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Do contractors undertake more learning and innovation than multinational subsidiaries at least developed host-sites? A study of clothing firms in Cambodia

Rajah Rasiaha, Vignes Gopal Krishna and Kurunathan Ratnavelu

This paper seeks to test the argument that contractors introduce significant learning and innovation activities comparable more or than integrated multinational clothing producers at least developed host-sites. This follows from recent developments in the theory of multinationals that lead firms are increasingly abandoning peripheral innovation activities that are characterised by low value added operations to focus on branding and associated R&D activities. Any such development will offer opportunities for contract manufacturers, both national and foreign owned, to upgrade and specialise in innovative activities related to manufacturing at distant host-sites as the brand holders at major markets will then specialise on product R&D and design, and branding activities. The results from tobit regressions show that contract firms show higher process technology and innovation capabilities (ICs) than integrated firms in the clothing industry. Hence, there is econometric evidence to support the argument that changes in manufacturing offers tangible opportunities for contract manufacturers in global value chains to upgrade into cutting-edge processes and techniques, and ICs.

Keywords: innovation capability, value chain, contract firms, integrated multinational producers, clothing

1. Introduction

There has been a growing trend among firms in particular industries and locations to extend their outsourcing conduct from just production components to include products and services that involve innovative activities, which has evolved since the onset of vertical disintegration of transnational corporations (Sturgeon 2002; Gereffi, Humphrey, and Sturgeon 2005). Indeed, Feenstra and Hanson (1996) had earlier argued that the greater integration of global markets has led to the ‘disintegration of the production process’. Thus, lead firms concentrate instead on product design, development and marketing while leaving production and related innovations to others (Sturgeon 2002, p. 468; Plambeck and Taylor 2005). Besides avoiding the potential financial risks of creating plant capacity for new products that have not established themselves in the marketplace or to stretch their resources to compete a wide range of firms, by offshoring to poorer countries, firms are also able to leverage on tax incentives and lower labour costs. Starting off with electronics, firms in other industries such as pharmaceutical and clothing have also moved their whole manufacturing process to contract manufacturers.

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It has been argued that contract manufacturers are better able to manage plant level innovations and capacity leading to greater efficiency than integrated multinational producers (Sturgeon 2002). Although Sturgeon’s (2002) and Gereffi et al. (2005) made their argument on the basis of production modularisation in the automotive and electronics industries, we use the same logic as the decoupling of production from R&D and marketing and its relocation at distant underdeveloped sites offers the same opportunity for suppliers to inject learning and innovation activities to win orders from lead firms. Thus, this paper seeks to test this evidence econometrically by comparing the degree of innovations associated with production activities associated with process technology between contract and non-contract export manufacturers in the clothing industry of Cambodia. As they compete in the global marketplace, exporters seek efficient plant sizes, increasing returns to scale and scope, production efficiencies and better management processes especially when innovation is confined to incremental engineering and other related forms of improvements to production, which does not require participation in in-house R&D activities (Hobday 1995). Contract manufacturers are also able to pool brand owners and maximise capacity utilisation to amortise their investments quickly especially if asset specificity is low (Plambeck and Taylor 2005).

The evidence of drivers of global value chains outsourcing production to contract firms can also be tested with a surge in clothing exports from the least developed countries, which have been offered a window of opportunity to access most favoured nation trade privileges since the dismantling of the Multi-Fibre Arrangement (MFA) governing clothing trade (that began since the formation of the World Trade Organization in 1995) and ended since its termination in 2004. Bangladesh, Cambodia, Laos, and Myanmar are some of the beneficiaries in Asia of this process attracting strong inflows of foreign clothing capital. Myanmar suffered a serious setback when the United States imposed trade sanctions on the country in 2003 (Rasiah and Myint 2013). Cambodia took advantage of preferential access agreements with the United States (bilateral trading agreement) and the European Union (everything but arms clause) to attract massive inflows into clothing investment to access quotas (Rasiah 2009). Both the integrated multinational producers and contract manufacturers have started labour-intensive cut make and trim (CMT) and freight on board (FOB) operations. Most contract manufacturers are from China, Hong Kong, Korea, Taiwan, Singapore, and Malaysia. Clothing exports from Cambodia in nominal prices rose from US$970 million in 2000 to US$2199 million in 2005 and US$4051 million in 2011 (WTO 2006: Table 6.83, 2012: Table 11.70). The share of clothing exports in total exports of Cambodia rose from 69.8% in 2000 to 71.5% in 2005 before falling to 58.3% in 2011. Hence, although Cambodia is not among the giant clothing exporters, it has become a major production base in which both contract and non-contract firms dominate exports.

The paper uses a sample of 91 firms drawn from a survey in 2012. Unless otherwise stated the survey is for the year 2011. The rest of the paper is organised as follows. Section 2 discusses the theoretical considerations. Section 3 presents the methodology and data. Section 4 analyses statistical differences relationships between contracting and non-contracting clothing firms in Cambodia. Section 5 presents the conclusions.

2. Theoretical considerations
As multinational corporations (MNCs) from the developed countries realised that neither diversification nor vertical integration offered them steady returns, firms moved away from diversification and began to concentrate instead on core competencies (Hilmer and Quinn 1994). While some firms, such as the integrated circuits firms in Taiwan, have continued to specialise on the basis of scale in particular production stages even after the decomposition process, some firms, such as machine tools, have continued to specialise on particular technologies on the basis of
economies of scope but targeting different product markets. However, clothing, and consumer and industrial electronics value chains have increasingly experienced a move towards retaining the portion of business that enhances their competitive advantage, which includes product innovation, marketing and brand development (Gereffi 2001; Sturgeon 2002). Where once MNCs aimed to minimise production costs by seeking to locate operations around the world with the best factor cost conditions and tax privileges, clothing, and consumer and industrial electronics MNCs have since the 1980s begun outsourcing production to contract manufacturers who are able to provide global supply chain services in order to combine cost reduction, product differentiation and time-to-market (Ernst and Kim 2002). The contract manufacturers are also able to provide their clients with great flexibility in ramping up or reducing production capacity on short notice (Sturgeon 2002). Sturgeon (2002) went further to argue over the impact of modularisation on value chains, in which the lead firm keeps control of the value chain by retaining product design and marketing in the headquarters, while outsourcing the management of production to suppliers – including process and organisational innovations. The international division of labour used by Apple in the production of iPhones and iPads supports Sturgeon’s argument as Apple has retained product design, software development, and marketing functions in the United States while the assembly is undertaken by a Taiwanese firm in Shenzhen, China (Xing and Detert 2010). The same logic is visible in the clothing industry where the lead firm often concentrates on branding and R&D associated with branding (Rasiah 2009).

However, while the vertical dispersal of production has dominated some industries, others have provided evidence to show that it cannot be generalised to all industries (Nelson 2008; Rasiah 2012). Indeed, Taiwanese chip manufacturers have continued to increase their control over a number of chip implant and product R&D design with Taiwan Semiconductor Manufacturing Corporation (TSMC) having successfully moved from a latecomer in the 1980s to a first mover from the late 1990s in logic chips (Yap 2014). Nevertheless, as originally recognised by Gereffi (2001), clothing value chains have continued to be driven by brand holders. The taxonomy of Pavitt (1984) provides a good starting point to examine the complexity of clothing manufacturing, which is symbolised by the dominance of suppliers and the technical progression of development. Sturgeon (2002) showed succinctly how the transfer of codifiable techniques and processes, as well as, manufacturing design and R&D, and testing, packaging and parts purchasing marketing to contract firms has allowed lead firms to compete better by specialising on product strategy and R&D, functional marketing, form design and prototype fabrication. However, Sturgeon (2002, p. 468) specifically targeted modularisation as the basis for such a development. In this paper we use a similar development, albeit with no particular reference to modularisation that has been brought about by the decoupling of production from product R&D and marketing using the clothing industry in Cambodia to test the argument that learning and innovation is higher among contractors than in integrated multinational firms. Such an argument is predicated on the logic that subsidiaries rely on their multinational parents and mature subsidiaries located in the more developed countries to access innovation through internalised transfers of relational contracting of knowledge (Cantwell, Dunning, and Janne 2004). The latter argument does not preclude the fact that even in such integrated multinational operations, subsidiaries do undertake learning and innovation (Rasiah, Gopal Krishna, and Sanjivee 2013).

There is now extensive work linking innovation (and technological) capability positively with export performance (Hirch and Bijaoui 1985, pp. 240–241; Teece 1996, pp. 194–195; Smith, Erik, and Mogens 2002; Roper and Love 2002; Biesebroeck 2005; Harris and Li 2006). Hirch and Bijaoui (1985) and Smith et al. (2002) observed a positive connection between exporters and innovation arguing that innovative firms concentrate on export expansion. Smith et al. (2002) went further to show evidence that innovation is faster among exporting than non-exporting firms. Harris and Li (2006) argued that innovation played an important role in overcoming barriers to internationalisation.
Özçelik and Taymaz (2004) showed a positive correlation between product and process innovations and export intensity in Turkish manufacturing. Roper and Love (2002) showed that product innovations had a positive impact on the likelihood and intensity of exports in manufacturing firms in the United Kingdom and Germany. Biesebroeck (2005) asserted that large scale exports may speed up productive activities of manufacturing firms in Sub-Saharan Africa.

However, the lack of differentiation between capabilities and competencies, and innovation effort and result in much of the econometric works has left questions unanswered over the robustness of most of these accounts. Moreover, sector differences may explain why the orientation of production is different in one sector and another. Consistent with evolutionary arguments (see Nelson 2008; Malerba and Nelson 2012), Kirner, Kinkel, and Jaeger (2009) provided quantitative evidence to show that the paths and levels of innovation differs significantly across sectors. For example, Suzuki, Jarvis, and Sexton (2011) argue that the expanding rate of production efficiency and moral hazards has led contracting exporters to vertically integrate in plantation agriculture. This evidence goes against the grain of vertical disintegration and production outsourcing. Hence, we attempt in this paper to disentangle the key sources of technology within clothing production, as well as, construct an innovation capability (IC) index to test differences between the contract and integrated exporters.

While innovation is the key to explaining the effects of technology on exports, like most measures of competitiveness its estimation is elusive (see Lall and Pietrobelli 2001). Hence, we chose to rely on the technological capability literature to undertake this exercise. There is evidence over a strong positive relationship between technological capabilities and export performance in light manufactured goods (Lee and Duong 2010; Rasiah, Mohamad, and Sanjivee 2011; Rasiah and Myint 2013; Rasiah et al. 2013). Hence, this paper uses the concept of technological capabilities, which refer to ‘tangible and intangible assets’ firms acquire or develop to compete (see Bell 1986; Lall 1992). However, while Bell (1986) attempted to add the concept of ‘flow’ and transformation to include higher capabilities it suffered from a serious lack of positioning in the global technology frontier. By only assessing the upgrading patterns and timing at the firm-level, this framework did not have the depth to locate the firm’s technological intensity against lead firms in the particular industry-type.

Nevertheless, the concept of IC is vital as it presents the capacity dimensions that firms hold at a particular time to acquire, learn, adapt, and innovate new products, processes, machinery, and organisational systems. Given its estimation on the basis of embodied technologies, it allows the capture of capabilities that firms possess and have at their disposal to carry out certain specified activity. The types, timing and processes of capability developed was articulated lucidly by Rosenberg (1976). Rosenberg and Frisctak (1985) defined technological capability as a process of accumulating technical knowledge or a process of organisational learning. Dahlman, Ross-Larsen, and Westphal (1987) drew up a sequence of capability deepening that enables firms to upgrade from technology-using to innovation-driving production capabilities, running from production capability to investment capability to IC, which became the basis of the taxonomies of technological capabilities developed by Bell (1986) and Lall (1992).

Rasiah (2009) drew on these contributions to differentiate within production a typology of capabilities based on the depth and trajectory of knowledge among firms by locating them in the international technology ladder by trajectories and taxonomies, which allowed the industry-specific measurement of embodied technological capabilities. However, because innovation in clothing firms located in underdeveloped countries, such as Cambodia, and undertaking cut, make, and pack (CMP) and FOB operations are associated with only incremental upgrading (Rasiah 2009), the analysis in the paper is confined to production capabilities. The confinement of innovation activity to incremental production innovations helps the econometric testing of Sturgeon’s (2002, p. 468) thesis that lead firms or brand holders are more likely to outsource
such activities to firms originating from the developing firms so that they can focus on product innovation and marketing. Although the type of modularisation that Sturgeon took on from electronics (and automotive) manufacturing is not prevalent in the clothing industry the nature of differentiation of stages of production by manufacturing, brand-holding and logistics offers sufficient similarities for testing his thesis in the industry as contract producers role in taking care of full responsibility in manufacturing (including R&D and design) and logistics have expanded sharply (Rasiah 2009).

We hypothesise that contract manufacturers will show at least equivalent technological capabilities as integrated multinational producers. However, because Cambodia is located at the base of the technology trajectory we do not expect firm-level engagement in explicit R&D activities. Hence, we analyse in this paper technological differences between contract manufacturers and integrated manufacturers with a focus on the different components of embodied ICs.

3. Methodology and data

This section introduces the methodology and data used for examining differences in production IC that clothing firms specialise on in locations where the focus of innovation is primarily incremental. In the absence of product R&D operations in Cambodia, we examine a wide range of embodied technological capabilities through which clothing firms generate incremental innovation. Since the focus of clothing production in Cambodia is on low wage (despite the adherence to the International Labour Organization (ILO) convention of minimum wage) low skill labour, none of the statistical results comparing human workforce competencies between contracting and non-contracting firms were significant, and hence, the results analysed in this paper are confined to production ICs.

As presented in the theoretical guide, elements of innovation embodied in production capabilities are important considerations in determining plant level competitiveness. Unlike non-contracting firms who enjoy access to superior production technology from subsidiaries located in superior national and regional innovation systems, contracting firms often import and adapt depreciated machinery and equipment, and absorb and adapt processes, techniques and make layout changes to compete better in international markets (see Lall 1992). Contract clothing manufacturers tend to enjoy strong developmental capability in production at host-sites because their business model is reliant on offering clients greater flexibility and efficiency at lower costs to ensure they are profitable. They are unable to benefit from price premiums resulting from product differentiation as designing and the R&D activity, which are associated with product development, are largely controlled by brand-holding buyers (Gereffi 2001).

The questionnaire to collect data and the variables were defined only after a pilot study of five clothing firms in 2011. The pilot study involved a detailed visit over a day each to the five firms, two integrated multinational producers, and three contract manufacturers (two foreign and one national). The purpose was to understand the dynamics of technology and the focus of technological upgrading that the firms considered key to their competitiveness. The firms were recommended to us by the Ministry of commerce. The pilot study showed that only three types of technology related to production capabilities taking place at the host site in Cambodia were important and were researchable (where it did not involve seeking information from headquarters) in the clothing firms in Cambodia.

The focus on training was not extensive and confined largely to in-house activities, though foreign organisations such as the German Technical Cooperation (GTZ) support such activities in Cambodia. We did not find statistically significant differences in human resource capabilities between contracting and non-contracting firms, which could be a consequence of the same Cambodian workforce hired by both sets of firms. We found statistically significant differences collectively in the introduction of cutting-edge process techniques, such as total quality management
(TQM), total preventive maintenance (TPM), materials requirement planning (MRP), statistical process control, certification with the at least one of international standards organisation (ISO) series, which the pilot study showed as critical for firms to improve coordination of production, as well as, delivery of inputs and output. Hence, the sources of incremental innovation within production capability that we examine in this paper is confined to upgrading of machinery and equipment, improvements to fabric and other materials (e.g. thread, zippers and buttons) use, changes to plant layout, and changes to the organisational structure.

### 3.1. Specification of variables

The dependent, explanatory and control variables are specified in this section. The firm-level dependent variables refer to the components of production and human resource technology and IC. We have differentiated the dependent variables by cutting-edge techniques and processes (CTP), IC, and human resource practices (HRP). The composition of these variables are explained in this section.

### 3.2. Dependent variables

Three technology variables were formulated as dependent variables, namely, CTP, IC, and HRP. All three are framed as multinomial logistic variables through the integration of several proxies.

#### 3.2.1. Cutting-edge techniques and processes

We expanded from the original components identified by Sturgeon (2002, p. 467) on the CTP following the pilot study of clothing firms in Cambodia.

CTP in this paper was counted as 1 each time a firm reported having introduced a CTP, and 0 otherwise. CTP was estimated as follows:

\[ CTP_i = SQC_i + TPM_i + QCC_i + MRP_i + QS_i + JIT_i + Ka_i + ISO_i + OTH_i, \]

where \( SQC_i \), \( TPM_i \), \( SCM_i \), \( QCC_i \), \( MRP_i \), \( QS_i \), \( MST_i \), \( Ka_i \), \( ISO_i \), and \( OTH_i \) refer to statistical quality control (SQC), total preventive maintenance (TPM), supply chain management (SCM), quality control circles (QCC), materials requirement planning (MRP), quality standards (QS), minimum stock turnaround (MST), kaizen (Ka),\(^1\) international standards organization (ISO) certification, and other techniques (OTH) used in firm \( i \).

#### 3.2.2. Innovation capability

Schumpeter’s (1961, p. 66) definition of entrepreneurship was used as the basis for examining IC in the paper,\(^2\) namely,

1. The introduction of a new good. This good can be completely new or adapted from existing sources of knowledge.
2. The introduction of a new method of production. This method can be either completely new or absorbed from other industries.
3. Opening of a new market. Rather than simply exporting to a new geographical market, it involves at least some adaptation to meet the new market.
4. Conquest of a new source of raw material or intermediate goods supply. It refers to a lowering of material or intermediate good cost as a consequence of identifying cheaper alternative suppliers.
Carrying out of a new organisation of industry. We include in organisation of the firm or the production process.

Hence, IC refers to new forms or changes made to products, processes or the organisation of the firm, or other internal parts of the production system in the clothing firms, and was measured as follows:

\[ IC_i = ME_i + PL_i + MAT_i + ORG_i + ICT_i, \]

where \( ME_i \), \( PL_i \), \( MAT_i \), \( ORG_i \), and \( ICT_i \) refer to the upgrading made to machinery and equipment, production layout, materials, materials used in the production, organisational change, and use of information and communication technology to support production in firm \( i \) in 2011. A score of 1 was given if the firm reported yes and 0 otherwise. Since the integrated multinational producers are likely to access their superior technological capabilities from their subsidiaries located in the more developed countries (Amsden and Chu 2003; Amsden and Tschang 2003), we expect contract firms to upgrade their ICs at host-sites to compete more effectively internationally. While all integrated multinational producers were foreign owned, most contract clothing firms were also foreign owned. Except for three national firms, the remaining contract firms were controlled by firms from Taiwan, China, South Korea, Singapore, and Malaysia with equity exceeding 50%.

### 3.2.3. Human resource practices

HRP refer to firm-level practices that are considered to enrich the human resource of the clothing firms. It was measured as follows:

\[ HRP_i = EM_i + IN_i + MCE_i + FE_i + PA_i + IGL_i + SUM_i + EF_i + OTH_i, \]

where \( EM_i \), \( IN_i \), \( MCE_i \), \( FE_i \), \( PA_i \), \( IGL_i \), \( SUM_i \), \( EF_i \), \( OTH_i \) refer to the emphasis on teamwork, informal contact between managers of different units, multi-skilling and cross-expertise, feedback from marketing for technology and R&D, participation from lower level employees, independent and group learning, strong upward mobility of employees, environment-friendly measures facing employees, and other practices to support production in firm \( i \) in 2011. All variables were counted as 1 if the firm reported having such a practice, and 0 otherwise. They were then added to form HRP.

### 3.3. Explanatory variable

Using a binary classification, contract manufacturers were classified as 1 and integrated multinational producers are 0. Hence, the explanatory variable is a dummy, which is measured as:

\[ TE = \begin{cases} 1 & \text{if the enterprise is a contract manufacturer;} \\ 0 & \text{if the enterprise is an integrated multinational producer,} \end{cases} \]

where \( TE \) refers to the type of enterprise.

### 3.4. Control variables

We used three control variables. Labour and capital inputs were included because they are factors of production, while age was included to remove the significance of the constant in the HRP regressions.
3.4.1. Labour and capital inputs

Labour (L) and capital (K) inputs were used as control variables. They were measured using employment and fixed capital respectively, and were measured as follows:

Labour input = \( \ln(L) \) of firm \( i \) in year 2011.
Capital input = \( \ln(K) \) of firm \( i \) in year 2011.

3.4.2. Age

We used age as a control variable. Age (A) was measured as follows:

\[ A = \text{number of years in operation in Cambodia in 2011}. \]

3.4.3. Data

The data for this paper were gathered from the registered list of 283 clothing firms in the country, by officials of the Ministry of Commerce, Cambodia, based on a stratified sampling procedure taking account of ownership, and size (employment). All nationalities of foreign firms were classified together. Because there were only medium and large firms, size was selected based on these categories. The officials sent out 100 questionnaires and managed to receive 94 responses in 2012. We dropped three firms because of incomplete data. Unless otherwise stated the data used is for the year 2011. The sample questions’ response rate of 91% easily passed the Cronbach-alpha sample validity statistics of 70% (Tavakol and Dennick 2011). Of the 91 firms in our sample, 80 fully export all clothing produced. The breakdown by contract manufacturers and integrated multinational producers was 55 and 36 respectively (see Table 1). Integrated manufacturers were from China, Hong Kong, South Korea, Taiwan, and Malaysia. These firms had the entire value chain spread internationally. However, their own branded clothing (e.g. Padini, Allan Dillon, and Bang Bang) were largely sold in the developing countries, while they exported a share of their output to sales outlets in the developed countries for the large brand holders, such as JC Penney, Walmart, and Levis Strauss. Contract manufacturers are firms that undertook only clothing manufacturing for export to buyers.

4. Statistical results

The paper first examines the descriptive statistics by employing the Levene’s two-tailed \( t \)-tests comparing the means of technology capabilities of contracting and non-contracting firms. The Levene’s two-tailed \( t \)-test is used for evaluating the homogeneity of variance between two sets of composite indices. When the Levene’s two-tailed \( t \)-test is insignificant, then we used the

<table>
<thead>
<tr>
<th>Type of exporters</th>
<th>Garment firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sampled contract manufacturers</td>
<td>55</td>
</tr>
<tr>
<td>Sampled integrated multinational producers</td>
<td>36</td>
</tr>
<tr>
<td>Sampled Responses Used</td>
<td>91</td>
</tr>
<tr>
<td>Sampled Firms</td>
<td>100</td>
</tr>
<tr>
<td>Response rate</td>
<td>91%</td>
</tr>
<tr>
<td>Population</td>
<td>283</td>
</tr>
<tr>
<td>Sample share in population</td>
<td>32.2%</td>
</tr>
</tbody>
</table>

Source: Ministry of Commerce, Cambodia.
results of the equal variances assumed (independent samples) to compare means between two
groups. The paper then uses tobit regressions to estimate these differences while controlling
for Labour (Ln[L]) and capital (Ln[K]) inputs and age.

4.1. **Descriptive statistics**

This section examines differences in innovation variables between contract and integrated
clothing manufacturing firms in Cambodia (see Table 2). Except for ME, contract firms
show higher technological capabilities and show larger workforce. Integrated clothing firms
not only use newer machinery and equipment, but also hire less workers and are more capital-

Intensive.

Contract firms show a statistically significant (at 10% level) advantage in CTP over integrated
multinational producers (see Table 2). Contract firms enjoyed statistically significant higher
means than integrated multinational producers in TPM (1%), TQM (5%), MRP (1%), QS
(10%), and Ka (5%). Among the process technology techniques, integrated multinational
producers enjoyed higher incidence only in quality control circles (QCCs). The findings
largely support our hypothesis that contractors are likely to undertake more learning and
innovation activities at host-sites located in the least developed countries than integrated multi-
national producers.

The simple comparison of innovation activities related to processes, techniques, use of
information communication technology (ICT) in computer aided design (CAD), computer

<table>
<thead>
<tr>
<th></th>
<th>TE</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>SE</th>
<th>t-stat (of mean)</th>
</tr>
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<tbody>
<tr>
<td>CTP</td>
<td>0</td>
<td>55</td>
<td>3.56</td>
<td>1.70</td>
<td>0.28</td>
<td>−1.98*</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>36</td>
<td>4.31</td>
<td>1.89</td>
<td>0.26</td>
<td></td>
</tr>
<tr>
<td>SQC</td>
<td>0</td>
<td>36</td>
<td>0.56</td>
<td>0.50</td>
<td>0.08</td>
<td>−1.47</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>55</td>
<td>0.71</td>
<td>0.46</td>
<td>0.06</td>
<td></td>
</tr>
<tr>
<td>TPM</td>
<td>0</td>
<td>36</td>
<td>0.14</td>
<td>0.35</td>
<td>0.06</td>
<td>−3.33***</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>55</td>
<td>0.44</td>
<td>0.50</td>
<td>0.07</td>
<td></td>
</tr>
<tr>
<td>TQM</td>
<td>0</td>
<td>36</td>
<td>0.33</td>
<td>0.48</td>
<td>0.08</td>
<td>−2.57**</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>55</td>
<td>0.60</td>
<td>0.49</td>
<td>0.07</td>
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<tr>
<td>QCC</td>
<td>0</td>
<td>36</td>
<td>0.69</td>
<td>0.47</td>
<td>0.08</td>
<td>3.25***</td>
</tr>
<tr>
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<td>55</td>
<td>0.36</td>
<td>0.49</td>
<td>0.07</td>
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<tr>
<td>MRP</td>
<td>0</td>
<td>36</td>
<td>0.22</td>
<td>0.42</td>
<td>0.07</td>
<td>−3.12***</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>55</td>
<td>0.53</td>
<td>0.50</td>
<td>0.07</td>
<td></td>
</tr>
<tr>
<td>QS</td>
<td>0</td>
<td>36</td>
<td>0.69</td>
<td>0.47</td>
<td>0.08</td>
<td>−1.98*</td>
</tr>
<tr>
<td></td>
<td>1</td>
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<td>0.87</td>
<td>0.34</td>
<td>0.05</td>
<td>1.04</td>
</tr>
<tr>
<td>JIT</td>
<td>0</td>
<td>36</td>
<td>0.69</td>
<td>0.47</td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>43</td>
<td>0.58</td>
<td>0.50</td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td>Ka</td>
<td>0</td>
<td>36</td>
<td>0.08</td>
<td>0.28</td>
<td>0.05</td>
<td>−2.11**</td>
</tr>
<tr>
<td></td>
<td>1</td>
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<td>0.26</td>
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<tr>
<td>ISO</td>
<td>0</td>
<td>36</td>
<td>0.11</td>
<td>0.32</td>
<td>0.05</td>
<td>−0.71</td>
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<td>1</td>
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<td>0.38</td>
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<tr>
<td>OTH</td>
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<td>0.17</td>
<td>0.03</td>
<td>0.06</td>
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<tr>
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<td>1</td>
<td>39</td>
<td>0.03</td>
<td>0.16</td>
<td>0.03</td>
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</tr>
</tbody>
</table>

* Statistical significance at 10%.
** Statistical significance at 5%.
*** Statistical significance at 1%.

Source: Computed from Cambodia clothing survey data using SPSS 19.0 for Windows package.
aided manufacturing (CAM), and SCM, process R&D in reducing material (fabric) spoilage and wastage, organisational change and supporting showed contract firms to enjoy higher capabilities than integrated multinational producers. As shown in Table 3, contract firms show higher IC than integrated multinational producers, and it is statistically highly significant (1%). Among the components of IC, contract firms enjoyed statistically significant higher means than integrated multinational producers in MAT (5%), ICT (10%), and ORG (1%). Integrated multinational producers only showed a statistically higher mean in ME (10%).

Not only is the HRP mean for contract and integrated multinational producers almost equal, they were also not statistically significant (Table 4). Among the components of HRP, contract firms show a statistically significant advantage over integrated multinational producers in FE (1%) and PA (5%). Integrated multinational producers only showed a statistically significant higher mean in EF, which could be a consequence of observance of standards originating from their parent locations in the developed countries. The results involving other HRP practices were not statistically significant. Hence, there is no clear difference between contract and integrated multinational producers in HRP suggesting that contract firms are comparable to those utilised by integrated multinational producers.

In short, contract firms enjoyed higher CTP and IC than integrated multinational producers but not in HRP. Interviews with two integrated multinational producers’ show that they enjoy access to superior technology from their parent plants and subsidiaries abroad so as to reduce labour control problems in Cambodia. Nevertheless, the results show that contract firms have managed to respond to competition by absorbing innovation-intensive higher value added activities from buyers through greater effort it CTP and IC.

### 4.2. Econometric analysis

We employed tobit equations due to the fact that dependent variable was censored on both sides. The purpose is to test if the statistical differences between contract firms and integrated multinational producers are still significant after controlling for labour and capital inputs, and age. CTP, IC, and HRP were introduced both as composite indices, as well as, individual components, but
were not examined together in the regressions because of colinearity problems (see Appendix 1). The following tobit equations were specified for this exercise:

\[ CTP_i = \beta_0 + \beta_1 TE_i + \beta_2 \ln(L_i) + \beta_3 \ln(K_i) + \beta_4 A_i, \]  
\[ IC_i = \beta_0 + \beta_1 TE_i + \beta_2 \ln(L_i) + \beta_3 \ln(K_i) + \beta_4 A_i, \]  
\[ HRP_i = \beta_0 + \beta_1 TE_i + \beta_2 \ln(L_i) + \beta_3 \ln(K_i) + \beta_4 A_i. \]

Because the constant is not significant we assume that there is no endogeneity problem in all three models. The integrated variables of CTP and IC were statistically significant with the positive coefficients showing that contract manufacturers enjoyed a strong advantage over integrated multinational producers in both types of IC, that is, IC at 1% level and CTP at 10% level reinforcing our earlier finding over the upgrading impact of changes in the clothing value chain following the outsourcing of innovation and other higher value added activities by lead firms (see Table 5). The likelihood of firms being contract manufacturers engaging in CTP, and IC activities is 75% and 71% respectively, compared to 25% and 29% respectively among integrated multinational producers. However, HRP was insignificant. Hence, even after controlling for capital and labour inputs, and age, contract firms enjoyed higher IC and CTP than integrated multinational producers. No such advantages were found in HRP.

The results show that contract manufacturers undertake more innovation activities associated with inventory and quality control techniques and also show more IC at host-sites than integrated multinational producers to meet the standards required to supply clothing buyers (especially the

Table 4: Levene’s two-tailed t-test results, HRP and its components, employment and capital-intensity, clothing firms, Cambodia, 2011.

<table>
<thead>
<tr>
<th></th>
<th>TE</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>SE</th>
<th>t-stat (of mean)</th>
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</thead>
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<td>4.70</td>
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</tr>
<tr>
<td></td>
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<td>55</td>
<td>30.44</td>
<td>4.72</td>
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<td>EM</td>
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<td>4.31</td>
<td>0.79</td>
<td>0.13</td>
<td>-0.02</td>
</tr>
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<td></td>
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<td>55</td>
<td>4.31</td>
<td>0.79</td>
<td>0.11</td>
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</tr>
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<td>IN</td>
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<td>36</td>
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<td>1.00</td>
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<td>-0.21</td>
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<tr>
<td>MCE</td>
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<td>3.83</td>
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<td>-0.16</td>
</tr>
<tr>
<td></td>
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<td>55</td>
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<td>0.97</td>
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<tr>
<td>FE</td>
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<td>1.17</td>
<td>0.19</td>
<td>-3.40***</td>
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<tr>
<td></td>
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<td>55</td>
<td>3.65</td>
<td>0.82</td>
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<td>PA</td>
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<td>3.00</td>
<td>0.76</td>
<td>0.13</td>
<td>-2.43**</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>55</td>
<td>3.40</td>
<td>0.78</td>
<td>0.11</td>
<td></td>
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<td>0.86</td>
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<td>0.69</td>
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<td>1.62</td>
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<td>0.89</td>
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<tr>
<td>EF</td>
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<td>0.65</td>
<td>0.11</td>
<td>1.74*</td>
</tr>
<tr>
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<td>3.76</td>
<td>0.74</td>
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<td>0.46</td>
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<td>0.17</td>
<td></td>
</tr>
</tbody>
</table>

* Statistical significance at 10%.
** Statistical significance at 5%.
*** Statistical significance at 1%.

Source: Computed from Cambodia clothing survey data using SPSS 19.0 for Windows package.
brand holders). Integrated multinational producers internalise and transfer much of the capabilities directly from parent plants and subsidiaries. However, there were no differences in HRP between the two types of producers, which could be a consequence of the firms operating in the same labour market environment and facing the same market structures. A separate study is required to confirm this statistically.

Taken together, the evidence shows that contract clothing firms in Cambodia that demonstrate higher CTP, and ICs than integrated multinational producers. However, there was no obvious difference in HRP between the two types of firms.

5. Conclusions

Using a randomised sample of clothing firms in Cambodia, this paper set out to test the hypothesis that contract manufacturers participate more on innovation and process technology activities than integrated multinational operations at host-sites. Gereffi’s (2001) and Gereffi et al. (2005) framework positing that lead firms have increasingly started to focus on product R&D and marketing operations, thereby leaving R&D activities to related to processes, and product adaptation to contractors. Because integrated multinational producers have access to superior ICs at their home-sites (Amsden and Tschang 2003), we hypothesised that they will show less innovation and process technology capabilities than contract manufacturers at host-sites.

The empirical evidence using both the Levene’s two-tailed t-test, and tobit regressions controlling for labour and capital inputs, and age, support our hypothesis. Contract firms enjoyed higher means than international multinational producers with in CTP, IC, and HRP. When not controlled for labour and capital inputs, and age, integrated multinational producers only enjoyed higher ME, QCC, and EF means than contract manufacturers. Contract firms enjoyed higher statistically significant means than integrated multinational producers in TPM, TQM, MRP, Ka, MAT, ICT, ORG, FE, and PA. The tobit regression results showed that contract manufacturers enjoyed a statistically higher mean in both CTP and IC when controlled for labour and capital inputs, and age. These results offer econometric evidence to support the argument that contractors undertake more learning and innovation activities at least developed host-sites than integrated multinational producers in the clothing industry.

Table 5: Tobit regression, CTP, IC, and HRP, clothing firms, Cambodia, 2011.

<table>
<thead>
<tr>
<th>Variable</th>
<th>1(DV = CTP)</th>
<th>2(DV = IC)</th>
<th>3(DV = HRP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.53(2.09)</td>
<td>0.16(1.52)</td>
<td>9.07(11.48)</td>
</tr>
<tr>
<td>TE</td>
<td>0.75(0.39)*</td>
<td>0.71(0.28)**</td>
<td>0.38(1.02)</td>
</tr>
<tr>
<td>Ln(L)</td>
<td>0.15(0.27)</td>
<td>0.20(0.19)</td>
<td>-0.13(0.70)</td>
</tr>
<tr>
<td>Ln(K)</td>
<td>0.15(0.11)</td>
<td>0.05(0.08)</td>
<td>0.20(0.28)</td>
</tr>
<tr>
<td>A</td>
<td>0.21(0.33)</td>
<td>0.15(0.16)</td>
<td>-0.37(0.11)**</td>
</tr>
<tr>
<td>LL</td>
<td>-181.28***</td>
<td>-150.47***</td>
<td>273.99***</td>
</tr>
<tr>
<td>Pseudo R²</td>
<td>0.435</td>
<td>0.379</td>
<td>0.122</td>
</tr>
<tr>
<td>Left</td>
<td>3</td>
<td>5</td>
<td>22</td>
</tr>
<tr>
<td>Right</td>
<td>1</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>N</td>
<td>91</td>
<td>91</td>
<td>91</td>
</tr>
</tbody>
</table>

* Statistical significance at 10%.
** Statistical significance at 5%.
*** Statistical significance at 1%.
Note: Figures in parentheses represent standard errors.
Source: Computed using Eviews 6.
The findings also provide evidence that developments in the clothing value chain has offered upgrading opportunities at underdeveloped host-sites. Hence, firms from latecomer countries can break in into such value chains and strategise to upgrade their ICs by focusing on CTP, and ICs related to production technology. However, keeping to the evolutionary argument, that industries are different, these findings should be confined to clothing firms in the least developed countries. Governments in the poor economies should attract foreign firms even if they start initially in low value added CMP operations. In doing so it is also good to woo latecomer contract firms seeking to access developed markets through quota privileges provided the host-government has in place a well-crafted leveraging strategy to stimulate upgrading in the firms. Such strategies should be organised around broader efforts to develop the systemic pillars (Rasiah 2007). This study is not bereft of limitations as we used cross-sectional data, which does not allow for the establishment of causality. Future studies should undertake longitudinal analyses to trace upgrading.

Acknowledgements
The authors thank three anonymous referees for their constructive comments.

Funding
We wish to thank the University of Malaya research grant for funding the purchase of the data.

Notes
2. The translation uses the term ‘development’ rather than ‘innovation’. However, we have preferred innovation in this paper as it refers to innovations other than those that are drawn from those dependent on scientific knowledge new to the universe (Schumpeter 1961, p. 66).
3. Chettra Kuo from the Ministry of Commerce, Cambodia, coordinated the data collection from funds paid from the University of Malaya research grant (UMRG).

References


Appendix 1. Pearson correlation coefficient matrix on dependent, independent and control variables, Cambodia, 2011

<table>
<thead>
<tr>
<th></th>
<th>CTP</th>
<th>IC</th>
<th>HRP</th>
<th>TE</th>
<th>L</th>
<th>K</th>
<th>A</th>
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</thead>
<tbody>
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<td>CTP</td>
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<td></td>
<td></td>
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<tr>
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<td>1.00</td>
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<td>0.24**</td>
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</tr>
<tr>
<td>TE</td>
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<td>0.30***</td>
<td>0.05</td>
<td>1</td>
<td></td>
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</tr>
<tr>
<td>L</td>
<td>0.12</td>
<td>0.15</td>
<td>0.01</td>
<td>0.20*</td>
<td>1</td>
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<tr>
<td>K</td>
<td>0.14</td>
<td>0.07</td>
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<td>0.19*</td>
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<td>AGE</td>
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<td>0.07</td>
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<td>1</td>
</tr>
</tbody>
</table>

* Statistical significance at 10%.
** Statistical significance at 5%.
*** Statistical significance at 1%.
Source: Computed using SPSS 19.0.