&D internationalization has become an important innovation strategy for multinationals (Almeida and Kogut, 1999; Awate, Larsen, and Mudambi, 2015; Hansen and Løvås, 2004; von Zedtwitz and Gassmann, 2002), but only a few studies have examined this strategy with a specific focus on emerging or high-income countries (see Asakawa and Som, 2008; Gassmann and Han, 2004; Gassmann and Keupp, 2008; Kinkel, Kleine, and Diekmann, 2014; von Zedtwitz, 2004). As offshoring R&D in developing or emerging countries seems to be a DMNE leading strategy for successfully achieving RI (Govindarajan and Euchner, 2012; Govindarajan and Ramamurti, 2011; Govindarajan and Trimble, 2012b), it will definitely make a substantial contribution to this field. Moreover, sources of knowledge are increasingly sought in emerging countries (in particular China and India), and teams immersed in the local reality who understand the market's needs and constraints are an important aspect of RI success.

Directly associated with this idea is the strategy of building local growth teams (LGTs). LGTs are usually located in the targeted country and include local members (Immelt et al., 2009). They represent a full business unit with its own profit and loss responsibility, are focused on long-term performance and have access to the company's global resource base (Govindarajan and Euchner, 2012; Govindarajan and Ramamurti, 2011; Govindarajan and Trimble, 2012b). Some papers have emphasized the importance of LGTs in RI (see Corsi and Di Minin, 2014; Corsi et al., 2014; Govindarajan and Euchner, 2012; Hang et al., 2010; Huet et al., 2013; Immelt et al., 2009). Moreover, scholars agree that intercultural design teams bring diversity and an array of different perspectives, which are valuable assets for RI (Corsi et al., 2014). As underlined by Zeschky et al. (2014) and others (Persaud, 2005; Young and Tavares, 2004), a local, native development team could be necessary to assist companies in adapting to the local environment, absorbing local requirements and thinking out of the box.

Two other dimensions discussed in papers are the clean-slate/zero-based innovation strategy (see Govindarajan and Ramamurti, 2011; Govindarajan and Trimble, 2012a, 2012b; Huet et al., 2013; Immelt et al., 2009) and marketing strategy (see Dubiel and Ernst, 2012; Govindarajan and

Euchner, 2012). It has been argued that the clean-slate/zero-based strategy is the only way to develop an entirely new product that offers a price-performance ratio acceptable for a resource-constrained environment in emerging countries. Selling new products to new markets (especially emerging markets) is a considerable challenge (Dubiel and Ernst, 2012). Co-locating with marketing organizations in order to foster an understanding of local consumer problems and then facilitating marketing of the solution is sometimes mentioned as preferable (Govindarajan and Euchner, 2012).

An important side effect of RI could be the increase in partnerships between companies from high-income countries and developing or emerging countries (Corsi and Di Minin, 2014; Crisp, 2014; Dubiel and Ernst, 2012; Esko et al., 2013; Govindarajan and Euchner, 2012; Govindarajan and Trimble, 2012b; Laperche and Lefebvre, 2012; Syed et al., 2012). In his interview with Euchner (2012), Govindarajan stated that DMNE R&D teams operating in emerging countries should partner with the local supply chain and local marketing organizations to accurately target customer needs and effectively market new solutions. Laperche and Lefebvre (2012) reported some examples of DMNEs collaborating with local universities and suppliers, and Corsi and Di Minin (2014) anticipated a new technology-focused generation of joint ventures between advanced and emerging multinationals. Finally, regardless of the company's origin (a firm from a developed country trying to enter emerging markets or from an emerging country trying to bring innovations to developed markets), local partners could provide an excellent network within the local industry to overcome the liability of foreignness (Dubiel and Ernst, 2012).

Despite all the strategies companies implement, organizational attributes also impact the company's capacity to practice RI. In their first paper, Borini et al. (2012) measured the impact of subsidiaries' strategic R&D orientation, integration, entrepreneurial orientation, entry mode and age on RI (which they defined as an innovation designed in a subsidiary and ideally absorbed by the parent company) and found that all these variables were positively correlated with RI. In a subsequent paper, Borini et al. (2014) explained how autonomy and integration positively influence this practice. They proxied RI through the existence of centers of excellence in emerging market subsidiaries and then demonstrated the importance of the multinational corporation's structure for RI to occur. In a more qualitative paper, Zeschky et al. (2014) also noted integration and autonomy as key characteristics of subsidiaries that practice RI. All these

findings refer to the strategy of shifting power to LGTs (or subsidiaries) that Immelt et al. (2009) noted when they first introduced the concept of RI.

Finally, corporate headquarters' resistance to change coming from emerging market innovations developed by subsidiaries or from the empowerment of these subsidiaries could also challenge the success of RIs (Corsi et al., 2014; Govindarajan and Euchner, 2012; von Zedtwitz et al., 2015).

2.5.3.2 The importance of the environment

Govindarajan and Trimble (2012a) defined five gaps that separate the reality of emerging countries from that of developed countries: price-performance, infrastructure, sustainability, regulatory and preference. Some of these gaps were later incorporated into other academic papers to describe or explain RI. Others appeared (to the best of our knowledge) only in Govindarajan's papers and still need to be discussed in further detail.

The price-performance (cost-constrained) gap occurred the most frequently in the literature (see Bottles, 2012; Burger-Helmchen et al., 2013; Corsi et al., 2014; Dakshinamoorthy and Gordon, 2010; Dubiel and Ernst, 2012; Govindarajan and Euchner, 2012; Govindarajan and Ramamurti, 2011; Govindarajan and Trimble, 2012a, 2012b; Hang et al., 2010; Huet et al., 2013; Immelt et al., 2009; Judge et al., 2015; Laperche and Lefebvre, 2012; Ostraszewska and Tylec, 2015; Snowdon et al., 2015; Spiridon and Clipa, 2010; Zeschky et al., 2014). Despite the fact that developing or emerging market consumers have less purchasing power, consumers in these markets still have needs, which are generally different from the needs of consumers in rich countries. To conquer these markets, cheaper (but not necessarily low-cost) products with new functionalities have to be developed.

The infrastructure gap refers to the potential lack of infrastructure in developing or emerging countries, such as unreliable electric power (Dakshinamoorthy and Gordon, 2010; Govindarajan and Euchner, 2012; Govindarajan and Trimble, 2012a, 2012b; Immelt et al., 2009). This reality sometimes imposes particular features on products or even different product solutions.

The sustainability gap suggests that emerging countries have (or will soon have) more severe environmental concerns than high-income countries (see Adriaens et al., 2013; Brem and Ivens, 2013; Dakshinamoorthy and Gordon, 2010; Govindarajan and Euchner, 2012; Govindarajan and

Trimble, 2012a, 2012b; Spiridon and Clipa, 2010). Govindarajan and Trimble (2012a) gave the example of China's extreme air pollution problems and the development of electric cars by local companies such as BYD[10]. Brem and Ivens (2013) published an article on the positive relationship between RI and sustainability management.

To the best of our knowledge, the regulatory and preference gaps (see Govindarajan and Euchner, 2012; Govindarajan and Ramamurti, 2011; Govindarajan and Trimble, 2012a, 2012b) have not yet been extensively discussed in the literature. The regulatory gap refers to the differences in regulations between developing or emerging countries and developed countries. This gap can be problematic if innovations in developing or emerging countries do not follow the basic regulatory standards in place in industrialized countries and therefore could put some people at risk. However, as Govindarajan and Trimble (2012a) highlighted, in some cases regulatory systems can also be needless barriers that result in innovation friction and slower progress. The preference gap refers to diversity of tastes, habits and rituals influencing innovations, succinctly noted by Corsi et al. (Corsi et al., 2015).

Beyond these gaps, the economic crisis in developed countries is also mentioned in some papers as an environment that fosters RI (see Govindarajan and Trimble, 2012b; Leavy, 2011; Li, Zhang, and Lyles, 2013; Simula, Hossain, and Halme, 2015). Cost awareness has become common in developed countries as a result of the economic downturn. Many potential customers wishing to save money might consider RI products as interesting alternatives. Finally, the creative economy (designated as a precursor to the concept of RI in Burger-Helmchen et al. [2013]) as a new society growth phase—in which creative ideas could emerge from poor territories and then spread to wealthier zones—might also be fertile ground for RI.

Other identified RI challenges include different market conditions and often unstable political and regulatory environments (see Dubiel and Ernst, 2012), intellectual property risks (see Corsi and Di Minin, 2014; Esko et al., 2013; Furue and Washida, 2014) and resource scarcity (see Dubiel and Ernst, 2012; Furue and Washida, 2014).

[10] For more information, see http://www.byd.com/.

2.5.4 RI externalities

The strategies described above are not without risks for the organizations that implement them. Some papers have tried to highlight some of these, and the risk most frequently mentioned in the literature is cannibalization (see Corsi et al., 2014; Dubiel and Ernst, 2012; Furue and Washida, 2014; Govindarajan and Ramamurti, 2011; Immelt et al., 2009; Zeschky et al., 2014). RI products can cannibalize higher-margin products in high-income countries, preventing companies from bringing frugal innovations back from abroad. Another often raised issue associated with RI is product quality perception (see Dakshinamoorthy and Gordon, 2010; Govindarajan and Euchner, 2012; Govindarajan and Trimble, 2012b; von Zedtwitz et al., 2015) and its consequences for a company's reputation.

From an economic point of view, RI could drive *reverse spillovers* (reverse knowledge transfer spillovers or reverse FDI spillovers) (see Adriaens et al., 2013; Esko et al., 2013; Govindarajan and Ramamurti, 2011; Lee and McNamee, 2014; Radojevic, 2013). The literature on spillover effects has not reached a consensus (Javorcik and Spatareanu, 2005). However, most studies make a similar assumption: technology transfer moves from north to south[11]. Since technology and productivity levels are higher in the north, logic would suggest a technology transfer from top to bottom. This also creates the assumption that northern firms have nothing to learn from those in the south (Govindarajan and Ramamurti, 2011). RI and the associated strategy of collaboration are changing these assumptions. Similar to north-south spillovers, south-north spillovers are now occurring as DMNEs learn about new business models, management practices and technologies from local competitors, suppliers and customers in emerging markets (Govindarajan and Ramamurti, 2011). RI can also result in leapfrogging in emerging countries, which occurs when innovators in developing countries skip over legacy technologies to adopt frontier technologies (Burger-Helmchen et al., 2013; Govindarajan and Euchner, 2012; Govindarajan and Ramamurti, 2011).

[11] Some important studies on the topics include Aitken and Harrison, 1999; Djankov and Hoekman, 2000; Haddad and Harrison, 1993; Javorcik, 2004; Kokko, Tansini, and Zejan, 1996; Wang, 2005; Wei and Youssef, 2012; Young and Lan, 1997.

To conclude, few papers on the social implications of RI have moderated the general enthusiasm surrounding the concept. Poverty and inequality reduction, as well as social infrastructure and social relationship developments are discussed (see Radojevic, 2013; Spiridon and Clipa, 2010), and another paper evaluated the perception of the concept (see Armanios and Li, 2013). There is not yet a consensus on a potential positive impact of RI on these variables, but the social impact of RI seems to be mitigated at first sight.

2.6 Managerial Implications

The previous analysis can be summarized in a conceptual framework (see the following figure), showing that although organizational and environmental factors can impact RI, RI can also have an impact on organizational risks, as well as economic and social issues. The framework also provides the most frequently discussed topics by noting the occurrence of each term in the existing literature.

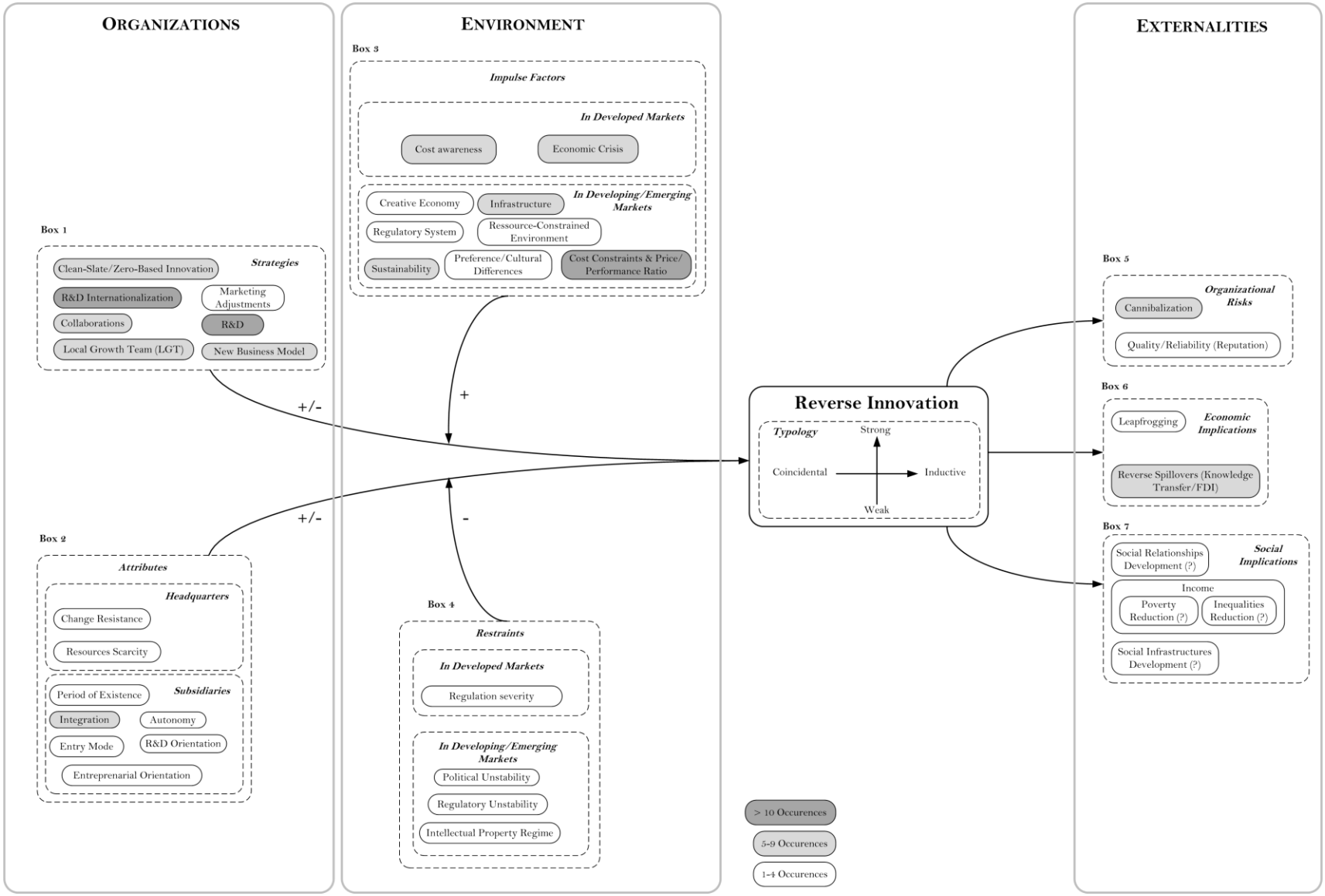


Figure 2-3: The conceptual framework of reverse innovation depicted in the existing literature

The literature tends to focus on RI success stories (see Table 7 in the Appendix). However, it seems clear that RI practice may often be accompanied by important managerial challenges, which are depicted in Figure 3 and further explained below. The success of the reversal of an innovation might come from the original attributes, in addition to the strategies organizations put in place (Organizational Factors in the previous figure).

Managers should carefully choose their strategies according to the nature of their organization. R&D internationalization, LGT building, business model changes or partnerships with local actors are strategic decisions that could ensure RI success (or not). Implementing local teams in India was a critical step in General Electric's development of frugal but sophisticated products that could then be sold in high-income countries.

Firms with subsidiaries abroad should take into consideration some of their corporate attributes (organizational culture, level of autonomy, etc.), because these parameters could impact the efficiency of their activities abroad or the relation to the parent company, subsequently influencing the RI process. Resistance in the parent company may occur when innovations from subsidiaries in developing or emerging markets are brought back to developed markets. Headquarters might have negative preconceived ideas about these innovations. As Yip and McKern (2014) suggested, home-country managers may find it hard to accept that their counterparts in developing or emerging market subsidiaries have high levels of capability.

The framework also highlights the fact that different environmental factors can foster or restrain RI (Environmental Factors in Figure 3). The innovation context cannot be ignored, and managers should verify the presence of gaps between developing or emerging market and developed markets (which may constitute a fertile environment for RI first steps, such as frugal innovation), as well as growing cost awareness in developed countries in terms of the targeted innovation, in order to facilitate its reversal. Although there is great potential in some emerging markets, companies should not be blind to local institutional realities (for example, political or regulatory instability or a deficient intellectual property regime, etc.). As Rottig (2016, p. 13) stated, "Emerging markets constitute a double-edge sword for multinationals," as they offer opportunities caused by institutional voids or a lack of formal rules, but also have major challenges to overcome. Understanding the importance and influence of local government, differences in ways of doing business in these markets, as well as the importance of local

leadership is crucial (Rottig, 2016). Multinational companies conducting RI therefore face the challenge of managing the gaps between emerging and developed markets and need to ensure that the political, economic and social demands placed on the multinational companies in emerging markets do not interfere with or impede their ability to reverse innovations. Essilor's lens coating innovation developed in China is a noteworthy example. The world leader in optics developed a much less expensive, higher performing, more resistant lens coating in China, thanks to collaboration with local partners and regulatory flexibility in China. Although the product's return to developed markets would highly benefit consumers, it would be blocked by European Union regulations.

Managers should be aware of and even anticipate RI externalities (Externalities in the previous figure), especially in terms of organizational risks, since consumer perception is of particular interest nowadays. RI could impact a company's reputation, especially through social media. Product appearance can be crucial in developed markets, because customers are used to certain specific features, and the cheaper appearance of innovations from developing or emerging market subsidiaries could be problematic. For example, when Renault first launched the Dacia Logan car in high-income European countries, the company faced consumer perceptions of low quality and low security, in particular from French consumers[12].

To summarize, practicing RI may represent a disruption in an organization's managerial balance. Managers should therefore be cautious and proactive when engaging in this innovation process.

2.7 Agenda for Future Research

Our review has led us to propose research suggestions in order to continue building this field and ensuring the sustainability of RI theory.

Suggestion 1: clarify the definition of RI

A consensus on the definition of RI has not yet been reached. Numerous nuances and subtleties in the literature may have blurred the original definition. The concept of RI should therefore be

[12] Source: https://hbr.org/2015/07/engineering-reverse-innovations, consulted on February 3, 2016.

clarified and redefined, in particular because it is still a relatively new concept. As mentioned previously, we have already made a first step in that direction by giving an overview of the different ways RI has been defined in practice by academics. Based on our findings, we believe that authors should be more cautious when using the term reverse innovation.

A more balanced definition of RI could be proposed. Originally, RI referred to any innovation first adopted in the developing world that then flowed into a developed market. Here, adoption (developing markets first) is the decisive factor. Subsequently, several authors have used other variants of this definition.

We believe developing or emerging markets as a necessary condition for RI is questionable and may confuse understanding and the descriptive power of the concept. The convergence between developing or emerging markets has already been already demonstrated by many economists (see Hadengue and Warin, 2014; Rodrik, 2011). This economic convergence will eventually weaken the concept of RI as commonly defined. RI is mainly motivated by and depends on constraints that characterize current developing or emerging markets and is therefore either a temporary phenomenon or has not yet been properly defined. We believe that an RI is, first and foremost, the result of a constrained environment, but not necessarily a developing or emerging market. We argue that the notion of a new constrained market should be prevalent to the notion of developing or emerging markets in the definition of RI. Such an approach expands the concept by considering reverse innovations between developed markets with different constraints. Additionally, following the logic of von Zedtwitz et al. (2015), an RI does not have to be adopted in the developing or emerging market to be classified as such (meaning that the constrained market does not even have to be capable of adopting the RI). Following these arguments, we are inclined to adopt Radojevic's (2015) definition.

Suggestion 2: define a more firm-perspective theoretical framework for RI

Beyond several efforts made for disentangling RI and similar innovation concept such as frugal or disruptive innovation, very little work has been done to properly situate RI in a more firm-integrated point of view. In other words, except for one conference paper, no one has made the effort to identify the organizational strategies linked to the practice of RI. Such a theoretical work

could not only clarify the concept and its practice but also open the path for a wealth of empirical studies.

Suggestion 3: improve identification of the risks associated with RI in order to help companies to successfully practice this new innovation strategy

RI is not easy to achieve. Organizations diving into this strategy face significant risks that could not only prevent the process from occurring but also demolish previous credentials. One example among others could be the risk associated with the regulatory gap as defined by Govindarajan and Trimble (2012a). Discrepancies between emerging market regulations and developed market ones may, for example, prevent an innovation to be reversed. The collection of all documents on RI has shown that RI's role in the health sector seems to be crucial. However, this industry is highly concerned with regulatory issues, highlighting a major paradox. In sum, identifying RI risks may help companies to better manage or even avoid problems. Challenges behind RI have been almost ignored in the literature until now.

Suggestion 4 highlight the impact of RI on collaborations and knowledge/technology transfer between companies

In the literature, RI has mainly been example driven. No one has empirically shown an established practice of RI in a specific industry branch. Doing so would allow for a more in depth study of the phenomenon and its impacts on collaborations as well as on potential reverse knowledge or technology transfers between EMNEs and DMNEs.

Suggestion 5: further explore RI social consequences

The frugal character of several RIs may imply that this innovation strategy fosters social innovation. However, one of the papers we retrieved suggests that RI may also have negative consequences for consumers, companies and markets, and that these consequences should not be ignored, regardless of the recent enthusiasm for the concept. More literature on the social consequences of RI (positive or negative) in emerging countries but also in developed ones should be developed.

Suggestion 6: consider another designation for the phenomenon of RI

Finally, the term reverse innovation raises concerns of ethnocentrism (von Zedtwitz et al., 2015). In the long term, this could be problematic as academics from developing or emerging countries start to study the phenomenon in greater depth. It might be tempting to judge RI as a nonsensical business term and to use a more positive term to refer to it.

2.8 Conclusion

The goal of this systematic review was to highlight the complex subtleties of the literature on RI. Although it is a relatively new concept, RI has been defined in several nuanced ways. This fragmentation can be misleading, and a systematic review can provide a useful analysis in order to highlight the fragmentation and propose boundaries to better define RI. However, a systematic review also has its own methodological limitations, including the level of precision. To tackle this limitation, we started broadly and then focused on specific databases and research terms. Although some dimensions might have been missed, we believe our conclusions obtained a reasonable level of redundancy in the databases that we used for this study. We also wanted to contribute to the literature and hope that further research on this important innovation concept will refine and clarify our results.

This systematic review also provided an improved theoretical and practical framework for the concept of RI. In terms of theory, we have demonstrated that the idea behind the concept is not entirely new. The literature does not come to a consensus on the definition of RI, and positioning in organizational theory contexts is sometimes misleading. Moreover, many other innovation theories have been developed recently, and the overlap with RI can be confusing. Although some papers have attempted to separate these concepts, there is still a need for increased clarification.

More generally, RI already seems to be an influential, accepted concept, as it is used and studied around the world. The concept of RI has significant managerial implications, and the conceptual framework proposed here has helped us to identify them. The strategies firm choose could determine the success of RI, as well as the environment in which they operate. Finally,

companies should be aware of possible economic and social repercussions, as well as the risks to the organization's reputation. On the ground, corporate RI practices seem destined to intensify over the years. We should ensure that this practice is thoroughly studied to help enterprises successfully implement it.

CHAPITRE 3 DÉMARCHE DE L'ENSEMBLE DU TRAVAIL ET ORGANISATION DE LA RECHERCHE

3.1 Question de recherche et objectifs

En se basant sur la revue systématique de la littérature de la section précédente et sur les suggestions de recherche qui y sont faites, la thèse propose d'aborder la question de recherche générale suivante:

Quels sont les dynamiques et les enjeux qui caractérisent l'innovation inverse telle qu'elle est pratiquée aujourd'hui?

Plus spécifiquement, la thèse a pour but de répondre à trois suggestions de recherche[13] de la revue de littérature (suggestions 2, 3 et 4). Les sous-questions de recherche suivantes sont donc considérées (représentant chacune un objectif de la thèse):

- Dans quelle mesure les multinationales pratiquent-elles l'innovation inverse et quelles sont les implications en termes de transfert technologique entre marchés développés et marchés émergents ?
- Quels sont les défis associés à la pratique de l'innovation inverse et quels sont les mitigateurs de risque pour favoriser le succès de cette stratégie ?
- Quels impacts la configuration du réseau (interne et externe) de la multinationale a-t-elle sur la pratique de l'innovation inverse ?

[13] Dans un souci de cohérence, l'expression ***suggestions de recherche*** est utilisée dans tout le document pour désigner les ***axes de recherches*** découlant de la revue systématique de la littérature (premier article de la thèse) et traités dans la thèse.

Les objectifs de la thèse sont les suivants:

Objectif 1: Déterminer dans quelle mesure les multinationales (et plus particulièrement les multinationales du secteur de la santé pour lesquelles le processus de R&D est très sensible) pratiquent l'innovation inverse ainsi que les effets de cette pratique sur les transferts technologiques entre marchés développés et marchés émergents **(article 2 de la thèse)**.

a. Vérifier le récent positionnement des pays émergents (plus spécifiquement la Chine) comme les nouveaux centres de l'innovation;
b. Vérifier la pratique de l'innovation inverse par les grandes multinationales et déterminer les effets de cette pratique en termes de transferts technologiques.

Objectif 2: Analyser plus en profondeur la pratique d'innovation inverse afin d'identifier les challenges qui y sont associés ainsi que les actions à entreprendre pour les surmonter **(article 3 de la thèse)**.

a. Identifier les principaux challenges associés à la pratique de l'innovation inverse aujourd'hui;
b. Identifier les bonnes pratiques pour prévenir ou surmonter ces challenges;

Objectif 3: Proposer un cadre théorique pour l'innovation inverse en identifiant les dynamiques internes et externes de l'entreprise multinationale qui favorisent la pratique de cette stratégie **(article 4 de la thèse)**.

a. Caractériser le réseau de la multinationale et analyser l'influence de la configuration de ce réseau sur la pratique de l'innovation inverse;
b. Proposer un cadre théorique de l'innovation inverse.

3.2 Organisation de la recherche

Le tableau suivant présente l'organisation de la thèse par article. Au total, quatre articles, dont trois publiés et un soumis, composent la thèse.

Table 3-1: Résumé de l'organisation de la recherche

	Article 1	**Article 2**	**Article 3**	**Article 4**
Titre original	Reverse Innovation: A Systematic Review of the Literature	Reverse Innovation and Reverse Technology Transfer: From Made in China to Discovered in China in the Pharmaceutical Sector	Avoiding the Pitfalls in Reverse Innovation: Lessons learned from Essilor	Reverse Innovation: A MNC's Network Perspective
Question(s) de recherche	Comment l'innovation inverse est-elle positionnée dans la littérature existante?	La Chine est-elle devenue un nouveau centre de l'innovation? Dans quelle mesure les multinationales y pratiquent-elles l'innovation inverse et quelles sont les implications en termes de transfert de connaissances?	Quels sont les challenges associés à la pratique de l'innovation inverse et quels sont les mitigateurs de risque pour favoriser le succès de cette stratégie?	Quelle influence la configuration du réseau (interne et externe) de la multinationale a-t-elle sur la pratique de l'innovation inverse?
Concepts clés	Reverse Innovation, Systematic Review, Trickle-up innovation, Emerging Markets, Multinational Corporations, Globalization	Innovation, Reverse Innovation, Technology Transfer, Spillovers, Pharmaceutical Companies, China	Reverse Innovation, Global Innovation, Emerging Markets, Product Cannibalization, Not-invented-here Syndrome, Reverse Product Localization	Reverse Innovation, Multinational Corporations, Network, Knowledge Flows, Power bargaining, Resources Configuration
Objectifs de recherche	Faire l'état de l'art de l'innovation inverse	Déterminer dans quelle mesure les multinationales pratiquent l'innovation inverse ainsi que les effets de cette pratique sur les transferts technologiques entre marchés développés et marchés émergents	Analyser plus en profondeur la pratique d'innovation inverse afin d'identifier les challenges qui y sont associés ainsi que les clés pour les surmonter	Proposer un cadre théorique pour l'innovation inverse en identifiant les dynamiques internes et externes de l'entreprise multinationale qui favorisent la pratique de cette stratégie
État de la publication	À paraître dans **International Journal of Emerging Market (2017)**	Publié dans **Management International (2015)**	À paraître dans **Research-Technology Management (2017)**	Soumis à la **European Business Review**

3.3 Méthodologie

L'innovation inverse étant un phénomène récent, la thèse de doctorat a pour but de contribuer à la compréhension et au positionnement théorique de ce nouveau modèle d'innovation, mais également d'identifier les facteurs clés du succès d'une telle stratégie. Pour ce faire, une méthodologie principalement qualitative est utilisée. Ce design de recherche, particulièrement approprié pour étudier les phénomènes émergents, a semblé le plus adéquat.

Deux facteurs principaux expliquent ce choix. Tout d'abord, la théorisation du phénomène étant largement incomplète, l'observation et la description de la pratique de l'innovation inverse sont encore nécessaires à une meilleure compréhension de cette stratégie et de ses implications pour les organisations. De plus, la pratique de l'innovation inverse restant encore relativement peu commune, les entreprises sont, la plupart du temps, assez réticentes à partager leurs expériences de gestion de cette nouvelle stratégie d'innovation à l'international, rendant ainsi difficile la construction de bases de données importantes.

Le faible positionnement théorique du concept couplé à cette rareté des données appelle ainsi clairement à davantage de travail qualitatif. Dans un second temps seulement, et lorsqu'un nombre plus important d'entreprises auront acquis une expérience de la pratique de l'innovation inverse, des recherches quantitatives pourront permettre de tester les différentes hypothèses qui auront émergé de la recherche exploratoire. En effet, selon la littérature, il est considéré que:

> « *(...) l'analyse qualitative précède et prépare l'analyse quantitative (qu'elle est exploratoire) en lui fournissant des phénomènes à étudier et des concepts à tester statistiquement ou économétriquement (...)*. » (Dumez, 2011).

Bien qu'une justification méthodologique soit développée au sein de chacun des articles qui composent la thèse, la sous-section suivante synthétise chacun des designs de recherche employés. Quelques précisions quant au choix du secteur d'activité privilégié dans la recherche (le secteur de la santé) ainsi qu'au sujet de la difficulté d'accès des données sont ensuite proposées. Puis, la justification méthodologique du troisième article de la thèse (étude de cas unique) étant assez peu développée puisque cette étude a été publiée dans un journal destiné au monde des affaires, la dernière sous-section apporte quelques éléments supplémentaires sur ce design de recherche.

3.3.1 Synthèse des méthodologies employées par article

Le tableau suivant reprend les différentes méthodologies utilisées dans chacun des articles. Dans chaque cas (et s'il y a lieu), la littérature clé de la méthodologie en question, l'unité d'analyse considérée, mais aussi les données utilisées sont spécifiées.

Il est à noter que le design de recherche de l'article 2 représente une exception à la méthodologie générale de la thèse. En effet, une méthodologie de recherche mixte (quantitative puis qualitative) a été utilisée. Une analyse statistique quantitative est réalisée sur trois niveaux de brevets puis une analyse de contenu de discours officiel est menée. Davantage de détails figurent dans le tableau ci-dessous.

Table 3-2: Synthèse des méthodologies employées par article

	Article 1	**Article 2**		**Article 3**	**Article 4**
Objectif principal de l'article	Faire l'état de l'art sur l'innovation inverse	Déterminer dans quelle mesure les multinationales pratiquent l'innovation inverse et les effets de cette pratique sur les transferts technologiques		Analyser plus en profondeur la pratique d'innovation inverse	Proposer un cadre théorique pour l'innovation inverse
Méthodologie	Revue systématique de la littérature	Méthodologie mixte		Étude de cas	Étude conceptuelle
		Statistiques descriptives	Analyse de contenu		
Littérature clé méthodologique	Briner and Denyer, 2012; Tranfield, Denyer, and Smart, 2003	-	Gioia, Corley, & Hamilton, 2012; Krippendorff, 2012	Yin, 2014	-
Unité(s) d'analyse	Le concept d'innovation inverse	Les brevets	La pratique de l'innovation inverse et du transfert technologique inverse	Les cas d'innovation inverse chez Essilor: Myopilux, verres Azio/India, Ready-to-Clip et Gemcoat	L'influence de la configuration du réseau de la multinationale sur la pratique de l'innovation inverse
Données	377 documents (articles scientifiques, livres, chapitres de livres, thèses)	Les brevets en général, les brevets dans le secteur pharmaceutique et les brevets publiés par les dix plus grandes sociétés pharmaceutiques	Le discours officiel des 10 plus grandes entreprises pharmaceutiques en termes de revenus en 2014	Des entrevues avec les employés d'Essilor + des données complémentaires	La littérature existante
Sources des données	Un ensemble de bases de données scientifiques	L'OMPI et le SIPO	Les médias Internet spécialisés, les sites internet des entreprises, les rapports annuels, des entretiens menés avec des parties prenantes du secteur	Plus de 20 entrevues réalisées avec 14 employés à différents niveaux hiérarchiques sur plus d'une année + des brochures, des rapports internes, des courriels internes et les rapports annuels	n/a

3.3.2 Le choix stratégique du secteur de la santé

L'innovation inverse semble représenter une stratégie particulièrement adéquate pour améliorer les soins de santé en général. En effet, les humains, partout dans le monde, sont potentiellement vulnérables aux mêmes maladies. Les récentes épidémies généralisées de maladies chroniques et de nouvelles souches de maladies infectieuses résistantes aux médicaments appellent à des innovations globales en matière de santé, et les contraintes de coûts ainsi que les conditions difficiles auxquelles sont confrontés les pays en développement ou les pays émergents rendent la tâche encore plus difficile (Crisp, 2014). L'austérité dans le Nord et la demande croissante de meilleurs services dans le Sud encouragent les entreprises à développer de nouvelles solutions moins chères et plus accessibles pour les pays en développement. Ces solutions sont ensuite *ramenées* dans les pays développés, en faisant ainsi des innovations inverses. Certains auteurs ont montré le potentiel de cette stratégie pour le secteur de la santé, notamment en soulignant l'importance des partenariats entre les pays développés et les pays en développement pour générer des solutions peu dispendieuses, originales et efficaces (Bottles, 2012; Snowdon, Bassi, Scarffe, & Smith, 2015; Syed et al., 2012, 2013; Talaga, 2010).

Parmi les exemples concrets d'innovation inverse en santé et outre l'électrocardiographe de General Electric, il est possible de mentionner le Lullaby Incubator de la même entreprise, l'Oncovin d'Eli Lilly, le pacemaker de Medtronic, le Ventilator de OneBreath, le PACT Program de Partners In Health, le Patient Monitoring System de Philips Healthcare, le sirop VickMiel de Procter & Gamble, le moniteur cardiaque fœtal de Siemens Healthcare ou le scanner CT de Toshiba.

Se concentrer sur le secteur de la santé pour mieux identifier et comprendre la pratique de l'innovation inverse semble donc tout à fait indiqué. C'est le cas des sections de la thèse portant sur l'identification de la pratique de l'innovation inverse par des multinationales (article 2), sur l'impact en termes de transfert technologique (article 2) ainsi que sur les challenges rencontrés lors de la mise en œuvre de cette stratégie (article 3). En effet, le deuxième article est basé sur l'analyse de contenu du discours officiel des dix plus importantes entreprises pharmaceutiques dans le monde et le troisième article utilise le cas de l'entreprise Essilor, spécialisée dans les verres correcteurs et les équipements d'optique ophtalmique.

Cependant, et tel que le reflètent certaines des conclusions plus générales établies dans les articles en question, la thèse de doctorat ne se veut pas exclusivement centrée sur le secteur de la santé. Le but du doctorat n'était pas de faire l'état de la pratique de l'innovation inverse dans cette branche industrielle en particulier, mais plutôt d'utiliser ce secteur pour augmenter la pertinence des résultats. L'innovation dans l'industrie de la santé peut être considérée comme un cas critique, et ce, en raison de la sensibilité particulière du processus. En effet, le développement puis la mise en marché des produits nécessitent d'importantes ressources financières alors que les retombées économiques peuvent être nulles pendant plusieurs années. Mettre au point un nouveau médicament ou un nouvel appareil médical requiert de passer au travers d'un grand nombre d'étapes telles que celle de la découverte, mais également celle des tests précliniques, des tests cliniques puis de l'approbation par les organismes de surveillances nationaux et/ou régionaux. Plus spécifiquement, il est par exemple évalué qu'entre 10 et 12 ans et plus de 2 milliards de dollars US sont requis pour développer et commercialiser un nouveau médicament (DiMasi, Grabowski, & Hansen, 2016). La protection de la propriété intellectuelle tout au long de ce processus de développement, mais aussi après la commercialisation des produits, représente alors un enjeu crucial pour assurer la rentabilité de ces projets d'innovation.

Les investissements étant très importants et les garanties de rentabilité non préalablement déterminées, innover dans le secteur de la santé constitue donc une grande prise de risques de la part des entreprises. Faire de l'innovation inverse dans ce même secteur semble intuitivement encore plus risqué. En effet, et tel que montré dans la revue de la littérature présentée au début de la thèse, cette nouvelle forme d'innovation est très souvent associée à un déplacement de la R&D dans les marchés émergents ainsi qu'à la mise en place de collaborations ou de partenariats avec des entreprises locales. Ces stratégies, pourtant favorables à la réussite de la démarche, car permettant une meilleure appréhension du marché local, peuvent potentiellement augmenter considérablement le niveau de risque en termes de protection de la propriété intellectuelle (Keupp, Beckenbauer, & Gassmann, 2010; Keupp, Friesike, & von Zedtwitz, 2012).

Ainsi, il apparait clairement que l'innovation inverse dans cette branche de l'industrie constitue un cas critique pour lequel les conclusions tirées pourraient potentiellement être plus facilement généralisables à d'autres secteurs dont le processus d'innovation est moins sensible. Cibler les entreprises pharmaceutiques en particulier permet de pousser à l'extrême ce raisonnement puisque le développement de médicaments reste parmi les processus d'innovation les plus longs

et les plus couteux au monde (Pharmaceutical Research and Manufacturers of America, 2013; Talaga, 2010).

3.3.3 Un terrain de recherche difficile d'accès

Tel que montré dans la première partie de la thèse, l'innovation inverse est une stratégie d'innovation à l'international que l'on pourrait qualifier de nouvelle. Si sa pratique au sein des entreprises est croissante, elle est encore souvent le fruit du hasard – on parlera alors d'innovation inverse de coïncidence (Furue & Washida, 2014) – . Dans les cas plus rares où elle est le résultat d'un processus délibéré – on parlera alors d'innovation inverse inductive (Furue & Washida, 2014) – elle émerge principalement d'une approche par essais-erreur non régis selon une feuille de route bien établie par l'organisation. Ainsi, nombreuses sont les entreprises qui, pas au fait de cette nouvelle stratégie, ne réalisent pas encore qu'elles font de l'innovation inverse.

Ce dernier point a été un enjeu important à surmonter lors de la collecte de données du deuxième article de la thèse présenté à la section suivante. Ce travail avait pour objectif de déterminer dans quelle mesure les multinationales pratiquaient l'innovation inverse ainsi que les effets de cette pratique sur les transferts technologiques entre marchés développés et marchés émergents. La volonté initiale était d'interviewer des acteurs clés du secteur de la santé, plus spécifiquement des hauts cadres de grandes entreprises, afin de mener une étude multicas. Malgré la réalisation de plusieurs entrevues exploratoires (6 au total), les résultats sont restés non concluants, principalement pour les deux raisons suivantes : (1) les entreprises ou les organismes ne pratiquaient pas (encore) l'innovation inverse ou (2) les acteurs interviewés n'étaient pas suffisamment haut placés dans la hiérarchie organisationnelle pour bénéficier de la vision d'ensemble nécessaire à l'identification d'exemples concrets d'innovation inverse.

Accéder à de plus hauts responsables n'était pas envisageable dans le temps imparti pour la thèse. Une alternative fut de collecter puis de coder – via un logiciel d'analyse textuelle – le discours officiel de hauts responsables de dix entreprises quant à l'état de leurs activités ainsi que de leurs intentions de développement en Chine. La limite de cette analyse de contenu réside bien entendu dans le fait même qu'il s'agisse de l'analyse de discours officiels, de messages construits et véhiculés par l'entreprise pour envoyer un signal particulier ne reflétant pas nécessairement la réalité. Le contre argument à cela : des entrevues directement menées auprès de ces hauts dirigeants ne nous auraient certainement pas permis d'obtenir un discours différent. Ainsi, bien

qu'il soit raisonnable d'admettre que les données collectées soient teintées par l'image corporative désignée, ce travail a néanmoins permis de déterminer si le discours de ces entreprises contenait les indicateurs clés d'une pratique active actuelle ou envisagée de l'innovation inverse - ainsi que les potentiels impacts en termes de transferts technologiques de la mise en place d'une telle stratégie. Tel qu'indiqué dans l'article, une façon de renforcer ces résultats serait de mener une étude de terrain dont le design de recherche serait par exemple l'observation participante.

La collecte de données pour le troisième article traitant des challenges associés à la pratique de l'innovation inverse s'est également révélée plus complexe que prévu. Bien qu'un certain nombre d'exemples à succès aient été décrits dans la littérature, les obstacles à l'innovation inverse sont encore largement méconnus et donc pas ou peu étudiés et documentés. Ainsi, il est probable qu'aujourd'hui encore, un nombre important de tentatives d'inversion d'innovation se soldent par un échec. Dans ce contexte, un manque d'enhousisame des entreprises quant au partage de leurs expériences d'innovation inverse a été constaté tout au long des travaux de recherche de la thèse. Même dans le cas où une innovation eut été inversée avec succès, les entreprises se montraient généralement frileuses quant à l'idée de divulguer les tenants et les aboutissants d'une telle expérience.

L'idée originale de la recherche était de mener une étude dans deux multinationales distinctes afin d'identifier les challenges rencontrés par ces dernières lors de leurs projets d'innovation inverse. Compte tenu de la sensibilité du sujet pour les entreprises, le projet a cependant dû être ajusté durant le processus de recherche. En effet, si la première entreprise s'est montrée très coopérative, il n'en a pas été de même de la seconde.

Pour la première entreprise, la personne contacte, c'est-à-dire la personne clé apportant son soutien à l'étude, était le Président directeur général. L'étude a pu être complétée sans embuche, avec la grande coopération des employés, et ce, à tous les niveaux hiérarchiques de l'entreprise. Dans le cas de la seconde multinationale, la personne ressource était la directrice des ressources humaines de l'Amérique du Nord. Malgré plus d'une semaine passée à temps plein au siège social d'Amérique du Nord de la multinationale et plusieurs entrevues réalisées avec la directrice R&D, la directrice ingénierie ainsi qu'un directeur innovation en Amérique, les recherches n'ont malheureusement pu aboutir. La cause principale de l'arrêt de cette étude a été un manque de

soutien de la haute direction qui jugeait le projet trop sensible.

La partie de la thèse portant sur l'identification des challenges rencontrés lors de la pratique de l'innovation inverse est donc basée sur une étude de cas unique. Le choix d'un tel design de recherche peut éventuellement représenter une limite importante à la généralisation des résultats. Pourtant, pour l'objet de recherche « innovation inverse », il est possible de montrer que, même si une étude multicas aurait été un atout dans la mesure où elle aurait pu renforcer les résultats, *in fine* l'étude de cas unique apporte une contribution notable à l'avancement des connaissances quant à ce phénomène très nouveau et difficile d'accès. La sous-section suivante s'attelle à présenter cet argument.

3.3.4 Le choix du design de recherche : l'étude de cas unique

3.3.4.1 Justification du design

Une étude de cas est une enquête empirique qui s'intéresse à un phénomène contemporain en profondeur et dans son contexte réel, en particulier lorsque les frontières entre le phénomène et le contexte ne sont pas évidentes (Yin, 2014). Ce type de recherche permet d'absorber et de comprendre le contexte riche dans lequel un phénomène est intégré, générant ainsi une compréhension approfondie des variables internes et externes qui l'influencent (Eisenhardt, 1989; Yin, 2014). Particulièrement appropriée pour explorer des processus complexes comme l'innovation et le transfert des connaissances au-delà des frontières nationales (Birkinshaw, Brannen, & Tung, 2011), l'étude de cas semble donc représenter un design de recherche approprié pour l'innovation inverse.

La difficulté d'accès aux données ainsi que la nécessité d'analyses contextualisées pour rendre compte de la complexité de cette nouvelle stratégie d'innovation renforce ce choix. L'innovation inverse est en réalité un processus à deux étapes: (1) l'adoption d'une innovation par un marché émergent puis (2) le retour de cette innovation dans un marché développé. Cette dynamique s'effectue entre deux nations, mais surtout entre deux marchés dont les niveaux de développement sont souvent drastiquement différents, favorisant ainsi l'apparition d'enjeux importants en termes de transfert de connaissances par exemple.

Réussir l'innovation inverse exige donc une coopération importante à l'intérieur même du réseau de l'entreprise, mais également une gestion paradoxale des ressources de celle-ci. En effet, une

certaine configuration peut favoriser le succès d'une étape du processus tout en étant une entrave à l'autre étape (il s'agit du propos de l'article 4, le dernier article présenté dans la thèse). Réaliser une innovation inverse implique donc la participation active des filiales de l'entreprise dans le marché émergent ou en développement, mais aussi celle du siège de l'entreprise et/ou de ses filiales dans les marchés développés. Au-delà du réseau interne, l'environnement extérieur influe également sur le succès potentiel de cette stratégie dans la mesure où les collaborations avec d'autres entreprises, mais aussi les instutitons et les réglementations locales peuvent à la fois faciliter ou entraver le processus. Dans ce contexte, et tel que proposé dans la thèse, une méthodologie de recherche qualitative, et plus particulièrement l'étude de cas, permet un premier défrichage du champ indispensable, mais aussi nécessaire pour ouvrir la voie à de futures études davantage quantitatives.

Bien que l'étude de cas unique ait souvent été critiquée en raison de potentielles difficultés à généraliser les résultats qui émergent de ce type de design de recherche, des travaux fondateurs ont montré qu'il s'agissait d'une méthode particulièrement appropriée pour étudier les phénomènes nouveaux et émergents (Eisenhardt, 1989; Siggelkow, 2007; Yin, 2014). La généralisation formelle telle qu'elle est entendue ici, c'est-à-dire la potentialité d'un résultat à être reproductible ou encore la généralisation statistique, est jugée comme trop souvent surévaluée alors que la force de l'exemple est largement sous-estimée (Flyvbjerg, 2006). Une métaphore intéressante, tirée de Siggelkow (2007) et adaptée de Ramachandran (1998), résume bien l'argument précédent:

> *« You cart a pig into my living room and tell me that it can talk. I say, "Oh really? Show me." You snap with your fingers and the pig starts talking. I say, "Wow, you should write a paper about this." You write up your case report and send it to a journal. What will the reviewers say? Will reviewers respond with "Interesting, but that's just one pig. Show me a few more and then I might believe you"? I think we would agree that that would be a silly response. A single case can be a very powerful example. » (Siggelkow, 2007, p.20)*

L'étude de cas Essilor étant la première et la seule à ce jour à faire état des challenges rencontrés par une multinationale pratiquant l'innovation inverse, les résultats de ce travail peuvent être considérés comme tout à fait originaux. Cette étude monocentrique définie comme un cas

révélateur (Yin, 2014) n'a pas pour but de valider des hypothèses basées sur une théorie existante et ne prétend pas fournir des conclusions statistiquement généralisables. Il contribue cependant à renforcer la compréhension du phénomène, à étendre la théorie et à ouvrir la voie vers une généralisation analytique (Yin, 2014).

3.3.4.2 Qualité du design

L'étude de cas Essilor répond à la question de recherche « *Quels sont les challenges et quels sont les mitigateurs de risque ?* » et correspond donc à une étude de cas exploratoire (Yin, 2014). La vérification de la validité interne n'étant pas requise pour ce type d'étude de cas, il est tout de même nécessaire de se pencher sur la validité de construit de la recherche ainsi que sur sa validité externe et sa fiabilité.

Validité de construit : il s'agit de définir l'objet étudié en termes de concepts spécifiques et d'identifier les mesures opérationnelles correctes qui correspondent à ces concepts (Yin, 2014). Autrement dit, il s'agit dans notre cas (1) de définir la pratique de l'innovation inverse selon le ou les concepts spécifiques à travers le(s)quel(s) elle sera observée, puis (2) d'identifier de quelle façon l'observation sera effectuée.

L'étude de cas Essilor a pour objet l'innovation inverse et plus spécifiquement les challenges associés à cette pratique. Suivant la définition originale de l'innovation inverse (toute innovation d'abord adoptée dans un marché émergent avant d'être ensuite ramenée dans un marché développé), un challenge à cette stratégie peut être défini comme tout événement entravant ou étant susceptible d'entraver ce processus. La mesure ou plus précisément dans notre cas, l'identification de ces challenges a été effectuée directement par les sujets interviewés eux-mêmes. Autrement dit, ce ne sont pas les chercheurs, mais 14 employés d'Essilor, situés à différents niveaux hiérarchiques et interviewés entre 2015 et 2016 qui ont, au cours des entretiens, formulé un ou plusieurs des challenges rencontrés ou anticipés.

Afin de renforcer la validité de ces résultats, plusieurs de ces employés ont été interviewés une seconde fois durant le processus de rédaction de l'étude de cas, dans le but de confirmer ou d'enrichir certaines analyses. Pour limiter les biais d'analyse, les données ont été triangulées avec plus de 80 sources publiques (site web, communiqués de presse, etc.) (Jick, 1979) et un coauteur supplémentaire s'est joint au projet après la collecte de données. Amenant un regard extérieur sur la recherche, cette démarche a permis l'énonciation d'hypothèse rivales plausibles et donc une

amélioration de l'objectivité de l'analyse. Une fois l'étude de cas rédigée, cette dernière a été renvoyée à chacun des employés interviewés afin que ces derniers puissent confirmer ou infirmer les faits exposés ainsi que l'analyse effectuée. Suite à cette étape, certains ajustements ont d'ailleurs été effectués.

Validité externe : il s'agit ici de définir si les résultats de l'étude sont généralisables (Yin, 2014). Tel que discuté précédemment, cette étude de cas n'a pas pour ambition de produire des résultats généralisables. Les entreprises et les innovations inverses étant toutes différentes, il existe surement autant de challenges que de cas. Cependant, l'étude d'Essilor représente un pas – et en l'occurrence le premier pas – vers une meilleure connaissance des entraves que sont susceptibles de rencontrer les multinationales occidentales qui pratiquent cette stratégie d'innovation à l'international.

Fiabilité : il s'agit de démontrer que la répétition des opérations – telles que les procédures de collecte de données par exemple – permettrait l'obtention de résultats similaires à ceux de l'étude (Yin, 2014). Pour le cas d'Essilor, le protocole de recherche a été rigoureusement défini avant le début de la recherche. Ainsi, toutes les entrevues ont été effectuées à partir d'un même guide d'entrevue semi-structuré. Ces entrevues ont ensuite été retranscrites puis regroupées avec les sources secondaires dans un logiciel d'analyse lexicale afin d'être rigoureusement codées. Bien que le codage reste une étape subjective du processus d'analyse, la participation, dans un deuxième temps, d'un chercheur extérieur au projet a permis de limiter les biais et de substantiellement augmenter l'objectivité de l'analyse. Finalement, la relecture du cas par les employés interviewés a également participé à l'augmentation de la fiablitié des résultats.

3.3.5 Certificats éthiques

Deux certificats éthiques ont été demandés au cours du doctorat. Un premier pour le projet ayant abouti à l'article intitulé *Reverse Innovation and Reverse Technology Transfer: From Made in China to Discovered in China in the Pharmaceutical Sector* (article 2). Le certificat éthique du Comité d'éthique de la recherche (CÉR) de Polytechnique Montréal a été accordé le 26 juin 2014 (Dossier CÉR -1314-16). La seconde demande pour le projet ayant abouti à l'article intitulé *Avoiding the Pitfalls in Reverse Innovation: Lessons learned from Essilor* (article 3) a été accordée le 3 août 2016 (Dossier CÉR -1516-55).

CHAPITRE 4 ARTICLE 2: REVERSE INNOVATION AND REVERSE TECHNOLOGY TRANSFER: FROM MADE IN CHINA TO DISCOVERED IN CHINA IN THE PHARMACEUTICAL SECTOR

Auteurs: Marine Hadengue, Nathalie de Marcellis-Warin et Thierry Warin

4.1 Présentation de l'article

L'article présenté dans la deuxième section de la thèse (article 1) a permis de faire l'état de l'art de l'innovation inverse. Plusieurs suggestions de recherches futures ont émergé de ce travail, chacune d'entre elles ayant pour but de contribuer à une meilleure connaissance du phénomène.

Confirmant que les pays émergents, et plus particulièrement la Chine, représentent aujourd'hui les nouveaux grands centres de l'innovation, l'article qui suit propose de répondre en partie à la suggestion 4 émergeant de la revue systématique de la littérature. Ainsi, la pratique de l'innovation inverse et son impact sur les transferts technologiques entre les entreprises issues de pays développés et de pays émergents ou en développement y sont identifiés.

Plus précisément, il est démontré que les dix plus grandes pharmaceutiques au monde (en termes de revenus) font, ou ont l'intention de faire, de l'innovation inverse. Selon un processus itératif entre la littérature et les données collectées, sept différents critères propres à l'innovation inverse sont identifiés. Selon la même stratégie, l'étude met en relief l'existence de transferts technologiques *inverses* et définit trois critères propres à ce processus. Les résultats suggèrent un changement de paradigme important: les transferts de connaissance ne se font plus uniquement du Nord vers le Sud mais également du Sud vers le Nord.

Cet article, dont le titre original est *Reverse Innovation and Reverse Technology Transfer: From Made in China to Discovered in China in the Pharmaceutical Sector*, est coécrit avec Nathalie de Marcellis-Warin et Thierry Warin et a été accepté pour publication en juin 2015 dans la revue

Management International. Il a été publié à l'automne 2015[14].

[14] Hadengue, M., De Marcellis-Warin, N., & Warin, T. (2015). Reverse Innovation and Reverse Technology Transfer: From Made in China to Discovered in China in the Pharmaceutical Sector. *Management International*, Vol. 19, No. 4, pp. 49–69.

Abstract

The emergence of a giant like China changes the landscape. The potential localization of multinational companies' R&D centers into emerging countries changes the analytical perspective. This phenomenon moves the knowledge frontier and creates a real paradigm change in terms of innovation and technology transfer. On the one hand, we confirm the global trend of knowledge sources implied in previous studies and we demonstrate that multinationals might now choose emergent countries as a strategic place to externalize R&D. On the other hand, we go further by empirically showing the phenomena of reverse innovation and reverse technology transfer in the pharmaceutical sector.

Keywords

Innovation, Reverse Innovation, Technology Transfer, Spillovers, Pharmaceutical Companies, China.

4.2 Introduction

Our paper is about R&D internationalization, and the conjunction between reverse innovation and reverse technology transfer in the pharmaceutical industry in China.

The emergence of the Chinese, Indian and Brazilian giants is characterized by the impressive expansion of their middle class. This phenomenon corresponds to a second stage in the globalization process[15] (Trimble, 2012) and results in the birth of new and huge markets for multinational companies (MNCs). In this context, China seems to stand out as the key new market since it represents more than 300 millions of consumers (Friedman, 2012). This key market is certainly attractive for MNCs from advanced economies.

However, to conquer these consumers, firms must create new products and services (clean-slate innovation) to fulfill specific local needs (Govindarajan & Ramamurti, 2011; Govindarajan & Trimble, 2012; Immelt, Govindarajan, & Trimble, 2009). As highlighted by Trimble (2012), selling advanced economies' products with no - or small - adjustments is inadequate.

In this perspective, MNCs might be interested in opening R&D centers in China in order to develop new products fitting the local needs. As a result, this conjunction between the presence of these R&D centers and the consideration of local needs leads to local innovation. Then, the products developed locally might be brought back to advanced economies. Called reverse innovation, this new phenomenon has been first introduced theoretically by Immelt, Govindarajan, and Trimble (2009). An innovation is called reverse when first developed for and adopted in the developing world (or emerging world) before "spreading" to the advanced economies (Ramamurti and Govindarajan, 2011).

Moreover, it might also be possible for MNCs to learn from local firms (via local collaborations). In the literature on technology transfer, it is often assumed that firms from the south can learn from firms from the north (Aitken & Harrison, 1999; Djankov & Hoekman, 2000; Haddad & Harrison, 1993; Javorcik, 2004; Kokko, Tansini, & Zejan, 1996; Wang, 2005; Wei & Youssef, 2012; Young & Lan, 1997). However, there is today a large number of MNCs from emerging

[15] The emergence of some countries as China implies the outsourcing of specific global value chain stages (Baldwin, 2012).

countries. This changes the global competitive landscape (Ramamurti & Singh, 2009), in particular in the pharmaceutical sector (Chittoor & Ray, 2007). Local firms might have an advantage in terms of time, market penetration and knowledge of the local needs. Hence, it can be useful for firms from the north to collaborate with local firms to gain access to strategic information. Therefore, reverse innovation and reverse technology transfer (knowledge transfer from emerging economy firms to advanced economies' MNCs) are intrinsically linked.

The contribution we make in this paper is part of the strategy and international business literature and more precisely the internationalization of R&D activities (global knowledge management). The process of R&D internationalization and its evolution through time is already well documented in the academic literature. However, these studies are concentrated on firms from developed countries having R&D affiliates mostly in the Triad region (Gassmann and von Zedtwitz, 1999; Gerybadze and Reger, 1999; Kuemmerle, 1997; von Zedtwitz, Gassmann, and Boutellier, 2004). The emergence of a giant like China motivates new research either to validate the existing research propositions or to create new ones. Although we confirm the global trend of knowledge sources (Filippaios, Papanastassiou, Pearce, & Rama, 2009; Gassmann & von Zedtwitz, 1999; Gerybadze & Reger, 1999; Kuemmerle, 1997; von Zedtwitz & Gassmann, 2002; von Zedtwitz, Gassmann, & Boutellier, 2004), we show that MNCs might now choose emergent countries as a strategic place to externalize their R&D.

Indeed, the localization of MNCs' R&D centers into emerging countries changes the analytical perspective. This phenomenon moves the knowledge frontier and creates a real paradigm change in terms of innovation and technology transfer. Reverse innovation and reverse technology transfer open the way for a new analytical framework assuming that innovations are first developed to fulfill local needs (thus adopted by the developing world first) and then are brought back to the developed world.

Our research question stands as an extension of these statements and can thus be formulated as: **“Does China now stand as a new key center for innovation and, if it is the case, what are the implications in terms of innovation and technology transfer? In other words, do we really observe reverse innovation and reverse technology transfer?”**

The rest of the paper is organized as follows. The next section presents the review of the literature, followed by the methodology. We then use qualitative methods to empirically test the

new paradigms of reverse innovation and reverse technology transfer. We finally discuss our results and conclude.

4.3 Literature Review

The literature review can be separated into two major parts. On the one hand, we investigate the academic literature focusing on the evolution of the localization of R&D centers and R&D internationalization. On the other hand, we highlight the academic literature on the new concepts of reverse innovation and reverse technology transfer.

4.3.1 R&D internationalization

R&D internationalization is becoming a major source of competitive advantage for multinationals (Almeida, 1996; Awate, Larsen, & Mudambi, 2015; Hansen & Løvås, 2004; von Zedtwitz & Gassmann, 2002b). With the intensification of competition, R&D internationalization is fast becoming a competitive necessity for science and technology-based businesses (Moitra, 2004). However in 2005, the report of the United Nations Conference on Trade and Development indicates that on a total of 2,584 affiliates across the world, 85 percent of them were located in the Triad (Western Europe, United States, Japan) and only 10 percent in developing countries (including Africa, Latin America, the Caribbean and Asia) (United Nations conference on trade and development, 2005). In light of these facts, it is understandable that the bulk of the literature on R&D internationalization has focused on issues concentrated in the developed world.[16] Very few studies address R&D internationalization issues regarding developing countries. For example, von Zedtwitz, Gassmann, and Boutellier (2004), identifying the drivers of R&D globalization and the possibility for multinationals to benefit from the full potential of global innovation, discussed very briefly the question of R&D internationalization in developing countries: "The rapid increase of performance compared to costs leads to the paradoxical phenomenon that some R&D sites in developing countries leapfrog technological generations and install more advanced infrastructure than the R&D headquarter." Also, Filippaios, Papanastassiou, Pearce, and Rama (2009), exploring the strategic internationalization of R&D

[16] Important works, among others in this field, include Kuemmerle (1997), Gassmann and von Zedwitz (1999), and Gerybadze and Reger (1999).

activities of the world's 100 largest food and beverages (F&B) multinational enterprises in 1996 and 2000, argued that overseas R&D laboratories or technological affiliates can also undertake creation activities of genuine knowledge from capitalizing on the scientific heterogeneity fostered in individual host countries as well as distinctive demand conditions. However, even if the possibility to locate R&D centers in developing countries is quickly raised, their results suggested that such companies still favor locating their most important R&D centers in the Triad. Finally, Awate, Larsen and Mudambi (2015) published very recently an in-depth comparison of R&D internationalization strategies (more specifically knowledge flows) between an advanced economy multinational and an emerging economy multinational. Their work inherently suggests that MNCs from advanced economies open R&D subsidiaries in emerging markets, but also that MNCs from emerging markets are now strong enough to export their activities to the developed world. Thus:

Proposition 1: Consistent with a new global trend in R&D internationalization, emerging countries now stand as key centers for innovation.

4.3.2 Reverse innovation and reverse knowledge transfer

Relying on these fundamentals, some interesting questions arise. If MNCs from advanced economies start to open R&D centers in emerging countries, what are the innovation process implications? This being asked and considering the potential local skills, the same question should be asked about technology transfer. Immelt, Govindarajan, and Trimble (2009) and Govindarajan and Ramamurti (2011) started to address these changes with the new theoretical concepts of reverse innovation and, by extension, reverse technology transfer.

The concepts of reverse innovation and reverse technology transfer represent an important shift by considering the new implantation of R&D centers in emerging and developing countries as a very recent strategic move for MNCs. Immelt, Govindarajan, and Trimble (2009) define reverse innovation in opposition to glocalization. Glocalization is the process whereby multinational firms develop excellent products in domestic markets and then distribute them around the world with minor modifications to adapt to market conditions. An innovation is called reverse when first developed for and adopted in the developing world (or emerging world) before "spreading" in the industrial world (Ramamurti and Govindarajan, 2011).

Glocalization allows companies to have the perfect balance between a global scale (to minimize costs) and their adaptation to local conditions (to maximize their market share). However, it is not anymore the best option in today's world (Immelt, Govindarajan, and Trimble, 2009). The emergence of giants as China changes the needs and reverse innovation is a direct result. This implies some significant changes in corporate mindsets (Govindarajan & Trimble, 2012): (1) the questioning of principles attached to glocalization hindering reverse innovation and the recognition by decision makers that success in emerging economies requires a fresh start with global rather than local issues; (2) the movement of workers, power and money where the growth is - in the developing world; (3) the creation of a culture of reverse innovation in the company through the development of local activities, the immersion of employees and the nomination of local officials; (4) the creation of a distinct set of activities for branches of the company in developing countries, with separate financial results and a focus on growth metrics. Govindarajan and Trimble (2012) also propose management techniques to promote reverse innovation: (1) giving full powers to local teams so that they can act as new companies in their search for innovations; (2) enabling local teams to take advantage of possible local partnerships to increase overall resources of the company; (3) managing reverse innovation initiatives as disciplined experiments, with willingness to resolve critical issues quickly and at low cost.

von Zedtwitz, Corsi, Søberg, & Frega (2015) recently proposed a typology of global innovation including reverse innovation. Hypothesizing that each phase of the innovation process (ideation, product development, primary target market introduction, and subsequent secondary market introduction) can take place in different geographical locations (Jaruzelski & Dehoff, 2008; United Nations conference on trade and development, 2005), they provide a mapping of global innovation flows that proposes a subset of reverse innovations.

The recognition of the existence of reverse innovation leads to an actual change in the direction of classical studies on technology transfer. Indeed, two major new ideas emerge: (1) the existence of reverse innovations implies that western MNCs operating in emerging countries can learn from local businesses; (2) the existence of reverse innovations also means that western MNCs can learn from new MNCs from emerging countries when installed in developed countries. In this case, there is reverse technology transfer, as described by Govindarajan and Ramamurti (2011): there is a real opportunity for western MNCs established in emerging countries to acquire

new knowledge, learn new business models, new management practices or even new "adapted" technologies from their local competitors, suppliers or even their local customers.

The literature on technology transfer and externalities (or spillover effects) is not totally consensual (Javorcik & Spatareanu, 2005). However, most studies have a similar assumption: technology transfer goes from the north to the south. Technology and productivity level being higher in the north, intuition suggests a technology transfer from top to bottom.[17] Unfortunately, this also involves the belief that northern firms have nothing to learn from those in the south (Govindarajan & Ramamurti, 2011). The concept of reverse innovation (and therefore R&D capacity building by MNCs and collaborations between local firms and MNCs in emerging countries) has changed these paradigms. Similar to north-south spillovers, **south-north spillovers** can occur through observation or the recruitment of qualified employees who worked in MNCs from emerging countries. They can also be generated by the provision of new knowledge, new technologies, new processes, new management techniques and marketing through partnerships and collaborations.

In terms of articles with empirical evidence of reverse innovation and reverse technology transfer, it is only the beginning of this literature. Zeschky, Widenmayer and Gassmann (2014) examined the question of how multinationals organise their international R&D for reverse innovation and highlighted the importance for MNC's subsidiaries to be based in a resource-constrained environment. Corsi, Di Minin and Piccaluga (2014) explained that reverse innovation could be associated with internal resistance and the risks of cannibalizing its existing products. Judge et al. (2015) analyzed how users from developing countries could be *lead users* in the confection of a wheelchair. Finally, Winter and Govindarajan (2015) highlighted some lessons for multinationals in terms of engineering reverse innovation.

In the health sector, Syed, Dadwal, and Martin (2013) recognized the importance of this phenomenon, explaining that a growing number of leaders and practitioners see a flourishing future for reverse innovation in global health systems (Syed et al., 2013). DePasse and Lee

[17] To only cite the last studies on the subjects: (Aitken & Harrison, 1999; Djankov & Hoekman, 2000; Haddad & Harrison, 1993; Javorcik, 2004; Kokko, Tansini, & Zejan, 1996; Wang, 2005; Z. Wei & Youssef, 2012; Young & Lan, 1997).

(2013) combined the concepts of reverse innovation and innovation diffusion in order to build a theoretical model supporting reverse innovation in global health systems. More specifically, they integrated innovation concepts (reverse innovation, innovation adoption, innovation spread and its acceleration) to create a new reverse innovation model including four steps: (1) problem identification; (2) low income countries innovation and spread; (3) crossover; and (4) high income countries innovation and spread. Their model is represented by a normal distribution graph showing the dynamics of innovation spread. However, their study is limited to theoretical assumptions and does not give any empirical evidence of the phenomenon.

In terms of reverse technology transfer, a pioneering paper published by (Wei, Liu, & Wang, 2008) explored mutual spillovers between MNCs from emerging and western MNCs. The authors showed that technology and knowledge transfer from seven Chinese multinationals have much improved the productivity of western MNCs operating in China.

Our work stands in the extension of this stream of the literature and tries to fulfill the empirical gap about reverse innovation and reverse technology transfer. Doing so, it also enriches the R&D internationalization literature by showing that sources of knowledge are now more and more sought in emerging countries. Thus:

Proposition 2: When MNCs open R&D centers in emerging countries, they practice reverse innovation and, while collaborating with local firms to benefit from their knowledge, they generate reverse technology transfer.

4.4 Methodology

To support both propositions, we choose to focus on a more precise field in terms of industry and in terms of geography. As suggested by the trend of the literature (Syed et al., 2013), we have decided to concentrate on the health sector and, more particularly, the pharmaceutical industry. Indeed, pharmaceutical companies are very R&D sensitive as this stage represents the most expensive and time-consuming part of the industry global value chain (DiMasi, Feldman, Seckler, & Wilson, 2010; Mestre-Ferrandiz, Sussex, & Towse, 2012; Paul et al., 2010; Pharmaceutical Research and Manufacturers of America, 2013). These factors make intellectual property (IP) protection very crucial for this industry. Moreover, pharmaceutical companies are

going today through an important R&D productivity crisis leading them to rethink their business models (Booth & Zemmel, 2004; DiMasi, Hansen, & Grabowski, 2003; Juliano, 2013; Light & Lexchin, 2012; Mestre-Ferrandiz et al., 2012; Munos, 2009; Pammolli, Magazzini, & Riccaboni, 2011; Paul et al., 2010; Scannell, Blanckley, Boldon, & Warrington, 2012). According to a McKinsey & Company report, 13 of the 20 largest global pharmaceutical companies have established R&D centers in China and several have also announced major coming investments in the manufacturing industry (Le Deu, Parekh, Zhang, & Zhou, 2010). This is why we have also chosen China as our geographical area of interest. Many advanced economy companies now opt for partnerships with local firms (Daemmrich, 2013). The pharmaceutical industry also allows us to test our reverse technology transfer hypothesis as the Chinese are now particularly active in this industrial sector (Hughes, 2010b; Qi, Wang, Yu, Chen, & Wang, 2011).

Our methodological design is based on the hypothetico-deductive approach. Our methodology follows two steps: one quantitative and one qualitative. The combination of qualitative and quantitative methods is called mixed methods research or, as defined by Venkatesh, Brown, and Bala (2013), the third methodological movement. The use of this type of methodology is increasingly accepted and valued by the scientific community (Caruth, 2013). Venkatesh et al. (2013) outlined specific mixed methods research qualities in science, including the possible development of hypotheses arising directly from a first method and the possibility to test these hypotheses via a subsequent method. This is exactly our case as the quantitative validation of the first proposition (China is now a new world-class laboratory for research and development) leads to the emergence of the hypothesis of changes in terms of innovation and technology transfer. We can then test proposition 2 (reverse innovation and reverse technology transfer) with a subsequent qualitative method.

4.4.1 Quantitative Approach

We started our research by a quantitative approach to measure innovation in China via patent publications. Indeed, patents are recognized as innovation proxies (Hagedoorn & Cloodt, 2003) and also as technology transfer measures (Keller, 2004). Three levels of patents are observed: (1) patents in general, (2) patents in the pharmaceutical field and, finally, (3) patents published by the ten largest pharmaceutical companies having recently invested in China. Patent data made available by the World Intellectual Property Organization (WIPO) and the Office of Chinese

intellectual property (properly named State Intellectual Property Office of the P.R.C.) (SIPO) allowed us to find numbers about these categories. Extracting, sorting and formatting the data allowed us to show the rise of innovation in China. WIPO provides a statistical database on issued patents. It also provides the "Patentscope" tool, an improved search engine that extracts specific data on patents. SIPO also offers an English search engine for patents in the world and a Chinese search engine for patents in China. These patents may also be delivered elsewhere in the world, but patents filed in China are required to be in Chinese. The language of study was Chinese for this part of our research since patents are tracked by the name of the applicant in Chinese.

4.4.2 Qualitative Approach

As aforementioned, to test our second proposition, we use a qualitative approach. Reverse innovation and reverse technology transfer represent new concepts that describe very recent progressive practices for organizations. The choice of a suitable methodology was therefore of great importance in this context. Indeed, quantitative data or even proxies to measure reverse innovation do not exist and the novelty of these phenomena limits the sample size. However, we believe it is in the interest of the business world and also the research community to better understand these concepts and their implications for business strategies, particularly in the pharmaceutical environment, where R&D is a significant part of the value chain. The qualitative axis therefore seems interesting to the extent that quantitative data are limited. The word *qualitative* means putting emphasis on the qualities of entities, processes and the explanation of a phenomenon that is not examined or measured experimentally in terms of quantity, amount, intensity or frequency (Denzin & Lincoln, 2005).

Given these limitations, we chose to use the **content analysis** developed by Krippendorff (2012) and the coding system specified by (Gioia, Corley, & Hamilton, 2012). By choosing the exploration and validation of reverse innovation and reverse technology transfer phenomena, especially for the pharmaceutical sector, we naturally imposed a theoretical framework. That being said, we remained as much as possible open-minded to the extent that, at the beginning of the study, we did not know whether we would be able to support our propositions. In addition, we also remained open to the emergence of any new reverse innovation criteria, potentially emerging from our study, that could be added to the list we had previously established.

For the content analysis, we collected on the Internet all the available material related to China for the ten largest world pharmaceutical companies between 2009 and 2014 in both English and French. This material mainly includes official discourse that it was possible to capture through specialized Internet media, media interviews with senior Asian pharmaceutical officials, company websites, annual reports and, finally, interviews conducted face to face with related stakeholders in the sector. The information was sought and analyzed until saturation (redundancy of the elements). To conduct the content analysis, all documents gathered were analyzed one by one using NVivo software. We tried to verify, through the discourse analysis, what were the new recent strategies implemented by the biggest pharmaceutical companies. The tables below present the research method used to retrieve our data.

Table 4-1: Method used to collect information

Browser	**Keywords used for saturation**
Google	R&D + pharmaceutical + China
	R&D + «company name» + China
	Interview + «company name» + China
	Reverse innovation + pharma + China
	Technology transfer + pharma + China
	Reverse innovation + «company name» + China
	Technology transfer + «company name» + China

All texts found between 2009 and 2014 inclusive were analyzed. This material can be summarized in the following table:

Table 4-2: Material used for the content analysis

Type	Number
Specialized press with official discourse reported	36
Specialized press with interviews reported	6
Total	**42**

We then established an analysis grid through the identification of specific reverse innovation and reverse technology transfer criteria. We identified seven criteria characterizing a company practicing reverse innovation and three criteria that involve reverse technology transfer. Of course, we do not claim that this list is exhaustive, and other features could also be associated with this type of strategy. Our criteria are described in the table below.

Table 4-3: Reverse innovation and reverse technology transfer criteria

Reverse innovation criteria	Abbreviation	Description	Key authors
1- Emergent market targeted	Target market	Will to develop products for emerging countries needs	Govindarajan & Ramamurti (2011); Govindarajan & Trimble (2012)
2- Localization in emerging markets	Localization	Localization effort of R&D centers in emerging countries	
3- Innovations originality	Originality	Search for new, original and innovative solutions adapted to the country's needs	
4- Prices optimization	Optimization	Will to optimize price/quality/functionality of the products	
5- Local needs identification	Adaptation	Search for local staff or collaboration/partnerships with local firms to better define the real local needs	
6- Delegation of authority to local subsidiaries	Power	Will to provide local teams with enough power to ensure leverage at the top company level	
7-Innovations made for emerging countries flow uphill to the developed world	Flow uphill	Current or future will of a possible return of products developed in emerging countries to developed markets	
Reverse technology transfer criteria	**Abbreviation**	**Description**	**Key authors**
1- Local capacities recognition	Recognition	Recognition of local capacities already existing in the emerging country	Agarwal, Gupta, & Dayal (2007) ; Belderbos, Van Roy, & Duvivier (2013); Blomström & Kokko (1998); Hoppe (2005); Javorcik & Spatareanu (2005); Keller (2004); Kokko, Tansini, & Zejan (1996); Maskus (2003); Vaidyanathan (2008); Wang (2005); Wei & Youssef (2012); Young & Lan (1997).
2- Local labor force employment	Employment	Will to employ locally trained individuals to benefit from knowledge transfer with employees relocated.	
3- Collaborations with local firms	Collaboration	Research of collaborations/partnerships to benefit from local knowledge	

It was then possible to identify any relevant material to deepen the understanding of new strategies being developed by these pharmaceutical companies in China. It is important to note that to state whether or not a company is practicing reverse innovation (or reverse technology transfer), it is not necessary that it meet all the criteria. Indeed, these strategies can be implemented gradually. When a company meets one of the criteria, it is possible to note a change in strategy (compared to conventional strategies such as innovation or usual glocalization). These

criteria were transcribed in the NVivo software (a qualitative software for data analysis). The Open Coding technique was used, directly holding respondents' words or phrases, which had a link with R&D, innovation or technology transfer in China. Thereafter, each sample extracted from the text was associated (through the analysis grid) to a criterion (in our case, the criteria of reverse innovation and reverse technology transfer that we previously developed) (see the figure below).

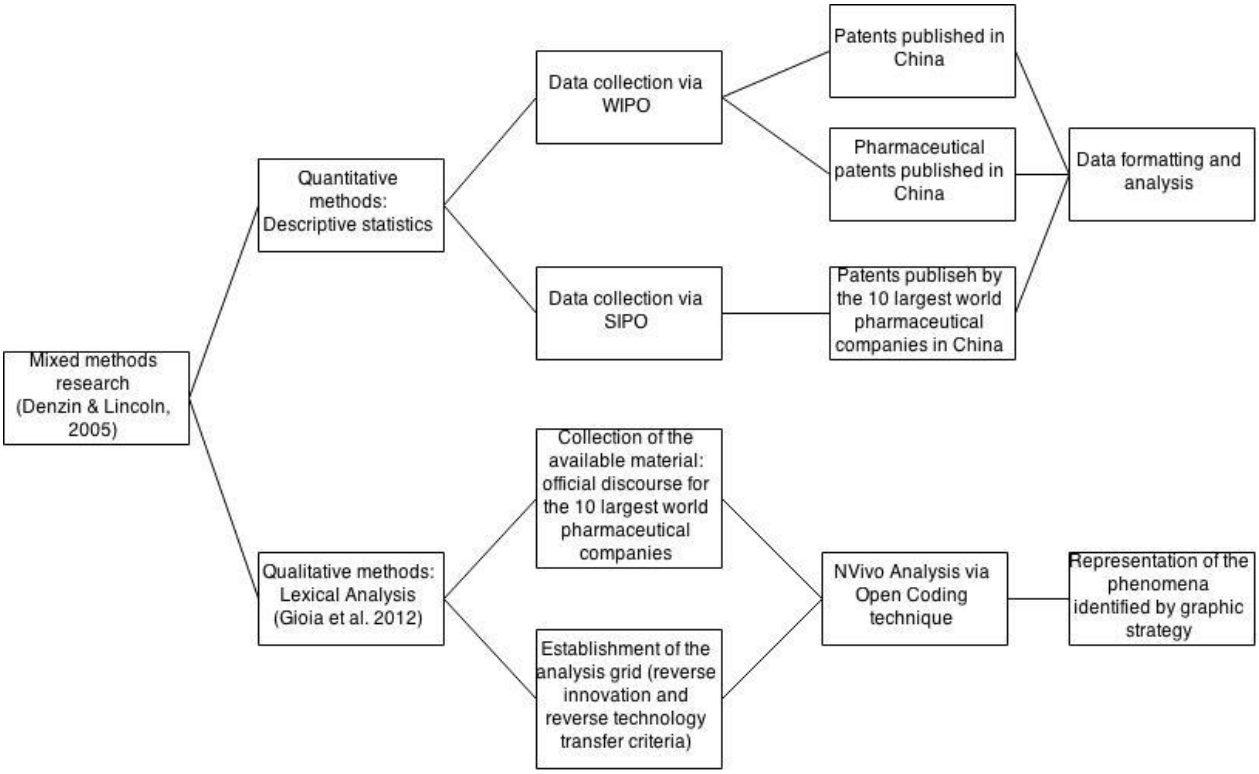


Figure 4-1: Methodological design used in our study

Moreover, since NVivo allows for a recording of identified criteria, a weighting equal to the sum of these accounts was completed. Although it could not be associated with an accurate measure of the value of each criterion, it nevertheless gave us a representation of the importance of each concept. A graphic strategy was also used to represent the phenomena that arise.

4.5 From Made in China to Discovered in China

4.5.1 Stylized facts about China's R&D and Patents

Before starting the patent quantitative analysis, we think it is relevant to highlight some major facts about China, notably the recent evolution of the country in terms of R&D efforts. Since 2010, China is the second largest country, after the United States, in terms of R&D investments, with a total of 178 billion U.S. dollars (the United States has invested 403 billion U.S. dollars for the same period) (Wu, 2012). China ranks first in terms of researchers, with a total of 2.9 million people working full time in R&D in 2011 (about double the number of researchers in the United States) (Wu, 2012).

In 2012, for the first time in its history, Chinese residents represented the majority of patent applicants in the world (World Intelligence Property Organization, 2013). SIPO is also the largest recipient of patenting requests in the world with 560,681 requests made by Chinese residents against 460,276 applications in the United States (World Intelligence Property Organization, 2013). In terms of patent applications, China surpassed Europe in 2004, and the United States for the first time in 2011 and since then.[18] In 2012, there were 652,777 patents filed in China against 542,815 in the United States. For patent grants, China is still slightly behind the United States, but the trend suggests an imminent catching up. In 2012, there were 253,155 patents granted in the United States against 217,105 in China.

An important question remains: Does measuring the number of patents truly reflect innovations made in China? Indeed, the recent economic rise of the country over the last ten years has represented a growing motivation for western companies to patent their innovations in China. In other words, to determine whether China is really a new attraction for R&D, it is important to take a closer look at the number of patents filed by residents and non-residents (Xie & Zhang,

[18] We used two databases: (1) the World Intellectual Property Organization (WIPO) database; (2) the Chinese Intellectual Property Office (SIPO) database. The database built by the World Intellectual Property Organization (WIPO) allows us to measure the evolution of innovation in China compared to Canada, the United States and Europe, but also to other emerging countries such as Brazil and India.

2014). A much larger number of patents filed by non-residents could be simply related to the fact that western researchers now seek to protect their inventions in China (Hu, 2010). In contrast, a large and growing number of patents filed by Chinese residents proves the country's research capacities (Hu & Jefferson, 2009).

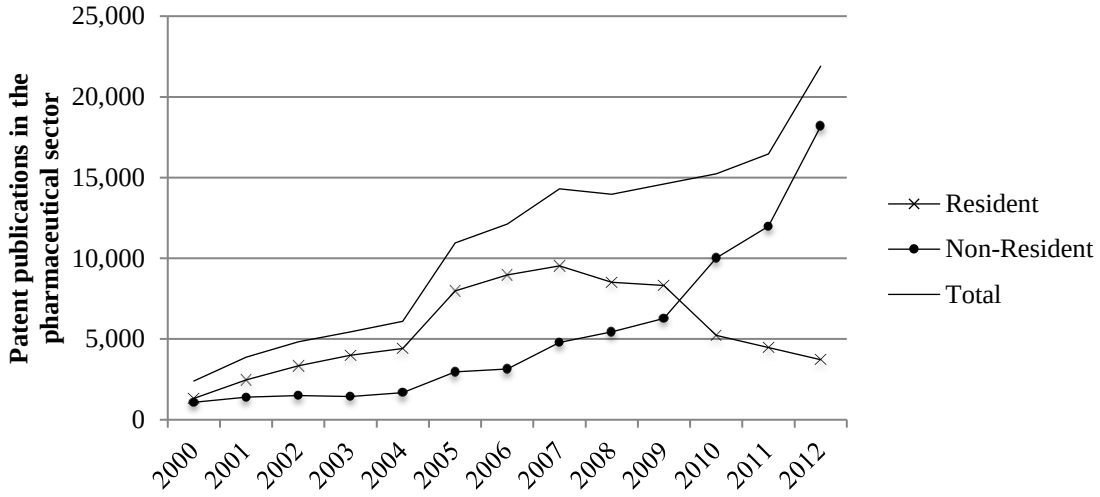
4.5.2 Stylized facts about the pharmaceutical sector in China

If we look more specifically at the pharmaceutical sector, some stylized facts about China should also be mentioned before starting with the analysis. In 2011, China ranked third in the global pharmaceutical market (Qi, Wang, Yu, Chen, and Wang, 2011). By 2015, China is expected to be the second largest pharmaceutical market after the United States (Hughes, 2010b). This sector is the eighth largest industry in China in terms of R&D expenditures and the fourth in terms of profits relative to expenditures (Wu, 2012). Total drug sales in China reached 69 billion U.S. dollars in 2011 and are estimated to be around 100 billion U.S. dollars in 2013 (Business Monitor International, 2012). Some analyses predict that health spending in China could grow to more than a trillion dollars in 2020, which would triple the 2010 amount and bring the spending share to 7% of GDP (Le Deu et al., 2010). Moreover, since the mid-1990s, expenditures on prescription drugs increased with an annual growth rate of around 20% (World Bank, 2010). In 2010, prescription drugs accounted for 40% of health spending (compared to about 12% for other countries such as France, Germany, Japan or the United States) (Daemmrich, 2013). Indeed, changes in lifestyle, dietary habits and the environment accompanying industrialization and rapid economic growth in China resulted in an epidemiological transition (Daemmrich, 2013).

4.5.3 Patent analysis in the pharmaceutical sector

In terms of patent application for the pharmaceutical sector, the results are more complex to interpret. In terms of the quantity of patents filed and issued, the pharmaceutical industry ranks 5th out of the 35 largest industries in China (World Intelligence Property Organization, 2013). Since 2000, the number of patents in the pharmaceutical sector has constantly been growing, evolving from about 2,500 to 22,500 between 2000 and 2012. After western countries, it is interesting to note that China is today the first emerging country welcoming pharmaceutical researchers (World Intelligence Property Organization, 2013).

If we look at the patent applicant's origin (see the following graph), the pattern may, at first, be somewhat confusing. Indeed, despite a significant increase in the deposit (and delivery) of patents in the pharmaceutical sector since 2004, the number of patents filed by Chinese residents is decreasing, while the number of patents filed by non-residents is largely increasing.



Graph 4-1: Changes in the number of pharmaceutical patents filed by residents and non-residents in China between 2000 and 2012. Sources: WIPO, 2014; own computation

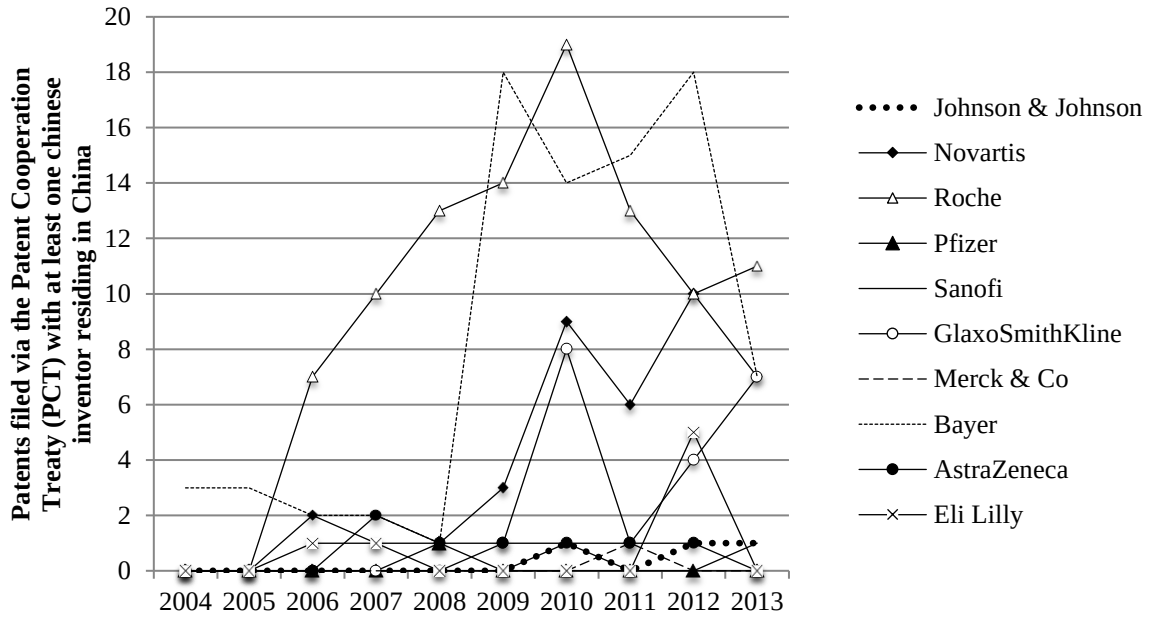
Since 2009, the number of patents filed by residents became much lower than the number of patents filed by non-residents. However, this phenomenon does have a logical explanation, which also introduces the second part of our article. Indeed, the WIPO classification of patents filed by residents or non-residents is based on the following concepts:

> *"The residence of the first-named applicant (or inventor) recorded in the IP document (e.g. patent) is used to classify IP data by country of origin. (…)*
>
> *A resident IP filing refers to an application filed by an applicant at its national IP office. For example, an application filed by an applicant resident of Japan at the IP office of Japan is considered a resident filing for Japan IP office data. Similarly, a non-resident filing refers to an IP application filed by an applicant at a foreign IP office. For example, an application filed at the IP office of China by an applicant residing in France is considered a non-resident filing for China IP office data. The IP grant (registration) data are based on the same concept."*
>
> *WIPO methodology: http://www.wipo.int/ipstats/en/general_info.html*

Patents filed by pharmaceutical industries, developed by researchers residing in the country of origin of the company or not, always have the company itself as the first inventor or the first applicant. In other words, even if Pfizer has an R&D facility in China, makes an innovation and files a patent at the Intellectual Property Office in China, the said invention will be classified as a patent filed by a non-resident as the first name on the document will be global Pfizer based in New York.

It seems that foreign pharmaceutical companies have filed an important number of patents in China, especially since 2009. Given the classification methodology used by WIPO (described above), there are four potential interpretations of this observation: (1) foreign pharmaceutical companies protect their patents - developed abroad - in China, in order to protect their property locally (we see in the second part of the article that many large pharmaceutical companies have opened R&D centers in China), and then continue to work locally on these innovations; (2) R&D centers recently opened in China by the major pharmaceutical industries have already started to produce and protect their local advancements (in drug discovery, patenting can start very early in the research process, although it is advantageous to patent as late as possible to ensure the longest protection) (Paul et al., 2010); (3) companies protect their innovations in China by the precautionary principle; (4) all the above assumptions.

In an attempt to clarify these questions, we conducted two subsequent searches. First, to determine whether the amount of R&D performed by large western pharmaceutical companies in China is growing, we used the Patentscope search tool developed by WIPO. The following graph shows the evolution of patents filed in China by the ten biggest pharmaceutical companies (based on their income, see the table in the next section for more details) and for which there is, in the list of inventors and applicants, at least one Chinese resident whose addresses (main and work) are listed as being in China. This work validates that these western companies do not only patent innovations made abroad (in their country of origin for example), but also innovations resulting from research carried out in China, or at least in partnership with the Chinese.

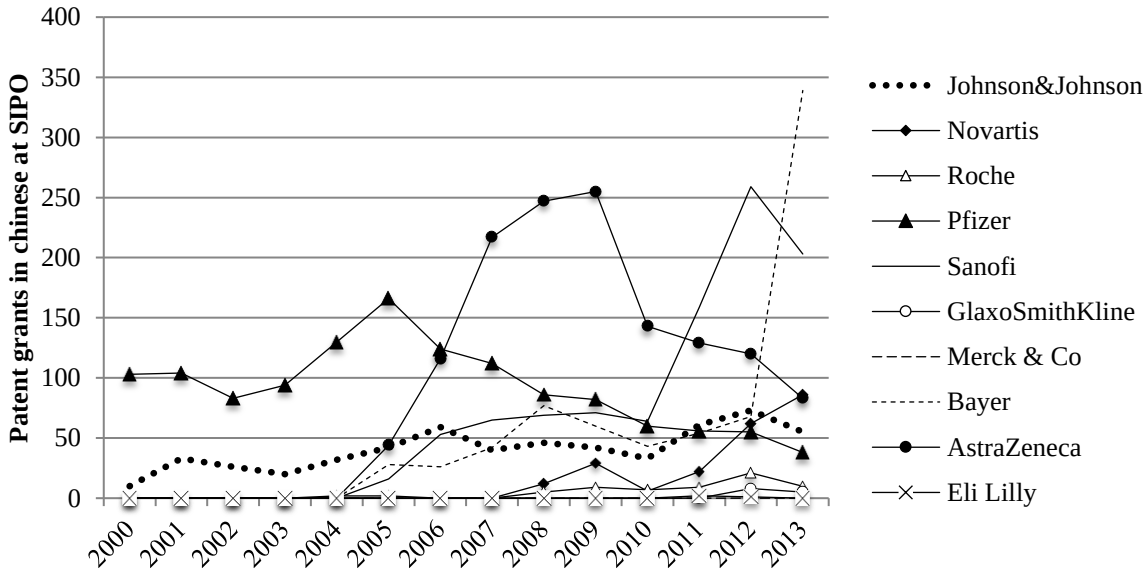


Graph 4-2: Patents filed by big pharmaceutical companies and for which there is at least, in the list of applicants and inventors, one Chinese resident. Sources: WIPO, 2014; own computation

Here, it is important to note that Patentscope provides the information for patents filed through the Patent Cooperation Treaty (PCT). The PCT helps applicants to obtain patent protection internationally. By filing one international patent application, applicants may seek protection for an invention simultaneously in 148 countries around the world without redundancy. It is then up to the worldwide different offices to issue or not these patents. More and more companies (particularly MNCs) use this shortcut and, today, Asia represents 58.4% of all patent applications worldwide, in contrast to the lower shares received by IP offices in North America (23.6%) and in Europe (13.5%) (World Intelligence Property Organization, 2013). The data in the following chart are valid within the limits described above. Except for Bayer Pharmaceuticals, no activity took place before 2005. However, since 2005 and particularly since 2008, all these big companies seem to have filed at least one patent for which one of the inventors was a Chinese living in China. Although irregular, this new tendency seems to continue.

We then observe the evolution of the number of patents filed at the State Intellectual Property Office in China (SIPO) for the ten largest pharmaceutical companies in the world. This information is only available in Chinese on the official SIPO website. It was therefore necessary to find the Chinese translations for each firm and then examine each patent to keep only the

relevant information (see Appendix D). The following graph represents the evolution of patents filed in Chinese and granted by the SIPO for each company over the last decade. The numbers are almost null before 2005 (except for Johnson & Johnson and Pfizer). However, since 2005, we can observe an increase of patents in Chinese granted to these companies (innovations are required to be written or translated into Chinese to be filed at SIPO and then properly protected in the country). This growth may result from patents related to innovations made in the west then filed in China (in an idea of continuity), but also from patents related to innovations directly made in China in the companies' new R&D centers.



Graph 4-3: Evolution of the number of patents filed in Chinese by the ten biggest western pharmaceutical companies over the last decade. Sources: SIPO, 2014; own computation.

The previous two analyses do not allow us to stricto sensu validate our propositions. However, the research activity of the pharmaceutical industry is moving to China since 2005 and this activity is not limited to systematic protection or precautionary protection of innovations previously made in advanced economies.

Furthermore, it could also be interesting to study the evolution of the number of patents filed abroad by Chinese pharmaceutical companies. This information can be directly extracted from

the WIPO database. This number has been constantly growing to pass from about 35 patents in 2000 to approximately 570 in 2012.

As aforementioned in the stylized facts, we observe the decline of R&D in the pharmaceutical sector in advanced economies. At the same time, R&D activity is rapidly growing in China, especially since the mid-2000s. Firms from advanced economies open R&D centers in China. Moreover, they collaborate more and more with local firms to get some advantages in terms of time, market penetration and knowledge about the local needs. Related to our second proposition, the questions are now (1) whether we observe reverse innovation and (2) whether reverse innovation is accompanied by reverse technology transfer.

4.6 Reverse Innovation and Reverse Technology Transfer

For the scope of our study, we chose to focus our analysis on the ten largest global pharmaceutical companies in terms of revenues for 2013. Indeed, these companies account for about half of the global market in the sector.

Table 4-4: Ten biggest pharmaceutical companies in terms of revenue for 2013. Source: Annual reports of the companies.

Rank	Top 10 Pharmas	Origin	2013 revenue (millions of US $)
1	Johnson & Johnson	United States	71 312
2	Novartis	Switzerland	57 920
3	Roche	Switzerland	52 307
4	Pfizer	United States	51 584
5	Sanofi	France	45 078
6	GlaxoSmithKline	England	44 146
7	Merck & Co	United States	44 033
8	Bayer	Germany	25 969
9	AstraZeneca	United States	25 711
10	Eli Lilly	United States	23 113

As aforementioned, the material used for our content analysis mainly includes all the official discourses it was possible to capture through specialized Internet media, media interviews with senior Asian officials, and pharmaceutical companies' websites. A first intuition would have been to look at companies' annual reports. However, and surprisingly, we could not find any information related to the strategies they intend to implement in China. All companies are insisting on the importance of emerging countries and particularly China for their business, but they do not reveal any details in terms of investments or strategies.

Before analyzing the results for each of the criteria that characterized the concepts of reverse innovation and reverse technology transfer (see the table in the Methodology section), we propose to verify the second criterion of reverse innovation: the localization of the company in the emerging market (criterion 2). It was, in our sense, irrelevant to identify the rhetoric associated with this criterion since it can be validated as a fact. The localization is a key criterion for reverse innovation. A first work was therefore to identify the existence of R&D centers in China for the big pharmaceutical companies. The following table summarizes the available information.

Table 4-5: R&D centers opened in China by the ten big pharmaceutical companies. Source: Hughes (2010b) and information available in specialized press articles[19].

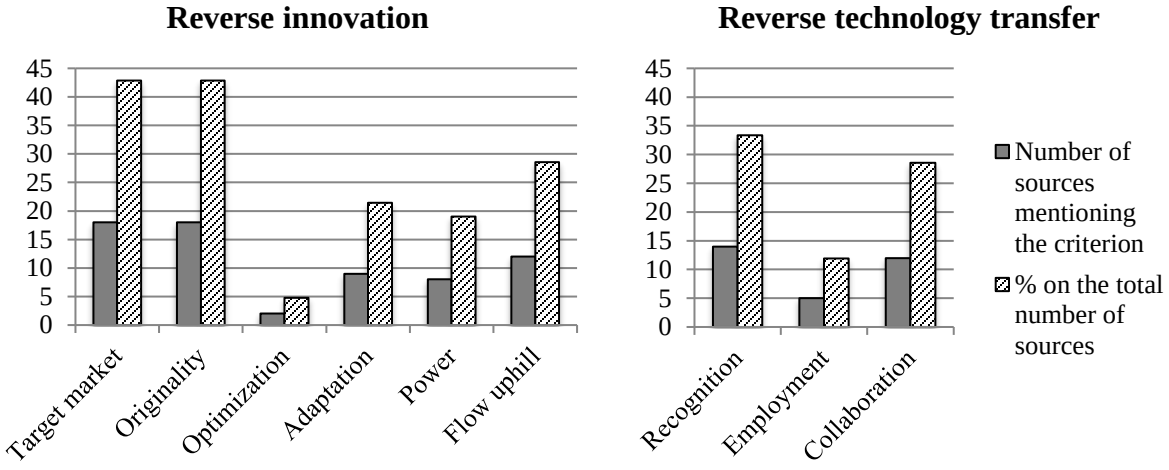
Big Pharmas	R&D centers in China	Opening date	Research topics
Johnson & Johnson	**Asia R&D Center** Shanghai	2009	Cancer, infectious diseases, metabolic diseases
Novartis	**The Novartis Institute of BioMedical Research** Shanghai, Zhangjiang High-Tech Park	2008	Infectious disease linked to the most common cancers in Asia, research in chemistry and biomarkers
Roche	**Roche R&D Center** Shanghai, Zhangjiang High-Tech Park	2004 and 2008	Between 2004 and 2008: medicinal chemistry services to international teams. Since 2008: research on innovative medicines (early stages of development) for virology and oncology
Pfizer	**Pfizer Asia Research** Shanghai, Zhangjiang High-Tech Park	2006	Research on liver diseases and tuberculosis.
	Wuhan	2010	Extension of the Shanghai R&D center
Sanofi	**China Discovery platform** Shanghai	2010	Neurological diseases, diabetes and cancer
GlaxoSmith Kline	**GSK Global R&D Center** Shanghai, Zhangjiang High-Tech Park	2007	Neurodegeneration with a focus on multiple sclerosis, Alzheimer and Parkinson diseases
Merck & Co	Beijing, Wangjing Park	2014 (expected)	Vaccines and diabetes
Bayer	**Global Scale R&D Center** Beijing	2010	-
AstraZeneca	**Innovation Center China (ICC)** Shanghai, Zhangjiang High-Tech Park	2007 then extended in 2012	Cancer with a focus recently extended to research on respiratory diseases
Eli Lilly	**Lilly China Research and Development Center (LCRDC)** Shanghai	2012	Innovative medicines for diabetes

[19] The number of employees in R&D could not be clearly identified. However, according to information available in the annual reports and in the press, it is possible to estimate the number between 100 and 700 employees by R&D center. For a cross table between the opening year of R&D centers in China and the evolution of the patents filed via the Patent Cooperation Treaty (PCT) with at least one Chinese inventor residing in China, see Appendix E.

It is therefore possible to conclude that all these big pharmaceutical companies have recently opened R&D centers in China. All of them already had production sites or clinical trials in the country (usually for more than ten years). However, it is only very recently that they have invested in basic research in China. To better understand this strategy, it is now useful to continue with the content analysis of the official discourse collected.

According to our reading grid established above, six criteria remain to be examined for reverse innovation (target market, originality, optimization, adaptation, power, flow uphill) and three criteria for reverse technology transfer (recognition, employment, collaboration).

The 42 sources selected were analyzed and the following graphs show the occurrence of each criterion emerging from the reading.



Graph 4-4: Number of sources mentioning each criterion and percentage on the total number of sources (analysis using the NVivo software)

First of all, we could see that all the criteria emerged largely in the material analyzed. About reverse innovation criteria, target market, originality and flow uphill are the most discussed concepts in the official discourse, with respective scores of 43%, 43% and 29% of the sources in which they are mentioned. For reverse technology transfer, recognition and collaboration seemed privileged with 33% and 29% of the sources in which they are respectively mentioned. Originality and employment criteria are less highlighted, with scores of about 5% of the sources

in which they are mentioned. The following tables cover some of the most relevant citations for each criterion.

Table 4-6: Selected quotations to illustrate reverse innovation criteria, extracted directly from the analyzed material

Reverse innovation criteria	Sample (selected quotations)
Target market	"The mission of EMIC is to develop new and affordable products addressing the specific consumer needs of emerging markets." (Johnson & Johnson) The facility specialises in basic research and development and focuses on the discovery of new drugs such as small molecule and biological medicines. The facility mainly develops drugs for diseases prevalent in China. (Novartis) R&D chief Marc Cluzel says in a statement that the new R&D center will help Sanofi develop therapies specifically for the Chinese population. (Sanofi) "Rather than trying to find a use for approved medicines that were developed for a non-Asian phenotype, the move is to discover and develop medicines specifically to treat Asian diseases." (GSK) Its R&D centre in Beijing would pay special attention to drugs for diabetes, hypertension, and liver and gastric cancers, diseases which have high prevalence in China. (Bayer) AstraZeneca has a center in Shanghai focused on cancers more common in Asia. (AstraZenaca) The goal of the LCRDC is to discover innovative diabetes medicines with novel mechanisms of action that can be tailored specifically for the Chinese population to delay the progression of the disease. (Eli Lilly)
Originality	"When you have a country like China that is so big that you have clusters of populations that live in fairly remote areas and cannot easily get prescriptions refilled or have regular check-ups, you have to think about what is the most appropriate dosage form and the right formulation to deliver benefits." (Johnson & Johnson) "We want to focus on treating serious diseases, gaining a critical mass of understanding and critical insights that will guide our research and clinical development," continued McCracken. "We want to develop first-in-class or very highly differentiated drugs, and we want to be able to predict who is going to respond to these drugs." (Roche) In addition to the establishment of development functions, we will also launch the Global Drug Discovery Innovation Center here in Beijing where our scientists will expedite new innovative approaches together with our Chinese partners. (Bayer) "We're not going to replicate what has been done in the West. We will try to innovate and transform how we do R&D. " (AstraZenaca) Lilly's R&D chief Jan Lundberg said the firm will be looking at diabetes "in new and different ways. " (Eli Lilly)

Table 4-6: Selected quotations to illustrate reverse innovation criteria, extracted directly from the analyzed material (cont'd)

Optimization	“The mission of EMIC is to develop new and affordable products addressing the specific consumer needs of emerging markets.” (Johnson & Johnson)
Adaptation	The division headed by Lee recently started to collaborate with the Tianjin Medical University Cancer Institute and Hospital to study pharmacogenetics and biomarker research in oncology with a particular focus on cancers that have a high incidence in Asia that may not have been as aggressively studied as some other cancers. (Johnson & Johnson) We have a diversified leadership team, with Americans, Europeans, and local Chinese, with a global view and strategic vision, which they combine with local insight and networking connections that work very well together. (Pfizer) In addition to the establishment of development functions, we will also launch the Global Drug Discovery Innovation Center here in Beijing where our scientists will expedite new innovative approaches together with our Chinese partners. (Bayer)
Power	CNIBR is expected to be the third largest R&D center for Novartis, after the R&D center in Cambridge, Massachusetts, U.S. and the facility at the Novartis headquarters in Basel, Switzerland, and to become the largest comprehensive R&D center in China. (Novartis) Zang said GSK had provided its China center with plenty of resources and the power to decide on the direction of neuroscience research. (GSK) Today, to give you a sense of how important China is for Lilly, in 2011, the 150 top executives, who usually meet in Indianapolis - it has been this way for as long as I’ve been in the group - met for the first time outside the US. They came to Shanghai, which gave me the chance to accommodate the logistics for 150 of my colleagues! (Eli Lily)
Flow uphill	"We are confident that our expanded investment in R&D will result in innovative therapies for patients in China and other countries nurtured by the growing scientific excellence in China." (Novartis) "The facility also specializes in discovery chemistry and biomarker research. It combines the latest drug discovery methods with traditional Chinese medicine to develop drugs for the Chinese population and worldwide population." (Novartis) "Newly formed unit is working with academic TCM experts in China to develop new TCM products for the benefits of patients in China and the rest of the world." (GSK) The medicines and vaccines developed in Beijing would not be targeted at China or Asia, said Kim, but at a global market, without saying which diseases the center would focus on. "(What) we will be looking to do in China, as we do throughout the world, is identify opportunities to develop drugs to treat diseases that would be applicable globally." (Merck & Co) "Together with AstraZeneca's world class scientists, we hope to understand the mechanisms of the disease better and ultimately develop

Table 4-6: Selected quotations to illustrate reverse innovation criteria, extracted directly from the analyzed material (cont'd and end)

	novel medicines to benefit patients – not only in China but worldwide." (AstraZeneca) "We will do this by looking at diabetes in new and different ways and through collaborations with local academic research centers and partners that enable us to link Lilly scientists with scientists in China. With an eagerness and optimism to explore new theories about disease development and progression and potentially translate this to tailored diabetes medicines, I believe we will make a difference for people with diabetes, in China and around the world." (Eli Lilly)

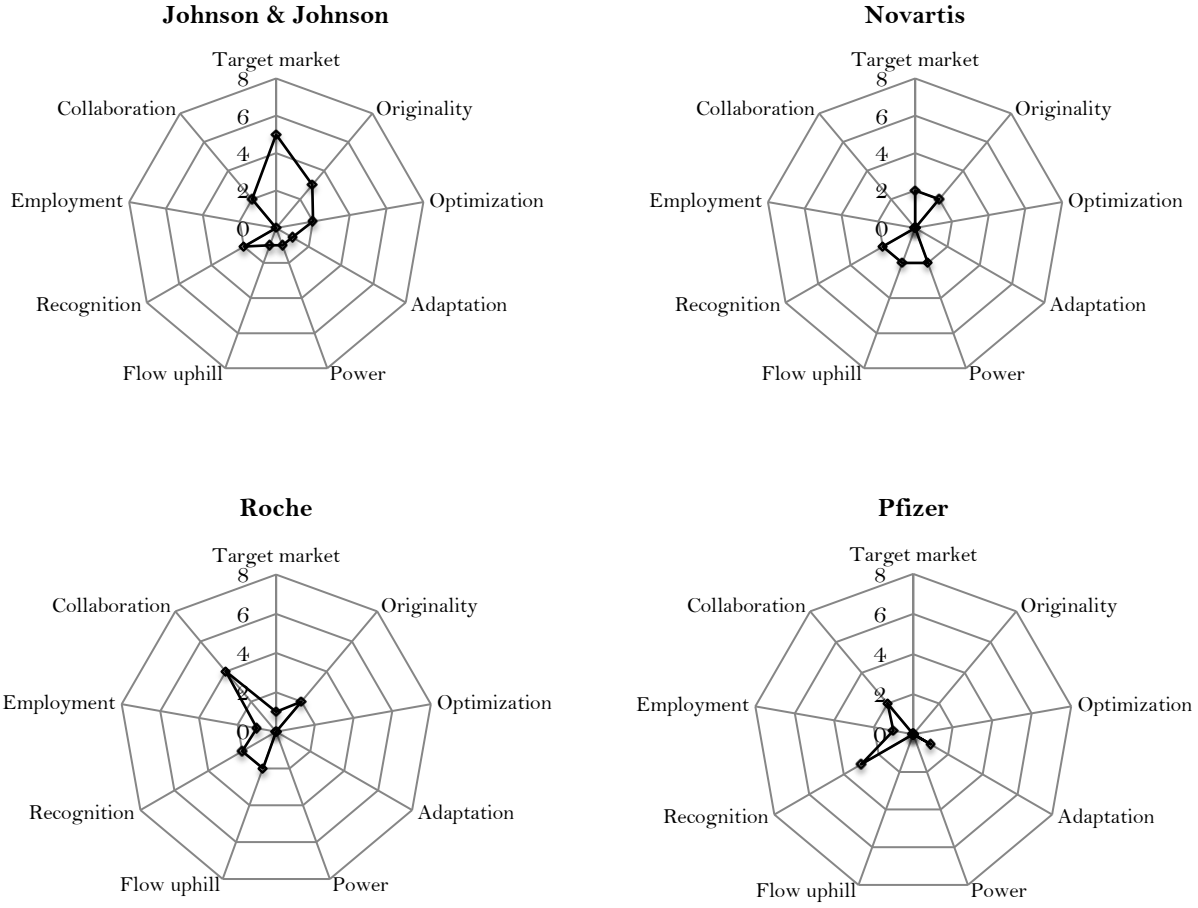
Table 4-7: Selected quotations to illustrate reverse technology transfer, extracted directly from the analyzed material

Technology transfer criterion	Sample
Recognition	“Our goal is to invest in research and development in the region, fuel entrepreneurship, and tap into Asia’s vast scientific excellence and talent to foster new therapeutic approaches for the region and the world.” (Johnson & Johnson) "We are confident that our expanded investment in R&D will result in innovative therapies for patients in China and other countries nurtured by the growing scientific excellence in China." (Novartis) Pfizer noted that its Wuhan operation will liaise with local research institutes and universities “utilising the rich resources of local talent and existing industry capabilities to develop research collaborations”. (Pfizer) “We believe that China bears tremendous potential in terms of innovation. ” “China is home to a large pool of skilled medical and scientific talents. ” "We are excited about the opportunity to collaborate with the excellent scientists at Peking University." (Bayer)
Employment	The LCRDC, which employs approximately 150 scientists and staff, hired primarily from China. (Eli Lilly)
Collaboration	“We’re taking a unique approach in Asia by actively seeking out and collaborating with the numerous exciting research institutions in academia and industry and building a strong network of researchers throughout the region to create a virtual R&D community. ” (Johnson & Johnson) "As we span the value chain from discovery to early development in China, we need to continue to hire the brightest talent and collaborate with the best biotech organizations, as well as the top academic and clinical institutions. We already have several collaborations with local institutes and are continuously developing our external network.” (Roche) Pfizer noted that its Wuhan operation will liaise with local research institutes and universities “utilizing the rich resources of local talent and existing industry capabilities to develop research collaborations”. (Pfizer) “With the group in Tianjin, we tested the water to see how successful discovery research in China could be. We realized that the collaboration was really good, so we have since established a systematic way of looking for opportunities.” (Sanofi) “We think we can leverage our recent acquisition of Steigerwald in combination with Dihon’s herbal TCM expertise and pipeline to benefit both these areas, which have a different but related heritage.” (Bayer) “Our goal is to work closely together with our Chinese partners to support China conducting their own R&D activities and at the same

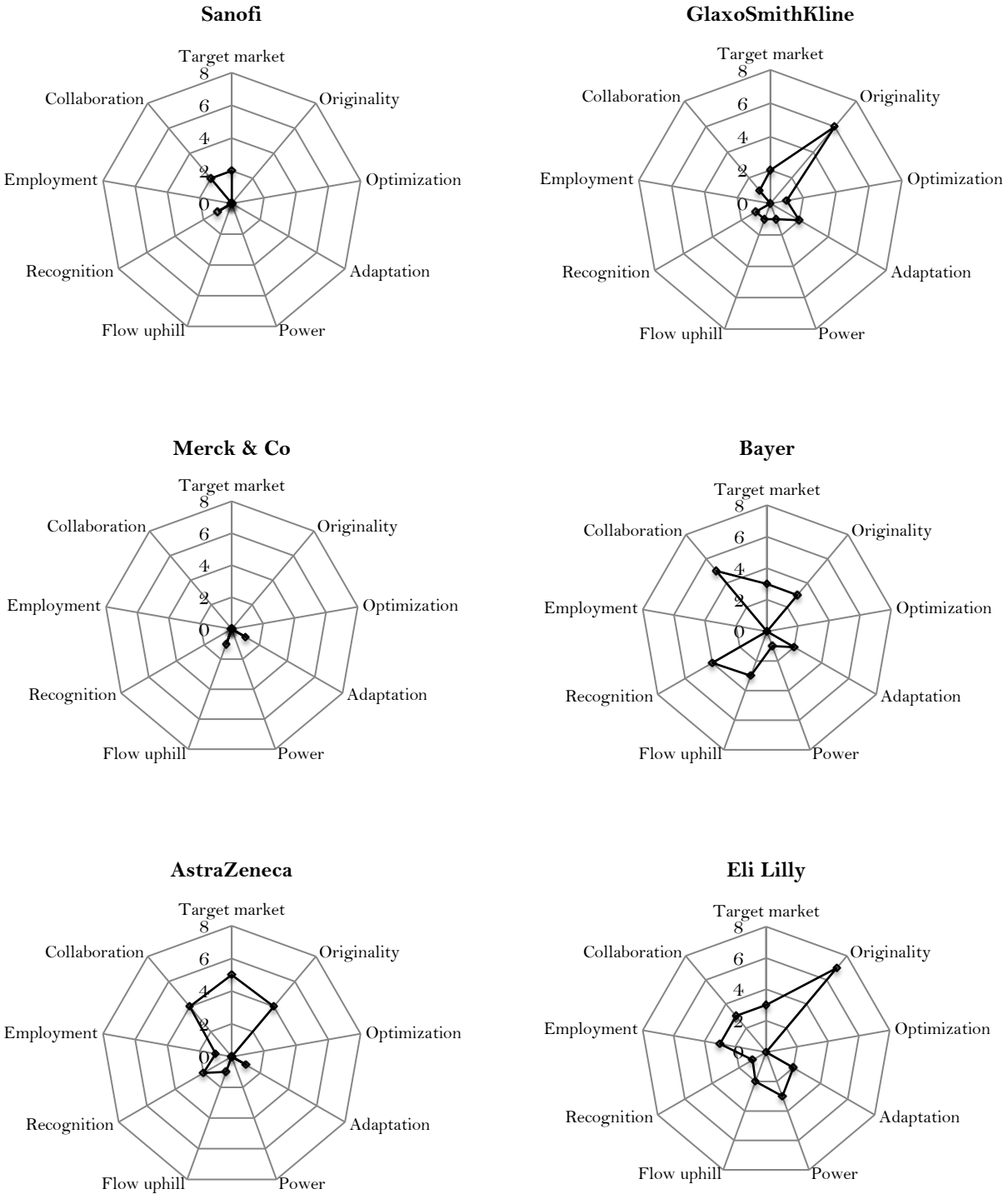
Table 4-7: Selected quotations to illustrate reverse technology transfer, extracted directly from the analyzed material (cont'd and end)

	time we will be able to strengthen our own R&D capabilities." (Bayer) Under the terms of the agreement, scientists from Shenzhen University Health Science Center's Nephrology and Urology Center will work in collaboration with teams from AstraZeneca's Innovation Center China in Shanghai, bringing together complementary skills that will harness and foster medical innovation. (AstraZeneca) Today Lilly and Covance announced a new agreement to establish a diabetes discovery partnership in China. Under this agreement, Covance's wholly owned entity in China will provide the LCRDC with a range of services, including pharmacology studies, pharmacokinetic screening and other preclinical research to test and evaluate potential new diabetes medicines. (Eli Lilly)

It is also possible to make the same analysis, but by pharmaceutical company. The following Kiviat charts illustrate the differences between firms. The goal here is to show whether the company has, at least once, mentioned one of the criteria defined. It is important to note here that comparing scales would mean that the more a company mentions a criterion, the more it practices reverse innovation and/or reverse technology transfer. This finding may be biased by the level of media coverage and the number of articles published per company.



Graph 4-5: Kiviat graphs representing each pharmaceutical company involvement in reverse innovation and reverse technology transfer



Graph 4-5 : Kiviat graphs representing each pharmaceutical company involvement in reverse innovation and reverse technology transfer (cont'd and end)

As already mentioned, companies do not have to fill all the criteria to be qualified as practicing or willing to practice reverse innovation or reverse technology transfer.

In terms of general results, according to the above graphs, it is then possible to note that the majority of companies meet at least three (3) of the reverse innovation criteria (+ criterion 2, since they all have R&D centers in the Chinese territory) and observe at least one reverse technology transfer criterion (except for Merck & Co., as its R&D center is not completed and was only expected for 2014).

In terms of specific results, we find two interesting trends to support proposition 2: (1) a first trend about reverse innovation and (2) a second trend about reverse technology transfer. Let us start with the first trend about reverse innovation: criteria 1, 3 and 7 are ranked high by companies. For instance, Eli Lilly is quoted first, directly followed by GlaxoSmithKline, on research for new solutions for emerging countries' needs (criterion 3). Johnson & Johnson, AstraZeneca and Bayer show a strong desire to develop products for emerging countries' needs (criterion 1), as well as to have innovative solutions adapted to the countries' needs (criterion 3). Another interesting result is that most of the companies mentioned in our sample weigh criterion 4 very low, which is about price optimization. This criterion is not part of their discourse. However, almost all the companies show an interest in criterion 7, which is about their future will of a possible return of products to advanced economies. Bayer is leading the trend on this criterion, followed by Eli Lilly, Roche, and Novartis.

Let us now have a look at the second trend about reverse technology transfer. Criteria 8, 9 and 10 are of particular interest for this analysis. For instance, Roche, Bayer and AstraZeneca rank very high in terms of collaboration with local firms and benefits from local knowledge (criterion 10)[20]. Bayer and Pfizer, followed by AstraZeneca, GlaxoSmithKline, are high in terms of local capacity recognition (criterion 8). Another interesting result is that, so far, local labor force employment is not ranked high (criterion 9).

[20] For more examples of alliances and partnerships between western Big pharmas and Chinese organisations, see Appendix F.

The question asked in our paper was mainly whether big pharmaceutical companies were beginning to practice reverse innovation and reverse technology transfer in a country where R&D was more and more stimulated (in our case, China). Based on these results, even if the intensity differs, it seems clear that all the big pharmaceutical companies have started to establish this kind of strategy. We do believe it is the beginning of a new trend considering both (1) the Chinese economy and its huge consumer base and (2) the trend illustrated in our quantitative analysis on top of the results from the qualitative analysis.

4.7 Discussion and Conclusion

Our analysis tests two propositions: (1) China is moving from being the world factory to becoming a new world-class laboratory for research and development, in particular in the pharmaceutical sector, and (2) in this context, when multinational pharmaceutical companies open R&D centers in China, they practice reverse innovation and, while collaborating with local Chinese firms to benefit from their knowledge, they generate reverse technology transfer.

From a theoretical perspective, our contribution is in line with the literature on the transnational organization (Bartlett & Ghoshal, 1990; Bartlett & Ghoshal, 1988), its developments about R&D internationalization in developing countries (Filippaios et al., 2009; von Zedtwitz & Gassmann, 2002), and the more recent works about reverse innovation (Govindarajan & Ramamurti, 2011; Govindarajan & Trimble, 2012; von Zedtwitz et al., 2015). It is noticeable that in previous studies on R&D internationalization, complementarity between the knowledge developed by the subsidiaries and headquarters (Filippaios et al., 2009) is often suggested. In our case, we do not find strong evidence of complementarity. Indeed, about the pharmaceutical sector in China, we observe more of a substitution phenomenon illustrated by China becoming a new leader in terms of patents, R&D centers, etc. In this regard, our findings may illustrate one of von Zedtwitz et al., 2015's managerial implications, which is that "only the most experienced MNCs are able to systematically benefit from reverse innovation." Pharmaceutical MNCs are very experienced and thus are good candidates for strong reverse innovation, which is also an element in favor more of the substitution phenomenon than the complementarity one. This phenomenon is also a fertile ground for reverse knowledge transfer.

Our mixed methodology was particularly interesting to highlight the new position of China in terms of R&D, but also to support our second proposition about innovation and technology transfer. Indeed, these two phenomena are very new and, as no data or proxy are yet available to measure their existence, qualitative research was necessary.

About our first proposition, the mixed methodology was useful in two ways. Firstly, based on WIPO and SIPO data, our first results allowed us to show that China is today an important player in terms of R&D, in particular in the pharmaceutical sector. We argued that not only there were more patent applications in China than in any other country, but also that Chinese residents generated these patents. This reality implies that the biggest impact in terms of innovation is not from abroad, but from local firms. We also highlighted that multinational pharmaceutical companies were starting to publish patents in China and that Chinese were also increasingly active abroad in this sector. Secondly, we also used a qualitative approach to verify whether the ten biggest pharmaceutical companies in the world were implementing a strategy change in terms of R&D practices. Eventually, the content analysis allowed us to confirm that all of them have started to shift their strategy by establishing R&D centers in China. Both these quantitative and qualitative analyses (mixed methodology) support our first proposition, while providing a useful background for the validation of our second proposition.

About our second proposition, the content analysis showed that innovation in the pharmaceutical sector in China leads to reverse innovation and reverse technology transfer. Indeed, the criteria related to reverse innovation and reverse technology transfer are all mentioned (at a more or less important frequency) in the official discourse of these companies.

Indeed, to summarize, target markets, localization and originality are the criteria most mentioned by companies. For these big pharmaceutical companies, choosing China as the next target market for their innovations reflects their willingness to direct their future research to first meet Chinese needs. The emphasis on originality in the development of new pharmaceutical products underlines the willingness to use innovation strategies not already used before. It seems that companies want to innovate based on locally available resources, such as traditional Chinese medicine. Bayer, recently buying one of China's largest pharmaceutical companies specialized in

traditional medicine,[21] is a good example of this phenomenon. Pharmaceutical companies also seem willing to develop new treatments for diabetes, more suitable to the Chinese in terms of composition, but also in terms of dosage and packaging (Hughes, 2010a, 2010b). The price optimization is of very little attention. It is not clear whether the local R&D actually costs less and if developed drugs can then be sold at lower prices. However, measures of drug reimbursement implemented by the Chinese government might suggest that companies have little to worry about this issue. All companies also seem inclined to employ Chinese labour and to form strategic partnerships to better understand local needs. At this level, these alliances often take place with universities that already have a good knowledge of the local contemporary research boundaries. The power that is given to R&D centers opened by the big pharmaceutical companies in China is not really discussed. However, interviews and official statements reported in the press and investigated here are almost always those of Asian directors or Asian R&D vice-presidents. The importance of these positions suggests a degree of autonomy from the headquarter for these new research centers (or at least a certain importance of these facilities as they seem to require senior positions). Finally, eight out of ten companies talk about bringing the innovations made in China to developed countries (or to "the world"). This last criterion ensures that we are well in the presence of reverse innovation. It may be too early, or only in process, to have concrete examples of products resulting from this new strategy. However, it seems that it is at least one of the next important challenges facing these companies. Beyond their new reverse innovation strategies, big pharmaceutical companies benefit from local technology transfer. Chinese pharmaceutical companies are now very active in terms of innovation: between 2003 and 2010, 25 candidate molecules per year were approved to enter into clinical phase by the China Food and Drug Administration (CFDA) and an average of four drugs per year were subsequently approved for sale to the public (some of these drugs are approved and also protected in the United States and Europe) (Qi et al., 2011). Although pharmaceutical R&D has been slow to develop in China, government incentives have helped the development of this sector. In 2008, the government launched the New Drug Creation and Development Program, thereby injecting 960 million U.S. dollars to accelerate research and domestic drug discovery (Hughes, 2010a). Although advanced economies' MNCs certainly have knowledge to transmit to China, nine out of

[21] http://www.reuters.com/article/2014/02/27/us-dihon-bayer-idUSBREA1Q0LO20140227.

ten of them recognize that they have to learn from Chinese expertise, for example in terms of Chinese traditional medicine. Indeed, they are all engaged in alliances and partnerships with local organizations and continue to call for greater collaboration (see Appendix D).

The limitations of our study are embedded in our methodological choices. Indeed, as we did not observe on-site implementation of the strategies described in official speeches, it is impossible for us to confirm that these companies "are doing what they say." It would be great for further research to confront our findings with field research to check the internal validity.

Another limitation is that we cannot generalize our findings to other sectors. Indeed, our study is solely based on the pharmaceutical sector. However, we believe the methodology presented in this paper can be replicated to study another sector. Contingency elements should also be considered such as the nature of the technology, the global innovation flows (ideation, development, market introduction, etc.) (United Nations conference on trade and development, 2005).

With this paper, we tried to open the way for more in-depth studies in this direction and to show the path for future research in this area, and in particular for case studies. Further work may focus on a company in a less sensitive sector than pharmaceuticals that is willing to give information about its reverse innovation process in China. In this case, interviews with key actors and/or participative observation could be an interesting methodology to enrich the field.

CHAPITRE 5 ARTICLE 3: AVOIDING THE PITFALLS OF REVERSE INNOVATION: LESSONS LEARNED FROM ESSILOR

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5.1 Présentation de l'article

Tout en confirmant que les pays émergents, et plus particulièrement la Chine, représentent aujourd'hui de nouveaux grands centres de l'innovation, la section précédente a montré la pratique de l'innovation inverse par de grandes multinationales du secteur de la santé (ou tout au moins la volonté de la pratiquer) et l'impact de ce changement de paradigme tant au niveau des stratégies d'innovation à l'international qu'au niveau des transferts technologiques.

Si l'innovation inverse apparait théoriquement attrayante pour les entreprises, qu'en est-il de sa pratique? Une fois de plus, si la littérature se focalise surtout sur les exemples à succès, qu'en est-il des échecs? Quels sont les enjeux reliés à cette stratégie et quels sont les pièges que les entreprises devraient éviter afin d'assurer le succès d'un tel projet?

Aucune recherche n'a encore été effectuée sur le sujet et l'article qui suit représente le premier pas vers une réponse aux questions précédentes. Cette étude de quatre cas d'innovations inverses de la multinationale Essilor propose de répondre en partie à la suggestion 3 émergeant de la revue systématique de la littérature en édifiant une liste des challenges associés à la pratique de l'innovation inverse ainsi que les actions possibles pour surmonter ou mieux, prévenir ces challenges.

Tel que discuté dans la note méthodologique de la thèse, la forme monocentrique de cette étude de cas peut entraver la généralisation des résultats. Cependant, elle ouvre la voie vers de plus amples investigations et pourrait, peut-être, servir d'exemple phare afin que d'autres entreprises se montrent plus coopératives quant à l'étude de ce phénomène au sein de leurs propres instances.

Cet article, dont le titre original est *Avoiding the Pitfalls of Reverse Innovation : Lessons Learned*

from Essilor, est coécrit avec Nathalie de Marcellis-Warin, Max von Zedtwitz et Thierry Warin et a été accepté pour publication en février 2017 dans la revue Research-Technology Management[22].

[22] Hadengue, M., De Marcellis-Warin, N., von Zedtwitz, M., & Warin, T. (2017). Avoiding the Pitfalls of Reverse Innovation: Lessons learned from Essilor. *Research-Technology Management*, Vol. 60, No. 3, pp. 40–47.

Abstract

The economic benefits of reverse innovation are intuitively compelling, but this new innovation strategy presents several challenges to established firms, ranging from fears of product cannibalization to not-invented-here syndrome. French ophthalmic lens maker Essilor has experimented with reverse innovation over several projects; an examination of its experiences suggests how the specific challenges of reverse innovation may be anticipated and overcome to allow companies to better leverage the results of their global innovation efforts.

Keywords

Reverse innovation; Emerging markets; Case study

5.2 Introduction

Reverse innovations are those that are created for an emerging market and then eventually sold in advanced countries. They are “reverse” because they reverse the direction of knowledge and technology flow generally accepted as typical. Reverse innovation has been spurred by the exponential growth of emerging markets. Multinational companies are now investing more in emerging markets than in the developed markets of the United States, Europe, and Japan (UNCTAD 2015), and as part of their investments in these markets, many firms have built local R&D centers. These centers typically were intended to provide local-for-local innovation, but as they have matured, some have become lead centers for certain applications and technologies. Inevitably, some have sent their technology back to the companies’ home markets in the west. As market growth has slowed in some emerging markets, these local centers have begun to look more aggressively for growth opportunities elsewhere—including in their firms’ home markets, where they have well-established support networks. At the same time, indigenous companies bolstered by the market growth in their own home markets are also seeking opportunities to expand beyond their national borders. Attracted by higher price margins in developed markets, they have begun to use their increased innovation capability and quality to attack markets in the United States and other advanced countries.

Given this set of circumstances, it is logical to expect that global firms, whether based in emerging markets or developed ones, will either increase their product portfolio with reverse innovations, or see their businesses eroded by those that do. However, although the potential benefits of reverse innovation are appealing, companies seeking to execute reverse innovation face a number of challenges, ranging from product cannibalization to not-invented-here syndrome at headquarters R&D. As a result, many intuitively compelling reverse innovation projects fail.

To explore the phenomenon of reverse innovation and identify the key factors in its success or failure, we looked at its execution in the global firm Essilor. Through four different cases of reverse innovation (or attempted reverse innovation) at Essilor, we identify the most pronounced challenges presented by reverse innovation and the actions the company took to respond proactively to these challenges. Essilor’s experience can help other companies to embark on their reverse innovation journeys with eyes open.

5.3 Reverse Innovation

The term *reverse innovation* was popularized by a 2009 *Harvard Business Review* article describing the development of GE's handheld electrocardiogram machine (Immelt, Govindarajan, and Trimble 2009), but the concept was inspired by earlier work on global knowledge flows (for instance, Frost and Zhou 2005) and innovation in emerging economies (Prahalad 2004). Since 2009, a growing literature has sought to capture the dynamics of reverse innovation, clarifying both its practical usefulness (Govindarajan and Trimble 2012) and theoretical soundness (von Zedtwitz et al. 2015). A recent literature survey identified more than 350 publications on the subject and indicated that about 60 companies were actively practicing reverse innovation (Hadengue, de Marcellis-Warin, and Warin, in press).

Most of the literature, especially articles in management journals, focuses on a few success stories and anecdotal evidence. Research on reverse innovation is particularly prominent in consumer packaged goods industries (for instance, Corsi, Di Minin, and Piccaluga 2014) and in the healthcare sector (for instance, Bottles 2012; Bhattacharyya et al. 2017). Academic research has focused on characterizing the prerequisites for successful reverse innovation, as well as its organizational and managerial attributes in multinational companies. For instance, studies have examined the role of the local subsidiary's strategic R&D orientation, integration with the central organization, autonomy, entrepreneurial orientation, and entry mode or age in the success of reverse innovation (Zeschky, Widenmayer, and Gassmann 2014; Borini et al. 2012).

To the best of our knowledge, no studies have offered a typology of the challenges specific to reverse innovation, although the risk of product cannibalization has been widely discussed (Corsi, Di Minin, and Piccaluga 2014; Dubiel and Ernst 2012; Zeschky, Widenmayer, and Gassmann 2014). As a result, little is known about the full range of risks and challenges associated with reverse innovation. Indeed, information is scarce about actual failures and unsuccessful reverse innovations, as well as how companies adjusted and developed successful strategies.

To begin to fill this void, we undertook a case study of one company's efforts to bring its emerging market innovations over into western markets (see "The Study," ***below***). The case study approach makes it difficult to generalize results and will always require contextualization, but it allows a thorough analysis of the realities of executing reverse innovation in a multinational corporation, providing insights that may be valuable for both practice and research.

5.4 The Study

In the course of a program of field research in multinational companies to explore the challenges of reverse innovation (Corsi and von Zedtwitz 2016; Hadengue, de Marcellis-Warin, and Warin 2015; von Zedtwitz et al. 2015) the authors were invited by the management team of Essilor to perform an in-depth analysis of its global R&D processes. Between July 2015 and July 2016, we conducted multiple semi-structured interviews with 14 Essilor executives (including the CEO, the Executive Vice President Global R&D, the Executive Vice President Global Engineering, the Corporate Senior VP Strategic Marketing, and the Vice President R&D Asia). The discussions, which lasted between 40 minutes and 3 hours, were recorded and analyzed using NVivo, a qualitative data analysis software. For data triangulation, we collected data from more than 80 public sources (websites, press releases, and other sources) to build an accurate overview of the company's international innovation activities.

5.5 The Challenges of Reverse Innovation at Essilor

In 2015, Essilor International S.A., a global leader in corrective ophthalmic lenses, generated €6.72 billion in sales; the company had approximately 60,000 employees in 62 countries. Half of those sales came from products less than three years old. The company invested €214 million in R&D that year, conducted mainly in France and North America, but also at joint research centers at Wenzhou Medical University and Shanghai University in China and an innovation technology center in Singapore. These facilities were the result of a shift in strategy in the early 2000s, based on the fact that only 1 person in 10 in developing markets had access to needed sight correction.

The market proximity provided by the Asian facilities has been highly rewarding for Essilor. According to Leanirith Yean, Essilor's Vice President R&D Asia, "Asian consumers have proper needs, proper characteristics, and can be more sensitive to some criteria than Western world people." Essilor was able to respond to these needs with new products that differentiated substantially from what had been offered in the European or the American markets, including:

- Myopilux—Lenses that control the progression of myopia in children.

- Ready-to-Clip Lenses—A simple frame-and-lenses solution that can be used to create glasses without expensive machinery.
- Azio and India Lenses—Lenses customized to the anatomical requirements of particular ethnicities.
- Gemcoat—A lens coating that is less expensive to produce and more resilient to hostile environments.

All of these innovations were expected to do well in global markets, as well, especially in the quality-sensitive and service-oriented markets in advanced economies. But the strategy shift required to reverse these innovations had significant impacts not only within the firm but also on Essilor's positioning in the marketplace. These impacts presented new and sometimes unexpected challenges, some of which meant that—in spite of the product's potential—the attempt to bring the products home would have failed unless Essilor made radical changes in the positioning or marketing of the product. The cases of these four products illustrate the many challenges a company can face when attempting a reverse innovation and show how a proactive response can mitigate them.

5.5.1 Case 1: Myopilux Lenses

Asians suffer more frequently from myopia than do non-Asians. For instance, in Chinese urban regions, the prevalence of myopia is 74 percent among 17- to 18-year-olds, compared to 41.6 percent for the same age group in the United States. On average, myopia progression rates are estimated at –0.82 D per year among Asian children, compared to –0.55D per year for Caucasian children (Yeo et al. 2015). With this in mind, Essilor established an early research agenda for its Asian R&D focused on reducing the progression of myopia in childhood. Collaborating with researchers at Essilor's headquarters in France, the company's Asian R&D teams conducted the bulk of the research with local scientists who were already working on the subject. That research effort resulted in the Myopilux lens, which reduces accommodative lag during reading; the lens has been shown to slow myopia progression by up to 62 percent (Yeo et al. 2015).

After the product met with great success in China, the relevance of Myopilux to western markets seemed obvious. Essilor planned to introduce it in the United States and Europe, but the attempt to bring the product into Essilor's home markets created a number of issues that had to be

overcome. As in any other large organization, external innovations at Essilor risked faced not-invented-here (NIH) syndrome, which discounts the validity of outsider ideas in favor of internal know-how. At Essilor, this meant that products created by emerging market units were perceived to be of inferior quality and were consequently subjected to stricter scrutiny. Besides NIH, and perhaps more importantly, the Myopilux reverse innovation effort seemed to signal a wider power shift, as the company's willingness to adopt innovations from emerging market R&D units for sale elsewhere gave developing market business units more control of the product's lifecycle. This led to tensions between Essilor's developed market and emerging market command centers, as developed market employees were not used to being followers, and emerging market employees were convinced they understood the product best.

As a result of these issues, the transfer of Myopilux to developed markets could have faced significant resistance inside the company. But Essilor had anticipated such internal tensions from the beginning of its Asia-based efforts and pursued an R&D strategy for managing global innovation that empowered its emerging market facilities, giving them lead center status with responsibility for key research areas and permitting them to act as business incubators in their own right. Essentially, these new centers were developed to become equal partners with the more established R&D centers in the United States and France. As Essilor's VP R&D Asia Yean explained, "40 percent of our activities are complementary activities compared to other R&D centers and the other 60 percent are related to the region advantage of local expertise. We take care of all the research for the Asian market. We have a certain degree of internal autonomy. Major policy decisions on research orientations are taken collegially with the entire R&D team but our teams offer local lines of research related to our expertise and the management committee for R&D decides budget allocations based on these proposals."

Essilor addressed the risk of NIH syndrome by relocating one of its France-based lead scientists to Asia, first as Senior Researcher and then as R&D Director in Asia. Both headquarters and Asia employees recognized this researcher's appointment as a sign of the firm's seriousness in its engagement in Asia as well as a guarantee that the Asia R&D centers were targeting important advances in myopia research. This star researcher was a symbol of credibility for Essilor employees worldwide, preventing them from developing detrimental preconceptions about emerging market innovations and facilitating the transfer of products from Asia back to developed markets.

As a result Myopilux was successfully introduced to the European and US markets, where the number of myopic people has been growing dramatically, and is selling well there.

5.5.2 Case 2: Ready-to-Clip Lenses

Essilor estimates that 2.5 billion people worldwide need vision correction, and 95 percent of them live in emerging market countries. Anticipating a need, in 2013, Essilor launched its 2.5 New Vision Generation strategy to help people with uncorrected vision and low income. Addressing these needs required not only quick lens delivery at low prices, but also a new business model allowing easy access to the lenses in remote places. The Ready-to-Clip lens system was the first result of this effort. Ready-to-Clip lenses are pre-edged, left-right–interchangeable lenses that are also unbreakable and hard coated. As a result, instead of waiting one to two weeks for lenses to be surfaced and treated according to their vision needs and then edged to fit the frame, patients can be examined, diagnosed, and immediately provided with spectacle lenses for a very reasonable price. The frame designs are limited, but this disadvantage is offset by immediate delivery and affordability. Essilor supported the innovation by training and equipping local entrepreneurs in target markets to start their own businesses, performing basic vision testing and dispensing Ready-to-Clip glasses.

There is a market for this kind of low-cost solution in developed markets. For instance, Essilor's research indicated that approximately 5 million people in France, or about 8 percent of the population, cannot afford eye care. With this in mind, the company considered marketing Ready-to-Clip lenses in western markets. However, bringing this innovation back to developed markets presented several challenges. It could put Essilor at risk of cannibalizing its other products, especially other low-cost lenses and frames, and it would have exposed the company to a risk of brand dilution, if the Ready-to-Clip lenses came to be associated with Essilor's more quality-focused, pricier products. Further, the business model associated with the lenses—training entrepreneurs to provide the service—would not have worked in more regulated western markets, where these operators would have competed with licensed opticians. In this context, providing the new lenses instantaneously at the point of sale would not have been feasible. Thus, adopting this innovation in the company's home market was seen as a high-risk move.

Essilor addressed the risks of brand dilution and product cannibalization by recharacterizing its innovation in France, presenting the product as a symbol of the company's commitment to

corporate social responsibility. Rather than introducing it to the market through conventional channels, Essilor distributed it at charity events and through welfare organizations (for example, the French Popular Relief). This move allowed the company to fulfill a key tenet of its corporate mission—to provide better vision to all—and, at the same time, to enhance its reputation, and provide positive spillover to other Essilor products. Although this approach did not directly generate sales or profits, it undoubtedly had a positive impact on the company's overall performance.

This strategy also addressed fears of brand dilution by ensuring that the price, place, and promotion components of the offering compensated for the product not being aligned with Essilor's usual top-range solutions in developed markets. This prevented customers from associating the Ready-to-Clip lenses with other Essilor bestsellers, thus avoiding brand dilution.

5.5.3 Case 3: Azio and India Lenses

Each individual's visual requirements emerge from a combination of eye anatomy (prescription and eye length), facial anatomy (the shape of the face and the way the frame will sit), reading behavior (reading posture), and visual habits. According to Essilor's research, anatomical measurements—both face and eye—are quite similar among members of an ethnic group; the company thus set out to make lenses to fit particular ethnic groups. The innovation technology center in Singapore and the R&D center in France worked together to develop the Azio and India lenses in 2007, building on research originally done at Essilor's joint research center with Singapore University. These lenses provided a better fit, improved contrast, greater degree of comfort for near vision, and wider fields of vision compared to standard lenses for the groups to whom they were targeted, Asians and Indians.

The introduction of the Azio lenses in China and India was a real success, as Alain Riveline, Corporate Senior VP Strategic Marketing, explained: "Chinese consumers were really sensitive to the fact that the world leader in optics has made special lenses for them." As these lenses allowed for the best eyesight correction for the groups to which they had been tailored, Essilor's Asian teams were excited by the possibility of offering these products to the Chinese and Indian diasporas all over the world.

Both products were well received in Australia and the United Kingdom. However, Essilor's Paris-based headquarters was reluctant to introduce the products in the French market, because the management team anticipated consumer misinterpretation of the intent. "In France, the sales team was completely opposed to the idea. These products could have been interpreted as offensive. Anatomy based on ethnicity could not be the criteria of choice when proposing lenses to patients," explained Diane Ceccarelli, the former marketing product manager responsible for the project. Overcoming this attitude would have required a thorough and costly study of consumers in the home market. Further, addressing the cultural differences would have necessitated redefining the marketing strategy and localizing the product for French customers, a potentially costly process that would have eaten into already-small profit margins.

In the United States, management was more open to the idea; the lenses were introduced in the US market in 2010. However, as predicted by headquarters, some consumers were offended by being offered a product based on their ethnicity. What had been a highly appreciated proposition for customers in Asia, Australia, and the United Kingdom completely backfired in France and the United States, due to cultural differences in perceptions about race and ethnicity.

Essilor's management team understood that the key was to shift the entire marketing strategy for these products to shift the focus away from ethnic traits. Alain Riveline, Corporate Senior VP Strategic Marketing, explained, "Optically there is a reason for the existence of these lenses, but we have not managed to repatriate the idea. Communicating the ethnic aspect is too sensitive. We now avoid putting the emphasis on ethnicity. We avoid qualifying lenses as Chinese ones, but instead we put the emphasis on personalized lenses (according to each person's measurements). Then we focus more on occupations: if you use a computer all day, then we will give you lenses adapted to this activity."

The process of bringing Azio and India into western markets provided a great learning experience for Essilor, as responses to the products varied in different countries, reiterating that markets can never be assumed to be homogeneous in their responses to particular products.

5.5.4 Case 4: Gemcoat

Essilor developed Gemcoat in China in 2013 in collaboration with Chinese partners. Gemcoat allows lenses to be thinner, but also more transparent and scratch resistant, and offers better UV

protection than other lenses on the Chinese market at the time. Lenses coated with Gemcoat are also more durable, an important feature for harsher Chinese work environments. Given its superior performance compared to other options on the market, Gemcoat was also considered a potential flagship product for developed markets from its inception.

Gemcoat was successfully launched in continental Asia, but the technical team anticipated that the product would face regulatory issues in the United States and Europe, mostly due to concerns about its chemical composition. Beyond the regulatory concerns, Essilor was sensitive to ethical concerns associated with the perception that some multinational corporations operate under a set of double standards, exercising less care with health and safety issues in less-regulated emerging markets.

Could the regulatory concerns have been anticipated during the product's development? Perhaps, but Patrick Poncin, Executive VP Global Engineering, explained that "sometimes we cannot even do R&D testing on limited-quantity lenses because some products cannot be imported. On the other hand, developing these lenses to have them compliant with the US FDA as well as the European regulatory bodies will have put a lot of delay in the development while they are safe." As a result, Gemcoat's introduction to western markets has been delayed indefinitely while the company seeks a technical solution to the regulatory and ethical challenges.

5.6 Addressing the Challenges of Reverse Innovation

These four cases vividly illustrate the range of challenges a reverse innovator may face in bringing products created in and for emerging markets "home" to developed markets. We identified 10 separate challenges in these four cases, which can be grouped into four categories (Table 5-1).

Table 5-1: Reverse innovation challenges encountered by Essilor

Category	Challenges	Case
Corporate Culture	HQ rejects innovations from emerging market subsidiaries due to NIH syndrome.	Myopilux
	Emerging market innovators are not trusted as sources of quality products.	Myopilux
	Developed market organizations resist change from emerging market subsidiaries.	Myopilux
Business Model	Reverse innovation cannibalizes more expensive products in developed markets.	Ready-to-Clip
	Critical components in the value chain cannot be replicated in a developed market.	Ready-to-Clip
Customer	Emerging market innovations face poor-quality brand image with developed market consumers.	Ready-to-Clip
	Different cultural values lead developed market consumers to reject product.	Azio and India
	Developed market sales organization cannot recreate customer value specific to emerging market.	Azio and India
Ethics and Legal	Emerging market innovations face ethics issues in developed market.	Gemcoat
	Emerging market innovations face regulatory difficulties in developed market.	Gemcoat

1. *Corporate culture challenges* such as Not-Invented-Here syndrome, resistance in the parent organization to innovations from emerging market units, or organizational adjustments;
2. *Business model challenges* such as difficulties in implementing new business models to support an emerging market innovation, risks of cannibalization or brand dilution, or supply chain and technical capability issues;
3. *Customer challenges* such as differing consumer perceptions between developing and emerging markets and differing reactions to value propositions in different markets;
4. *Ethics and legal challenges* such as regulatory differences that prevent a product being offered or tested in some markets.

Each category aggregates challenges that are characterized by related fundamental issues, and the approaches to resolve or mitigate them are similar. Essilor took a proactive approach to mitigate the challenges it could anticipate and ultimately managed to overcome most of them, eventually getting most of its products into western markets (Table 2).

Table 5-2: Actions taken by Essilor to avoid or overcome reverse innovation challenges

Challenges	Actions
Corporate Culture	• Empower emerging market R&D centers/teams with product or technology mandates. • Create clear roadmaps for development of emerging market R&D centers and independent center missions. • Rotate key developed market personnel through emerging market R&D units and vice versa.
Business Model	• Coordinate marketing strategy globally to avoid product cannibalization. • Be open to new developed market sales channels for emerging market innovations. • Do your homework: check replicability of reverse innovation advantages in developed markets.
Customer	• Don't shortcut 4-P marketing of reverse innovations in developed markets even if the product is already proven in emerging markets. • Anticipate need to reverse-localize emerging market products back to developed markets, even if the original product idea came from developed market. • Truly globalize product development; avoid having the emerging market as the sole target market from the beginning.
Ethics and Legal	• Be a good "local citizen" in both home and emerging markets, especially in R&D. • Avoid falling into the trap of low safety standards in emerging markets. • Aim for regulatory compliance in both emerging and developed markets from the start.

5.6.1 Overcoming Corporate Culture Challenges

Corporate culture can present particularly resilient challenges because it is often what makes a company successful in other areas. But in multinational companies, each subsidiary develops its own culture over time; the resulting cultural distance, between subsidiaries and between the subsidiary and headquarters, adds to the complexity of reverse innovation. Essilor's experience

offers two lessons: (1) To overcome cultural dissonance between headquarters and local subsidiaries, it is best to transfer people between local centers and headquarters; this allows different value systems to blend and perceptions to be shared between local and corporate cultures. (2) To maintain a fair balance of power, it is important to listen to key executives in the different geographies and move responsibilities to the business leaders and technical experts with the most relevant capabilities, even if they challenge the status quo in the firm.

5.6.2 Overcoming Business Model Challenges

Business model challenges include threats to the core business model, such as risks of product cannibalization or brand dilution, as well as challenges related to bringing a product and associated business model created for an emerging market into the very different context of a developed market. For Essilor, the key to most of these challenges was to look beyond immediate short-term profits to identify other avenues to market and other kinds of benefits. For instance, with Ready-to-Clip, Essilor realized it had transferred not just a product but an entire value chain to a completely different ecosystem.

With Azio and India, Essilor faced a different kind of value-chain challenge—the product design was tailored to the particular manufacturing resources and supply chain of the markets for which it was designed. As a result, it was difficult to maintain profit margins when the product was manufactured in France. If upstream or downstream activities are made to work in emerging markets, Essilor learned, it can be difficult to recreate the value proposition for the innovation in a more developed market context. Firms that couple solid product road mapping with intelligent product-market segmentation are less exposed to this kind of surprise. Essilor was able to bypass the challenge with a new distribution campaign, but companies with more complex products and sourcing networks need to address this challenge head-on.

5.6.3 Overcoming Customer Challenges

Customer challenges may include differing customer expectations with regard to value and brand identity as well as more fundamental differences in social expectations and preconceptions. Essilor learned that, to make its emerging market products acceptable to developing market customers, it had to engage in “reverse product localization”—tailoring the product and its marketing to the expectations of its new customer set. For example, French customers have high

expectations based on Essilor's strategy in France of positioning itself as a premium brand; this is not the case in China or India. Also, Chinese customers in France and the United States have different cultural expectations from Chinese customers living in China—expectations which made it impossible to market Azio and India lenses in these countries. As a result, Essilor refocused its product development efforts away from ethnically based distinctions and toward lens uses. It has recently released lenses that selectively filter harmful UV and blue-violet light emitted by the sun and by artificial light sources such as computer screens or smartphones. Developed in Asia, this product has become very successful worldwide. In this case, the strategy was clear from the start: avoiding having emerging markets as the sole target for the product allowed the company to assess its global value early and avoid challenges associated with differing customer expectations.

5.6.4 Overcoming Ethics and Legal Challenges

More lenient regulatory systems in emerging markets can sometimes foster innovation by allowing for experimentation that wouldn't be possible in developed markets. However, it may also prevent reverse innovation, as tougher developed market regulations prohibit the innovation coming back to western markets (Govindarajan and Trimble 2012). If a product has the potential to come back to a developed market, these legal aspects must be anticipated and accommodated from product design forward. Developing a product for global markets rather than for a single local target market is significantly more expensive, and the local product-market fit may be less optimal, but the long-term benefits may make this approach the more profitable choice.

Moreover, for products developed for emerging markets, differences in local standards can raise ethical questions for some. To what extent can a company in good conscience exploit double standards as a source of profit? This question extends beyond product safety and testing to the full value chain. For example, developed market companies have traditionally offshored operations to benefit from less stringent safety policies and reduced labor costs, resulting in lower costs for products sold in the developed market. There is no easy answer to this dilemma, but as customer awareness of these decisions increases, companies must consider them in the context both of legal, regulatory, and ethical obligations and of customer-based challenges.

Reverse innovation is more difficult than the typical innovation approach, but these cases show that action can be taken to mitigate or avoid the challenges. No single fix will solve every

problem for every company, but Essilor's actions point to likely sources of solutions. Companies—and especially R&D and innovation managers—can learn from Essilor's approaches and develop good internal practices, including for instance, support from the C-suite, perhaps in the form of a "global innovation" expert who maintains a reverse innovation playbook to guide such efforts. Ultimately, this can be the basis for the development of a reverse innovation competence in the firm, with proven tools and methods to leverage innovation globally.

5.7 Conclusion of the case

Not every successful emerging market innovation will also succeed in developed markets. Gaps in terms of price-performance, infrastructure, sustainability, regulatory requirements, and customer preferences make the transition both attractive and difficult (Govindarajan and Trimble 2012). The challenges are myriad: Business models and value-chain challenges and customer, legal, and ethical barriers can be strong enough to stop reverse innovation before it even has a chance to be introduced in new markets. Internal resistance to reverse innovation can be unspoken yet persistent, and internal powers often do not favor product champions from far away. Not-Invented-Here syndrome is pervasive, especially in R&D organizations spoiled by success. Resolving such issues is difficult, but the benefits extend well beyond a single reverse innovation.

CHAPITRE 6 ARTICLE 4: REVERSE INNOVATION: AN MNC NETWORK PERSPECTIVE

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6.1 Présentation de l'article

Grâce à une étude de cas, l'article précédent s'est attelé à définir les obstacles que pouvaient rencontrer les entreprises qui pratiquaient l'innovation inverse. De plus, il a été possible de faire émerger quelques solutions ou actions préventives pour surmonter ces obstacles. Évidemment la liste des challenges établie n'est pas exhaustive et les mitigateurs de risque proposés sont génériques et devraient être adaptés en fonction de l'entreprise et de l'innovation.

Il est intéressant de noter que cet article, dont le public visé est davantage la communauté des affaires que la communauté académique, utilise un grand nombre de concepts appartenant à différents sous-ensembles de la théorie du management. Bien que l'exercice soit tout à fait pertinent, il semble cependant qu'un *démêlage* théorique est nécessaire afin de replacer ce travail dans une perspective davantage académique.

La section suivante fait un premier pas dans cette direction en tentant de replacer le concept d'innovation inverse dans un contexte plus théorique de l'organisation. Ce quatrième article de la thèse fait émerger des hypothèses quant à l'impact de différentes configurations organisationnelles du réseau interne et externe la firme sur la pratique de l'innovation inverse. Pour ce faire, il est proposé de considérer l'innovation inverse comme un processus et de décomposer ce dernier en deux étapes distinctes, mais non dissociables sur lesquelles la configuration du réseau de l'entreprise peut avoir un impact tantôt positif, tantôt négatif.

Ce travail conceptuel répond en partie à la suggestion 2 émergeant de la revue systématique de la littérature et représente la première étape vers un meilleur ancrage théorique de ce nouveau modèle d'innovation globale qu'est l'innovation inverse. Il appelle désormais à une validation empirique des propositions énoncées.

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avec Nathalie de Marcellis-Warin et Thierry Warin et a été soumis en mars 2017 à la *European Business Review*.

Abstract

Despite several efforts made in the recent literature to improve our understanding of Reverse Innovation (RI), very little work has been done to properly situate its practice in a more firm-integrated point of view. Using a MNC network perspective, this paper intends to improve the positioning of the RI concept in the literature, namely develop a theoretical framework for understanding it in a firm-integrated perspective. As our contribution is not an empirical one, we shall endeavor to substantiate our argument through the existing literature but also practical examples. The theoretical positioning of RI that we put forward allows us to draw several propositions that call for a wealth of empirical further investigations. Our analysis is conducted in the context of Western MNCs operating in emerging markets.

Keywords

Reverse Innovation, Multinational Corporations, Network, Knowledge Flows, Power bargaining, Resources Configuration.

6.2 Introduction

Global integration is often understood as the necessity for Western multinational corporations (MNC) to enter emerging markets (EMs). For instance, with more than 200 million potential consumers in China (China's middle class reported by the China General Chamber of Commerce, 2016) - and at least as much in India and Brazil - Western MNCs cannot ignore the rise of these markets. Moreover, the 2008 economic crisis and cost awareness in the industrialized world have negatively affected Western consumers' purchasing power and the consumption level tremendously (Burger-Helmchen, Cohendet, & Nebojsa, 2013). Although the crisis has also impacted EMs, they still remain highly relevant for MNCs in order to compensate for the losses in their core economies and hopefully benefit from a quicker recovery. There are good reasons to believe so, since before the crisis, EMs were already in great demand (Prahalad, 2004) and they continue to offer increasingly strong local technical and scientific expertise (Kao, 2009).

But to be successful over there, Western MNCs have to seriously consider these markets' own distinctiveness. Indeed EM consumers often have specific requests that strongly differ from Western consumers ones. For instance, they ask for new smart solutions in order to address local needs while taking into account important constraints such as price, available infrastructure or even cultural sensitivity (Brown & Hagel, 2005). In addition, Western MNCs have to deal with a changing global market landscape as EM MNCs have drastically expanded during the last decade, gaining market share not only locally but also abroad in developed countries (Ramamurti, 2012; Marco Zeschky, Widenmayer, & Gassmann, 2011). Western MNCs then have to face fierce competition with EM companies, often less important in terms of resources, but with a better understanding of the indigenous market regarding needs and constrains. To close the gap, an increasing number of Western MNCs have localized some of their Research and Development (R&D) efforts in EMs (Zeschky, Widenmayer, & Gassmann, 2014) in order to develop innovation closer to the local consumer's needs. Such a geographic diversification has a twofold interest for MNCs: (1) it allows them to innovate in a consistent manner with these markets and (2) to be in a better position to compete from within (von Zedtwitz, 2004).

Going one step further, some of these Western MNCs have realized that the main interest is not only to sell these EM-developed products locally, but also in their home market (Immelt, Govindarajan, & Trimble, 2009). For a Western MNC, the strategy is therefore to innovate for an

EM and then to transfer such an innovation (being a product or a process innovation) to their primary market, namely a developed market (DM). This phenomenon called reverse innovation (RI) and still poorly theoretically positioned in the literature, is the focus of our article. An innovation is considered *reverse* when first developed for, and adopted in an EM before "spreading" to the industrial world (Govindarajan & Ramamurti, 2011; Govindarajan & Trimble, 2012b)[23].

The practice of RI surely represents an opportunity but is also a source of considerable challenges for Western MNCs. RI can be restrained or even prevented by external or internal resistance. For example, as regulation is sometimes lower in EMs, innovations coming from there can face standardization issues at the Food and Drug Administration or the European Committee when being brought back in DMs. EM innovations can also face a poor-quality brand image with consumers in DMs just because they are *coming from* less advanced markets. But they could also face internal resistance. DM MNC staff can sometimes impede the return of EM innovations because of NIH (not-invented-here) syndrome or, again, lack of trust regarding the product's quality (Hadengue, De Marcellis-Warin, von Zedtwitz, & Warin, 2017). Another example of a hindrance may be the fear of cannibalization generated by the potential return of some EM innovations - less expensive and sometimes more efficient - (Corsi, Di Minin, & Piccaluga, 2014).

These examples give just a glimpse of the issues that could be faced but well highlight the potential need for heavy adjustment of a MNC organizational strategies if RI is to be successfully achieved. Using a network perspective, namely (1) the organization of knowledge flows, (2) internal power distribution and (3) resources organization, our paper intends to look at the configurations that would positively influence the RI practice. To do so, we propose to split the RI process into consecutive steps that are (1) innovate for an EM need and market the innovation

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[23] RI can sometimes occur unexpectedly. An MNC could choose and target one or more EMs in which to establish some new R&D facilities and then locally innovate without expecting for these innovations to *trickle-up* to DMs. This is coincidental RI. Conversely, RI planned in advance is called inductive RI (Furue & Washida, 2014). We will concentrate on the latter because the coincidental RI will be *a priori* a successful punctual fact without much impact on the MNC structures. For simplification purpose, inductive RI will be simply called RI from now on.

over there, (2) bring back this innovation in the company's home market or any other DM market. To deconstruct the RI allows us to analyze it in greater depths and to put forward very interesting paradoxical conclusions about what exactly will positively influence the practice of RI. Indeed, our conclusions are far from obvious as some MNC network configurations may at the same time positively influence RI first step while impeding the second one.

In other words, our work intends to improve the positioning of the RI concept in the MNC literature, namely build a theoretical framework for it. Beyond several efforts made for disentangling RI and similar innovation concept such as frugal or disruptive innovation (Corsi & Di Minin, 2014; Hadengue, De Marcellis-Warin, & Warin, 2017), very little work has been done to properly situate RI in a more firm-integrated point of view. In this paper we close this gap by using the network perspective in order to build a RI unitary framework.

To the best of our knowledge, only one conference paper has tried to define a theoretical framework for RI using the theory of knowledge-based view and more specifically the concept of reverse knowledge transfer (see Lee & McNamee, 2014). Our analysis, by focusing on the MNC internal and external dynamics, is complementary to this previous work. The theoretical positioning of RI that we put forward allows us to draw several propositions that should subsequently be empirically tested. This second step falls, however, beyond the scope of our article that is more a research agenda for further investigations. Our analysis is conducted in the context of Western MNCs operating in EMs.

The remainder of the paper is organized as follows. The next section expands upon the concept of RI and exposes how this new innovation strategy represents a true paradigm shift. Section 3 makes an overview of the MNC network theory in order to introduce how we intend to bridge the underlying concepts with RI. In section 4, we build upon the theory to draw propositions linking RI with internal as well as external networks of the firm. Section 5 gives some concluding remarks, limitations, and further research suggestions.

6.3 Reverse Innovation as a Major Change in Western MNCs' Innovation Strategies: The Need for a Theoretical Framework

Before innovating for EM and bring back those innovations home, Western MNCs have tried to practice *Glocalization*, which is the process whereby firms develop excellent products in domestic markets and then distribute them around the world with minor modifications to adapt them to market conditions. In EMs, it often ended with deteriorated products to ensure lower prices. This strategy was unsuccessful as EMs customers were not inclined to compromise regarding product quality and had specific demands, most of the time, very different from DM customers. In sum, adapting existing products to EM's conditions happened to be either impossible or very expensive.

Conversely, a *start from scratch* strategy has proven very efficient (Govindarajan & Trimble, 2012b, 2012a; Immelt et al., 2009). Western MNCs have then started to open R&D centers in EMs. Although this strategy used to be considered risky in terms of intellectual property protection (Maskus, 2003), this is increasingly no longer the case (Hadengue, De Marcellis-Warin, & Warin, 2015). Instead the literature has recently focused more on five specific gaps proper to EMs that stimulate innovation, force companies to think their product differently (Govindarajan & Trimble, 2012a): (1) The first gap - and the more sensitive one - is the price-performance gap. To conquer these new markets, an important challenge is to develop less expensive - but not low-cost - products with new adapted functionalities; (2) The infrastructure gap refers to the potential lack of infrastructure in EMs, such as unreliable electric power; (3) The sustainability gap suggests that emerging countries have (or will soon have) more severe environmental concerns than high-income countries; (4) The regulatory gap refers to the differences in regulations between EMs and developed ones. This gap can be an innovation catalyst but also a serious ethic issue if EM innovations do not follow basic regulatory standards in place in industrialized countries and therefore put people at risk; (5) And finally, the preference gap which refers to diversity of tastes, habits and rituals between peoples.

All of these gaps, although fostering innovation, also represent very new constraints for Western R&D teams, bringing them to think out of the box and to often come out with breakthrough innovations instead of incremental ones. A significant number of concepts to describe this phenomenon has emerged. A very popular one is probably *frugal innovation* (Banerjee, 2015; M.

Zeschky et al., 2014), which describes products “that respond to severe resource constraints (…) and have extreme cost advantages compared to existing solutions” (Zeschky, Widenmayer, & Gassmann, 2011b: 39). Another one is *disruptive innovation* described as “innovation that results in worse product performance in mainstream markets” or “typically cheaper, simpler, smaller and frequently more convenient to use” version of an existing product (Christensen, 1997; Christensen & Bower, 1995). Because the frugal innovation concept emphasizes the importance to consider environmental constrains in the innovation process, it is usually associated with EM innovation and could represent the first step of RI. The case of disruptive innovation is trickier. As pointed out in Govindarajan & Trimble blog post (2009) and then more extensively explained by Corsi and Di Minin (2014), RI and disruptive innovation only overlap in specific circumstances. More precisely, as not all EM innovations are disruptive ones, the disruptive innovation framework allows us to better understand and interpret only some innovations rising from EMs.

But RI is not just about innovating for EMs. It is going one step further. Not only it implies that the innovation has to be developed for and first adopted in an EM, but it also has to *trickle-up* (Prahalad, 2004) to *at least* one DM. A theoretical framework only considering RI first step (innovate for EMs) is then not sufficient. Indeed, the two-step process further complicates the requirements in terms of the MNC network configuration as it goes from thinking local-for-local to local-for-global or even sometimes global-for-global. It represents an important paradigm shift.

The practice of RI is not only a new way of doing innovation but also a new way of thinking about the innovation process as a whole. Very importantly, because the mature innovation will be marketed in both EMs and (subsequently) DMs, the practice of RI by Western MNCs implies a more complex and holistic innovation process. This singularity changes somewhat our frontiers of knowledge about innovation and its management in general. In fact the RI two-step process is strewn with new and unprecedented pitfalls (Hadengue et al., 2017) and a firm’s internal as well as external networks might definitely be adjust to successfully achieve RI. In other words, the practice of RI might be correlated with certain firm-network peculiarities.

Our article, by linking the concept of RI to knowledge transfers, power distribution and resource configurations - united under the banner of the MNC's network -, sheds light on this new practice

and ground RI in a more dynamic and solid theoretical framework. Before getting to the heart of the topic, the next section gives a general overview of the network theory in the MNC literature.

6.4 Network Perspectives in the MNC Literature

MNC literature has predominantly used the concept of the network as a tool to consider the firm's components and the linkages between them. One of the first works to explicitly integrate the notion of the network in a non-metaphorical sense to the MNC literature is Ghoshal & Bartlett's article. They defined the MNC as a network of "geographically dispersed and goal disparate organizations that include the headquarters (parent company) and the different national subsidiaries" (Ghoshal & Bartlett, 1990: 2). They used the connectedness between the parent company and its subsidiaries to measure the multinational *internal network*. Similarly, the connectedness between the different organizations constituting the MNC and the external actors (such as customers, suppliers, regulatory agencies, competitors, and collaborators) constituted the *external network*. Building upon this, they proposed a model assessing the impact of the connectedness within and among the external network on the internal network resource configuration of the firm, i.e. "the way in which the resources of the multinational are distributed among the parent company and subsidiaries" (Ghoshal & Bartlett, 1990: 8).

This seminal work paved the way for an important number of studies relying on the term *network* as a fairly generic feature to describe the MNC and its internal or external relations. More precisely, scholars have used the concept of the network as a tool to describe the internal and external dynamics of the MNC because it allows for considering individually its components as well as the linkages between them. Based on this, and the financial aspect being set apart, the research community has addressed three main dimensions through the MNC's network lens: (1) the knowledge flows, internal as well as external to the MNC (e.g. Andersson, Gaur, Mudambi, & Persson, 2015; Gupta & Govindarajan, 1991, 2000; Haas & Cummings, 2015; Inkpen & Tsang, 2005), (2) the balance of power between the parent company and its subsidiaries (e.g. Andersson, Forsgren, & Holm, 2007; Asakawa, 2001; J. M. Birkinshaw & Morrison, 1995a; Gupta & Govindarajan, 1991; Mudambi, Mudambi, & Navarra, 2007) and (3) the resource configuration within the MNC (e.g. Mudambi, 2008).

Although the concept of network is broadly used to analyze knowledge transfer in an intra or inter-firm context, the studies looking at the linkages between the MNC's network attributes and the innovation process have been surprisingly scarce. Two important exceptions are Cantwell's empirical study stating that innovation was not taking place only in the MNC's home country (1995) and Cantwell's article on the impact of a decentralized network for innovation (2013). In this latter work, Cantwell proposed to integrate open innovation in the analysis and emphasized the relationships between knowledge networks within, as well as between firms.

Furthermore, as MNCs have started to increasingly delocalize or expand their activities in EMs, very few studies have examined this paradigm shift in terms of network organization (e.g. Hansen & Gwozdz, 2015; Wang, Sutherland, & Ning, 2014) and even less so in an innovation specific context.

The goal of this article is to fill these gaps by looking at the MNC's innovation process in EMs, and more specifically at the very recent practice of RI through the MNC network perspective. We ask the following question: How organizational configurations of the MNC network will influence the practice of RI? Using the network perspective, we aim at providing a theoretical starting point to answer this question. As our contribution is not an empirical one, we shall endeavor to substantiate our argument through the existing literature but also practical examples.

6.5 Reverse Innovation: Management of Contradictions in the MNC's network

In the three following subsections, we present 8 propositions about the influence of particular organizational strategies over RI. More specifically, we analyze to what extent these strategies will impact the RI process. Our propositions are summarized in Figure 1.

As previously mentioned, the RI process has been decomposed in two steps: (1) innovate for an EM need and market the innovation over there, (2) bring back this innovation in the company's home market or any other DM market. As our iterative process of analysis has shown paradoxical influences from the identified strategies over one step or the other, this decomposition allows us to be more accurate about the influence that organizational strategies will have on RI.

For our model to be valid, it, however, forces us to consider that the organizational strategies are stable during the whole reverse innovation process. Said differently, a given strategy should remain the same between the first and second steps of the RI process. Indeed, a change of strategy in the middle of the process would invalidate our propositions.

We believe that this status quo assumption is not a strong one as the RI process is expected to happen within a limited time frame and that organizational strategies have enough inertia so they can hardly be radically changed back and forth between the two RI steps.

6.5.1 RI and knowledge flows

By definition, knowledge flow is knowledge traveling between - at least two - different parties. Bring together, these parties form the network, which can be internal to the firm (between parent company and its subsidiaries) but also external (between subsidiaries and different external actors). The concept of knowledge flows has generated an abundance of research in IB as the MNC has early been recognized as a bundle of knowledge, existing mainly because of its potential ability to transfer and exploit knowledge (e.g. Kogut & Zander, 1992; Teece, 1981).

Three main different directions of knowledge flows characterizing the internal MNC network have been defined by the literature: (1) subsidiaries to subsidiaries knowledge outflows also called *lateral knowledge transfer* (e.g. Andersson et al., 2015); (2) parent company to subsidiaries knowledge outflows (home-centric view) also called *forward knowledge transfer*

(e.g. Patel & Pavitt, 1991; Porter, 1985; Vernon, 1966); and finally (3) subsidiaries to parent company knowledge outflows also called *reverse knowledge transfer* (e.g. the seminal works of Håkanson & Nobel, 2000, 2001). Some seminal studies have also investigated the last two at the same time (e.g. Birkinshaw & Morrison, 1995; Gupta & Govindarajan, 1991).

As discussed in the previous section, an RI can be considered as a two-step process. First, a newly developed innovation, responding to an EM needs and complying with local constraints, has to be adopted in this market. Then this innovation (and the knowledge associated with it) has to trickle up to one or several DM(s). It is only when this second step is achieved that an innovation can be called reverse.

The RI first step, namely innovate for an EM, is clearly a new way of doing innovation for occidental MNCs. If the bulk of the literature generally assessed that knowledge accumulation in an organization will foster innovation (Chang & Lee, 2008), the practice of RI may require a slightly different starting point. Indeed, the transfer by the parent company to the EM' subsidiary of important specific accumulated knowledge could not actually be an asset for local R&D teams. Indeed, a traditional conceptualization of customer needs or product features could impede the EM innovation process, and then the first step of the RI process. As stated by the promoters of the concept: "RI begins not with inventing but with forgetting" (Govindarajan & Trimble, 2012b). EMs' innovations have to result from new knowledge creation, unique opportunities arising from the subsidiary's location and the constraints associated with this environment. The rigidity of the knowledge - or the "invisible force inducing the firm to hold and use specific knowledge for quite a long time" (Zhou & Chen, 2011) – could in fact prevent EM R&D teams to be creative and to come up with original solutions. Following the same rationales, it seems fair to assume that knowledge transferred from DM subsidiaries to EM subsidiaries will have the same disadvantage.

Then, although sometimes valuable at a more advanced stage of the product development, knowledge inflows from the parent company (forward transfer) or from DM subsidiaries (DM lateral transfer) could at first jeopardize all the creative process responsible for the frugal character of the first step of RI. Thus, we propose:

- ***Proposition 1: RI first step will be negatively influenced by forward knowledge transfers (from the parent company to EM subsidiaries).***

- ***Proposition 2: RI first step will be negatively influenced by lateral DM knowledge transfers (from DM subsidiaries to EM subsidiaries).***

Having established that, one could ask about reverse knowledge transfers (RKT). The literature on RKT is very extensive both conceptually and empirically (e.g. Ambos, Ambos, & Schlegelmilch, 2006; Andersson et al., 2015; Gupta & Govindarajan, 2000; Håkanson & Nobel, 2000; Mudambi, Piscitello, & Rabbiosi, 2014). These studies showed that (and how) RKT may depend on several criteria, either subsidiary specific (e.g. the subsidiary's mandate, autonomy, entry mode, etc.), subsidiary-parent company (dyad) specific (e.g. cultural distance, formal and informal coordination mechanisms, etc.) or knowledge specific (codified or tacit knowledge).

Although the extensiveness of this literature, it seems that subsidiary's specific location (in our case in EMs) has not yet been fully taken in consideration in the studies. At best, some seminal papers have looked into the new phenomenon of EM MNC creating new products, new knowledge then being transposed to DMs (e.g. Hang, Chen, & Subramian, 2010). But the bulk of the literature does not differentiate between DM subsidiaries and EM subsidiaries when examining RKTs. We then argue that some findings may be reexamined in the context of RI, more concretely in the case where Western MNC subsidiaries are evolving in an EM context.

For an EM innovation to properly reverse is a very challenging process (Hadengue, De Marcellis-Warin, von Zedtwitz, et al., 2017). As already mentioned in the introduction, a lot of barriers can prevent the innovation to be successfully marketed in the DM. We could think of barriers such as regulation issues, risks of cannibalization, or even poor cosmetic appeal of the product. For instance, consumers' perceptions merit special attention when bringing back an EM innovation. The Dacia Logan of the French company Renaud is a very representative example. The small-family and less expensive vehicle was originally developed for Romanian customers. Its great success then pushed the company to bring it back to DMs (Western Europe first). But when launching the car in France, the company faced high skepticism about the quality of the product. Renault had to adapt the car by adding more safety and cosmetic features[24] because of French customers sensitivity in terms of product appearances. Beyond this success story, product

[24] Source: https://hbr.org/2015/07/engineering-reverse-innovations

features can sometimes be very specific and impossible to change, then leading to the abortion of the reverse innovation process (Hadengue, De Marcellis-Warin, von Zedtwitz, et al., 2017).

In sum, when trickling-up to DMs, an EM innovation has to comply with a set of either tacit or codified rules that, if not accounted for, will prevent the innovation from being reverse. This phenomenon may, however, be attenuated if these imperatives are considered from the beginning of the innovation process. Otherwise, even if the penetration of the innovation in the EM is a success, its return to a DM may fail. In order to prevent these types of issues, a solution may be for the parent company to keep being involved in the innovation process, namely ensure RKT all along the process.

Indeed, the EM subsidiary detains crucial knowledge about the EM innovation (potential future RI). Wherever the innovation ideation and development phases are located, the primary launch market has to be the EM. During this process, if not about conception or development, the subsidiary on site will inevitably gain knowledge about downstream activities such as marketing, advertising or brand management. This clearly implies that, even in the extreme case where the innovation is conceptualized and developed elsewhere (for example in HQ), the EM subsidiary will inevitably have to transfer some knowledge to other DM firm's components in order to facilitate the second step of the RI process.

In case where the innovation trickles up to the home-market of the enterprise, exchange of knowledge will probably happen only between the EM subsidiary and the parent company. However, in case where the innovation trickles up to several DMs, knowledge will have to be exchanged between the EM subsidiary and other DM subsidiaries.

Globally the literature has differentiated between two different types of subsidiaries. The *replicators*, which are subsidiaries mainly in charge of adapting knowledge coming from the parent company to their local environment (Ambos et al., 2006) and the *innovators*, namely subsidiaries that will seek for new competencies in order to generate new products, technologies, practices, etc. (Cantwell & Piscitello, 1999). Laying on Gupta & Govindarajan (1991)’s article about the various nature of subsidiaries according to direction and magnitude of the knowledge flows, it is possible to assume that an *innovator* can be of two natures. If it receives and sends low knowledge inflows from and to the parent company (poor RKT), it is called a *local innovator*. Conversely, high knowledge outflows sent to the parent company with still low

knowledge inflows from the latter describe a *global innovator*, i.e. “a fountainhead of knowledge for other units” (Gupta & Govindarajan, 1991: 773). In order to enable the parent company to have enough knowledge about the EM innovation to successfully reverse it, the subsidiary should act as a global innovator and include the HQ (or any other DM subsidiary interested to retrieve the innovation) all along the innovation process. During this process, compromises may have to be done between EM and DM requirements in order to be successful in both markets at the end. Even in the case where compromises are difficult to achieve, the HQ has to previously be aware of any issue that could possibly jeopardize the reversion of the EM innovation in order to limit failures. In sum, the EM subsidiary has to be able to transfer sufficient knowledge to the parent company or to any other firm's component aiming at retrieving the EM innovation. We thus propose:

- ***Proposition 3: RI second step will be positively influenced by EM subsidiaries acting as global innovators, i.e. allowing RKT.***

Considering now the network in the other way around, namely from the parent company perspective, the literature has investigated the role and the influence of the HQ over RKT. HQ actually happens to be both an indispensable linkage and knowledge coordinator between the different subsidiaries (Holm & Pedersen, 2000) as well as an important RKT obstacle (Lee & McNamee, 2014). Indeed, parent companies are frequently entrenched in their preexisting paradigms and perspectives, then leading to internal resistance that could hamper the RKT process. It is for example not uncommon that HQ does not recognize a subsidiary’s knowledge resource and its potential competitive advantage for the entire company. In that case, the parent company sometimes refuses to cooperate and absorb knowledge from the subsidiary itself then prejudicing the transfer of knowledge (Ambos et al., 2006).

Because occidental MNCs and their management forces are accustomed to mass produce in EMs but not to innovate in it, we argue that the fact that new knowledge may come from EM subsidiaries could represent an additional psychological hurdle for an effective RKT (and then a successful RI process). To common minds, EMs are considered as followers, not as leaders. If nothing else, the term RI itself is a proof of this paradigm as it represents the *reverse of what usually happens*.

The technological level and the productivity being *a priori* superiors in the North (UNIDO, 2012), intuition suggests a top to bottom knowledge transfer. In the same vein, one could have the erroneous belief that spillovers are always generated by the north for the south profit because the north has "nothing to learn from the south" (Govindarajan & Ramamurti, 2011). When it comes to absorption of knowledge developed abroad, the literature has identified several obstacles such as the liability of foreignness (e.g. Zaheer, 1995), stickiness (e.g. Jensen & Szulanski, 2004), psychological resistance (e.g. Birkinshaw & Ridderstråle, 1999) or the "not invented here" syndrome (e.g. Katz & Allen, 1982).

In sum, the willingness from the HQ to absorb new knowledge coming from EM subsidiaries is positively correlated with RKT efficiency, itself positively influencing RI second step. It is interesting to note that RKT and the willingness from the HQ to absorb new knowledge could mutually influence each other. It seems then fair to assume that:

- ***Proposition 4: RI second step will be positively influenced by the acceptance of the parent company of the fact that knowledge could come from EM subsidiaries.***

Finally, knowledge inflows between Western MNCs and their EM local counterparts are also important to consider. As already stated, innovate for EMs (RI first step), implies that Western MNCs have to create new knowledge according to local needs and constrains. The literature has generally stated that locally embedded foreign subsidiaries, i.e. subsidiaries having important relationships with local markets' actors, have a better chance to identify or create new knowledge (Andersson, Forsgren, & Holm, 2002; Lane & Lubatkin, 1998).

As previously shown, EM contexts are very different from DM ones. For this reason, EM MNCs may have better assets in terms of customer intimacy, flair for low-cost solutions or access to local resources and capabilities than Western ones (Govindarajan & Ramamurti, 2011). Born from the ground and composed with indigenous people, EM companies then represent an important source of wealth when it comes to innovate under local constraints (Brown & Hagel, 2005).

The literature has already shown that Western MNC capacity to innovate in EMs could be correlated with the increase in partnerships with EM MNCs (Corsi and Di Minin, 2014; Crisp, 2014; Dubiel and Ernst, 2012; Esko et al., 2013; Govindarajan and Euchner, 2012; Govindarajan and Trimble, 2012b; Laperche and Lefebvre, 2012; Syed et al., 2012) even in very R&D sensitive

sectors as the pharmaceutical one (Hadengue et al., 2015). Laperche and Lefebvre (2012) reported some examples of Western MNCs cooperating with local universities and suppliers, and Corsi and Di Minin (2014) anticipated a new technology-focused generation of joint ventures between DM and EM MNCs. Considering Asia as a region divided into several clusters, Western MNCs locate their subsidiaries accordingly (Amann, Jaussaud, & Schaaper, 2014) in order to extensively exchange knowledge, technology, and capital (Lorenzen & Mudambi, 2012). These types of partnerships could also represent an excellent strategy to overcome the liability of foreignness (Dubiel and Ernst, 2012).

However, the literature has also reported that "externally embedded subsidiaries can provide access to a variety of competencies, but they may also reduce the subsidiaries' interest in contributing to the overall performance of the MNC" (Andersson, Forsgren, & Holm, 2007: 803). This could limit the amount of knowledge that an EM subsidiary will be willing to transfer to the parent company. In other words, if collaboration with EM local companies can foster EM innovation (RI first step), it could also impede RKT and then limit successful return of EM innovations in DMs. In that regard, we thus propose:

- ***Proposition 5: RI first step will be positively influenced by collaborations between EM subsidiaries and local firms, whereas RI second step will be negatively influenced by collaborations between EM subsidiaries and local firms.***

6.5.2 RI and Power Distribution

Ghoshal and Bartlett (1990) were among the first to propose a model that includes power distribution within the internal MNC network. In their view, power could be represented by the idea of centrality, namely "the degree to which relations within the multinational network were guided by the formal hierarchy (the parent company)" (Ghoshal & Bartlett, 1990: 8).

Following this seminal work, most of the studies regarding the power distribution within the MNC agreed on the fact the MNC was "a dispersed structure of powers in which the top management's authority did not necessarily result in hierarchical power being the ultimate control mechanism" (Andersson et al., 2007: 802). Indeed, the dominant position of the parent company has evolved with the internalization of the firm in general. Originally in charge of

downstream activities such as sales, service and assembly, subsidiaries now often assume greater responsibilities, as for example being the innovation driver (Birkinshaw & Morrison, 1995; Gupta & Govindarajan, 1991).

The practice of RI falls directly within this context of MNC structural reorganization. This new innovation strategy appears as a logical continuity, but also as a starting point for more shifts in power distribution or even power bargaining within the MNC. To better analyze to what extent RI and power distribution are influencing each other, it requires deconstructing the RI process again. RI first step, i.e. to innovate for EMs, requires creating new knowledge adapted to EM realities. As shown in the previous section, it should be correlated with limited knowledge flows from the parent company in order to avoid reproduction of thinking patterns.

In terms of empowerment, and in the context of firm internationalization, the literature has stated that "subsidiary self-determination on inputs such as sourcing and hiring, and self-determination on outputs such as marketing and product development, emerged as positive determinants of knowledge generation in R&D subsidiaries" (Mudambi et al., 2007: 442). In other words, subsidiary's autonomy, namely the willingness of the HQ to properly step backwards and empower the subsidiary in a number of key areas, is a crucial condition to ensure the subsidiary's fruitfulness in terms of local innovation. Moreover, this phenomenon will become self-reinforcing as there is a natural subsidiary's desire for autonomy and influence (Asakawa, 2001).

This statement seems to be easily transposable in the context of EMs. Indeed, RI literature has highlighted the importance of EM subsidiaries to be able to develop innovations from a blank slate by hiring and empowering Local Growth Teams (LGT) (Govindarajan & Trimble, 2012b). LGTs, partially composed of local people having a more accurate knowledge of the indigenous culture, significantly improve the subsidiary's propensity to innovate for the EM (Corsi & Di Minin, 2014; Govindarajan & Euchner, 2012; Immelt et al., 2009; M. Zeschky et al., 2014). In this vein, it is not uncommon to have EM LGTs with their own budget, objectives and key project indicators. Some MNCs did not even hesitate to impoverish their central R&D (located in the DM) of a strategic axis of research to attribute it exclusively to an EM subsidiary (Hadengue et al., 2017).

But giving a subsidiary its autonomy and self-determination does not come freely for the parent company. Mudambi & Navarra (2004) have shown that "the dispersal of knowledge-creating

activities within the MNC (…) increased the extent and scope of subsidiaries bargaining power within the firm (…) then underlying intra-organizational tension" (Mudambi & Navarra, 2004: 401). More recently, Mudambi, Piscitello & Rabbiosi (2014) confirmed these findings by showing that when a subsidiary is been recognized by the parent company as having extremely valuable and specific competencies, this subsidiary usually withholds these competencies from the HQ in order to use them as a lever for bargaining power.

In the context of RI, these findings could be very problematic. To be *reverse*, an innovation first developed for an EM has to *trickle up* to the Western MNC home market (or any other DM) and this process could be very challenging (Hadengue, De Marcellis-Warin, von Zedtwitz, et al., 2017). As stated in the previous section, high knowledge outflows from the subsidiary to the HQ (RKT) are required in order to successfully achieve the reversing of the innovation. However, from a more power-perspective, this knowledge could be deliberately retained by the subsidiary itself in order to gain more power within the MNC network, then jeopardizing the entire RI process. Retaining this knowledge could prevent the HQ from getting the required information to properly retrieve an EM innovation and successfully market it at home. Sometimes it may even prevent the parent company to be aware of potential EM innovations that could fit in DMs, consequently preventing any RI.

In other words, if more subsidiary empowerment will be positively correlated with an EM subsidiary's efficiency to innovate, it may, at the same time, negatively affect the propensity of theses innovations to trickle-up to the MNC home market, i.e. to become RIs. Indeed, EM subsidiary's research of autonomy and self-determination will be negatively correlated with RKT, that is itself positively correlated to RI second step. Power bargaining within the MNC will then be both a catalyst and an obstacle to RI. These antagonistic statements stress one more time the difficulty of practicing RI. We then conclude:

- ***Proposition 6: RI first step will be positively influenced by EM subsidiaries autonomy and self-determination, whereas RI second step will be negatively influenced by EM subsidiaries autonomy and self-determination.***

6.5.3 RI and Resources Configuration

Finally, the way resources are dispatched within the internal network of the MNC also represents an interesting angle to look at. Ghoshal & Bartlett's (1990) proposed a model assessing that the dispersal, i.e. the differentiation between each subsidiary resources, and the specialization, i.e. the extent to which the company's resources are concentrated in one subsidiary, were influenced by the connectedness within and across the external network. Leaning on Ghoshal & Bartlett's model, a more recent seminal work is 2008 Mudambi's article. Emphasizing the recent Global Value Chains (GVC) dispersion of MNCs, it differentiated between the geographical location strategy (concentrated or dispersed) and the control strategy (vertical integration or specialization), each strategy being associated with a different result in terms of knowledge creativity.

MNC's GVCs are basically composed of (1) upstream activities such as design or R&D, (2) downstream activities such as marketing, advertising or brand management and (3) finally middle activities such as manufacturing or any other repetitious process (Mudambi, 2008). For a Western MNC that operates in an EM, activities can be concentrated onshore (in the MNC home market) or dispersed offshore (in the EM). Moreover, wherever these activities are located (DM or EM), the MNC can choose to keep these activities in-house (vertical integration strategy) or the outsource them (specialization strategy).

When looking at the GVC in an RI context, it seems fair to assume that middle activities are not of first interest. Indeed, most of the time, manufacturing has already been taking place in EMs for a long time now (whether outsourced or not) in order to control costs. Even if it is not the case, the different possible configurations should not affect or be affected by the RI process. At worst, RI practice could represent an opportunity for the company to move some of the manufacturing process in EMs.

Strategies of upstream and downstream activities should be more carefully considered. Regarding the geographical strategy of upstream activities, we know that RI can happen if the R&D team is located either in an EM or a DM. Indeed, the only important criterion is that the innovation proposed by the R&D team is first adopted in an EM and, in a second time, in the Western MNC home-market (or any other DM). Although the literature on RI clearly urges companies to offshore their R&D in EMs in order to have a better understanding of the local environment

(Govindarajan & Trimble, 2012b), it is not mandatory (Trimble, 2012). Then, whether the R&D is offshored or not will probably depend upon the industrial sector of the company or the availability of local expertise. For example, very sensitive R&D could be difficult to operate in EMs. Qualified researchers could sometimes be really rare due to the *brain drain* phenomenon (although this is starting to shift[25]) and intellectual property protection could also be a serious concern in EMs (Maskus, 2003). In sum, it seems difficult to forecast a precise link between RI and upstream activities, if only that offshoring R&D in EMs could facilitate RI first step.

- ***Proposition 7: RI first step will be positively influenced by the offshoring of upstream activities in EMs.***

In the context of RI, downstream activities are far more interesting to focus on. Although sometimes neglected in favor of upstream activities, marketing for example is a very important value added activity (Mudambi, 2008) to consider when looking at RI. Selling new products to EMs is in fact a considerable challenge for Western MNCs (Dubiel & Ernst, 2012; Govindarajan & Euchner, 2012). Needs, expectations and cultural sensitivities really differ between EMs and DMs, making it very difficult for Western marketing, advertising or brand management teams to properly promote a product, let's say in China or India. Stressing this important issue in his interview with Euchner (2012), Govindarajan stated that a good strategy was to partner with local marketing organizations in order to accurately target customer needs, understand the environment and effectively market new solutions.

But the difficulties do not stop there. To bring back the innovation in the home market or to any other DM (RI second step) also requires being careful to different issues like cultural differences between EM and DM customers or even the risk of cannibalization. To fail to adapt the marketing or the communication strategy between one market and another could be very risky. In other words, an EM marketing strategy will not automatically be accurate for a DM.

A good illustration is Essilor ethnic lenses, developed by the Asian R&D team. These lenses were adapted to the anatomy and physiology of Chinese wearers. It was a great success in China because people were proud that the world leader in optics would make a new product adapted to

[25] China ranks first in terms of researchers, with a total of 2.9 million people working full time in R&D in 2011 (about double the number of researchers in the United States) (Wu, 2012).

their special needs. Local marketing teams then used this angle to promote the lenses. Bringing back this innovation in Western markets to sell it to Chinese Diasporas seemed, at first, a good idea. But to use the same marketing strategy in DMs happened to be a mistake. In the United States, people of Chinese ethnicity were not proud that Essilor had developed a product just for them but rather offended by the fact that they were advised to buy a customized product because of their ethnicity. Marketing teams in America should have not rest on the work done by the Chinese marketing team because it was not taking into consideration cultural sensitivities of American customers.

In sum, downstream activities have to be considered with attention when it comes to RIs. Offshoring and outsourcing marketing in EMs could definitely facilitate RI first step but it could also be a trap for RI second step. Thus, we propose:

- ***Proposition 8: RI first step will be positively influenced by the offshoring and eventually outsourcing of downstream activities in EMs, whereas RI second step will be negatively influenced by the offshoring and eventually outsourcing of downstream activities in EMs.***

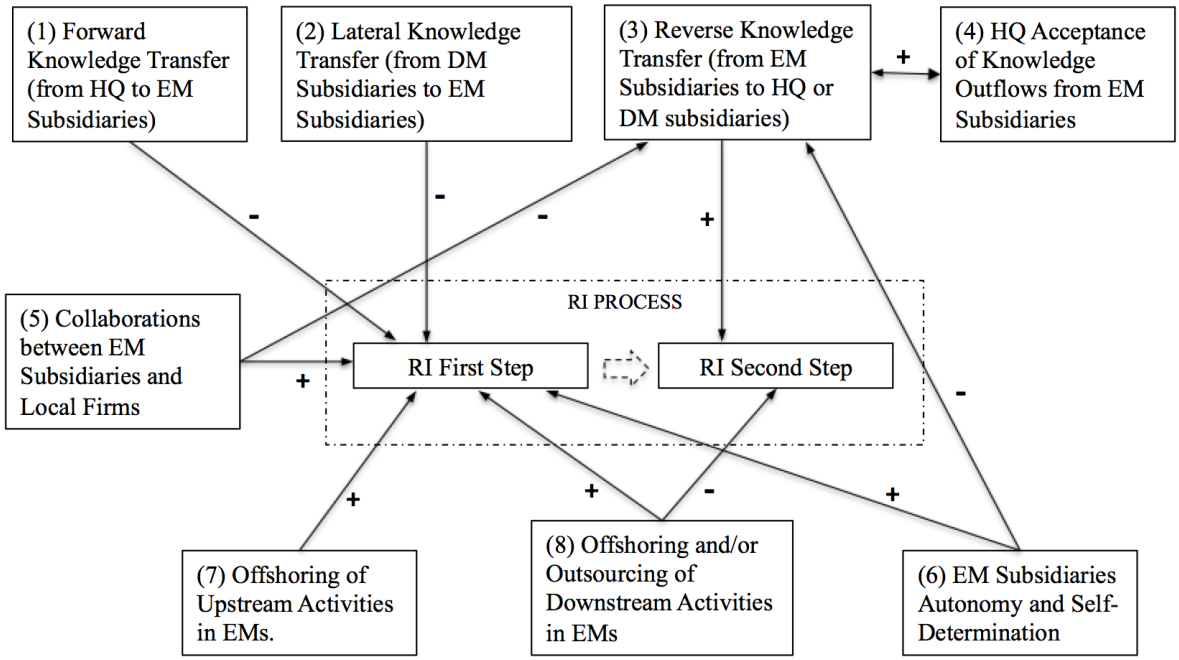

Figure 6-1: A RI theoretical framework through the lens of the MNC network

6.6 Concluding Remarks, Limits and Research Agenda

Nowadays, MNCs are often practicing RI either by coincidence or by imitation. It is still too often a trial and error approach and we do not know a lot about all RI failures that probably occur in a lot of MNC. Furthermore, the available literature, although being very vocal about the great advantages of practicing successful RI, does not propose any evaluation grid or theoretical framework allowing for a deeper integration of this new strategy within the MNC reality.

Our article represents such an effort: contributing to a theoretical framework for RI. Even though they have not yet been empirically tested, our propositions strongly suggest that RI may impose a paradoxical style of management. This important challenge not only calls for more academic studies but could also partially explain why MNCs have not yet integrated RI as an official strategy and why they are still not monitoring it properly.

At this point, MNCs have to be offered with better tools to be able to manage RI more effectively. Our theoretical framework sheds light on the impacts of the MNC internal and external network dynamics on the practice of RI. In a medium-term perspective, we hope that this theoretical effort will help having a better understanding of the RI process. This could hopefully improve the RI successful rate, pushing MNCs to a better monitoring of the overall process then allowing for more accurate empirical investigations.

Finally, a research avenue that we would like to highlight as really promising is the impact of MNCs' practice of RI on the EMs' actors composing clusters or ecosystems. Indeed, very recently, Cano-Kollmann et al. (2016) called for more studies on multidirectional knowledge connectivity, especially on the co-evolution of firms and locations. This broader viewpoint allows thinking not only in terms of the impact of location on the MNC but also the other way around. In this perspective, the fact that an MNC, within a cluster or an ecosystem, practices RI could have impacts on local actors such as firms, but also institutions.

CHAPITRE 7 DISCUSSION GÉNÉRALE

“The electric light did not come from the continuous improvement of candles” - Oren Harari

La discussion générale de la thèse s’articule en deux parties distinctes. Dans la première, il est proposé de faire la synthèse des principaux travaux menés durant le doctorat. Dans la seconde partie, d’autres perspectives d’intérêt sont présentées afin de pousser la réflexion sur l’innovation inverse au-delà du travail de thèse et d'ouvrir la voie à de futures recherches.

7.1 Synthèse

L'émergence de nouvelles classes moyennes dans certains pays, comme la Chine par exemple, change l'ordre établi. Les grandes multinationales occidentales, si elles veulent survivre à ce changement d'équilibre, n'ont d'autre choix que de s'intéresser à ces nouveaux consommateurs potentiels. Mais ces derniers ne sont pas les réplicats des consommateurs occidentaux: au-delà du fait que leur pouvoir d'achat soit encore inférieur à celui des clients traditionnels des entreprises occidentales, ils ont des besoins et des exigences qui leur sont propres. En effet, les contraintes qui composent leur environnement étant différentes, les produits proposés ne peuvent être exactement les mêmes que ceux vendus dans les pays développés. Ils doivent être moins chers, mais également plus autonomes, plus durables ou répondre à de nouvelles préférences culturelles. Les innovations ainsi créées sont habituellement empreintes d’une grande originalité. Moins dispendieuses et plus efficientes, elles peuvent ainsi, dans un deuxième temps, être ramenées dans les marchés développés durement affectés par les récentes crises économiques. Ce nouveau phénomène s'appelle l'innovation inverse.

Combinant des éléments à la fois anciens et nouveaux, le principal apport de l’innovation inverse réside dans sa considération des pays émergents ou en développement comme moteurs d’une innovation ensuite destinée à retourner dans les économies développées. Bien que l’intérêt général pour ce nouveau modèle d'innovation globale soit croissant, un travail important est encore nécessaire afin d’améliorer son positionnement théorique, mais également la maîtrise de sa pratique. La thèse de doctorat présentée dans ce document a contribué à ce projet d’envergure.

Tout d’abord, et dans un souci d’inclusion des travaux précédemment réalisés sur le sujet, une revue systématique de la littérature a permis de faire l’état de l’art de l’innovation inverse de la façon la plus exhaustive possible. Plus de 350 documents (en anglais et en français) ont été collectés via plusieurs bases de données, puis analysés.

Cette étude a tout d'abord permis de comprendre en quoi l’innovation inverse était à la fois un ancien et un nouveau phénomène et de vérifier que cette stratégie intéressait un nombre croissant de chercheurs. Puis, il a également été possible de montrer que la littérature sur l'innovation inverse était divisée en trois grands thèmes: (1) les études cherchant à améliorer la définition du concept en proposant notamment des typologies de l'innovation inverse ou simplement en cherchant à éclaircir les liens existants entre ce concept et d'autres concepts d'innovation préexistants (2) les études cherchant à définir les contextes environnementaux et organisationnels favorisant la pratique de l'innovation inverse et finalement (3) les études s'intéressant aux conséquences, en termes de risques ou d'implication économique et sociale, de la pratique d'une telle stratégie par les entreprises. À travers l'étude de ces différents thèmes, un cadre conceptuel a été construit. Ce cadre a permis de mettre en relief les fréquences auxquelles la littérature associe l'innovation inverse et les autres concepts identifiés dans les documents collectés.

D’un point de vue plus général, pour le champ de recherche, cet article a tenté de dépeindre une vision globale de l'innovation inverse et de son positionnement dans la littérature. Ce travail a fait émerger six suggestions ou axes de recherche pouvant possiblement orienter de futures réflexions. Sur ces six axes, trois ont été développés et constituent le corps de la thèse. Les paragraphes suivants reprennent l'essentiel des résultats obtenus.

Le premier axe développé dans la thèse traite de la pratique de l’innovation inverse, mais également des transferts technologiques inverses. Plus précisément, la recherche s'est concentrée sur le secteur pharmaceutique, industrie pour laquelle l’innovation est une étape particulièrement sensible de la chaîne de valeur. Testant deux propositions subséquentes, à savoir le récent positionnement des pays émergents comme nouveaux centres de l'innovation ainsi que la pratique de l'innovation inverse et son impact sur les transferts technologiques, ce deuxième article de la thèse utilise une méthodologie de recherche mixte.

Pour vérifier la première proposition, des données sur les brevets ont été collectées et analysées à trois niveaux: (1) les brevets en général (2) les brevets dans le domaine pharmaceutique et enfin (3) les brevets publiés par les dix plus grandes sociétés pharmaceutiques ayant récemment investi en Chine. Les brevets déposés en Chine devant obligatoirement l'être en chinois[26], le troisième niveau d'analyse a nécessité de retracer les brevets dans cette langue.

Pour vérifier la seconde proposition, une analyse de contenu du discours officiel des dix plus grandes pharmaceutiques en termes de revenus a été effectuée. Ce discours officiel a été récupéré via les médias Internet spécialisés rapportant des entrevues avec des hauts responsables, les sites internet des entreprises, les rapports annuels et enfin des entretiens menés en face à face avec des parties prenantes du secteur. Le codage, via un logiciel d'analyse textuel, de plusieurs centaines de pages de discours a permis de vérifier que ces multinationales pratiquaient ou avaient l'intention de pratiquer l'innovation inverse. Sept critères pouvant démontrer qu'une entreprise pratique l'innovation inverse ont été identifiés. Il est en effet attendu que l'entreprise (1) cible un marché émergent, (2) délocalise une partie de sa R&D dans ce marché émergent, (3) cherche à développer des produits nouveaux et originaux, (4) assure une optimisation des coûts pour proposer les produits aux prix les plus bas possibles, (5) effectue un travail d'identification des besoins propres au marché ciblé, (6) autonomise ses filiales locales et finalement (7) cherche à ramener les nouveaux produits dans les marchés développés. De façon similaire, 3 critères du transfert technologique inverse sont définis afin de vérifier l'existence du phénomène, c'est-à-dire un transfert de savoir des entreprises pharmaceutiques locales (en Chine) vers les multinationales étudiées. Ces critères sont: (1) la reconnaissance, par les grandes pharmaceutiques, d'une expertise locale, (2) l'embauche de personnel indigène et (3) la collaboration ou la volonté de collaborer avec des entreprises locales.

De façon générale, ce travail a permis de confirmer que la Chine se positionnait aujourd'hui comme un nouveau centre de l’innovation. De plus, il a été possible de démontrer l’intérêt des plus grandes entreprises pharmaceutiques, non seulement à innover pour ce marché, mais

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[26] Source: Règlement d'application de la Loi sur les Brevets, Chapitre III, Règle 40, (2), http://www.sipo.gov.cn/sipo_English/laws/lawsregulations/200804/t20080416_380326.html, consulté le 3 mars 2014.

également à envisager le retour des innovations dans les marchés développés, à savoir l'Europe de l'Ouest et l'Amérique du Nord. Dans un deuxième temps, cette étude a également mis en relief un renversement au niveau de la direction des transferts technologiques. Reconnaissant l'existence d'un savoir local important, ces multinationales occidentales dont les centres de R&D sont établis en Chine, embauchent localement et collaborent effectivement déjà avec des partenaires locaux. Ces démarches font émerger un changement de paradigme important: le transfert du savoir n'est plus exclusivement Nord-Sud, tel que généralement assumé, mais aussi Sud-Nord. En d'autres mots, les entreprises occidentales ont à apprendre des entreprises issues de pays émergents.

Le positionnement des pays émergents comme nouveaux moteurs de l'innovation et l'existence du phénomène d'innovation inverse ayant été démontrés, une suite logique est de se pencher sur l'étude en profondeur de la pratique de ce nouveau modèle d'innovation globale. Il s'agit du deuxième axe de recherche abordé dans la thèse.

La multinationale Essilor a alors été choisie pour réaliser une étude du cas. Des entrevues ont été menées avec des employés de l'entreprise et de nombreux documents internes, tels que des courriels ou des rapports, mais aussi des brochures marketing ou les rapports annuels de la compagnie, ont été collectés afin de trianguler les données. Quatre cas d'innovation inverses et leurs challenges associés ont alors pu être identifiés. Au total une vingtaine d'entrevues ont été réalisées avec quatorze employés de différents niveaux hiérarchiques, incluant notamment le Président directeur général, le vice-président exécutif de la R&D mondiale, le vice-président exécutif de l'ingénierie globale, le vice-président marketing stratégique ou le vice-président R&D Asie.

Au travers des cas d'innovation inverses analysés, dix challenges, rencontrés au cours de ces projets, ont été identifiés. Ils ont pu être catégorisés en quatre grands groupes: (1) les challenges internes à l'entreprise tels que par exemple le fait que les employés du siège social perçoivent les innovations des filiales de marchés émergents comme des produits de mauvaise qualité, (2) les challenges liés au marché tel que le risque que certaines innovations ramenées de pays émergents puissent cannibaliser les produits traditionnels de l'entreprise, (3) les challenges liés à la sensibilité des clients telle que le fait que l'image qu'ils ont de l'entreprise puisse être négativement affectée si les produits qu'elle propose viennent de marchés émergents et

finalement (4) les challenges liés aux écarts réglementaires entre pays développés et pays émergents et les enjeux éthiques que cela pourrait soulever. Les solutions mises en place par Essilor pour prévenir ou surmonter ces différents obstacles ont également pu être identifiées et sont présentées dans l'article.

Cette étude est la toute première à proposer une analyse en profondeur de quatre projets d'innovation inverse. De plus, elle met en lumière une compagnie innovante pratiquant l'innovation inverse et encline à partager son expérience. Il est envisageable d'imaginer qu'un tel exemple puisse éventuellement favoriser l'engagement d'autres entreprises à participer à de futures études similaires.

Finalement, la dernière partie de la thèse propose une réflexion davantage théorique, en se penchant plus spécifiquement sur l'innovation inverse replacée dans le contexte du réseau de la multinationale (troisième axe de recherche de la thèse). Porté par une volonté de clarification de l'ensemble des concepts clés intervenant dans l'étude de cas Essilor, le quatrième article de la thèse repose sur une analyse de l'influence de l'organisation du réseau de la firme sur la pratique de l'innovation inverse. Reprenant le modèle de la multinationale de Ghoshal et Bartlett (1990), ce dernier article s'intéresse particulièrement aux transferts de savoir, à la répartition du pouvoir ainsi qu'à la configuration des ressources au sein du réseau de l'entreprise.

Afin d'analyser l'influence de ces phénomènes sur la pratique de l'innovation inverse, il a d'abord été nécessaire de redéfinir cette dernière comme un processus à deux étapes distinctes, mais indissociables: (1) innover pour un marché émergent et y commercialiser l'innovation puis (2) ramener cette innovation dans le marché d'origine de l'entreprise ou tout autre marché développé. Il a ainsi été constaté que certaines configurations pouvaient avoir des influences différentes sur chacune des étapes du processus. En termes de répartition du pouvoir par exemple, il a été possible de faire l'hypothèse que l'autonomisation des filiales de l'entreprise ait un impact positif sur la capacité de ces dernières à être créatives et à innover différemment pour les marchés émergents. En revanche, il est aussi probable que cette autonomisation ait une influence négative sur les transferts de savoir inverses, c'est à dire sur la disposition des filiales à faire remonter le savoir à l'entreprise mère, mettant ainsi à mal le processus d'inversion de ces innovations.

De façon générale, cette étude propose le premier cadre théorique de l'innovation inverse et permet ainsi de mettre en relief la difficulté, mais surtout le caractère paradoxal de la gestion de

d'une telle stratégie.

Pour conclure, la thèse dans son ensemble avait pour but ultime d'améliorer la compréhension de l'innovation inverse. Tentant d'apporter une contribution tant au niveau théorique qu'au niveau pratique, les trois articles composant le corps de la thèse de doctorat ont chacun répondu à des problématiques différentes, préalablement identifiées dans le premier article. Trois autres suggestions de recherche n'ont cependant pas été abordées dans la thèse. Une première appelait à une réflexion sur une redéfinition plus générale du concept d'innovation inverse tandis qu'une seconde faisait la critique du terme en lui reprochant son caractère ethnocentrique et suggérait de le renommer. Ces deux axes ne seront pas davantage discutés ici. En revanche, la section suivante propose d'ouvrir la discussion sur la suggestion de recherche invitant à l'étude des conséquences sociales de la pratique de l'innovation inverse et plus précisément le lien entre innovation sociale et innovation inverse. Les questions de l'innovation radicale et du processus créatif sont également soulevées.

7.2 Vers d'autres perspectives de recherche pour l'innovation inverse

7.2.1 Innovation inverse et innovation sociale

Une innovation sociale, telle que définie par la Stanford Social Innovation Review est « une solution nouvelle à un problème social qui est plus efficace, plus efficiente, plus durable ou plus juste que les solutions existantes et pour laquelle la valeur créée bénéficie davantage à la société dans son ensemble qu'à des individus en particulier » (Phills, Deiglmeier, & Miller, 2008; traduction de l'auteur). Force est de constater qu'une proportion importante des innovations inverses ayant été identifiées comme de grands succès sont, avant tout, des innovations sociales.

L'électrocardiographe compact et le scanner à ultrasons portable de General Electric, les lunettes Ready-to-Clip d'Essilor, le lait en sachet de Parmalat pour les enfants malnutris ou encore l'automobile économique Dacia Logan de Renault en sont des exemples par excellence. Moins dispendieuses que les produits classiques de même catégorie, ces innovations, souvent plus facile

d'utilisation, parfois transpotables et autonomes sur le plan énergétique ont permis d'améliorer la qualité de vie ou même de sauver des vies à la fois dans les pays émergents pour lesquelles elles avaient été conçues, mais également dans les pays développés. Au total, sur plus de 60 innovations inverses répertoriées en annexe, environ un tiers d'entre elles peuvent être considérées comme des innovations sociales. Certaines de ces innovations ont été mises en place par des organismes à but non lucratif dont la mission primaire est exclusivement sociale. C'est le cas la chaise roulante tout terrain Leveraged Freedom Chair du MIT Mobility Lab ou du programme de soins de santé de Partners In Health pour les plus démunis. Mais dans d'autres cas, ce sont de grandes multinationales qui sont à l'origine de ces innovations sociales (General Electric, Essilor, Parmalat, Renault. etc.). Ce constat soulève des questionnements majeurs: pourquoi tant d'innovations inverses sont également des innovations sociales, alors que les multinationales dont elles émergent ne sont, à priori, pas des entreprises à vocation sociale? Ces innovations sociales répondent-elles aux mêmes besoins (sociaux) dans les pays émergents ou en développement que dans les pays développés? Si l'innovation sociale est traditionnellement associée à de l'innovation incrémentale, dans la mesure où les organismes à son origine disposent de peu de ressources (Gundry, Kickul, Griffiths, & Bacq, 2011), qu'en est-il des innovations inverses *à caractère social* (on pourra parler ici d'innovations inverses sociales) mises au point par des multinationales? Finalement, est-il possible de considérer que l'innovation inverse est une stratégie porteuse pour la création d'innovations sociales radicales globales? Bien que ces questions appellent à de plus amples recherches, les paragraphes suivants tentent de donner quelques éléments de réponse ou tout au moins, quelques pistes de développements possibles.

Pour répondre à ces questionnements, il est tout d'abord nécessaire de définir ce qu'est une entreprise sociale. Deux conceptions différentes sont développées dans la littérature (Dees & Anderson, 2006). La première, davantage centrée sur le statut de l'organisation, définit l'entreprise sociale comme ayant pour principal objectif une mission sociale dans laquelle elle pourrait réinvestir tout bénéfice, sans tenir compte du besoin de maximisation des profits de ses actionnaires et/ou de ses propriétaires (Dacin, Dacin, & Matear, 2010; Hartigan, 2006). Moins restrictive, la seconde vision de l'entreprise sociale considère celle-ci comme tout organisme, tant à but lucratif que non lucratif, dont les innovations ont un impact social majeur (Austin, Stevenson, & Wei-Skillern, 2006; Dacin et al., 2010).

Affirmer que de grandes multinationales comme General Electric deviennent, par la force du

marché, des entreprises sociales semble être une revendication audacieuse. Pourtant, la deuxième définition de l'entreprise sociale permet d'envisager la considération selon laquelle les multinationales occidentales pratiquant l'innovation inverse pourraient être amenées à *agir comme* des entreprises sociales. Deumeurant des entreprises traditionnelles dont le but premier est économique, il semblerait que les processus d'innovation qu'elles mettent en place pour pénétrer les marchés émergents ou en développement, mais aussi les innovations qui en résultent, floutent les limites qui existent aujourd'hui entre entreprise sociale et entreprise classique (entre le premier système économique orienté vers le profit et le troisième système économique dont la mission est avant tout sociale) (Peattie & Morley, 2008).

La clé réside ici probablement dans la nature des contraintes auxquelles doivent faire face les entreprises occidentales qui souhaitent conquérir ces nouveaux marchés et plus spécifiquement dans la réorientation de leur mission d'innovation. L'impératif de développer des produits moins chers, durables et au moins aussi performants, le manque important d'infrastructures sur place, les réglementations, mais aussi les usages ou les préférences culturelles parfois très différents de ces nouveaux marchés sont les principales contraintes évoquées par la théorie de l'innovation inverse (Govindarajan & Trimble, 2012b). Parmi ces contraintes, au moins deux (pas ou peu d'infrastructures et des moyens financiers très limités) représentent à elles seules les éléments de base responsables de la majorité des besoins sociaux dans le monde (World Bank, 2006). Ainsi, pour surmonter ces obstacles, et, quel que soit le milieu industriel, la pratique de l'innovation inverse par les multinationales occidentales fera potentiellement émerger de nouvelles solutions qui seront, par essence, des innovations sociales.

7.2.2 Innovation inverse et innovation radicale

Il est intéressant de noter que, bien souvent, de nouveaux axes de valeur sont développés durant le processus créatif d'une innovation inverse. Ainsi les innovations inverses sociales ne répondent pas nécessairement au même besoin dans les économies émergentes ou en développement que dans les économies développées. L'électrocardiographe compact ou le scanner à ultrasons portatif, initialement destiné à servir les populations indiennes rurales isolées, est aujourd'hui utilisé dans les ambulances et dans les urgences aux États-Unis en raison de leur transportabilité et de leur faible coût. Le lait en sachet de Parmalat pour les enfants malnutris représente aujourd'hui une solution environnementale durable dans les pays développés.

Finalement, la Dacia Logan de Renault, initialement conçue pour les consommateurs des pays de l'Europe de l'Est a été une option de secours pour les familles françaises dont les revenus avaient été diminués par la crise économique. Pour d'autres, les prix abordables auxquels étaient vendus ces véhicules en France représentaient la possibilité d'acquérir une seconde voiture.

En d'autres termes, non seulement ces innovations inverses sociales permettent des améliorations significatives en termes de performances et de coûts, transformant ainsi les marchés des pays émergents, mais elles créent également de nouvelles opportunités de marché dans les pays développés. Elles sont donc, par définition, des innovations radicales (Leifer, O'Connor, Rice, & O'Connoer, 2001).

Bien que la littérature décrive traditionnellement les innovations sociales comme des innovations incrémentales, principalement en raison du manque de ressources des entreprises à vocation sociale (Gundry et al., 2011), le cas des innovations inverses sociales semble appeler à un raisonnement différent. Les multinationales comptent en effet parmi les organisations les plus riches en ressources humaines et matérielles et ces ressources, couplées aux dynamiques de gestion de l'innovation inverse repoussent les limites traditionnelles de l'innovation sociale. Ainsi, l'autonomisation des filiales locales, la mise en place d'un nouvel écosystème d'innovation impliquant les employés du siège social, mais aussi de nouveaux employés directement issus des marchés locaux et la reformulation d'une nouvelle mission d'innovation (Govindarajan & Trimble, 2012a, 2012b; Hadengue, de Marcellis-Warin, von Zedtwitz, & Warin, 2017) sont autant de stratégies nouvelles pour ces entreprises. Elles permettent de remettre en causes les paradigmes traditionnels et de briser les schémas cognitifs favorisant ainsi l'émergence de nouvelles idées et potentiellement, d'innovations radicales (Agogué, 2013; Dewar & Dutton, 1986; Masson, 2010).

Bien sûr il est possible que certaines innovations inverses soient des innovations sociales sans être radicales ou radicales sans être sociales. Il est également possible que certaines ne soient ni l'une ni l'autre. Le dentifrice à saveur de thé initialement développé par Colagte-Palmolive pour la Chine et devenu, dans un deuxième temps, un succès mondial en est un exemple. Cependant, il apparaît raisonnable d'admettre que l'innovation inverse est un processus dont les propriétés intrinsèques peuvent potentiellement stimuler l'émergence d'innovations sociales globales.

7.2.3 Innovation inverse et créativité

Pour conclure, ces différents constats renvoient à la question de l'impact des contraintes sur le degré de créativité d'une organisation. Il n'apparait pas y avoir de consensus au sein de la littérature en gestion de l'innovation quant à cette question (Caniëls & Rietzschel, 2015). Si les contraintes organisationnelles semblent diminuer la créativité (Amabile, Schatzel, Moneta, & Kramer, 2006; Amabile, 1998), les contraintes de design ou encore les contraintes environnementales pourraient avoir tendance à stimuler le processus créatif (Arrighi, Le Masson, & Weil, 2015).

Dans le cas de l'innovation inverse, il semblerait que les nouvelles contraintes auxquelles doivent faire face les multinationales occidentales soient les principaux déterminants de la nature innovante des nouveaux produits qui émergent du processus créatif. Autrement dit, le contexte dans lequel ces innovations sont développées, puis commercialisées, stimule la créativité et permettre l'émergence de solutions originales, parfois sociales ou même radicales.

Reprenant le travail effectué dans le quatrième article de la thèse et décomposant l'innovation inverse en deux étapes distinctes, il pourrait être admis que la créativité soit stimulée par des contraintes différentes à chacune de ces étapes. La demande de produits peu dispendieux, efficients, autonomes, durables, etc. stimule le processus créatif durant la première étape. Les équipes de R&D sont forcées de redéfinir la mission d'innovation et à sortir de leurs schémas cognitifs traditionnels.

Dans un deuxième temps, d'autres contraintes à la fois externes et internes à l'organisation peuvent stimuler la créativité nécessaire au rapatriement de ces nouveaux produits dans les marchés développés (Hadengue, de Marcellis-Warin, von Zedtwitz, et al., 2017). Au niveau externe il est possible de penser par exemple au risque de cannibalisation des produits traditionnels de l'entreprise. Au niveau interne, la perception, par les employés du siège social, d'une mauvaise qualité des produits venant des filiales localisées dans les pays émergents ou en développement peut représenter un défi de taille. Dans ce dernier cas, des solutions créatives au sein même de l'entreprise doivent être mises en place pour vaincre ces a priori.

Ainsi, il apparaît clairement que l'étude de la pratique de l'innovation inverse selon l'angle de la créativité pourrait éventuellement venir enrichir cette littérature.

CHAPITRE 8 CONCLUSION ET RECOMMANDATIONS

La conclusion résume les apports théoriques et pratiques de la thèse, mais discute également des limites de celle-ci. Finalement, quelques recommandations sur les futures avenues de recherche sur l'innovation inverse sont présentées.

8.1 Résumé des apports théoriques et pratiques de la thèse

Dans son ensemble, ce doctorat contribue à la théorisation de l'innovation inverse, mais également à l'amélioration de sa pratique.

Tout d'abord, il apparait clairement au fil de la thèse que l'innovation inverse est un phénomène en émergence: nouveau modèle d'innovation globale pour les entreprises, il suscite un intérêt croissant dans la communauté scientifique. La littérature sur le sujet étant foisonnante et non structurée, la thèse participe, via la construction d'un cadre théorique, à l'organisation du champ et des connaissances entourant ce phénomène et permet ainsi une meilleure structuration des recherches actuelles et futures.

Vérifiant empiriquement le déplacement de la force d'innovation dans les pays émergents et notamment en Chine, la thèse contribue également à démontrer un changement d'équilibre important: les marchés occidentaux ne sont plus les seuls visés par les multinationales. En effet, ces dernières s'intéressent aujourd'hui également aux consommateurs composant les classes moyennes des économies émergentes.

Poussant la réflexion au-delà de ce constat, la thèse démontre que ces multinationales occidentales pratiquent aujourd'hui l'innovation inverse, mais également le transfert technologique inverse. La thèse contribue ainsi à la littérature en associant la pratique de l'innovation inverse à un changement de paradigme important en termes de transferts de connaissance: ils ne sont aujourd'hui plus exclusivement Nord-Sud, mais également Sud-Nord. De plus, un ensemble d'indicateurs de l'innovation inverse, mais également du transfert technologique inverse ont été déterminés, permettant ainsi une identification plus rigoureuse des entreprises pratiquant ces stratégies.

La thèse propose également le tout premier cadre théorique de l'innovation inverse. Ce cadre, articulé autour de la redéfinition de l'innovation inverse comme étant un processus composé de deux étapes distinctes, mais indissociables, permet un meilleur positionnement du concept dans la littérature. Faisant émerger le caractère paradoxal et donc complexe de la gestion de l'innovation inverse, la thèse contribue ainsi à la mise en perspective de cette stratégie et des enjeux managériaux qu'elle représente.

Sur le plan pratique, la thèse propose des outils de gestion pour favoriser le succès de l'innovation inverse dans les organisations. Grâce à une étude de terrain, dix principaux challenges rencontrés par les entreprises ayant mis en place ce modèle d'innovation globale sont identifiés. Des solutions pour surmonter ces obstacles sont également décrites.

8.2 Limites générales

Bien que l'innovation inverse soit une stratégie qui puisse aussi être pratiquée par des entreprises issues des pays émergents (dans ce cas-ci, les innovations, directement conçues dans les pays émergents par ces entreprises sont, dans un deuxième temps, transférées dans des économies développées), la thèse s'est principalement concentrée sur l'innovation inverse d'un point de vue des entreprises occidentales. L'accès aux données a été le déterminant clé de cette limite. En effet, les entreprises enclines à participer à notre recherche étant exclusivement issues d'économies développées, il a semblé raisonnable de ne pas essayer d'extrapoler nos résultats. Plusieurs exemples d'entreprises issues de pays émergents et pratiquant l'innovation inverse ont cependant été répertoriés en annexe. On compte parmi les plus célèbres les voitures électriques de BYD ou encore les poussettes Goodbaby. Certaines de ces entreprises, initialement de taille moyenne, sont même devenues de grandes multinationales grâce à ce processus de transfert de leurs produits vers les marchés développés (Hang, Chen, & Subramian, 2010).

Bien qu'il apparaisse que la pratique de l'innovation inverse par des petites ou de moyennes entreprises soit également possible (Radojévic, 2016), ce phénomène est plus rare. En effet, les plus faibles ressources de ces organisations peuvent rendre le processus plus difficile et surtout plus risqué. Dans le cadre de cette thèse, il a donc été décidé de se concentrer davantage sur les multinationales, organisations pour lesquelles l'innovation inverse est une nouvelle stratégie d'innovation nécessaire pour survivre à l'émergence de géants comme le Brésil, la Chine ou

l'Inde.

Finalement, bien que l'innovation inverse puisse tout aussi bien s'appliquer à des innovations produits qu'à des innovations de processus, la thèse se concentre ici principalement sur les premières. Un exemple intéressant d'innovation inverse de processus a été découvert durant le travail de terrain chez Essilor. Dans le cadre d'un partenariat avec un manufacturier de lunettes chinois, les équipes Essilor ont remplacé les joints traditionnels de protection des verres lors de l'étape de surfaçage par un *tape* spécial. Bien que beaucoup plus rustique, cette solution était plus efficace et moins dispendieuse. Cette innovation a par la suite été ramenée dans certaines usines Essilor situées dans les marchés développés. Ce type d'innovation inverse, *interne* à l'entreprise, mériterait d'être davantage étudié.

8.3 Recommandations

La discussion générale de la thèse a proposé plusieurs pistes de recherche pour continuer à contribuer au champ. Au-delà de ces propositions spécifiques, il est important de comprendre que l'innovation inverse influence ou est influencé par tous les aspects du management. En effet, l'innovation inverse est directement liée aux contextes d'actions, c'est-à-dire l'environnement global, mais également l'environnement d'affaires de l'organisation qui la pratique. Elle est également dépendante et/ou déterminante des logiques d'action et des pratiques de management de l'entreprise. Plus concrètement, elle peut par exemple être influencée par l'équilibre des savoirs et des pouvoirs d'une organisation ou encore, provoquer de grands changements au sein de cet équilibre.

Pour conclure, il apparaît clairement que plusieurs décennies de recherches seront encore nécessaires afin de pouvoir prétendre à une compréhension et à une maîtrise complète de ce nouveau modèle d'innovation globale et de ses implications en management. Cette thèse de doctorat s'inscrit donc parmi les premières contributions à ce projet ambitieux.

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ANNEXES

ANNEXE A - ANNEXES DU CHAPITRE 2 DE LA THÈSE

Table A-1: List of the A and B documents retrived (85)

Item Type	Publication Year	Author	Title	Publication Title
Working Paper	2013	Adriaens, Peter; de Lange, Deborah.; Zielinski, Susan	Reverse Innovation for the New Mobility	
Conference paper	2012	Agarwal, Nivedita; Brem, Alexander	Frugal and reverse innovation - Literature overview and case study insights from a German MNC in India and China	2012 18th International ICE Conference on Engineering, Technology and Innovation (ICE 2012), 18-20 June 2012
Journal article	2015	Agnihotri, Arpita	Low-cost innovation in emerging markets	Journal of Strategic Marketing
Journal article	2015	Angot, Jaques; Plé, Loïc	Serving poor people in rich countries: the bottom-of-the-pyramid business model solution	The Journal of Business Strategy
Working Paper	2013	Armanios, Daniel Erian; Li, Sha	How Companies (Prepare to) Disrupt Themselves: Towards a Theory of Intercultural Business Ethics	
Journal article	2015	Bessant, John; Rush, Howard; Trifilova, Anna	Crisis-driven innovation: the case of humanitarian innovation	International Journal of Innovation Management
Journal Article	2013	Bezerra, Maite Alves; Costa, Sidney; Borini, Felipe Mendes; de Miranda Oliveira, Moacir	Reverse Knowledge Transfer: A Comparison between Subsidiaries of Emerging Markets and Subsidiaries of Developed Markets	Iberoamerican Journal Of Strategic Management
Journal Article	2014	Bhadauria, Arun	Need of Innovation in Concept & Employment Avenues for Sustainable Livelihood	IFSMRC African International Journal of Research in Management
Working Paper	2013	Bhatti, Yasser Ahmad; Ventresca, Marc	How Can "Frugal Innovation" Be Conceptualized?	

Table A-1: List of the A and B documents retrived (85) (cont'd)

Journal article	2014	Borini, Felipe Mendes; Costa, Sidney; Bezerra, Maite Alves; de Miranda Oliveira, Moacir	Reverse innovation as an inducer of centres of excellence in foreign subsidiaries of emerging markets	International Journal of Business and Emerging Markets
Journal article	2012	Borini, Felipe Mendes; de Miranda Oliveira, Moacir; Silveira, Franciane Freitas; de Oliveira Concer, Ronald	The reverse transfer of innovation of foreign subsidiaries of Brazilian multinationals	European Management Journal
Journal article	2012	Bottles, Kent	Reverse innovation and American health care in a time of cost crisis.	Physician executive
Journal article	2013	Brem, Alexander; Ivens, Bjoern S.	Do Frugal and Reverse Innovation Foster Sustainability? Introduction of a Conceptual Framework	Journal of Technology Management for Growing Economies
Journal article	2014	Brem, Alexander; Wolfram, Pierre	Research and development from the bottom up - introduction of terminologies for new product development in emerging markets	Journal of Innovation and Entrepreneurship
Book section	2013	Burger-Helmchen, Thierry; Cohendet, Patrick; Nebojša, Radojević	L'innovation inverse: un retournement du principe de diffusion internationale des innovations?	Le Management International à l'écoute du local
Conference paper	2014	Buse, Stephan; Tiwari, Rajnish	Global Innovation Strategies of German Hidden Champions in Key Emerging Markets	ISPIM Conference Proceedings
Journal article	2014	Corsi, Simone; Di Minin, Alberto	Disruptive innovation ... in reverse: adding a geographical dimension to disruptive innovation theory	Creativity and Innovation Management
Book section	2015	Corsi, Simone; Di Minin, Alberto; Piccaluga, Andrea	New Product Development in Emerging Economies: Innovation in Reverse from China	The Handbook of Global Science, Technology, and Innovation
Journal article	2014	Corsi, Simone; Di Minin, Alberto; Piccaluga, Andrea	Reverse innovation at Speres a case study in China	Research Technology Management

Table A-1: List of the A and B documents retrived (85) (cont'd)

Journal article	2015	Costa, Renato Machado; Bruno, Marcos AC; Vasconcellos, Eduardo; Da Silveira, Luiz AB Jr	MNCs' subsidiaries in emerging countries driving internationalisation and innovation: a case study in Brazil	International Journal of Automotive Technology and Management
Journal article	2010	Crainer, Stuart	Face values: going for global growth	Business Strategy Review
Journal article	2014	Crisp, Nigel	Mutual learning and reverse innovation-where next?	Globalization and Health
Journal article	2015	Crisp, Nigel	Co-development, innovation and mutual learning - or how we need to turn the world upside down.	Healthcare (Amsterdam, Netherlands)
Working paper	2010	Dakshinamoorthy, Vijay; Gordon, Michael D.	Management Paradigms and Innovation at the Base of the Pyramid	
Journal article	2013	DePasse, Jacqueline W.; Lee, Patrick T.	A model for 'reverse innovation' in health care	Globalization and Health
Journal article	2013	Dev, Nathan; Sarkar, Sandip	Innovation and upgrading in global production networks	IDEAS Working Paper Series from RePEc
Book section	2015	Dru, Jean Marie	Reverse Disruption	The Ways To New
Book section	2012	Dubiel, Anna; Ernst, Holger	Success Factors of New Product Development for Emerging Markets	The PDMA Handbook of New Product Development
Journal article	2013	Esko, Siim; Zeromskis, Mindaugas; Hsuan, Juliana	Value chain and innovation at the base of the pyramid	South Asian Journal of Global Business Research
Journal article	2010	Frigo, Mark L.	How CFOs Can Drive Innovation	Strategic Finance
Journal article	2013	Frigo, Mark L.	Reverse Innovation: A New Pathway for Growth	Strategic Finance
Conference paper	2014	Furue, Nanami; Washida, Yuichi	Conception of the Inductive Reverse Innovation by developed-country multinational enterprises	2014 Portland International Center for Management of Engineering and Technology, PICMET 2014, July 27, 2014 - July 31, 2014
Journal article	2012	Govindarajan, Vijay; Euchner, Jim	Reverse Innovation: An Interview with Vijay Govindarajan	Research Technology Management

Table A-1: List of the A and B documents retrived (85) (cont'd)

Journal article	2011	Govindarajan, Vijay; Ramamurti, Ravi	Reverse innovation, emerging markets, and global strategy	Global Strategy Journal
Book	2012	Govindarajan, Vijay; Trimble, Chris	Reverse Innovation: Create Far from Home, Win Everywhere	
Journal article	2012	Govindarajan, Vijay; Trimble, Chris	Reverse innovation: a global growth strategy that could pre-empt disruption at home	Strategy & Leadership
Journal article	2015	Hadengue, Marine; de Marcellis-Warin, Nathalie; Warin, Thierry	Reverse Innovation and Reverse Technology Transfer: From Made in China to Discovered in China in the Pharmaceutical Sector	Management International
Journal article	2010	Hang, Chang-Chieh; Chen, Jin; Subramian, Annapoornima M.	Developing disruptive products for emerging economies: lessons from Asian cases	Research-Technology Management
Journal article	2015	Harris, Matthew; Weisberger, Emily; Silver, Diana; Macinko, James	'They hear "Africa" and they think that there can't be any good services' - perceived context in cross-national learning: a qualitative study of the barriers to Reverse Innovation	Globalization and Health
Book section	2012	Holloman, Dave M.	The New Export Machine	China Catalyst
Working Paper	2013	Hossain, Mokter	Adopting Open Innovation to Stimulate Frugal Innovation and Reverse Innovation	
Working Paper	2015	Hossain, Mokter; Simula, Henri; Halme, Minna	Can Frugal Go Global? Diffusion Patterns of Frugal Innovations	
Journal article	2013	Huet, Jean-Michel; Pompignan, Diane de; Noé Mathilde; Oster, Anne-Sophie	Le Sud, futur laboratoire d'innovation du monde	L'Expansion Management Review
Journal article	2009	Immelt, J.R.; Govindarajan, V.; Trimble, C.	How GE Is Disrupting Itself	Harvard Business Review

Table A-1: List of the A and B documents retrived (85) (cont'd)

Journal article	2013	Jha, Srivardhini K.; Krishnan, Rishikesha T.	Local innovation: The key to globalisation	IIMB Management Review
Journal article	2015	Judge, Benjamin M.; Hölttä-Otto, Katja; Winter, V ,Amos G.	Developing World Users as Lead Users: A Case Study in Engineering Reverse Innovation	Journal of Mechanical Design
Journal article	2012	Kamp, Bart	Reverse innovation: inversing the international product life cycle model and lead market theory	Boletín de Estudios Económicos
Journal article	2012	Laperche, Blandine; Lefebvre, Gilliane	The globalization of Research & Development in industrial corporations: Towards reverse innovation?. The cases of General Electric and Renault	Journal of Innovation Economics & Management
Journal article	2011	Laperche, Blandine; Lefebvre, Gilliane; Langlet, Denis	Innovation strategies of industrial groups in the global crisis: Rationalization and new paths	Technological Forecasting and Social Change
Journal article	2014	Leavy, Brian	India: MNC strategies for growth and innovation	Strategy & Leadership
Journal article	2011	Leavy, Brian	Vijay Govindarajan: innovation coach to the developed and developing world	Strategy & Leadership
Conference paper	2014	Lee, Ahreum; McNamee, Robert C	In Search Of A Theoretical Framework For Reverse Innovations	Academy of International Business. Annual Meeting. Proceedings
Business Case	2015	Li, Haiyang; Chung, Rebecca Y	GE China Technology Center: Evolving Role in Global Innovation	Ivey School of Business
Journal article	2013	Li, Haiyang; Zhang, Yan; Lyles, Marjorie	Knowledge Spillovers, Search, and Creation in China's Emerging Market	Management and Organization Review
Journal article	2014	Motohashi, Kazuyuki	India as a Destination of the R&D of Multinational Companies: Importance and Management Strategies of Local R&D Centers	Seoul Journal of Economics

Table A-1: List of the A and B documents retrived (85) (cont'd)

Conference paper	2015	Mudambi, Ram; Kiyak, Tunga	Licking the Dirt to Rise and Shine: EMNCs Path to Competitive Advantage	Academy of International Business. Annual Meeting. Proceedings
Working Paper	2013	Nathan, Dev; Sarkar, Sandip	Innovation and Upgrading in Global Production Networks	
Journal article	2015	Ostraszewska, Zuzanna; Tylec, Agnieszka	Reverse innovation â€“ how it works	International Journal of Business and Management
Thesis	2013	Parikh, Himanshu S.	Innovations in Chronic Disease Management (CDM) from Low and Middle Income Countries (LMICs)	
Journal article	2011	Petrick, Irene J; Juntiwasarakij, Suwan	The rise of the rest: hotbeds of innovation in emerging markets	Research Technology Management
Journal article	2013	Popescu, Alina Irina	Product Innovation Strategies on Emerging Markets: Bringing Theory and Practice Together	European Journal of Interdisciplinary Studies
Working Paper	2013	Nebojša, Radojević	Reverse Innovation and the Bottom-of-the-Pyramid Proposition: New Clothes for Old Fallacies?	
Journal article	2015	Nebojša, Radojević	Reverse Innovation Reconceptualised: Much Geo-Economic Ado about Primary Market	Management International
Journal article	2015	Riviere, Monica; Suder, Gabriele	Perspectives on strategic internationalization: Developing capabilities for renewal	International Business Review
Journal article	2014	Schmid, Stefan; Dzedek, Lars R.; Lehrer, Mark	From Rocking the Boat to Wagging the Dog: A Literature Review of Subsidiary Initiative Research and Integrative Framework	Journal of International Management
Book section	2015	Shah, Rajiv; Gao, Zhijie; Mittal, Harini	Chapter 9 - Opportunity Areas for Innovation	Innovation, Entrepreneurship, and the Economy in the US, China, and India

Table A-1: List of the A and B documents retrived (85) (cont'd)

Working Paper	2015	Simula, Henri; Hossain, Mokter; Halme, Minna	Frugal and Reverse Innovations - Quo Vadis? **	
Book section	2015	Simula, Henri; Hossain, Mokter; Halme, Minna	Frugal and Reverse Innovations: What, Where and Why? Clarifying the Concepts and Creating a Research Agenda **	Design for sustainable well-being and empowerment: selected papers
Conference paper	2014	Sinha, Shalvi; Dell, Michael	Reverse Innovation- A Chance for Small and Medium European Enterprises?	ISPIM Conference Proceedings
Journal article	2015	Snowdon, Anne W.; Bassi, Harpreet; Scarffe, Andrew D.; Smith, Alexander D.	Reverse innovation: an opportunity for strengthening health systems	Globalization and Health
Working Paper	2010	Spiridon, Pralea; Clipa, Paul	Innovation - Variation on the Same Topic	
Journal article	2012	Syed, Shamsuzzoha B; Dadwal, Viva; Rutter, Paul; Storr, Julie; Hightower, Joyce D; Gooden, Rachel; Carlet, Jean; Nejad, Sepideh Bagheri; Kelley, Edward T; Donaldson, Liam; Pittet, Didier	Developed-developing country partnerships: Benefits to developed countries?	Globalization and Health
Journal article	2013	Syed, Shamsuzzoha B; Viva Dadwal, Viva ; Martin, Greg	Reverse innovation in global health systems: towards global innovation flow	Globalization and Health
Journal article	2010	Talaga, Patrice	The future of pharmaceutical R&D: somewhere between open and reverse innovation?	Future Medicinal Chemistry
Working Paper	2012	Timane, Rajesh	Business Process Reengineering (BPR) to Business Model Reengineering (BMR)	
Journal article	2010	Tyfield, David; Jin, Jun	Low-carbon disruptive innovation in China	Journal of Knowledge Based Innovation in China

Table A-1: List of the A and B documents retrived (85) (cont'd and end)

Thesis	2014	van der Boor, Paul E. W.	Three Studies on Innovation and Diffusion: Evidence from Mobile Banking in Developing Countries and a User Innovation Survey in Portugal	
Journal article	2015	von Zedtwitz, Max; Corsi, Simone; Soberg, Peder Veng; Frega, Romeo	A Typology of Reverse Innovation	Journal of Product Innovation Management
Journal article	2015	Williamson, Peter J.	The competitive advantages of emerging market multinationals: a re-assessment	Critical Perspectives on International Business
Conference Paper	2013	Winter, Amos G.	Stakeholder and Constraint-Driven Innovation of a Novel, Lever-Propelled, All-Terrain Wheelchair	
Journal article	2016	Xu, Nana; Xu, Yusen	Research on the key success factors of reverse innovation of the latecomer engineering and technical services enterprises	Journal of Science and Technology Policy Management
Journal article	2015	Yelkikalan, Nazan; Aydin, Erdal	Evaluating the Potential for Reverse Innovation in BRIC-T Countries: A Panel Data Analysis	Journal of Applied Finance and Banking
Journal article	2014	Zeschky, Marco B.; Widenmayer, Bastian.; Gassmann, Oliver	Organising for reverse innovation in Western MNCs: the role of frugal product innovation capabilities	International Journal of Technology Management
Conference paper	2014	Zeschky, Marco B; Winterhalter, Stephan; Gassmann, Oliver	"Resource-constrained innovation": classification and implications for multinational firms **	ISPIM Conference Proceedings
Journal article	2014	Zeschky, Marco B.; Winterhalter, Stephan; Gassmann, Oliver	From cost to frugal and reverse innovation: Mapping the field and implications for global competitiveness **	Research Technology Management

Titles with stars (*) indicates similar documents, probably two different versions of a single work.

Table A-2: List of companies identified in the literature as doing reverse innovation. Research is limited to academic publications, complemented by own research and has not always been directly verified with companies. All these innovations have been made during the past ten years.

Company Name (from developed markets)	Headquarter location	RI product	Concept Idea Location	Development Location	Primary Market	Secondary Market	Type of RI[27]	Paper(s) Mentioning the Company
Bosch	Gerlingen	Screwdrivers	Malaysia	Malaysia	Japan	Germany	Strong	von Zedtwitz, Corsi, Soberg, and Frega (2015)
Carel	Brugine	Room terminal, controllers	China	Italy	China	Europe	Strong	von Zedtwitz, Corsi, Soberg, and Frega (2015)
Colgate-Palmolive	New-York	Colgate Plax Fresh Tea	China	China	China	Worldwide	Strong	Lee & McNamee (2014)
D-Rev	San Francisco	JaipurKnee (renamed ReMotion)	Stanford	Stanford	India	Ongoing	Undefined	Bottles (2012)
Deere & Company	Moline	Krish tractor	India	India	India	Worldwide	Strong	Govindarajan and Trimble, 2012b; Govindarajan and Euchner (2012)
Eli Lilly	Indianapolis	Oncovin	Madagascar	USA	USA	Africa	Weak	von Zedtwitz, Corsi, Soberg, and Frega (2015)
EMC Corporation	Hopkinton	iMecho	China	China	China	Ongoing	Strong	Govindarajan and Trimble (2012b)
Essilor	Paris	Myopilux lenses	France/Asia	Asia	Asia	Europe/US	Strong	Own research
		Ready-to-clip lenses	France/Asia	Asia	Asia	Worldwide	Strong	Own research
		Azio and India lenses	Asia	Asia	Asia	Australia/US/UK	Strong	Own research
		Gemcoat (coating)	Asia	Asia	Asia	Ongoing	Undefined	Own research

[27] According to von Zedtwitz, Corsi, Soberg, & Frega (2015). The secondary market as defined here could not be the real secondary market in the sense that these innovations may have been commercialized in other developing or emerging countries before trickle-up in developed countries.

Table A-2: List of companies identified in the literature as doing reverse innovation. Research is limited to academic publications, complemented by own research and has not always been directly verified with companies. All these innovations have been made during the past ten years (cont'd).

Fiat	Turin	Fiat 147	Brazil	Italy	Brazil	Europe	Strong	von Zedtwitz, Corsi, Soberg, and Frega (2015)
General Electric	Little Chalfond	Steam turbine	India	India	India	USA	Strong	Laperche and Lefebvre (2012)
General Electric Healthcare	Little Chalfond	Portable Ultrasound Device	China	China	China	USA	Strong	Immelt et al. (2009); Talaga (2010); Bottles (2012); Armanios and Li (2013); Brem and Ivens (2013); Zeschky, Winterhalter, and Gassmann (2014); Agarwal and Brem (2012); Furue and Washida (2014); Laperche and Lefebvre (2012)
		Lullaby Incubator	India	India	India	USA	Strong	Bottles (2012); Huet, de Pompignan, Noé, and Oster (2013)
		Handheld Electrocardiogram	India	India	India	USA	Strong	Govindarajan and Trimble (2012b); Immelt et al. (2009); Bottles (2012); Govindarajan and Euchner (2012); Laperche and Lefebvre (2012); Huet, de Pompignan, Noé, and Oster (2013); Snowdon, Bassi, Scarffe, and Smith (2015); Ostraszewska and Tylec (2015); von Zedtwitz, Corsi, Soberg, and Frega (2015); Agarwal and Brem (2012); Furue and Washida (2014)
GRIT (Global Research Innovation and Technology)	Cambridge	Leveraged Freedom Chair	USA	USA	India/Guatemala	USA	Weak	Judge, Hölttä-Otto, Winter and Amos (2015)
Grundfos	Bjerringbro	SQFlex	Denmark	Denmark	Africa/Asia	Australia/USA	Weak	von Zedtwitz, Corsi, Soberg, and Frega (2015)
Harman	Stanford	SARAS infotainment system	USA	China/India	China/India	Japan	Strong	Govindarajan and Trimble (2012b)

Table A-2: List of companies identified in the literature as doing reverse innovation. Research is limited to academic publications, complemented by own research and has not always been directly verified with companies. All these innovations have been made during the past ten years (cont'd).

L'Oréal	Clichy	Elseve Total Repair 5	Brazil	Brazil	Brazil	France	Strong	Own research
Logitech	Lausanne	Mouse M215	China	Switzerland	China	Worldwide	Strong	Govindarajan and Trimble (2012b); Zeschky, Winterhalter, and Gassmann (2014)
Medtronic	Tolochenaz	Low-cost, pill-sized pacemaker	-	-	India	Ongoing	Undefined	Bottles (2012)
Mettler Toledo	Greifensee	Scale	China	China	China	Worldwide	Strong	Own research
Nestlé	Vevey	Maggi dried noodles	Switzerland	Switzerland	India	Australia / New Zeeland	Weak	Laperche and Lefebvre (2012)
Nokia	Espoo	"Mass-entry market" phones	Finland	China	China	Europe	Strong	Govindarajan and Ramamurti (2011); von Zedtwitz, Corsi, Soberg, and Frega (2015)
OneBreath	Palo Alto	Ventilator	-	-	India	USA	Undefined	Bottles (2012)
Panasonic	Osaka	Washing machines	China	China	China	Japan	Strong	Furue and Washida (2014)
Partners In Health	Boston	PACT Program	Haiti	Haiti	Haiti	USA	Strong	Govindarajan and Trimble (2012b)
PepsiCo	Manhattan	Aliva snack	India	India/USA	India	Ongoing	Undefined	Govindarajan and Trimble (2012b); Govindarajan and Euchner (2012b)
Philips Healthcare	Andover	Patient monitoring system	USA	China	China and India	North America and Western Europe	Strong	Own research
Parmalat	Collecchio	Milk in a pouch	Italy	Italy	Colombia	Canada	Weak	von Zedtwitz, Corsi, Soberg, and Frega (2015)

Table A-2: List of companies identified in the literature as doing reverse innovation. Research is limited to academic publications, complemented by own research and has not always been directly verified with companies. All these innovations have been made during the past ten years (cont'd).

Procter & Gamble	Cincinnati	Naturelle feminine hygiene product	Mexico	Mexico	Mexico	USA/Europe	Strong	Govindarajan and Trimble (2012b)
Procter & Gamble	Cincinnati	VickMiel	Venezuela	Venezuela	Mexico	USA/Europe	Strong	Bottles (2012)
Renault	Paris	Logan	France	France	Eastern Europe	Western Europe	Weak	Laperche and Lefebvre (2012); Hossain (2013); Huet, de Pompignan, Noé, and Oster (2013)
SAP	Walldorf	Business One Suite	China	China	USA/ Europe	China/Latin America	Strong	von Zedtwitz, Corsi, Soberg, and Frega (2015)
		HANA in-memory apps	Germany	China/India	USA/Europe	China/India	Weak	von Zedtwitz, Corsi, Soberg, and Frega, 2015
Siemens	Munich	ADMOSS multifunctional operator service	Germany	India	Germany	Philippines etc.	Weak	von Zedtwitz, Corsi, Soberg, and Frega (2015)
Siemens Healthcare	Munich	Human Machine Interface	China	China	China	Germany	Strong	Agarwal and Brem (2012)
		Multix Select DR Machine	China	China	China	Globally	Strong	Dubiel and Ernst (2012); Agarwal and Brem (2012)
		Fetal Heart Monitor	India	India	India	Ongoing	Undefined	Agarwal and Brem (2012); Hossain (2013)
Speres	-	ChinaPc air conditioning	China	Italy	China	Europe	Strong	Corsi and Di Minin (2014)
Stanford University (BioDesign Program)	Stanford	Fluid delivery device	India	-	India	Ongoing	Undefined	Bottles (2012)
STMicroelectronics	Plan-les-Ouates	High-end TV set-top box	France	India	USA	USA	Weak	von Zedtwitz, Corsi, Soberg, and Frega (2015)
Toshiba	Tokyo	CT Scanner	Japan	China	China	Japan	Strong	Furue and Washida (2014)

Table A-2: List of companies identified in the literature as doing reverse innovation. Research is limited to academic publications, complemented by own research and has not always been directly verified with companies. All these innovations have been made during the past ten years (cont'd).

Company Name (from developing markets)	**Headquarter location**	**RI product**	**Concept Idea Location**	**Develo-pment Location**	**Primary Market**	**Secondary Market**	**Type of RI**	**Paper(s) Mentioning the Company**
Vestergaard Frandsen	Lausanne	LifeStraw	Denmark	Vietnam	Africa/Asia	Europe/USA	Strong	von Zedtwitz, Corsi, Soberg, and Frega (2015)
Vibram	Albizzate	FiveFingers shoes	Italy	China	USA/Europe	China	Weak	von Zedtwitz, Corsi, Soberg, and Frega (2015)
Bharti Airtel	New Delhi	Telecommunication solutions	-	-	-	-	Undefined	Govindarajan and Ramamurti (2011)
BYD	Shenzhen	Electric car	China	China	China	USA	Strong	Govindarajan and Ramamurti (2011)
Capillary Technologies	Bangalore	CRM solutions suite	India	India	India	Worldwide	Strong	Govindarajan (2013)
Galanz	Foshan	Microwaves	China	China	China	Worldwide	Strong	Hang, Chen and Subramian (2010)
Goldwind	Urumqi	Wind turbines	-	-	-	-	Undefined	Immelt et al. (2009)
Goodbaby	Shanghai	Some Dorel baby strollers	China	China	USA	Latin America	Strong	von Zedtwitz, Corsi, Soberg, and Frega (2015)
		Some Maxi-Cosi baby strollers	China	China	USA/Europe	USA	Strong	von Zedtwitz, Corsi, Soberg, and Frega (2015)
Haier	Hong Kong	Cheap fridges	China	China	China	Western market	Strong	Hang, Chen and Subramian (2010); Brem and Ivens (2013)
Huawei	Shenzhen	Several mobile phones	China	China	China	USA	Strong	von Zedtwitz, Corsi, Soberg, and Frega (2015)
Lenovo	Beijing	Computers	-	-	-	-	Undefined	Govindrajan and Trimble (2012b)
Mahindra & Mahindra	Bombay	Small tractors	India	India	India	USA	Strong	Brem and Ivens (2013)
Mindray	Shenzhen	Medical devices	-	-	-	-	Undefined	Immelt et al. (2009)
Reliance	Mumbai	Undefined	-	-	-	-	Undefined	Govindrajan and Trimble (2012b)

Table A-2: List of companies identified in the literature as doing reverse innovation. Research is limited to academic publications, complemented by own research and has not always been directly verified with companies. All these innovations have been made during the past ten years (cont'd and end).

Suzlon	Pune	Wind turbines	India	India	India	Western market	Strong	Immelt et al. (2009); Hang, Chen and Subramian (2010)
Tata Motors	Bombay	Tata's Acer (small truck)	India	India	India	USA	Strong	Nathan and Sarkar (2013)
Ushahidi	Nairobi	Map Disaster	US	Kenya	Kenya	USA	Strong	DePasse and Lee (2013)
WuXi AppTech	Shanghai	Compound targets	China	USA	USA	Europe	Weak	von Zedtwitz, Corsi, Soberg, and Frega (2015)
Yadea	Wuxi	Electric motorbikes	China	China	China	USA	Strong	Hang, Chen and Subramian (2010)
ZPMC	Shanghai	Harbor cranes	China	China	China	USA	Strong	Zeschky, Winterhalter, and Gassmann (2014)
ZTE	Shenzhen	Telecommunication equipment	-	-	-	-	Undefined	Agarwal and Brem (2012)

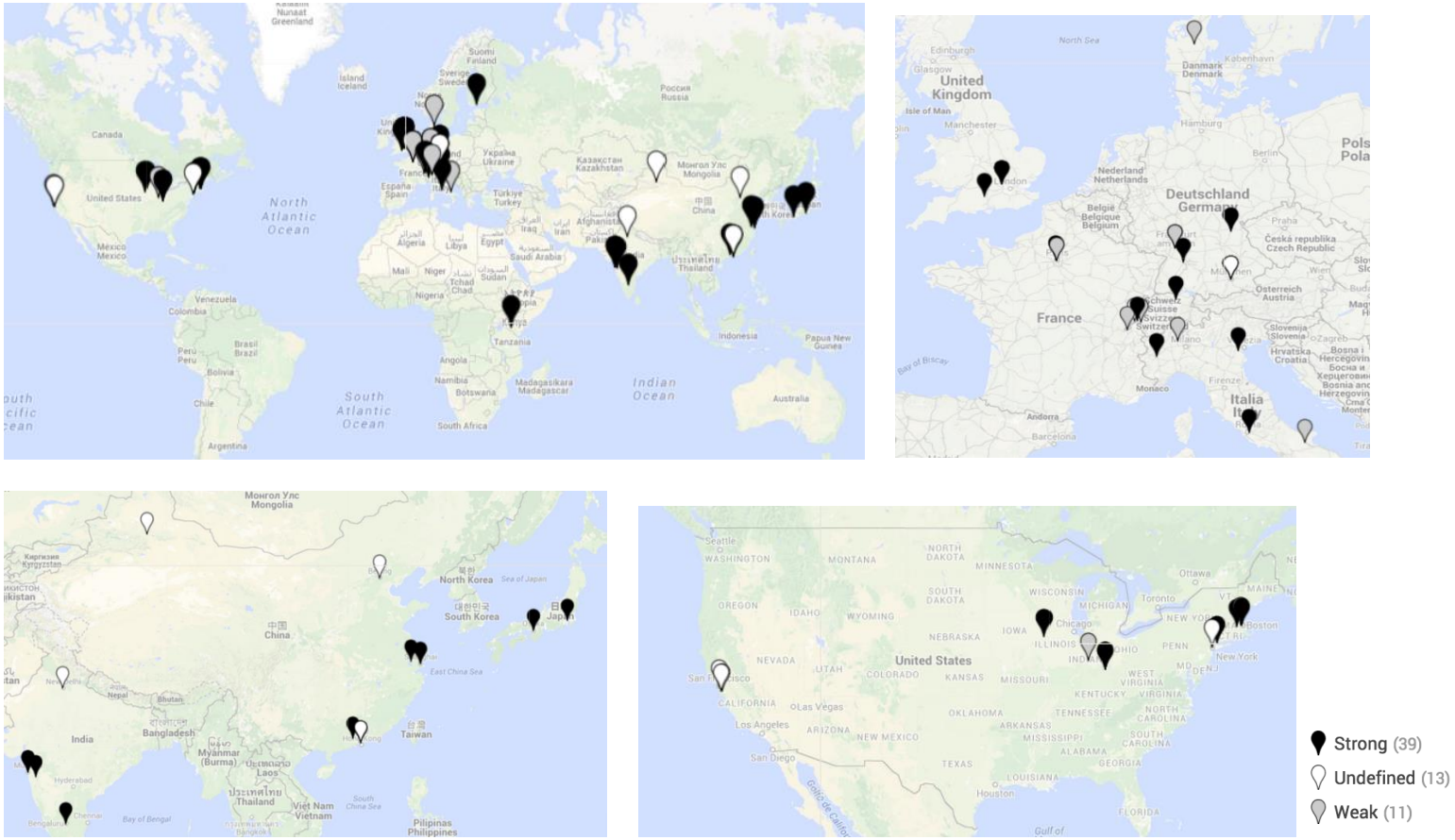

Figure A-1: Location of the companies identified in the literature as doing ri (by type: strong or weak reverse innovation according to von zedtwitz, corsi, soberg, and frega [2015] typology)

ANNEXE B - ANNEXES DU CHAPITRE 4 DE LA THÈSE

Table B-1: Numbers of patent grants by SIPO to big pharmas (translation work)

Rank	Pharmas	Applicant patent names	In chinese	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1	J&J	Johnson&Johnson Health Products & Co	强生巴西工商业健康产品有限公司	0	0	0	0	0	0	0	0	0	0	0	0	6	2
		J&J Consumer Companies	强生消费者公司	5	21	18	19	19	27	30	35	28	34	24	42	52	37
		J&J Pharmaceutical Co., Ltd	湖南省强生药业有限公司	0	0	0	0	2	0	0	0	7	0	4	2	0	4
		J&J Co.	强生有限公司	4	6	3	1	7	7	17	3	5	4	5	2	5	2
		Pékin Johnson Biotechnology Co., Ltd	北京九强生物技术股份有限公司	0	0	0	0	0	0	0	0	0	0	0	9	8	10
		J&J Pharmaceutical Research & Development Co., Ltd	强生医药研究及开发有限责任公司	0	0	0	0	0	0	0	0	2	0	0	2	0	0
		J&J Corporation	强生股份有限公司	1	6	5	0	4	3	3	2	4	4	0	4	2	0
		Shanghai J&J Ltd	上海强生有限公司	0	0	0	0	0	1	4	0	0	0	0	0	0	0
		Etats-Unis J&J Company	美国强生公司	0	0	0	0	0	4	5	0	0	0	0	0	0	0
		TOTAL		10	33	26	20	32	42	59	40	46	42	33	61	73	55

Table B-1: Numbers of patent grants by SIPO to big pharmas (translation work) (cont'd)

2	**Novartis**	Novartis Corporation	诺华股份有限公司	0	0	0	0	0	0	0	0	0	0	0	0	0	27
		Novartis Ltd	诺华有限公司	0	0	0	0	0	0	0	0	2	19	1	17	47	47
		Novartis Vaccins and Diagnostics limited	诺华疫苗和诊断有限公司	0	0	0	0	0	0	0	0	10	10	5	5	15	12
		TOTAL		0	0	0	0	0	0	0	0	12	29	6	22	62	86
3	**Roche**	Hoffman-La Roche Ltd.	**豪夫**迈·罗氏有限公司	0	0	0	0	1	1	0	0	2	3	1	0	4	4
		Shanghai Roche Pharmaceuticals Ltd	**上海**罗氏制药有限公司	0	0	0	0	0	0	0	0	0	0	0	0	5	0
		F. Hoffman- Company's shares	F·**霍夫曼**-**拉**罗氏股份公司	0	0	0	0	0	0	0	0	0	0	0	1	0	0
		Roche AG Gelikate	罗氏格黎卡特股份公司	0	0	0	0	0	0	0	0	0	0	2	4	8	2
		Roche Diagnostics Ltd.	罗氏诊断有限公司	0	0	0	0	0	0	0	0	0	0	0	3	0	0
		Roche Ltd.	罗氏有限公司	0	0	0	0	1	1	0	0	2	3	4	1	4	4
		F. Hoffdman- Roche AG	F·**霍夫曼** - 罗氏股份公司	0	0	0	0	0	0	0	0	1	3	0	0	0	0
		TOTAL		0	0	0	0	2	2	0	0	5	9	7	9	21	10

Table B-1: Numbers of patent grants by SIPO to big pharmas (translation work) (cont'd)

4	**Pfizer**	Pfizer Pharmaceutical companies	辉瑞大药厂	22	18	26	29	24	33	23	32	18	10	21	21	14	17
		Pfizer Ltd	辉瑞有限公司	0	0	0	0	0	0	3	16	22	14	22	27	19	7
		Pfizer Vaccines LLC	辉瑞疫苗有限责任公司	0	0	0	0	0	0	0	0	0	0	0	1	2	1
		Pfizer animal health	辉瑞动物保健公司	0	0	0	0	0	0	0	0	0	0	0	0	0	1
		Pfizer Society	辉瑞公司	0	0	0	0	0	0	0	0	0	0	0	1	3	4
		Pfizer Products Company	辉瑞产品公司	54	62	40	53	79	111	81	59	40	58	17	6	17	8
		US Pfizer Limited	**美国**辉瑞有限公司	27	24	17	12	27	22	17	5	6	0	0	0	0	0
		TOTAL		103	104	83	94	130	166	124	112	86	82	60	56	55	38
5	**Sanofi**	Sanofi - Aventis Deutschland GmbH	赛诺菲-**安万特德国有限公司**	0	0	0	0	0	0	0	0	0	0	0	18	115	96
		Sanofi - Aventis US LLC	赛诺菲-**安万特美国有限**责任公司	0	0	0	0	0	0	0	0	3	0	0	2	7	1
		Sanofi	赛诺菲	0	0	0	0	0	0	0	0	0	0	0	13	100	52
		Sanofi Pasteur Limitée***	赛诺菲巴斯德有限公司	0	0	0	0	0	0	2	1	12	6	10	9	5	15
		Sanofi-Aventis ou Sanofi Aventis	赛诺菲-**安万特** ou 赛诺菲 **安万特**	0	0	0	0	0	16	51	64	54	65	54	113	20	33
		Sanofi-Aventis & Hangzhou Minsheng Santé (coopération)	**杭州**赛诺菲民生健康药业有限公司	0	0	0	0	0	0	0	0	0	0	0	2	3	1
		Sanofi Corporation	赛诺菲股份有限公司	0	0	0	0	0	0	0	0	0	0	0	2	0	5
		TOTAL		0	0	0	0	0	16	53	65	69	71	64	159	259	203

Table B-1: Numbers of patent grants by SIPO to big pharmas (translation work) (cont'd)

6	**GlaxoSmithKline**	GlaxoSmithKline (China) Investment Co., Ltd	**葛**兰素史克（**中国**）**投**资有限公司	0	0	0	0	0	0	0	0	0	0	0	0	0	3
		GlaxoSmithKline LLC	**葛**兰素史克有限责任公**司**	0	0	0	0	0	0	0	0	0	0	0	0	4	1
		GlaxoSmithKline Intellectual Property Development Co., Ltd	**葛**兰素史克知识产权开发有限公司	0	0	0	0	0	0	0	0	0	0	0	0	1	1
		GlaxoSmithKline Research & Development Limited	**葛**兰素史克研究与发展**有限公司**	0	0	0	0	0	0	0	0	0	0	0	0	1	0
		GlaxoSmithKline Biologicals	**葛**兰素史克生物公司	0	0	0	0	0	0	0	0	0	0	0	0	2	0
		TOTAL		0	0	0	0	0	0	0	0	0	0	0	0	8	5
7	**Merck & Co**	Merck Society	**默沙**东公司	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Merck & Co., Ltd (ou Merck Sharp & Dohme Limited Liability Company)	**默沙**东有限责任公司	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Merck & Co.	**默沙**东有限公司	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		TOTAL		0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table B-1: Numbers of patent grants by SIPO to big pharmas (translation work) (cont'd and end)

8	**Bayer**	Bayer Healthcare	**拜耳医**药保健有限公司	0	0	0	0	0	9	1	0	6	7	2	12	8	5
		Bayer Healthcare AG	**拜耳医**药保健股份公司	0	0	0	0	0	18	23	27	31	19	0	0	0	0
		Bayer pharmaceuticals	**拜耳制**药公司	0	0	0	0	0	1	2	3	1	0	0	0	0	0
		Bayer Shering Pharma AG	**拜耳先灵医**药股份有限公司	0	0	0	0	0	0	0	12	39	34	40	39	8	10
		Bayer Healthcare LLC	**拜耳医**药保健有限责任公司	0	0	0	0	0	0	0	0	0	0	0	0	1	1
		Bayer Pharmaceuticals Co. Ltd	**拜耳制**药股份有限公司	0	0	0	0	0	0	0	0	0	0	1	1	1	0
		Bayer Intellectual Property - Limited liability	**拜耳知**识产权有限责任公司	0	0	0	0	0	0	0	0	0	0	0	2	50	319
		Bayer corporation Intellectual Property	**拜耳知**识产权股份有限公司	0	0	0	0	0	0	0	0	0	0	0	0	0	4
		TOTAL		0	0	0	0	0	28	26	42	77	60	43	54	68	339
9	**AstraZeneca**	**TOTAL**	**阿斯利康**	0	0	0	0	0	44	116	217	247	255	143	129	120	83
10	**Eli Lilly**	US Eli Lilly Pharmaceutical companies	**美国礼来大**药厂	0	0	0	0	0	0	0	0	0	0	0	0	1	0
		US Eli Lilly and Company	**美国礼来公司**	0	0	0	0	0	0	0	0	0	0	0	2	0	0
		TOTAL		0	0	0	0	0	0	0	0	0	0	0	2	1	0

*** Attention: Also contain Sanofi Pasteur Biologics Company and Sanofi Pasteur Bio-Pharmaceutical Co., Ltd

Table B-2: Cross table between the opening year of R&D centers in China (gray cells) and the evolution of the patents filed via the Patent Cooperation Treaty (PCT) with at least one Chinese inventor residing in China

	2004	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Johnson & Johnson	0	0	0	0	0	0	1	0	1	1	1
Novartis	0	0	2	1	1	3	9	6	10	7	9
Roche	0	0	7	10	13	14	19	13	10	11	1
Pfizer	0	0	0	0	1	0	0	0	0	0	0
Sanofi	0	0	0	0	0	0	1	0	0	1	0
GlaxoSmithKline	0	0	0	0	0	1	8	1	4	7	0
Merck & Co	0	0	0	0	0	0	0	1	0	0	0
Bayer	3	3	2	2	1	18	14	15	18	7	6
AstraZeneca	0	0	0	2	1	1	1	1	1	0	0
Eli Lilly	0	0	1	1	0	0	0	0	5	0	0

Table B-3: Examples of alliances and partnerships between western Big pharmas and Chinese organisations

Big Pharma involved	Collaborations	Date	Theme
AstraZeneca	Hutchison MediPharma Limited (Owned by Chi-Med)	2011	Cancer therapy[28]
	Guangdong General Hospital	-	Lung, liver, stomach and oesophageal cancers.
	Fudan University	2012	Cardiovascular diseases[29]
	Pharmaron	2012	General drug development[30]
	Shanghai Institute of Biological Sciences	2014	Cardiovascular diseases[31]
Eli Lilly	Hutchison MediPharma Limited (Owned by Chi-Med)	2013	Inhibition of the vascular endothelial growth factor[32] Cancer Therapy[33]
GlaxoSmithKline	Jiangsu Walvax Biotech Company	2009	Paediatric vaccines for use in China[34]
	Eddingpharm	2013	Breast Cancer drug[35]

[28] http://www.astrazeneca.com/Research/news/Article/20111221az-and-chimed-enter

[29] http://www.firstwordpharma.com/node/1043447?tsid=17#axzz2wzacLa31

[30] http://www.astrazeneca.com/Research/news/Article/15102012--pharmaron-forms-partnership

[31] http://www.astrazeneca.com/Research/news/Article/20140123--astrazeneca-and-shanghai-institutes-of-biological

[32] http://www.pmlive.com/pharma_news/lilly_enters_cancer_collaboration_in_china_508735

[33] http://www.chi-med.com/eng/media/pdf/news131009d.pdf

[34] http://us.gsk.com/html/media-news/pressreleases/2009/2009_pressrelease_10105.htm

[35] http://www.bloomberg.com/article/2013-04-09/apy2FKbzmfdE.html

Table B-3: Examples of alliances and partnerships between western Big pharmas and Chinese organisations (cont'd)

Merck & Co	Sinopharm	2010	
	BGI (Chinese genome center)	2011	Aid treatment[36]
Novartis	Institute of Biomedical Sciences- Fudan University	2010	Discovering of innovative medecine[37]
Pfizer	Guoyuan	2011	Animal vaccines in China[38]
	Zeijiang Hisun Pharmaceuticals	2012	Manufacturing and commercialization of generic drugs
	Wuxi PharmaTech	2008 renewed in 2014	Synthetic chemistry, parallel medicinal chemistry (PMC), and bioanalytical services.[39]
Roche	Biobay	2011	Cancer treatment[40]

[36] http://bgiamericas.com/merck-and-bgi-establish-strategic-collaboration-focused-on-biomarkers-and-genomic-technologies/

[37] http://www.massinsight.com/publications/corporate/14/file/1/pubs/2010/04/14/Novartis-Fudan.pdf

[38] http://www.pfizer.be/sites/be/nl/media/press_bulletins/research_and_development_and_business_development/Pages/PfizerAndGuoyuanFormJointVentureToExpand.aspx

[39] http://www.prnewswire.com/news-releases/wuxi-pharmatech-signs-new-collaboration-agreement-with-pfizer-65332862.html

[40] http://seekingalpha.com/article/303480-china-biotech-week-in-review-biobay-park-forms-partnership-with-roche-harvard

Table B-3: Examples of alliances and partnerships between western Big pharmas and Chinese organisations (cont'd and end)

Sanofi	Chinese Academy of Medical Sciences	2007	Leukaemia treatment[41]
	NovaMed Pharmaceuticals Inc	2008	Drug distribution[42]
	Shanghai Institute for Biological Sciences (SIBS)	2008	"Our agreement with SIBS is to discover first-in-class drugs to treat cancer, diabetes and neurological diseases," says Frank Jiang, Vice President (VP), Sanofi–Aventis R&D in China [43]
	Hangzhou Minsheng Pharmaceutical Group Co Ltd	2010	Vitamin and mineral supplement[44]

[41] http://www.firstwordpharma.com/node/86732?tsid=17#axzz2wzacLa31

[42] http://www.firstwordpharma.com/node/31194?tsid=17#axzz2wzacLa31

[43] http://www.nature.com/nrd/journal/v9/n8/full/nrd3238.html

[44] http://www.chinadaily.com.cn/bizchina/2011-05/17/content_12525097.htm