

Global Value Chain Governance in the MNE: A Dynamic Hierarchy Perspective

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The COVID-19 storm has battered the global economy with an arresting ferocity. The global value chains (GVCs) of numerous multinational enterprises (MNEs) failed as fragilities in upstream supply lines were exposed by the surge in demand for vital goods^{i ii iii}. A scarcity of crucial medical equipment led to recriminations over loss of national security for such critical supplies and calls were made to rebalance overly globalized supply chains in favour of domestication of production^{iv v vi viii ix}. Such appeals for reshoring of manufacturing operations willingly traded off production efficiency for strengthened supply resilience. Yet evidence swiftly emerged that, save for some few exceptions, reshoring is not widely prevalent^x. This is unsurprising as much empirical evidence over decades of IB research has shown that efficient governance modes in IB typically prevail over less efficient ones^{xi}.

The GVC model of disaggregated production activities availing of worldwide location advantages has been developed and honed for efficiency for much of the liberalised post war era^{xii}. GVC theory has been predominantly concerned with externalisation of MNE activities and asymmetric power relations, particularly with suppliers in developing countries having upgrade potential^{xiii}. Consequently, the GVC governance modes around 'market', 'modular', 'relational' and 'captive' dominate research attention and managerial guidance^{xiv}. As a result, we contend that hierarchy has comparatively become the forgotten sibling of the GVC governance family. The hierarchy GVC governance mode conventionally involves centralised control of internalised GVC configuration and activities, and has been relatively considered more insular and rigid^{xv}. However, no GVC framework is static. GVC scholars have made much use of the concept of the dynamics of upgrading for independent suppliers in external networks. And yet upgrading has been largely ignored under hierarchy governance.

It is well established by international business scholars that MNE subsidiaries can play a crucial role in the realisation of the benefits of hierarchical GVC governance of the MNE by improving their operational and innovation capabilities over time, often in partnership with external local actors^{xvi}. But some IB scholars at the intersection of internalisation and GVC theory maintain that GVC theory to date has had little to say about the reasons and ways by which MNEs might keep activities in-house and call for research to uncover how the GVC approach can extend and add nuance to internalisation theory^{xvii}. One aspect advocated for further study is how internalisation theory might better reflect the reality of GVC dynamics and how GVCs adjust over time. We contend that GVC theory on hierarchy governance mode has not sufficiently accounted for such internal upgrading dynamics and activities of subsidiaries within the MNE. Consequently, we propose that GVC theory could be extended for the internalised hierarchy governance mode by applying the core tenets around upgrading extensively developed by scholars of the more studied externalised GVC governance modes. In so doing, we explore how internal MNE dynamics of subsidiary upgrading play out under hierarchical GVC governance over time. The particular research question of this paper is: how did a subsidiary capably upgrade within an MNE, under hierarchical GVC governance mode, to provide an effective balance between global production efficiency and supply resilience? We were afforded the opportunity to stress test an internalised GVC's efficiency and resilience in a crisis when faced with a huge demand surge due to the generational disruptive shock of a global pandemic.

In this article we draw from a wider longitudinal study of the evolutionary dynamics of the GVC for one product division of an MNE in the medical technology sector, Medtronic Inc. Vertical integration was evidentially deemed the applicable organizational solution to best maintain hierarchical control over internalized operations and, principally, to safeguard valuable IP. For this protracted qualitative study we adopt an intensive single case approach^{xviii} wherein we particularly focus on Medtronic's foreign subsidiary in Galway Ireland, within its internalized product GVC. We traced, *in real time* over

fifteen years, this subsidiary's evolution from its original role as a basic assembly operation to its current status as a center of excellence for production and product development. The guiding theoretical focus of the broader research project was on providing a contextualized explanation^{xix} of how the case subsidiary upgraded within its internalized GVC through advancing its capabilities in manufacturing and product development. It thereby was able to assume a measure of shared responsibility with HQ for governance of this product's GVC^{xx}. Then when the pandemic suddenly struck corporate HQ had full confidence in the case subsidiary's capabilities to manage both efficiency and resilience of this GVC. Rather than reshoring, HQ organized for this competent foreign subsidiary to partner with a smaller, co-located Medtronic production site to help deliver extraordinary production and supply performance. Production of respiratory ventilators was ramped up in Galway to deliver back to the USA a tenfold increase in these essential medical supplies, within days, on time, and, of requisite quality.^{xxi}

Our research has practical implications for management fiat in the exercise of governance for a hierarchical GVC. In the final section of the article, we provide guidance on how the MNE can designate subsidiaries for support to upgrade within the GVC, increasingly build trust with those upgrading subsidiaries, and even devolve some governance responsibility to them. In the next section we provide our theoretical development and, subsequently, we present sections on company background, study method, case findings and discussion.

Theoretical Development

GVC within the MNE

The GVC framework provides an effective approach to understand the complexity brought about by the global dispersion of once co-located supply chains. Co-located supply chains are well documented in

the industrial districts and industrial clusters literature. They typically represent more optimal models of industrial organization when innovation is incremental. However, this logic was severely undermined by the emergence and diffusion of GVCs and the consequent dispersion of once co-located phases.

For an MNE, a GVC has been described as “a governance tool to organize IB activities”^{xxii} that can be geographically dispersed across many countries to avail of location advantages^{xxiii}. In the IB view, MNEs are concerned with what should be done inside the firm and outside it, and where^{xxiv xxv}. An MNE either plays the role of ‘lead firm’ in a networked combination of offshore and outsourced supplier firms centred on a key orchestrator, as in Buckley’s conception of a ‘global factory’^{xxvi} and Mudambi’s ‘GVC smile’^{xxvii} or of a network of subsidiaries within its internal boundaries^{xxviii} conventionally with HQ as the ‘lead’ unit.

According to the predominant stream of studies in the GVC field, the relationship between an MNE and its global suppliers is generally regulated by network-type forms of governance, such as 'modular', 'relational' and 'captive'. Situated between the two governance extremes of the market and the hierarchy, these forms of coordination don't imply any formal participation of an MNE in the ownership of the global producer. Hence, they are commonly referred to as non-equity forms of governance. These governance forms have allowed MNEs to exploit the benefits of globalization while avoiding the rigidity induced by foreign direct investments. Advocates report that, by using network-type forms of governance, MNEs have increased their profitability and global reach without impacting on their overall efficiency. They suggest that, by relying on independent contractors they have increased their flexibility and efficiency, and developed a lighter and more agile organizational structure.

Some scholars assert that reports of the demise of the vertically integrated MNE may have been largely exaggerated^{xxix}. For these scholars, conditions persist where it may well be the most efficient solution

to GVC organisation. For instance, in certain high technology industries, such as medical technology and pharma, where a strong imperative for protection of valuable proprietary knowledge applies, some knowledge-intensive MNEs have good reason to maintain control over activities. Moreover, the global system is facing ever more disruptive shocks which will inevitably continue to adversely impact GVC activities and increase pressure for greater internal control. This calls for the hierarchical mode of GVC governance. Under hierarchy, activities are contained mostly within an MNE and control is typically exercised by HQ management^{xxx}. But a hierarchical GVC is not a static framework; naturally its coordination mechanisms and internal power dynamics evolve over time. Within the scope of internalised GVC activities of an MNE, overseas subsidiaries can upgrade to improve their position. Internal dynamics can be vibrant under hierarchy.^{xxxi} Subsidiaries cooperate on some GVC activities yet compete with sister subsidiaries for investment, resources and upgraded mandates. Subsidiary success, as reflected in enhanced long-term survival prospects within an MNE, comes through upgrading its production and innovation capabilities over time. Subsidiaries that successfully upgrade may well gain the competence trust, and maybe later goodwill trust, of HQ in their increasingly advanced production, innovation and organisational capabilities.

If we maintain that externalisation is the only (or predominant) way a GVC is organized and orchestrated, then it's easy to understand why efficiency and resilience of GVCs are seen as two opposing values. Indeed, efficiency is achieved by dispersing production activities to independent contractors, which inevitably leads to a sharp decrease in the control an MNE exerts over value chain functions globally. As a result, the most obvious way to enhance the resilience of an MNE and stabilize its supply chains, even more so in times of crisis, is to withdraw global operations, relocate production close to an MNE's HQ and increase inventories. If implemented, however, this approach may lead to the demise of many GVCs and prevent MNEs from exploiting the various benefits globalization has

offered over the past two decades. In short, reshoring implies compromising efficiency for improved resilience.

Balancing Efficiency and Resilience in GVCs

Efficiency is the ratio of outputs to inputs in a production or value creation system^{xxxii}, and has been one of the pivotal considerations for MNEs when growing and coordinating their GVC activities across borders and locations. The prioritizing of efficiency has led to the rise of South-East Asian countries, particularly China, as the primary locations of manufacturing and increased the dependence of GVCs on these countries for the supply of products^{xxxiii}. The recent interest in GVC resilience has sparked some ideas about how the world and GVCs can deal with global pandemics^{xxxiv} but has also raised enquiries about the interface between efficiency and resilience^{xxxv}. Both scholars and practitioners have highlighted the significance of resilience and the need for GVCs to diverge from the efficiency imperative and move towards a resilience imperative^{xxxvi}. There is no definitive answer to whether efficiency and resilience are mutually exclusive and whether firms must sacrifice one to achieve the other^{xxxvii}. There is though limited knowledge apropos the prospective consequences of the resilience imperative for GVCs and the efficiency-driven management paradigm that has directed the up-to-date discourse on GVC governance and expansion.

We argue that, albeit efficiency and resilience in GVCs may be at odds with each other in the short-term perspective, they are not unescapably mutually exclusive in an elongated outlook. Further, a mainly in house GVC, i.e., within the realm of an MNE, is both managerially and socially different from a GVC solely outsourced to standalone firms. Almost two decades ago resilience was emphasized as one key characteristic of durable systems^{xxxviii} – along with diversity, efficiency, adaptability, and cohesion. Consequently, there might be more to the interplay between resilience and efficiency than the presumed

trade-off once the long-term perspective, the global aspects of the business environment, and the governance are considered.

Resilience is embodied by the long-term survival of MNEs and their GVCs amidst disruptions and difficulties^{xxxix}. In this paper, we define resilience in GVCs as the adaptive capability of the supply chain to organize for unexpected incidents, act in response to disruptions, and recuperate from them by maintaining continuity of operations at the desired level of connectedness and control over structure and function^{xl}.

To achieve both resilience and efficiency MNEs ability to coordinate activities and actors at a distance is imperative. For effective coordination an MNE needs to realize three things^{xli}; manage bounded rationality, and reliability of the parties involved in the GVC and establish an environment supportive of innovation and capability generation. The above-mentioned challenges are all easier to achieve within the boundaries of an MNE than outside its realm. Particularly dealing with information asymmetries and constrained information processing capabilities (bounded rationality) and lessening risks with living up to open-ended or incomplete contracts (bounded reliability) is much less arduous between HQ – subsidiary and subsidiary – subsidiary within the same MNE despite that the relation might be quite distant compared to managing this between stand-alone firms.

The costs of knowledge exchange and monitoring and avoiding knowledge leakage are regularly more prone in relations between stand-alone firms in a market compared to relations between actors within the same ownership structure^{xlii}. Having a subsidiary supplying from a specific environment gives an MNE increased potential to leverage knowledge access to non-business actors within that environment compared to relying on stand-alone firms' benevolence. It does require that the HQ decentralizes decision making and autonomy to the subsidiary so that it can perform to its potential regarding leveraging knowledge from non-business actors as well as from local business actors^{xliii}. A further upside

derived from ownership of a GVC unit is that instituting common norms that generates social and relational capital, essential to a more efficient flow of tacit knowledge^{xliv} and contribution to common goals of the GVC^{xlv}, is facilitated.

To investigate the dynamics of the hierarchy mode of governance more closely, in what follows we draw on the case of Medtronic Inc and particularly focus on its subsidiary units in Galway, Ireland.

Case Background: Medtronic and its subsidiary sites in Galway, Ireland

The medical equipment industry contains multiple diverse GVCs but complex engineered goods are the focus of our study. This segment is dominated by large MNEs with huge R&D budgets and extensive global reach, often restricted to developed economies with requisite knowledge and skills and strong IP regimes. They tap into advanced knowledge repositories across the globe through dispersed subsidiaries. Medtronic Inc. is one of the world's largest complex medical equipment corporations. It has annual revenues of almost \$30 billion and approximately 90,000 employees worldwide. It is organised around four business groups centred on therapies for differential conditions, each containing multiple business divisions with respective GVCs (see Figure 1). The Minimally Invasive Therapies Group, which includes the production of ventilators that have been crucial in the pandemic accounts for about one-third of these revenues and employee numbers.

INSERT - Figure 1: Medtronic Inc Businesses - Groups and Divisions^{xlvi}

Recent quarterly results^{xlvii} from Medtronic - Q3 2021 (end of fiscal year is April) – show that whilst revenue fell in comparison to the same quarter in 2020 in the Cardiac and Vascular Group as well as the Restorative Therapies Group by 5.9% and -0.8% respectively, revenue grew by 4.6% in the Minimally Invasive Therapies Group and 0.8% in the Diabetes Group. The Respiratory, Gastrointestinal & Renal division has driven the revenue growth within the Minimally Invasive Therapies Group, growing by

25.4% over the same period compared with a decline of 5.3% for the Surgical Innovations activity also within this group. The declines in other activities and Groups are attributed mainly to declines in hospital procedure volumes as a result of COVID-19 resurgences. At the same time, Medtronic reports in its Q3 2021 results that the sales of ventilators increased almost three-fold. As a result, Medtronic's net profit margin at the 2020 fiscal year-end compares strongly at 16.56% against competitors - for example, Boston Scientific's -0.83%, Becton and Dickinson's 5.11%, Abbott Laboratory's 12.86% and Johnson & Johnson's 17.82%^{xlvi}. Of course, other competitors directly in the ventilator market that focus almost entirely on respiratory activity show larger net profit margin growth as they do not contend with the same level of offsets – for example, ResMed that achieved a net margin growth of 21.02% in 2020 and a net income growth of 53.65%^{xlvi}. Medtronic's net income growth in 2020 was 3.41% but was again much higher than many of the other main competitors: Boston Scientific (-101.74%); Becton and Dickinson (-29.17%), Johnson & Johnson (-2.68%), Stryker (-23.24%)^{xlvi}.

There are two main Medtronic subsidiary sites in Galway; one site (CARDIAC) operating within the Cardiac and Vascular Group of Medtronic and is known for its expertise in producing drug-eluting stents, and the other site (THERAPIES) is part of the Minimally Invasive Therapies Group and produces respiratory and monitoring solutions. Both site facilities have a long history in the region operating under the auspices of different corporate parents at various points in time. The Galway THERAPIES site established in 1989 as a subsidiary of Puritan Bennett, a worldwide producer of respiratory products since the early 20th Century including critical care ventilation. Indeed, the high-performance ventilators that Medtronic supplied during the pandemic is inherited from the Puritan Bennett era; that is the 'Puritan Bennett 980 and 840' series. Since establishment the site has experienced five acquisitions - Nellcor (1995), Mallinckrodt (1997), Tyco (2000), Covidien (2007) and most recently, Medtronic in 2015. On the other hand, the Galway CARDIAC site - which was also first established in the 1980s - has a much longer standing within the Medtronic Corporation itself. It has experienced three corporate

parents over the course of its lifetime starting as a subsidiary of CR Bard in 1982, which was subsequently acquired by AVE in 1998 and by Medtronic in 1999. The Galway CARDIAC site is also much larger than the Galway THERAPIES site, employing about 2000 people compared with a workforce of approximately 250 in the Galway THERAPIES site in March 2020. The main events and outcomes of the sites as well as significant decisions by Medtronic HQ over their history are depicted in Figure 2.

INSERT Figure 2: Temporal Evolution of Medtronic Galway Subsidiaries – Main Events and Outcomes

Our longitudinal study explains how the Galway CARDIAC site in particular achieved an all-important upgraded role within a particular product global value chain, and shows how it could be relied upon to collaborate with the Galway THERAPIES site to meet extreme ventilator production demands during the pandemic crisis. Before discussing these findings, the next section provides a description of the method used to collect and analyse our study's data.

Method

The GVC framework is particularly useful in the investigation of the organization of product-specific value chains. For this reason, focusing on a specific product or product line represents a necessary condition for an effective analysis of the dynamics underlying a GVC. To examine the evolution of this product GVC over time, we conducted semi-structured interviews over a 15 year period (2005 to 2020). A process study such as our longitudinal single case seeks to lay out and explain temporal evolution.^{xlix} Such a process research approach permitted us to chronicle the historical sequence of events and explain the evolutionary processes: in our case, the upgrading of a focal subsidiary over time. The longitudinal nature of the dataset enabled us to place the focal events in this paper into the context of the subsidiary's development over time. The result is that it allowed to explain how and why

these focal events occurred: specifically, how the changing nature of the subsidiary affected its responses, and that of the GVC, during the crisis posed by the pandemic. Our interviewees consisted of both HQ and subsidiary management. On one side were select senior management at Medtronic HQ chosen for their apposite knowledge of the Cardiac and Vascular Group division due to their executive responsibility for the Galway CARDIAC site. The preponderance of data, given our wider research interest in a subsidiary's upgrading within a multinational's GVC, was collected from interviews with senior executive management, past and present, operations and R&D managers in the Galway subsidiary. These managers possessed first-hand knowledge of the processes under investigation. For this particularly study we honed in on interviews over this extensive period that we particularly conducted with 14 senior managers, many repeatedly. There was naturally some churn due to turnover in management at the focal subsidiary. Some of these participants even advanced to roles in management fiat at Medtronic HQ. Our semi-structured interviews became more fluid over time as rapport developed and confidence in our research motives grew¹. Topics transformed over time but mainly focused on subsidiary strategies, HQ mandates, nature of evolutionary relations and trust, engagements with local actors, confidence at HQ and technology frontiers. Typically interviews lasted approximately one hour but some occasionally extended to twice that time. The interviews were transcribed verbatim immediately after the interview and organized in a case folder.

We supplemented this interview data with secondary data collated from the corporate website, press pieces and social media on Medtronic Inc. and its Galway subsidiary. Specifically, we tracked and collated secondary sources on key events, critical happenings and notable milestones in the case firm over the full course of the study. Latterly, much of the data in the immediate aftermath of the crisis was secondary in the form of contemporary interviews with Medtronic HQ management in the televisual, financial and economic press and on personal and organizational social media.

Data analysis for this particular article commenced with within case interrogation of data across the years in the case folder. We digitally searched our copious interview transcripts for data on the key themes of subsidiary upgrading activities and HQ governance in this GVC. We followed the logic of narrative analysis^{li} as an interpretivist technique to explain how the subsidiary's upgrading over time furnished a measure of shared governance of this product GVC. In doing so, we identified, interpreted and explained the meanings, decisions and perspectives of managers across time. Pertinent quotes were selected to specifically illustrate critical insights and particularly relevant evidence. We went back and forth between our ongoing interview data accumulation and GVC theory on governance and upgrading in interpretivist analytical mode to make sense of the internal GVC dynamics under hierarchy. Finally, we further deepened our interpretation of our interview data and enhanced the reliability and trustworthiness of our findings through triangulation with the comprehensive secondary data^{lii}. We lastly draw on secondary media and corporate performance data to demonstrate how this engendered a simultaneously efficient and resilient GVC through foreign operation, even when confronted by a hugely disruptive pandemic. As per process study analytical protocol, we provide a theorized narrative of the evolutionary process of GVC upgrading for the MNE subsidiary and the dynamics under hierarchy governance. We now present the findings from our case in the chronological form of an evolutionary narrative leading up to the challenge of the pandemic crisis.

Findings

From its establishment in 1982, to the mid-1990s the CARDIAC facility was largely a site that executed manufacturing projects mandated by the divisional parent company at the time. The primary motivation for establishing the facility was around cost-efficiencies. One of the ex-Managers who started working first as a process engineer in the facility in the early years explained; “My first job was to migrate manufacturing lines from the US...the products were pretty low-tech – catheters”. As noted in this interview, the site's initial projects were the manufacture of simple catheters, guidewires, and then

balloon catheters by the late 1980s, which were all in the field of cardiology. The manufacturing product area of expertise became (and still is to a large degree; albeit more sophisticated) balloon catheters used in angioplasty procedures where there is an obstruction in an artery wall of the heart. However, interviews with members of the original site management team showed that the subsidiary managers knew from the outset of the need to upgrade as a site to survive within a large foreign-owned corporation. As one ex-manager stated; “We had a very good, committed management team that were intent on building on all opportunities”. The strategy of the then management team was not just delivering the mandated project efficiently via replication but to add value by using engineering competencies in the local milieu, as demonstrated in the following statement by an ex-Manager; “During the migration we took products and if you take some of the manufacturing processes....so when I took the abrasing equipment from the US I wouldn’t replicate it, I would upgrade it, and get it sourced in Ireland so that it would be built in an Irish manufacturing site with upgrades...We also used control systems that they [the Division] didn’t do. We used PLC (Programmable Logic Controllers) technologies - that were just coming into the market at the time - and we built PLCs into the equipment as we transferred it”. The site sourced processes and equipment locally e.g. from research centres at the local university, as well as integrated new-to-market technology at the time into manufacturing projects. For instance, the site team took an initiative – independent of Corporate - to engage in a formal relationship with the local university around laser machining for adding more advanced manufacturing processes. This early ‘process’ upgrading was the beginning of corporate evolution completed by the site as an ex-Director from the site stated; “We scored an awful lot of brownie points for doing things like that with the Divisional HQ. We were all building kudos with senior corporate management teams... And by getting a couple of projects under our belts that showed our ability to do things; they just kept giving us more... We were always assuring the corporation that if they gave us the budget we would give them the return”.

In the early 1990s, the Galway CARDIAC site had the opportunity to vie for a new product development charter when a regulatory issue arose for Divisional HQ that limited the latter's engagement in developing particular cardiovascular products^{liii}. Having demonstrated competencies in adding value to projects as well as the favourable business context that the site operated in, e.g. a low corporate tax environment, access to skilled labour and the site's proximity to a university, the site won this charter and established a new product development team in 1993. As an R&D manager in an interview recounted: "There was difficulty then with CR Bard and the FDA concerning safety and management of the company...the company realised that it needed to develop new products and it decided to give an ambit of responsibility to the facility in Galway to start into developing new products itself". By the time Medtronic acquired the site in 1999, the site was affiliated to 23 patents filed in the US demonstrating a growing capacity for innovation. Significantly, when Medtronic finalised the acquisition deal in 1999 it continued and furthered the investment in the R&D function at the site - along with manufacturing - announcing plans shortly after the acquisition for 250 specialists to be working on-site in R&D. Furthermore, some managers from the site assumed Global R&D roles within the Cardiac and Vascular Group that demonstrated the credibility subsidiary managers had gained internally at corporate level.

During the first decade of the site under Medtronic's parental control, product design and development work focused primarily on the drug-eluting stent, which was the major technological development happening at the time in medical devices for angioplasty procedures. Building on its earlier expertise in balloon catheters, the site continued to develop a depth of engineering expertise in the delivery system of drug-eluting stents. As an R&D Director stated in an interview; "definitely delivery systems and balloon catheters is a key competency for this organisation here [in Galway] that has grown over the years". This was facilitated by formal linkages with local suppliers and the local university in establishing the subsidiary site's own collaborations. An interview conducted in 2005 with an R&D

manager reported the use of suppliers locally for finished components (e.g. hypotubes) as well as sub-assemblies. In response to whether the site uses the corporate network of suppliers the manager stated (in 2005) “because of our own tie with the product in terms of developing the product we would try and identify suppliers ourselves for those products”. Significantly the site became an industry partner to the local university’s research centres – REMEDI in 2003 and CURAM in 2015 - to collaboratively develop new products or technologies under formal contracts. As the expertise of the site evolved the subsidiary worked formally with physicians and research centres internationally as well as locally. An R&D Manager explained in an interview in 2005; “the way the sector works is that there are a number of physicians that are well respected internationally so we [in Galway] would work with those internationally-respected ones as well as the local ones”. Engaging in this more advanced activity resulted in the cumulated number of patent applications filed in the US linked to the site more than doubling between 2005 and 2014. Overall, during this decade, the Galway's subsidiary moved from being predominantly a manufacturing unit to becoming a generator of innovation, performing new GVC functions such as R&D and product development. It was thanks to this transformation that the Galway CARDIAC site accomplished 'functional upgrading' in its relevant GVC.

In the past 5 to 10 years, the site began to act in a GVC joint coordinator role for drug-eluting stents as it started to lead global product development teams for next generation delivery systems as well as stents and can now also choose to shift basic manufacturing to other sites abroad, such as Mexico. As a senior manager stated “Galway has inverted....We are behaving almost like a HQ....we have gotten to a point where we are such a key element of the [global] organisation that we actually can operate almost as we want”. This transition to a GVC joint coordinator role has not only been based on technical engineering competency but also project management and leadership competency. A Global R&D Director for the Cardiac and Vascular Group that we interviewed confirmed that he has “a team working today [in June 2019 when the interview was conducted] where the core team leader is based out of Galway....She has

her delivery system engineers that are based out of Galway and her stent engineers are based out of California”. This Global Director explains that for a site to gain responsibility it must have developed leadership competencies among its people as he states “So the biggest growth for any site in the world will be around can we grow the leadership on site....If you can get the leadership – and it takes a long time to grow leadership –.... the money follows the talent”. The existence of such technical, project management and leadership competencies allow the site to operate as a GVC joint coordinator and it is this status internally that Medtronic could rely on in a time of crisis.

As the virus brought devastation to New York city and across the USA, the pleadings for ventilators were vociferous^{liv}. In the face of such excruciating pressure, Medtronic’s CEO at the time, Omar Ishrak, conceded in an interview to CNBC that Medtronic would substantially ramp up production of these critical ventilators at its Galway subsidiary (THERAPIES site) on the West coast of Ireland^{lv}. For ventilators, these were the most advanced proprietary models of Medtronic - the high-performance Puritan Bennett™ 980 and 840 ventilator series - the IP for which was not shared externally, as very publicly happened for its less advanced models both in the USA and worldwide^{lvi}. With the onslaught of COVID-19, increased production responsibility fell on the Galway THERAPIES site to help meet demand of these advanced ventilators. Reflecting on the period in which COVID-19 began to advance in China, one employee from the Galway THERAPIES site stated, “I always knew it would come to our door”^{lvii}. Medtronic had planned substantial increases in ventilator production from 200 units per week in March 2020 to 700 units per week by June and 1000 by the end of that month^{lviii}. By the end of March 2020 the Galway THERAPIES site had already increased production of ventilators by over 40%^{lix}. Commenting on how this rise in production and increased responsibility was met, the leaders of Medtronic Corporation pointed to *collaboration* (both internal and external) as a key factor. Executive Vice President and President of the Minimally Invasive Therapies business group globally, Bob White, provided more details in a ‘frequently asked questions’ interview posted on the Medtronic

website in March 2020. He identified internal collaboration in the form of employees from the Galway CARDIAC site joining forces with the Galway THERAPIES site to help meet the commitment. In this interview on March 27th 2020 Bob White stated; “We have ramped our ventilator capacity in our Galway facility [THERAPIES] up by 40% already [end of March 2020]...the very skilled operators...[they] have come over from Galway – from the CVG plant [CARDIAC] as well – to help on the MITG [THERAPIES] plant. So we are really seeing tremendous Medtronic mobilization”^{ix}. Prior to the COVID pandemic the two sites – CARDIAC and THERAPIES - operated largely independent to each other because they function in distinct business groups within Medtronic. However, to meet the needs of the crisis CARDIAC site joined forces with the THERAPIES site. An article about the operations in the Galway THERAPIES site during the pandemic reports that “CVG [Galway CARDIAC site] builders, engineers, and quality teams have joined the Mervue team [Galway THERAPIES site]. The collaboration... has allowed the businesses to learn about one another — and from one another — in new ways”^{xi}. The same article quotes an employee of the Galway THERAPIES site; “If we widen the product knowledge, there may be times in the future when we need to call on Mervue [Galway THERAPIES site] to support Parkmore [Galway CARDIAC site].

It is clear that in this time of crisis Medtronic turned to offshore subsidiary sites to help achieve its commitment of meeting ventilator demands. The Corporation called for a collaborative effort between two subsidiary sites; one that had the expertise of manufacturing ventilators (the Galway THERAPIES site) and another co-located but distinct site (the Galway CARDIAC site) that over a long period within the Corporation had achieved an upgraded status to the point it had assumed a joint coordinator role in the GVC of a core Medtronic product. This elevated status of the Galway CARDIAC site placed it in a position of trust and reliability for the delivery of high value-added projects from Medtronic’s perspective. In achieving this status, the Galway CARDIAC site was driven by a motivation to improve its stability in terms of long-term survival as a subsidiary. In a time of crisis, this resulted in a win-win

situation; Medtronic Corporate could turn to its subsidiary sites for both expertise and reliability to deliver in a period of unprecedented demand. This could be successfully provided by offshore subsidiary sites exactly because Corporate have allowed a subsidiary to achieve an upgraded status, which in turn benefits the local site and milieu. Marrying the ventilator production expertise of the Galway THERAPIES site with the advanced leadership and project management competency of the Galway CARDIAC site made for a powerful offshore combination in weathering the pandemic storm.

Discussion: Dynamic Hierarchy Governance in the MNE's Global Value Chain

GVC theory has made substantive progress in expanding IB theory beyond the boundaries of the internalised MNE. However, we contend that reaping the benefits of globalization doesn't necessarily entail losing control of a global supply chain, nor does it entail the transfer of knowledge, technology and innovation to third parties located in foreign countries. For instance, internalised GVC organisation may be the optimal solution for MNEs dependent on IP protection for competitive advantage. Naturally, the imperatives for efficient production and stable delivery still apply. Whereas IB theory has underplayed the benefits of externalisation for efficiencies, we further contend that GVC theory has neglected the internal dynamics of the hierarchy governance form. Whether hierarchy, market or middle ground governance form, GVCs are not static. Yet little attention has been paid to the dynamics of the hierarchy mode involving capabilities' upgrading by internal subsidiaries and evolution of intra-organisational trust and power relations.

Consequently our principal contribution to GVC theory rests in our application of the tenets of externalised suppliers' upgrading to internalised subsidiary upgrading under the overlooked hierarchy GVC governance mode. We reintroduce MNE internalisation theory to the GVC discourse as called for by scholars at the nexus of MNE and GVC theories^{lxiii}. We demonstrate in our single case study how, even under quite stable hierarchical governance, the GVC constantly evolves and transforms whereby

internal subsidiaries' configurations, activities and responsibilities change. Subsidiaries differentially upgrade their capabilities and variably perform to expectations. Over time, a subsidiary may potentially even wrest some power and control from HQ over GVC activities. This enhances that subsidiary's prospects within an MNE. It also raises confidence of senior fiat of an MNE in being able to rely on the subsidiary to deliver on both production efficiency and supply resilience, even, as we demonstrate in this article, in times of extreme disruption. Our case study shows how capabilities, intra-organisational relations, competence and goodwill trust, and power-dependency evolved under hierarchy governance. Our study essentially shows that whilst the guiding principles of hierarchy governance of GVC exhibited no substantial change, over time, internal relational dynamics evolved and control over activities shifted somewhat in favour of the subsidiary through some measure of shared governance. In this way, HQ and a lead subsidiary have jointly orchestrated a hierarchical GVC to retain majority control, stabilize the functioning of its global production networks and preserve its overall resilience.

Before the outbreak of COVID-19, strategy research on GVCs mainly focused on MNEs' economic practices and outcomes as leading actors in GVCs but disregarded the vulnerability and hazards involved in GVCs and GVC structures^{lxiii}. The risks associated with interdependence among external business activities dispersed globally and how firms can respond when this interdependence is severely obstructed came to light during the pandemic crisis and as a result calls to re-shore activities abounded. Given this context, our revelatory case study additionally contributes to GVC theory by demonstrating that under the pressure wrought by a severe disruptive event, efficiency and resilience can coexist in a hierarchical GVC without deleterious compromise and costly trade-offs. In response to a sudden surge in demand for its vital category of complex medical products, Medtronic HQ strategically resolved to place its trust in the case subsidiary to manage the emergency requirements. Overall, the case MNE weathered the pandemic storm not by reshoring but, on the contrary, through a devolved reliance on its upgraded subsidiary. The internalised MNE has a much greater understanding of, and commitment from,

the specific ‘units’ in the GVC that need to ‘step up’ during a disruptive phase or crisis. In the event of a circumstance where the GVC is critically dependent on one unit to organise particular and prompt changes, common commitment to an entity, greater than the GVC as such, seems to mitigate different allegiance and dependencies among the parts of a GVC. Future disruptive shocks are inevitable and shielding domestically is inefficient. Our study demonstrates that in a disruptive crisis, managing GVC activities in-house, but not fully at home, eliminates compromise on efficiency, provides agility^{lxiv} and yet represents no loss of stability. It’s a case of not throwing the overseas subsidiary baby out with the reshoring bathwater.

Based on our case findings and discussion, we next devise practical and actionable lessons for MNE management.

Lessons for Management: An Actionable Guide for MNEs

Our study provides important lessons for management fiat of the MNE under hierarchy governance.^{lxv} An understanding that this GVC governance form, as with others, is not static summons a requirement for attention to, and ongoing assessment of, evolving and differential capabilities across subsidiaries and changing intra-organisational dynamics. The following are three actions that MNEs can take:

1. Assess subsidiaries for current and potential capabilities upgrading in GVC

Given changing internal dynamics, HQ needs to continuously monitor and assess the current and potential capabilities of its foreign subsidiaries. Subsidiary capability development often takes time and not all subsidiaries will evolve at the same pace and to the same degree; much will depend on factors external to the MNE such as those that are location-based (e.g. the availability of high skilled labour locally), as well as internal MNE factors like the knowledge and learning they receive from HQ and other sister sites. This means that at any given time subsidiaries will be at different stages of capability

development and with varying potential for capability evolution within its GVC. HQ needs to regularly consider and assess the upgrading trajectory of subsidiaries to understand where current and potential capability lies within the GVC hierarchy governance structure.

2. Support designated subsidiaries in upgrading activities

HQ itself can be a limiting factor in balancing GVC efficiency and resilience by not supporting capable subsidiaries and those showing potential to evolve into higher value-added activities. Supporting capable subsidiaries involves investing in resources locally to develop centres of excellence built around production, innovation and project leadership. HQ should then strenuously endeavour to cultivate competence trust with upgraded subsidiaries through the provision of supportive measures, resources, investments, improved mandates, internal championing, and, foremostly, increased autonomy to engage with external local partners.

3. Devolve some governance control to subsidiaries with advanced upgraded capabilities

Provide upgraded subsidiaries with increased decision-making and control responsibility over elements of the GVC. Co-orchestration on the GVC with HQ and the latitude to direct sister subsidiaries' activities are examples of some shared governance in hierarchy. This can allow for higher order levels of trust to evolve between management at HQ and its subsidiary. It is this trust that becomes an enabling factor for resilience allowing HQ to rely on the capable international subsidiary to deliver in disruptive times, as explicitly shown in our case study. When faced with an extreme disruptive event, such as a pandemic, an MNE's GVC does not necessarily have to suffer the loss of efficiency that would occur through reshoring. HQ confidence in capable subsidiaries to perform and deliver in times of disruption pays dividends.

Conclusion

Clearly, we do not expect the results of our findings to apply to each and every GVC across all industries. Indeed, our study provides an alternative narrative to the one dominating the ongoing debate on GVCs optimal configuration - that is, the buyer-supplier relationship is coordinated through 'non equity' forms of governance which preserve the autonomy of independent global suppliers while providing the buyer with high flexibility. We contend that this model will remain prevalent in the study of GVC and anticipate that globally dispersed supply lines will hardly be replaced by co-located supply chains via MNEs' reshoring strategies. Production of consumer electronics^{lxvi}, automotive^{lxvii} and clothing^{lxviii} will most likely remain anchored to 'loosely' governed GVC, in which leading firms' search for efficiency will keep dictating the coordination and configuration models of future production networks.

The idea of simultaneously reaching ample efficiency and resilience through a hierarchical governance mode of the GVC, i.e., utilizing a subsidiary, and not having to trade one for the other might also assist in tackling other global enigmas, such as climate- and general CSR issues. In most cases foreign subsidiaries will bring with them and adhere more to home-country perspectives on pollution and human/labour rights related to locally grown firms within e.g., an emerging market. This might help change, e.g., pollution from the production process, to the better without sacrificing efficiency and opportunities residing in the particular location altogether.

Notes

ⁱ Stephen Kobrin (2020) asserts that “some degree of redundancy and supply risk mitigation will have to be built into the (globalised) system. Regardless of efficiencies, the pandemic has shown that severe problems can result from depending on single sources of supply for critical products or technologies. Similarly, complex global supply chains have proven vulnerable to problems at ‘choke points’ that can bring the entire production process to a halt”. Stephen J. Kobrin, “How globalization became a thing that goes bump in the night,” *Journal of International Business Policy*, 3/3 (July 2020): 280-286.

ⁱⁱ Tanusree Jain and Louis Brennan, “COVID-19 exposes a major flaw in global supply chains”, *Open Access Government*, June 18, 2020, https://www.openaccessgovernment.org/global-supplychains/88723/?utm_content=132279690&utm_medium=social&utm_source=twitter&hss_channel=tw-722364500737921024

ⁱⁱⁱ This was particularly the case for essential medical supplies, such as personal protection equipment (PPE) predominantly made in China, and more complex engineered respiratory ventilators with more dispersed production in advanced worldwide locations.

^{iv} See for example, Rajat Panwar, “It's time to develop local production and supply networks” *Strategy Insights. California Management Review*, April 28, 2010, <https://cmr.berkeley.edu/2020/04/local-production-supply-networks/>; Willy Shih, “Is it time to rethink globalized supply chains?”, *MIT Sloan Management Review*, 61(4) (March 19, 2020); and Robert E. Lighthizer, “The era of offshoring of U.S. jobs is over”, *New York Times*, May 11, 2020, <https://www.nytimes.com/2020/05/11/opinion/coronavirus-jobs-offshoring.html?>

^v “Australia drank the free-trade juice and decided that off-shoring was okay. Well that era is gone” Andrew Liveris, advisor to Australian Prime Minister, Scott Morrison, as reported by Naoise McDonagh in *The Conversation*, ‘Sure, let’s bring production onshore, but it might not ensure supplies’, July 9, 23

2020, <https://theconversation.com/sure-lets-bring-production-onshore-but-it-might-not-ensure-supplies-142270>

^{vi} Verbeke (2020) cites (p.444) how The Economist reports that “Narendra Modi, India’s prime minister, told the nation that a new era of economic self-reliance has begun. Japan’s COVID-19 stimulus includes subsidies for firms that repatriate factories: European Union officials talk of ‘strategic autonomy’ and are creating a fund to buy stakes in firms. America is urging Intel to build plants at home”, in “Has COVID-19 killed globalisation?”, May 14, 2020, <https://www.economist.com/leaders/2020/05/14/has-covid-19-killed-globalisation>. Alan Verbeke “Will the COVID-19 pandemic really change the governance of global value chain?”, *British Journal of Management*, 31/3 (July 2020): 444-446.

^{vii} “...countries now want self-reliance. Earlier in the pandemic, China sometimes decided which countries received crucial supplies and demanded profuse and public thanks in exchange. President Emmanuel Macron of France pledged in March to produce homegrown masks and respirators by the end of this year. Peter Navarro, President Trump’s industrial policy adviser, has begun to push for the federal government to buy American-made pharmaceutical and medical supplies”, as quoted by Keith Bradsher in “China Dominates Medical Supplies, in this Outbreak and the Next”, *New York Times*, 5 July, 2020, <https://www.nytimes.com/2020/07/05/business/china-medical-supplies.html>

^{viii} “One of the things that this crisis has taught us, sir, is that we are dangerously overdependent on a global supply chain for our....medical equipment, like ventilators”, Peter Navarro again, as quoted by Martin Wolf, “What COVID-19 should have taught us about trade”, *The Irish Times*, 24 June, 2020, <https://www.irishtimes.com/business/economy/what-covid-19-should-have-taught-us-about-trade-1.4287270>

^{ix} Pressures to reshore were growing pre-pandemic, particularly of supplies of goods manufactured in China. For many political commentators and managers of global supply lines, after decades of favourable neo-liberal trade conditions, the pandemic has merely served to accelerate extant processes of de-globalisation (see, for example, Dani Rodrik, “Populism and the economics of globalization,”

Journal of International Business Policy, 1 (1-2) (June, 2018): 12-33. For quite some time there was recognition of exposure to GVC fragilities through weak chain links. They had focused on operations based in insecure nations governed by unpredictable political regimes (Stephen J. Kobrin, “How globalization became a thing that goes bump in the night,” *Journal of International Business Policy*, 3/3 (July 2020): 280-286). Attention had increasingly turned to locations beset by uncertain rule-of-law in the global environment, with special emphasis on China given its critical upstream position for a multitude of GVCs (Olga Petricevic and David J. Teece “The structural reshaping of globalization: Implications for strategic sectors, profiting from innovation, and the multinational enterprise,” *Journal of International Business Studies*, 50/9 (December, 2019): 1487-1512). This was compounded by a ratcheting up of economic hostilities between USA and China. This hegemonic battle heightened trade conflicts and raised fears over supplies from China becoming vulnerable. Second, an ever-growing number of lost manufacturing jobs in advanced production regions has emboldened populist politics to increase pressures to reshore production activities. Third, climate change concerns led to strong calls for a reduction in transport wrought by the orchestration of production activities across multiple global locations. Additionally, suspicions had been aroused for many MNEs over the security and protection of valuable intellectual property (IP) in weak institution locations (Heather Berry, “Managing valuable knowledge in weak IP protection countries,” *Journal of International Business Studies*, 48/7 (September 2017): 787-807). For any, or all of these reasons, many MNE managers were reassessing or even replacing governance arrangements of GVCs prior to the dramatically sudden incursion of Covid-19 and the deleterious fragility caused in upstream GVC failures.

^x Alan Beattie, “Coronavirus-induced ‘reshoring’ is not happening”, *Financial Times*, September 30, 2020, <https://www.ft.com/content/e06be6a4-7551-4fdf-adfd-9b20feca353b>; The Economist “Global supply chains are a source of strength, not weakness”, *The Economist*, March 31, 2021, 25 <https://www.economist.com/leaders/2021/03/31/global-supply-chains-are-still-a-source-of-strength-not-weakness>

^{xi} Peter Buckley “The role of international business theory in an uncertain world,” in Rob Van Tulder, Alan Verbeke and Barbara Jankowska, *International Business in a VUCA world: The Changing roles of States and Firms*, eds. (UK: Emerald Publishing, 2019): 23-29.; Verbeke (2020) op. cit.

^{xii} Ram Mudambi, “Location, control and innovation in knowledge-intensive industries”, *Journal of Economic Geography*, 8/5, (September, 2008): 699–725.; Liena Kano, Eric W.K. Tsang and Henry Wai-chung Yeung (2020). “Global value chains: A review of the multidisciplinary literature,” *Journal of International Business Studies*, 51/4 (June, 2020): 577-622.

^{xiii} John Humphrey and Hubert Schmitz, “How does insertion in global value chains affect upgrading in industrial clusters?,” *Regional Studies*, 36/9 (December, 2002): 1017–1027; Mark P. Dallas, Stefano Ponte and Timothy Sturgeon, “Power in global value chains,” *Review of International Political Economy*, 26/4 (July, 2019): 666–694.; Valentina De Marchi, Eleonora Di Maria and Stefano Ponte “Multinational firms and the management of global: insights from global value chain studies” in Torben Pedersen, Markus Venzin, Timothy M. Devinney and Laszlo Tihanyi, *Orchestration of the Global Network Organization (Advances in International Management, 27)*, eds., (UK: Emerald Publishing, 2014): 463-486. doi:10.1108/S1571-502720140000027009; Valentina De Marchia, Eleonora Di Maria, Ruggero Golinib, Alessandra Perri, “Nurturing International Business research through Global Value Chains literature: A review and discussion of future research opportunities,” *International Business Review*, 29/5 (October, 2020): 1-16.

^{xiv} Gary Gereffi, John Humphrey and Timothy J. Sturgeon “The governance of global value chains”, *Review of International Political Economy*, 12/1 (February, 2005): 78–104.

^{xv} For comprehensive debate and discussion on internalisation theory for the vertically integrated MNE and GVC theory see De Marchi et al. (2014; 2020) op. cit.; Roger Strange and John Humphrey “What lies between market and hierarchy? Insights from internalization theory and global value chain theory,”
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Journal of International Business Studies, 50/8 (October, 2019): 1401–1413; Gabriel R.G. Benito, Bent

Petersen and Lawrence S. Welch “The global value chain and internalization theory,” *Journal of International Business Studies*, 50/8, (February, 2019): 1414-1423.

^{xvi} Ulf Andersson, Mats Forsgren and Ulf Holm, “The strategic impact of external networks - subsidiary performance and competence development in the multinational corporation”, *Strategic Management Journal*, 23/11 (November, 2002): 979 – 996; Paul Ryan, Majella Giblin, Ulf Andersson, Johanna Clancy, (2018) ‘Subsidiary knowledge creation in co-evolving contexts’, *International Business Review*, 27/5, (October, 2018): 915-932.

^{xvii} Strange and Humphrey (2019) op. cit; Benito et al. (2019) op.cit.

^{xviii} Kathleen M. Eisenhardt, “Building theories from case study research”, *Academy of Management Review*, 14/4 (October, 1989): 532-51; Andrew Sayer, *Realism and social science* (London: Sage, 2000); John M. Stopford and Louis T. Wells Jr., *Managing the multinational enterprise: Organization of the firm and ownership of the subsidiaries*, (New York: Basic Books, 1972); Robert K. Yin, *Case Study Research: Design and Methods*, 4th ed, (London: Sage, 2009); Catherine Welch and Erikka Paavilainen-Mantymaki, “Putting Process (Back) In: Research on the Internationalization Process of the Firm”, *International Journal of Management Reviews*, 16/1 (January, 2014): 2-23.

^{xix} Catherine Welch, Rebecca Piekkari, Emmanella Plakoyiannaki and Erikka Paavilainen-Mäntymäki, “Theorising from case studies: Towards a pluralist future for international business research,” *Journal of International Business Studies*, 42/5 (June, 2011): 740-762.

^{xx} Ryan et al. (2020) op. cit.

^{xxi} Robert White, Group President, Minimally Invasive Therapies Group (MITG) Medtronic used LinkedIn to report the following in July, 2020, “We did it! Our #Galway, Ireland, manufacturing team celebrates our commitment to ramping production of lifesaving #ventilators from 180/week to 1,000/week in less than 5 months. Incredible! Congratulations, team! #furthertogether #medtronic”

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[https://www.linkedin.com/posts/robertwhitej_galway-ventilators-furthertogether-activity-](https://www.linkedin.com/posts/robertwhitej_galway-ventilators-furthertogether-activity-689622173130252288-LUVP)

[689622173130252288-LUVP](https://www.linkedin.com/posts/robertwhitej_galway-ventilators-furthertogether-activity-689622173130252288-LUVP)

^{xxii} Alan Verbeke “Will the COVID-19 pandemic really change the governance of global value chain?”, *British Journal of Management*, 31/3 (July 2020): 444-446.

^{xxiii} Some scholars have made progress in drawing on international business (IB) theory to make important progress on GVC governance modes for MNEs: Peter Buckley, “Internalisation thinking: From the multinational enterprise to the global factory”, *International Business Review*, 18/3 (June, 2009): 224-235; De Marchi et al. (2014) op. cit.; De Marchi et al. (2020) op. cit; Liena Kano, “Global value chain governance: A relational perspective,” *Journal of International Business Studies*, 49/6 (August, 2018): 684–705; Strange and Humphrey (2019) op. cit.; Benito et al. (2019) op. cit; Jean-Francois Hennart “Transaction cost theory and international business”, *Journal of Retailing*, 86/3 (September, 2010): 257-269.

^{xxiv} Verbeke, A. (2020) op. cit.

^{xxv} Kano et al. (2020), op cit.

^{xxvi} Buckley (2009) op. cit.

^{xxvii} Mudambi (2008), op. cit.

^{xxviii} Paul Almeida and Anupama Phene, “Subsidiaries and knowledge creation: the influence of the MNC and host country on innovation.”, *Strategic Management Journal*, 25/8-9, (August-September, 2004): 847-864. Andersson et al. (2002) op. cit.

^{xxix} Hennart (2010) op. cit; Benito et al. (2019) op. cit.

^{xxx} Strange and Humphrey (2019) op. cit.

^{xxxi} Ram Mudambi, Torben Pedersen and Ulf Andersson “How subsidiaries gain power in multinational corporations”, *Journal of World Business*, 49/1 (January, 2014):101–113.

^{xxxii} Peter F. Drucker, *Management: Tasks, Responsibilities, Practices* (New York: Harper & Row, 1973).

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^{xxxiii} See e.g. Farok J. Contractor, Vikas Kumar, Sumit K. Kundu, and Torben Pedersen, “Reconceptualizing the Firm in a World of Outsourcing and Offshoring: The Organizational and

Geographical Relocation of High-Value Company Functions”, *Journal of Management Studies*, 47/8 (December 2010): 1417-1433 and Liang Dong, Ming Dai, M., Hanwei Liang, Ning Zhang, Nabeel Mancheri, Jingzheng Ren, Yi Dou and Mingming Hu, “Material flows and resource productivity in China, South Korea and Japan from 1970 to 2008: A transitional perspective”, *Journal of Cleaner Production*, 141 (January 2017): 1164-1177.

^{xxxiv} Arun Rai “Editor’s Comments: The COVID-19 Pandemic: Building Resilience with IS Research”, *Management Information Systems Quarterly*, 44/2 (2020): iii-vii and Remko van Hoek, “Research opportunities for a more resilient post-COVID-19 supply chain—closing the gap between research findings and industry practice”, *International Journal of Operations & Production Management*, 40/4 (June 2020): 341-355.

^{xxxv} Martin Wolf, “The dangerous war on supply chains”, *Financial Times*, 23 June, 2020, <https://www.ft.com/content/e27b0c0c-1893-479b-9ea3-27a81c2506c9>

^{xxxvi} Julian Birkinshaw, “The New Boardroom Imperative: From Agility To Resilience”, *Forbes*. March 28, 2020, <https://www.forbes.com/sites/lbsbusinessstrategyreview/2020/03/28/the-new-boardroom-imperative-from-agility-to-resilience/#261828838671>.

^{xxxvii} Ismail Gölgeci, Harun Emre Yildiz and Ulf Andersson, “The rising tension between efficiency and resilience in global value chains in the post-COVID-19 world”, *Transnational Corporations Journal*, 27(2), (September, 2020): 127-142, <https://doi.org/10.18356/99b1410f-en>.

^{xxxviii} Joseph Fiksel, “Designing resilient, sustainable systems”, *Environmental Science & Technology*, 37/23, (November, 2003): 5330-5339, <https://doi.org/10.1021/es0344819>.

^{xxxix} See e.g., Ismail Gölgeci and Olli Kuivalainen, “Does social capital matter for supply chain resilience? The role of absorptive capacity and marketing-supply chain management alignment”, *Industrial Marketing Management*, 84, (January, 2020): 63-74. Ismail Gölgeci and Serhiy Y. Ponomarov, “Does firm innovativeness enable effective responses to supply chain disruptions? An

empirical study”, *Supply Chain Management: An International Journal*, 18/6, (September, 2013): 604-617.

^{xl} Serhiy Y. Ponomarov and Mary C. Holcomb, “Understanding the concept of supply chain resilience”, *The International Journal of Logistics Management*, 20/1, (May, 2009): 124-143.

^{xli} Kano et al. (2020) op. cit.

^{xlii} Peter J. Buckley, “Internal integration and coordination in the global factory”, *Management International Review*, 51/2, (March, 2011): 269, <https://doi.org/10.1007/s11575-011-0075-2>.

^{xliii} Ryan et al. (2020) op. cit.

^{xliv} Bruce Kogut and Udo Zander, “Knowledge of the firm and the evolutionary theory of the multinational corporation”, *Journal of International Business Studies*, 24/4, (December, 1993): 625-645.

^{xliv} Ismail Gölgeci and Olli Kuivalainen, “Does social capital matter for supply chain resilience? The role of absorptive capacity and marketing-supply chain management alignment”, *Industrial Marketing Management*, 84, (January, 2020): 63-74.

^{xlvi} Source: Medtronic Annual Report 2020, [online], available at: <https://investorrelations.medtronic.com/annual-meeting-reports>, Accessed: September 2020.

^{xlvi} Source: <https://investorrelations.medtronic.com/financial-information/quarterly-results>

^{xlviii} Source: Wall Street Journal (WSJ)/Markets – Market Data: <https://www.wsj.com/market-data>

^{xlix} Ann Langley, “Studying processes in and around organizations” in *The Sage handbook of organizational research methods*, eds. David A. Buchanan and Alan Bryman (London: Sage), 409–429; Ann Langley, Clive Smallman, Haridimos Tsoukas and Andrew H. Van de Ven, “Process studies of change in organization and management: Unveiling temporality, activity, and flow”, *Academy of Management Journal*, 56/1, (February, 2013): 1–13.

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¹ Tony Dundon and Paul Ryan “Interviewing Reluctant Respondents: Strikes, Henchmen and Gaelic Games,” *Organizational Research Methods*, 13/3 (July, 2010): 562–581.

^{li} Gary J. Buttriss and Ian F. Wilkinson, “Using narrative sequence methods to advance international entrepreneurship theory”, *Journal of International Entrepreneurship* 4/4 (December, 2006):157–174; Usha C V Haley and David M Boje, “Storytelling the internationalization of the multinational enterprise”, *Journal of International Business Studies*, 45/9, (December, 2014): 1115–1132.

^{lii} Rana Sobh and Chad Perry, “Research design and data analysis in realism research”, *European Journal of Marketing*, 40/11-12 (November, 2006): 1194-1209.

^{liii} See the following news article from 1993 that gives an account of the serious regulatory infringements by made CR Bard: John Schwartz ‘Firm Fined for Selling Faulty Surgical Devices’, *The Washington Post*, 16 October, 1993, <https://www.washingtonpost.com/archive/politics/1993/10/16/firm-fined-for-selling-faulty-surgical-devices/0d3169df-7ab7-4f40-bc45-bc04a8663273/>

^{liv} New York Governor, Andrew Cuomo, dramatically pleaded for the emergency delivery of 30,000 ventilators in a televised press conference.

^{lv} CNBC interview with Omar Ishrak, Squawk on the Street, podcast audio, March 25 2020, <https://www.cnbc.com/video/2020/03/25/medtronic-ceo-omar-ishrak-on-ramping-up-ventilator-production.html>

^{lvi} In an effort to meet the huge and emergency demand for ventilators, Medtronic took the unprecedented step to share its IP for its less advanced model PB560 openly worldwide and forged partnerships with other giant corporations such as Intel and Foxconn. There were over 20,000 downloads globally of this documentation. Yahoo Finance's Alexis Christoforous and Brian Sozzi speak to Bob White, Medtronic Minimally Invasive Therapies Group President, about the company's ongoing increased production of ventilators Medtronic Executive: 'The country's well prepared' for a second wave of COVID-19, Yahoo Finance Video, Yahoo Finance Video June 9, 2020. ‘Medtronic teams up with Intel to build remote ventilators for COVID-19 patients’ Medtronic’s Bob White talks to Fortune, **31** July 09, 2020 <https://fortune.com/videos/watch/Medtronic-teams-up-with-Intel-to-build-remote->

[ventilators-for-COVID19-patients/939220a7-60aa-440a-b379-9048943fd2f2?activePlaylistName=Voices%20from%20the%20Pandemic&sf125155242=1](https://news.medtronic.com/increased-ventilator-manufacture)

^{lvii} Medtronic, ‘Combating COVID-19: Medtronic Teams Ramp Up Ventilator Manufacturing – Amid a global pandemic, employees ban together to power ventilator production’, Medtronic website, March 27 2020, <https://news.medtronic.com/increased-ventilator-manufacture>

^{lviii} Medtronic, ‘Press Release: Medtronic Provides Ventilator Progress Update’, April 8 2020, <https://newsroom.medtronic.com/news-releases/news-release-details/medtronic-provides-ventilator-progress-update>

^{lix} Medtronic, ‘FAQs on Medtronic Ventilator Production’, Medtronic website, March 27 2020, https://news.medtronic.com/ventilator-production-faqs#assets_all

^{lx} Medtronic, ‘FAQs on Medtronic Ventilator Production’, Medtronic website, March 27 2020, https://news.medtronic.com/ventilator-production-faqs#assets_all

^{lxi} Medtronic, ‘Combating COVID-19: Medtronic Teams Ramp Up Ventilator Manufacturing – Amid a global pandemic, employees ban together to power ventilator production’, Medtronic website, March 27 2020, <https://news.medtronic.com/increased-ventilator-manufacture>

^{lxii} Strange and Humphrey (2019) op. cit; Benito et al. (2019) op.cit.

^{lxiii} Gary Gereffi and Joonkoo Lee, “Economic and social upgrading in global value chains and industrial clusters: Why governance matters”, *Journal of Business Ethics*, 133/1 (January 2016): 25-38.

^{lxiv} “...future IB research can hopefully demonstrate that the pandemic is no match for agile GVCs” (p. 446) in Alan Verbeke “Will the COVID-19 pandemic really change the governance of global value chain?”, *British Journal of Management*, 31/3 (July 2020): 444-446.

^{lxv} Our managerial lessons are not universally applicable. Medical technology is naturally a distinctive industry sector (and we are not prescribing hierarchy for every MNE), and because of the nature of the coordination –
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devolved responsibilities to the subsidiary worked in this scenario- our lessons may not in other MNCs with different configurations or industry contexts.

^{lxvi} Jason Dedrick, Kenneth L. Kraemer and Greg Linden, “Who Profits from Innovation in Global Value Chains? A Study of the iPod and Notebook PCs”, *Industrial and Corporate Change*, 19/1 (February, 2010): 81-116.

^{lxvii} Timothy J. Sturgeon, Olga Memedovic, Johannes Van Biesebroeck, Gary Gereffi, “Globalisation of the Automotive Industry: Main Features and Trends”, *International Journal of Technological Learning, Innovation and Development*, 2/1 (July, 2009): 7-23.

^{lxviii} Peter Gibbon “Governance, Entry Barriers, Upgrading: A Re-Interpretation of Some GVC Concepts from the Experience of African Clothing Exports”, *Competition & Change*, 12/1 (March, 2008): 29-48.

Figure 1: Medtronic Inc Businesses - Groups and Divisions

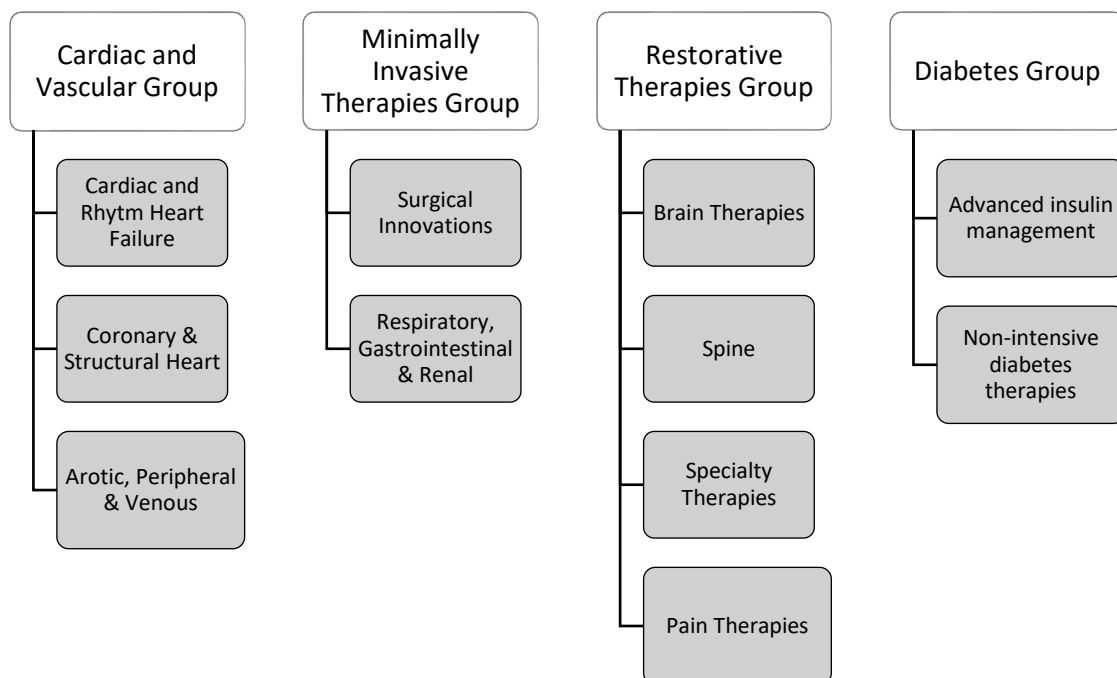


Figure 2: Temporal Evolution of Medtronic Galway Subsidiaries – Main Events and Outcomes

