

# Governing health and safety at lower tiers of the computer industry global value chain

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## Abstract

Global brands remain under increasing pressure to ensure labor standards and codes of conduct are met by their suppliers. Little is known about how this is addressed by lower tier suppliers. We investigate whether, and how, occupational health and safety standards permeate down the computer industry value chain. We compare first and second tier suppliers' engagement with a private voluntary industry code, the Electronic Industry Code of Conduct, and the publicly regulated European Union Directive on the Restriction of Hazardous Substances. We find the industry code absent at the lower tier, yet second tier suppliers do implement the European Union Directive. This is achieved without support from public agencies or global value chain linkages. Our findings question the emphasis placed on chain governance in studies of labor compliance in global value chains, and suggest that alternative and complementary approaches may be required for effective labor compliance throughout the value chain.

**Keywords:** computer industry, global value chains, labor standards, Malaysia, regulation.

## 1. Introduction

Improving labor and environmental conditions within global value chains (GVCs) is a key concern for many firms, shareholders, and civil society organizations (CSOs) (Ponte & Gibbon 2005; Nadvi 2008; Mayer & Gereffi 2010). This has led to a steady rise in the use of private standards and codes of conduct developed by firms, industry groups, CSOs, and international institutions across many global industries (Jenkins *et al.* 2002; Nadvi & Wältring 2004; O'Rourke 2005; Weil & Mallo 2007; Bartley 2010; Büthe 2010; Büthe & Mattli 2011; Loconto & Fueilleux 2013). It has also resulted in public regulatory interventions, including via legislation and enforcement (Amengual 2010; Bartley 2011). Various researchers note, however, that standards rarely reach lower tier suppliers (Pun 2005; Chan 2010; Locke 2013). This is especially pronounced where suppliers operate in home-based and informal settings (Mezzadri 2014). In sectors where lower tier suppliers function within formal manufacturing arrangements the expectation would be that standards, especially on occupational health and safety (OHS), should be more easily met. This, however, is an area where evidence remains limited. Most studies using the GVC framework to investigate suppliers' compliance with environmental and labor norms focus on the relationship between lead firms and first tier suppliers (Gereffi *et al.* 2005;

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Barrientos & Smith 2007). We know very little about the interaction on compliance between first and second tier suppliers. We seek to fill this gap. We focus on the global computer industry, and investigate the engagement with OHS standards by first *and* second tier suppliers within the GVC. Our central research question is: *How do occupational health and safety standards permeate down the value chain?* We address this question through a comparative discussion of two distinct standards which have an impact on OHS: one driven by global private industry actors – the Electronic Industry Citizenship Coalition's Electronic Industry Code of Conduct (EICC); the other by market access linked public regulation – the European Union's (EU) Directive on the Restriction of Hazardous Substances (RoHS).

We explore OHS governance between first and second tier suppliers producing printed circuit boards (PCB) in Penang, Malaysia for major global brands including Hewlett Packard (HP). HP has been an industry pioneer on labor compliance, supply chain transparency, and supplier governance over labor conditions. HP's code of conduct defined the parameters of the EICC. Our findings, in line with earlier studies, suggest that levels of actual compliance with the EICC code diminish as one moves down to lower tier suppliers (Raj-Reichert 2011; Locke 2013). However, we find that second tier suppliers respond positively to the RoHS and without assistance from their customers or public agencies. These findings suggest that for lower tier suppliers, who are often not targets for capacity building efforts by GVC lead firms, nor face external pressures from CSOs over labor conditions, other drivers may be needed for improving working conditions.

The paper is structured as follows: the next section presents our theoretical framework. Section three outlines our methodology. Section four describes and compares the scope and compliance requirements of the EICC and RoHS. Section five presents a brief discussion of the first tier suppliers interviewed and their level of engagement over OHS governance of their (second tier) suppliers. Section six details our findings from the case studies of second tier suppliers. Section seven concludes.

## 2. Governing labor conditions in global value chains

The GVC framework maps the transformation of raw materials into final products and services through various processes often undertaken by distinct actors across different geographical locations. It has been used to explain the governance of globally fragmented production systems (Gereffi *et al.* 2005; Ponte & Gibbon 2005; Ponte & Sturgeon 2014). A key observation from GVC analysis is that lead firms exercise power and control over the chain through their ability to coordinate ties between disparate suppliers. The degree of power asymmetry between lead firms and their suppliers, and the governance of chain ties, is determined by the capabilities of suppliers, the complexity of the transaction, and the degree to which it can be effectively codified (Gereffi *et al.* 2005). This leads to specific forms of network, and increasingly multipolar governance between lead firms and their suppliers.

A substantial and growing interest in both conceptual and empirical streams within GVC research is the governance of labor standards within global production arrangements and the implications for improving working conditions in outsourced factories in developing countries (Ponte & Gibbon 2005; Nadvi 2008; Barrientos *et al.* 2010; Lund-Thomsen & Nadvi 2010; Ponte *et al.* 2011; Raj-Reichert 2011; Locke 2013). Much of this research illustrates how labor compliance can shape governance ties between lead firms and first tier suppliers. Compliance is critical to reducing risks and ensuring brand integrity for lead firms. Consequently, in some sectors, such as sporting goods, where brand value is significant, lead firms often confront labor compliance

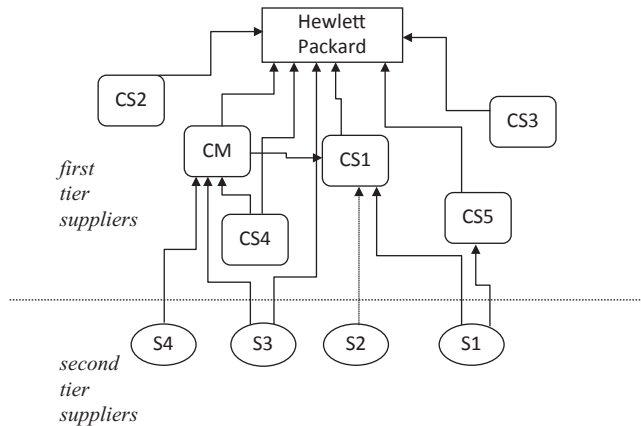
challenges by closely monitoring suppliers and enforcing relatively captive and even hierarchical governance ties if supplier capabilities are low (Nadvi *et al.* 2011; Lund-Thomsen *et al.* 2012). In apparel, where dismal working conditions continue to result in tragic outcomes, unease on labor compliance has led to industry-wide initiatives and awareness that process upgrading is often necessary for better worker outcomes (Locke & Romis 2007; Levi-Faur & Starobin 2014). In China's electronics and auto industries, where overtime pressures and limited workers' rights have resulted in workers' suicides and strikes (Chan 2013; Chan 2014), labor conditions remain a critical dimension of GVC governance arrangements. Whether the myriad private labor standards and codes of conduct to address such concerns have substantially improved working conditions in outsourced electronic factories remains unclear (Locke 2013). Some would argue that they have not (Pun 2005; Chan 2010). These concerns also apply to OHS hazards (Raj-Reichert 2011). This is especially significant in the computer electronics industry, where incidences of illness and death from hazardous chemical exposures continue to raise doubts on the effectiveness of OHS measures in computer electronics factories (LaDou & Rohm 1998; Smith *et al.* 2006; Brown 2009).

GVC researchers have seldom gone beyond an analysis of labor governance of first tier suppliers. Hence, there is little understanding of the governance relationships around labor conditions between first and second tier suppliers. Filling this lacuna is important because first tier suppliers in many industries, and particularly in electronics, rely on a much larger supplier base than lead firms within the industry. Supply chain labor governance challenges can, thus, be of far greater magnitude for first tier firms. This raises questions about how effectively lead firms' codes of conduct permeate down GVCs. First tier suppliers must reach larger numbers of second tier suppliers, and often with fewer resources devoted to supplier governance, as compared with lead firms. Incentives for maintaining long-term contracts with second tier suppliers are also less frequent, thereby reducing opportunities for strong inter-firm governance relationships. This is further compounded by the often weak technological and financial capabilities of many second and lower tier suppliers, and their inability to invest in better working conditions and cleaner production methods. Finally, second tier suppliers are rarely subjected to similar levels of external scrutiny by CSO campaigns. It is clearly at these lower tiers of GVCs where the greatest challenges on labor conditions often lie. To ensure effective governance of labor standards, it is critical to assess how lower tier firms receive standards and codes of conduct, and what drives them to comply if monitoring and enforcement activities weaken as one moves down the value chain.

### 3. Methodology

This paper draws on research undertaken in 2008 and 2010 in Europe, the United States (US), and Malaysia. A total of 36 respondents were interviewed, including 14 firm actors, 12 CSO and trade union respondents and key informants, and eight representatives of leading Malaysian public agencies. Firm respondents included HP's senior manager for global supplier governance; the Corporate Responsibility Director of a key first tier supplier to HP who was also a board member of the Electronic Industry Citizenship Coalition (CS5); senior OHS and corporate social responsibility (CSR) managers at the Penang manufacturing sites of five multinational first tier suppliers to HP (CS1 to CS4); and managers and senior OHS officers at seven second tier suppliers (S1 to S7) in Penang.<sup>1</sup>

Hewlett Packard (HP) was chosen as the brand firm because it had, at the time, the biggest share in the global personal computers market, managed one of the largest global supply chains



**Figure 1** Linkages between firms interviewed in the computer industry global value chain (CM designates a contract manufacturer and CS a component supplier.)

in the electronics industry, was the first to develop a supplier governance program, and was the recognized industry leader on the Electronic Industry Citizenship Coalition. HP's supplier governance program (including the EICC) is enforced only on its first tier suppliers. To help drive governance down the GVC, HP monitored first tier suppliers and trained some of them to govern and audit their own (second tier) suppliers. Thus, within the HP supply chain, the onus was on first tier suppliers to push the EICC down to second tier suppliers (Raj-Reichert 2011).

First tier suppliers were identified from the top 100 supplier list released by HP in 2008.<sup>2</sup> Unlike HP, none of the first tier firms publicly listed their own suppliers. Consequently, second tier suppliers in Penang were located through an online directory of electronics firms hosted by <http://www.InvestPenang.gov.my>. The directory records firms engaged in the PCB industry, including local manufacturing sites of some of HP's top 100 first tier suppliers and second tier firms. We purposely selected some of the most prominent and largest of HP's first tier suppliers on the grounds that these would be best endowed, and, thus, most likely to promote their own supplier governance programs. Second tier suppliers were randomly selected. Hence, while we adopted a positive sampling bias at the first tier, no such bias was sought at the second tier. In total, 28 firms, both multinational and local, were contacted for interviews. Out of these, six first tier suppliers<sup>3</sup> and seven second tier suppliers were interviewed. To ensure that we followed the HP supply chain we used firm websites and interviews to confirm that the second tier suppliers selected in Penang were supplying to HP's first tier suppliers (see Fig. 1).<sup>4</sup>

Through semi-structured firm interviews we identified each supplier's role within the chain; its engagement in private governance activities surrounding OHS, including interactions with external actors, such as customer firms and CSOs; its experiences and level of engagement with public regulatory agencies and processes; the drivers of OHS governance; and the potential challenges OHS concerns posed for the firm. Interviews averaged 90 minutes, but some extended over three hours and involved multiple meetings. Many interviews were recorded and transcribed, and standard ethical guidelines were followed.

#### 4. Private and public standards in the electronics industry

We explored how far two specific standards pertaining to OHS, one "private" and voluntary, the other "public" and regulatory, reached second tier suppliers in the computer industry GVC. The

standards considered were the EICC and the RoHS Directive. The EICC is an industry wide code of conduct. Since its development in 2004, it has steadily gained membership and includes most major brands and key contract manufacturers in the computer industry. The RoHS is a market access legislation that producers must meet to sell products in the EU. A further distinction is that the EICC is a process standard, concerned with *how* electronics are produced, whereas the RoHS is a product standard that aims to limit hazardous substances *in* electronic products.<sup>5</sup> Yet the RoHS also has important process attributes for OHS. We consider how these two standards vary in terms of their scope, compliance requirements, and implications for firms along the GVC, including lower tier suppliers. We conclude with a summary comparison of the main features of the RoHS and EICC governance mechanisms.

#### 4.1. The Electronic Industry Code of Conduct<sup>6</sup>

The EICC was established by a group of brand firms and contract manufacturers in response to a damning report by a CSO on working conditions in outsourced electronics factories in developing countries (see Raj-Reichert 2011). The EICC specifies guidelines for firm conduct and policies on labor, OHS, the environment, ethics, and management systems. It borrows heavily from the 2002 HP Supplier Code of Conduct and other international standards, such as the Organisation for Economic Cooperation and Development Guidelines for Multinational Enterprises, the Universal Declaration of Human Rights, the International Organization for Standardization (ISO) 14001, the Occupational Health and Safety Assessment Series (OHSAS) 18001, and the European Union Eco-Management and Audit System (Casey 2006; Electronic Industry Code of Conduct v. 3.0). The EICC seeks to replace the myriad standards and codes suppliers often receive from customers with one common industry-wide code, thereby reducing the burden and costs suppliers face in complying with numerous and different paperwork, reporting obligations, and audits.<sup>7</sup> It also aims to lower the costs of compliance within the sector by ensuring that core minimum standards are implemented by all leading brands and contract manufacturers and their supply chains.

On OHS, the EICC draws on OHSAS 18001 and the International Labour Organization (ILO) Guidelines on Occupational Safety and Health, and calls for the use of a management system to address OHS risks. Firms must ensure proper design, engineering, and administrative controls, in addition to maintenance and safe work procedures, training, and the use of personal protective equipment. Emergency situations, injury, illness, and exposure to chemicals have to be identified, classified, assessed, evaluated, and reported on. The EICC is implemented in four phases. In the first phase, member firms introduce the code to their direct suppliers and secure their commitments to implement it. Firms must conduct a “supplier risk assessment” to identify priority or high-risk suppliers for further evaluation. In phase two, the identified suppliers complete an online self-assessment questionnaire, which results in a set of performance metrics and a scorecard identifying areas for improvement. In phase three, supplier performance validations take place through third party audits, corrective action plans, and follow-up audits. Phase four is where firms engage in capacity building through training, education, and collaboration with suppliers (Electronic Industry Citizenship Coalition Annual Report 2008, 2009).

The EICC has become central to the supplier governance program for many brand firms. Since 2009, HP, for example, requires all new and existing suppliers to comply with the EICC. HP also expends a significant amount of resources on supplier governance (Hewlett Packard 2009; Locke 2013; Raj-Reichert 2011).<sup>8</sup> However, as the experience of large and key first tier firms shows, suppliers may not always have the interest and motivation, or allocate sufficient resources to effectively implement the EICC down the supply chain to their (second tier) suppliers. The

case of CS5, a key first tier supplier to HP, illustrates these challenges. CS5 is one of the largest multinational semiconductor manufacturers in the world, with net revenues of US\$10.35 billion in 2010. It has 14 manufacturing sites and 55 research and design centers in 10 countries. According to its Corporate Responsibility Director, CS5 faced various difficulties in pushing the EICC down to its lower tier suppliers. Unlike HP, CS5 had fewer resources allocated for supplier governance. CS5 did not face external pressure by CSOs over labor conditions in its supply chain, which, according to our respondent, contributed to reduced managerial support for a stronger supplier governance program. In 2008, it was not clear if CS5 could complete the first phase of the EICC implementation process. In 2009, four years after joining the Electronic Industry Citizenship Coalition, it had completed the phase one supplier risk assessments for only 27 out of around 12,000 suppliers. Its supplier base was 20 times that of HP's at the time. Our respondent felt the challenges with governing second tier suppliers were common among other large first tier suppliers in the industry (CS5 Annual Report 2009; Raj-Reichert 2011). CS5's experiences underline the different context facing labor compliance challenges for first tier suppliers *versus* brand firms.

#### **4.2. European Union Restriction of Hazardous Substances (RoHS) and the electronics industry**

The RoHS, which came into effect on 1 July 2006, addresses the mounting volume of hazardous electronic waste shipped from developed to developing countries. The RoHS seeks to reduce the hazardous content used in the production of electronic goods, thereby decreasing hazardous waste generated when electronic products are discarded and disassembled. The directive sets very low threshold levels for several hazardous chemicals, including lead, mercury, cadmium, hexavalent chromium, and the brominated flame retardants polybrominated biphenyls and polybrominated diphenylethers (Directive 2002/95/EC).<sup>9</sup> While the RoHS is a product standard, its implementation has a direct and positive impact on factory level OHS by reducing the use of hazardous chemicals within manufacturing processes. For the PCB industry, for example, the removal of lead (which has been used for soldering and can be inhaled by workers) has a significant impact on eliminating OHS risks in PCB factories (National Research Council of the National Academies 2005; LaDou 2006).

The RoHS is enforced by individual EU member states through national laws and regulations. Enforcement takes place either through requests for technical documentation or physical inspection by government agencies. Documentation requests may include information on internal control processes, certification, compliance records, and organizational details of the producer. Physical inspections are used to detect concentration levels of toxic heavy materials in products, in particular, lead, mercury, and cadmium (Calder 2007).

The implications of non-compliance depend on which government agency is charged with enforcing the RoHS. For example, if the Ministry of Environment conducts enforcement through physical inspections, non-compliance can result in a fine and court judgment. If the RoHS is enforced by a customs agency, which is more common, the penalty for non-compliance can be denial of importation. In this case, the importing company would incur the cost of shipping the product back to the country from which it came. In the United Kingdom, for example, the National Measurement Office on behalf of the Department of Business, Innovation and Skills enforces the RoHS through inspections, testing, issuance of corrective actions, and market surveillance (Wright & Elcock 2006; Bogaert *et al.* 2008). In Germany, the Federal Environment Agency is in charge of enforcement. Willful non-compliance can result in fines up to €50,000 (Bogaert *et al.* 2008). Large institutional customers, such as telecom operators, local

governments, and hospitals, normally return purchased products and sever procurement contracts with providers violating the RoHS (Calder 2007).

The RoHS holds brand firms and distributors responsible for ensuring products sold in the EU comply with the Directive's specification. The RoHS has presented significant challenges throughout the electronics industry GVC. Knowing where prohibited materials are present within vast and complex GVCs and ensuring relevant suppliers are RoHS compliant are demanding tasks for brand firms. Material procurement, manufacturing processes, and product designs have had to change to comply with the standard (Veleva & Sethi 2004; Yu *et al.* 2006; Lee & Kim 2011; Koh *et al.* 2012).

In order for brand firms to ensure RoHS compliance down their GVCs, it has been suggested that compliance systems that coordinate and communicate with every level of the supply chain need to be implemented (Calder 2007). Sony, for example, verifies RoHS compliance by its suppliers through pre-audit questionnaires, physical visits, requirements for certificates of non-use of concerned substances, data on chemical contents of concern, and signed agreements to its Green Partner supply chain program (Hirai *et al.* 2005). Because of the complexity and severe penalty of violations, some lead firms have created separate company divisions solely dedicated to RoHS compliance within their supply chains. Some firms have also required suppliers to prove elimination of restricted substances as far back as 2002 – four years before the RoHS came into effect (Goosey 2007).

For suppliers, RoHS compliance entails different reporting requirements, including product testing, inventory management, gathering material composition data, and relevant certifications (Centre for Sustainable Design 2006; Goosey 2007; Gorrepati & Garson 2008). Implementing the RoHS is said to be costly, compounded by a lack of clear guidelines on compliance and standardized testing procedures. For the PCB industry, the main challenge is the removal of lead, which was traditionally used in various materials and components during manufacturing and assembly. Switching to lead free components alters chemical compositions of traditional soldering processes, creating new quality challenges for PCBs. For example, lead free soldering requires much higher temperatures. This implies costly changes involving different components and materials, redesigning processes, and replacing equipment (Goosey 2007; Koh *et al.* 2012).

#### **4.3. Comparing the EICC and the RoHS**

Table 1 provides a comparative overview of the EICC and the RoHS. The EICC is a voluntary industry code covering a wide agenda related to manufacturing processes. The RoHS is a public regulatory standard with a much narrower focus related to hazardous materials in products. Electronic Industry Citizenship Coalition members are expected to implement the code with their direct suppliers, and for suppliers to implement it further down the supply chain. On RoHS compliance, the onus lies with brand firms and distributors. Failure to comply can lead to fines and restricted market access. With the EICC there is an extensive mechanism for ensuring compliance, including independent audits and a focus on training, yet failure to ensure compliance carries no specific costs beyond the need to implement corrective action procedures. We turn now to an assessment of how first and second tier suppliers engage with these specific standards.

### **5. First tier suppliers' challenges with governing occupational health and safety (OHS) standards**

Our aim is to assess how OHS standards travel down the computer industry GVC to first and second tier suppliers. This section discusses the experiences of five key first tier suppliers to HP

**Table 1** Comparison of the governance structures of EICC and RoHS

	EICC	EU RoHS
Year came into force	2004	2006
Type of standard	Private industry voluntary code of conduct; Process standard.	Public regulation (EU Directive) implemented via national laws by individual EU member states; Product standard with process related effects.
Scope	Guidelines on firm conduct and policies on OHS, labor, environment, ethics, and management systems.	Limits hazardous content in products.
Implementation	Firms adopting the code must implement it themselves and with their direct suppliers.	Brand firms and distributors are responsible for ensuring products are in compliance.
Compliance mechanisms	Customer firms conduct supplier risk assessments. Suppliers complete self-assessment questionnaires, audits, and corrective action plans. Uniform procedure for all Electronic Industry Citizenship Coalition members and their suppliers.	Manufacturers provide documentation on internal control processes, material composition data, self-declarations, certifications, or compliance records.
Monitoring and enforcement bodies	Customer firms and third party auditors.	Government agencies (such as environment, OHS ministries/agencies, or customs agencies); Customer firms.
Verification of compliance procedures	EICC validated third party audits (but only for high risk suppliers).	Government agencies conduct testing and physical inspection of products, and market surveillance. Customer firms verify supplier compliance through data on chemical contents in products, certificates of non-use of concerned substances, and factory visits.
Implications of non-compliance	Corrective action plans, company-specific actions.	Fine, court judgment, corrective actions, and denial of market access.

EICC, Electronic Industry Code of Compliance; EU, European Union; OHS, occupational health and safety; RoHS, Restriction of Hazardous Substances.

located in Penang. Almost all suppliers met several international standards, such as ISO 14001, OHSAS 18001, the EICC, and the RoHS (see Table 2). When it came to OHS standards within their own factories, each supplier had certified OHS managers in charge of training production line workers and executing their supplier governance measures.

Brand firms (including HP) rarely engaged directly on OHS with these first tier supplier sites in Penang.<sup>10</sup> OHS managers, company auditors, or third parties arranged by the first tier suppliers' headquarters normally conducted audits. Only two supplier sites, CS3 and CS4, had received OHS auditors from brand firms. This was in contrast with quality and other business related conditions, which were regularly audited by brand firms at most first tier supplier sites. It was not clear, however, whether any of these audits included assessments on the governance outcomes of (second tier) suppliers down the supply chain. In practice, first tier OHS managers



**Table 2** First tier supplier profiles

	CM	CS1	CS2	CS3	CS4
Country incorporated	USA	USA	USA	USA	Singapore
Firm size (employees)	200,000	80,000	15,000 (1,500 in Penang)	1,100 (450 in Penang)	14,000 (1,700 in Penang)
Number of suppliers	20,000	Over 9,000	N/A	N/A	N/A
Private standards complied with	ISO 14001	ISO 14001	ISO 14001	ISO 14001	ISO 14001
Resources for governance measures at the Penang facility	EICC (founding member)	OHSAS 18001	OHSAS 18001	OHSAS 18001	OHSAS 18001
Supplier governance	EHS officer	EICC (since 2004)	EICC (since 2006)	Safety and Health Officer and a Trainee	EICC (since 2008)
Customer audits	Requires ISO 14001	EHS team consisting of engineers and occupational nurses	One Senior Manager for Quality, EHS, Human Resources and Security	Safety and Health Officer and a Trainee	A consultant on EHS
Government inspections on OHS	Not on OHS but on quality	EHS requirements (safety policy and safety guide)	On-site inspections or paper-based assessments	On-site inspections and health declarations	No
EU Directives at Penang site	Not on OHS but on quality	Not on OHS but on quality	No	Yes on OHS	Yes on OHS
	Yes	Yes	No	Yes	Yes
	RoHs, WEEE, REACH†	RoHS, WEEE, REACH	RoHs, WEEE	RoHS	No

†The EU Directive on Registration, Evaluation, Authorisation, and Restriction on Chemicals (REACH) requires firms that manufacture and import chemicals into the EU assess and manage risks and provide safety information to users.  
 EHS, environmental health and safety; EICC, Electronic Industry Code of Compliance; EU, European Union; ISO, International Organization for Standardization; OHS, occupational health and safety; OHSAS, Occupational Health and Safety Assessment Series; RoHS, Restriction of Hazardous Substances.

were minimally engaged in governing their own (second tier) suppliers. While most of the first tier suppliers met several standards, none of them reported requiring their suppliers to do the same. Most of the first tier suppliers required second tier suppliers to have in place OHS self-declarations and meet local regulations. Only two first tier suppliers (CS2 and CS3) reported conducting on-site inspections of their second tier suppliers.

Annual reports of most of the first tier suppliers indicated slow and minimal implementation of the EICC with second tier suppliers. Two large first tier suppliers (CM and CS1) reported assessing less than five percent of their (second tier) suppliers against the EICC in 2008 and 2009. CM, for example, assessed less than two percent of its suppliers against the code in 2008, and in 2009 it worked with less than one percent of its suppliers on corrective action plans (which were, incidentally, on OHS issues).

## 6. Second tier suppliers and OHS standards compliance

As we have argued, second tier suppliers tend to be ignored in much of the research on labor compliance in GVCs. It is this gap we aim to address. Hence, we focus here in more detail on the individual cases of four second tier suppliers in Penang and their experiences in meeting the EICC and the RoHS. All four suppliers were involved in PCB assembly or manufacturing. They shared some common characteristics (see Table 3). Most are Malaysian firms that considered themselves to be small and medium sized enterprises (SMEs) and supplied mainly to multinational corporations (MNCs) in other countries. Besides these general features, there was considerable variation in actual size, positions within the GVC, industry diversification, and resources expended on OHS.

**Table 3** Second tier supplier firm profiles

	Supplier 1	Supplier 2	Supplier 3	Supplier 4
Type of firm: Ownership & Scale	Malaysian MNC	Malaysian SME	Malaysian SME	Malaysian MNC
Number of workers	2,900	30	60 to 70	500 workers in electronics division
Customers	Agilent, Cree, Intel, Ewargo, AMD, Fairchild Semiconductors, ST Microelectronics	Possibly Intel	Sony, Agilent, Flextronics, HP, GSPK	Flextronics, Canon; others located in Europe (e.g. Denmark), Asia and North America
Safety and Health officer	Yes	No	No	Yes
Government inspections over environment, health & safety	Yes	No	Yes	Yes
Customer audits on OHS	No	No	No	No
EICC compliant	No	No	No	No
Other private standards met	ISO 14001	None	None	ISO 14001 OHSAS 18001
RoHS compliant	Yes	No	Yes	Yes

EICC, Electronic Industry Code of Compliance; ISO, International Organization for Standardization; MNC, multinational corporations; OHS, occupational health and safety; OHSAS, Occupational Health and Safety Assessment Series; RoHS, Restriction of Hazardous Substances; SME, small and medium sized enterprises.

For several of the suppliers, governance activities were scarce and weak. None of the suppliers received customer audits on OHS or were requested by their customers (namely first tier firms) to comply with the EICC. Many were not required to comply with any other private standard, including specific codes of conduct of lead firms. Public regulatory oversight on OHS was also reportedly weak. According to the Malaysian legislation on OHS, firms with less than 500 workers in the electronics industry are exempted from having a Safety and Health Committee and a certified Safety and Health Officer (SHO) in place. Further, none of the suppliers interviewed had received assistance from Malaysian government agencies, such as the Department of Occupational Safety and Health (DOSH) or the National Institute for Occupational Safety and Health (NIOSH), on compliance with either public or private OHS standards. Despite these shortcomings, however, the majority of these suppliers complied with the RoHS. We discuss below the reasons behind the prioritization of the RoHS by these suppliers.

### 6.1. Supplier 1

Supplier 1 is a Malaysian firm established in Penang in 1991 and listed on the Kuala Lumpur Stock Exchange in 1997. It is one of the few success stories of a Malaysian supplier that had become a globally integrated MNC. In 2008, it had four manufacturing sites in Malaysia with over 2,500 employees at its Penang facility, sales and distribution centers in the Philippines and China, and a joint venture with a Japanese firm. Among the group of second tier suppliers interviewed, Supplier 1 was the largest firm and the only one undertaking the more technologically advanced PCB manufacturing.

It had a certified SHO and an active Environmental, Health and Safety (EHS) Committee. It also had a team of eight to 10 assigned to implement the environmental management system in compliance with the ISO 14001 standard. This team included an environmental management representative, who was appointed by the CEO and held a managerial role within the firm. This person was reportedly trained by the Standards and Industrial Research Institute of Malaysia (SIRIM) and responsible for conducting internal audits at the firm.

Supplier 1 had several large multinational customers, most of them American and Japanese. These included Intel, Agilent, AMD, and ST Microelectronics. It engaged in several self-regulatory practices over its EHS performance. For example, it produced monthly online reports, conducted internal audits, and received regular third party surveillance audits. The only standards Supplier 1 complied with in 2008 were ISO 14001 and the RoHS. It became ISO 14001 certified in 2004 in response to customer requirements, which came initially from ST Microelectronics and Agilent. Agilent was also among the customers that required Supplier 1 to comply with the RoHS. Reports, including lab reports, were sent to customers to prove RoHS compliance. Each customer was said to have its own RoHS reporting form. At the time of the interview, the supplier was also being asked to meet China RoHS requirements by some customers.<sup>11</sup> Supplier 1 was not requested to comply with the EICC.

When asked about the drivers for OHS standards, the SHO stated “foreign investment” and the “European market.” The SHO differentiated European pressures from US customers who were satisfied with only ISO 14001. The firm’s website also stated “The direction for the world’s environmental regulations tends to be set by European Union Directives.”

When it comes to engagement with regulatory agencies over OHS, Supplier 1 was the only second-tier supplier interviewed that found the Malaysian public agency DOSH beneficial and competent. The SHO found the government to be “well versed in [the] world of standards, foreign investment and the European market.” Supplier 1, however, had not received government assistance to meet international standards, such as the RoHS.

Supplier 1 stands apart from the other second tier suppliers interviewed in many ways. It is a large firm engaged in more technologically advanced manufacturing activities and an important supplier to key first tier suppliers in the industry. It also had generally more capacity and used more resources than the other second tier suppliers for its OHS governance activities. This may be a result of its position in the GVC, which ties it to first tier firms that were key suppliers to brand firms such as HP. Thus, the decision to comply with the RoHS would have been necessary given its large exposure to the EU market.

## 6.2. Supplier 2

Supplier 2 is a Malaysian SME established in 1991 in Penang. It is a small company with around 30 workers. Eighty percent of its business in 2008 was in PCB assembly. It produced tester PCBs for its customers that were not used in final products. The supplier purchased all of its parts and components, assembled them, and shipped them to customers. According to the managing director, it focused on product quality and value and not quantity because prices were too low in the industry. Supplier 2 did not have any OHS personnel because Malaysian legislation exempts it (because of its small size) from needing a certified SHO and a Safety and Health Committee. The managing director assumed responsibility over OHS at the factory and personally trained workers on OHS risks.

The customers of Supplier 2 were MNCs in Penang or close by on the Malaysian mainland. It also exported to Canada and was interested in expanding business to the US, Europe, and Australia. The firm was not aware of the identity of its final customers as products were shipped through a manufacturer's representative. It was policy, according to our respondent, not to ask who the end customers were in order to protect customer identity and intellectual property. However, having previously worked at Intel-Penang, he could identify that Intel was using some of the PCBs assembled in his factory as tester boards.

Supplier 2's managing director had undertaken a part-time two-year course on "Green Environment." This was hosted by the United Nations Environment Program and SIRIM and designed specifically for SMEs. The course provided information on the EU Directives on Waste Electrical and Electronic Equipment and Regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH). Despite this, Supplier 2 did not comply with any international standards on OHS. While ISO 14001 could be requested in the future, the managing director considered the certification costs, estimated in 2008 to be around US\$9000, too expensive for an SME.

Supplier 2 presents a more traditional case of a cost conscious small supplier focused on a niche market of low quantity, high value production, which decided against obtaining costly certifications of international standards. At the same time, it presents a unique position in the GVC where its products do not find their way into a final product. By only producing tester boards, Supplier 2 had effectively kept itself off the radar of labor and OHS governance requests by customers. Because Supplier 2 did not know who its final customers were and was not in contact with them, there were no requests to comply with the EICC. Further, because its PCBs were not destined for the EU, Supplier 2 was not required to comply with the RoHS. Finally, because of its size, Supplier 2 was exempted from having a Safety and Health Committee and a certified SHO. It did not receive government inspections nor did it interact with government agencies, such as DOSH or NIOSH.

## 6.3. Supplier 3

Supplier 3 is a Malaysian firm established in 1997 in Penang. In 2008, it had a workforce of around 70 in its factory. It is a PCB assembler and most of its products were used in satellite

radios and health care machinery at the time of the interview. It purchased boards and raw materials from companies in Taiwan, China, the US, and Europe to assemble into PCBs. According to the company manager, only a few of its completed products were for computers. Although its PCB products can be used in computers, the firm has stayed away from the industry because of price competition with suppliers in China and Taiwan. Instead, it focused its niche on small volumes and highly mixed products. The majority of its products (almost 98%) were exported to the United Kingdom, the US, and Australia. Its customers included top first tier suppliers and brand firms like HP, Sony, Flextronics, and Agilent.<sup>12</sup>

Because of its small size, Supplier 3 was also exempted from having a certified SHO and Safety and Health Committee by Malaysian legislation. When it came to government assistance and oversight on OHS, the manager complained of a lack of support. Supervisors in the company were self-taught on the OHS regulation and trained workers by themselves.

Customer engagement over OHS standards was close to absent for Supplier 3. There had been no customer audits on OHS. There was also no request made to comply with the EICC, despite some of its customers being founding members of the industry code. When asked about customer requests for OHS standards, the manager responded:

Definitely no . . . unless you talk about bigger customers . . . yeah they will. But even then a lot of them once they [complete initial pre-contract] audit they don't really care too much about it anymore.

More interestingly, however, was the decision made by Supplier 3 to conform to the RoHs one year before it came into force. According to the manager, the early compliance, which required costly equipment replacements and changes to production processes, was conducted in order to overcome a lag in supply time. New customers also inquired into how the supplier was meeting the RoHS, making its compliance to the EU Directive imperative.

When it came to the cost implications of RoHS compliance, the manager stated:

We're feeling it . . . because the material cost is ever increasing because of energy cost . . . and it's giving us a problem in terms of cost comparison. And of course our profitability in the business has also been affected by it.

For Supplier 3, cost reductions were crucial for the market. Like Supplier 2, Supplier 3 is a small firm focusing on a low quantity, high value niche market that buffers it from high quantity, low price competition. Despite these resource restrictions, Supplier 3 was positioned in the GVC to export into the EU market. It was forced to face the RoHS requirement and met it one year in advance to avoid disruptions to its orders. Attracting new customers also depended on its RoHS compliance. Because of a lack of interest by customer firms over its OHS conditions, the EICC and other standards proved to be inconsequential for Supplier 3. The RoHS was the only international standard Supplier 3 complied with.

#### 6.4. Supplier 4

Supplier 4 is a Malaysian firm established in 1978. In 1985 it began PCB assembly as a subcontractor to Sony for audio products. In 1996 it became a contract and original equipment manufacturer and moved into some contract design work for its customers. In 2005, it became a publicly listed Consumer Equipment Service Provider in the Singapore Exchange. In 2008 it had six manufacturing sites in Penang and other locations in Malaysia, with others in the Netherlands, Singapore, and China. In its Electronics Manufacturing Services division, production was focused on the automotive, office automation, and consumer electronics industries. Its

customers were located in Europe, Asia, and North America. Its customers included Flextronics and Canon, which were first tier suppliers to HP.<sup>13</sup> According to the Strategic Development Director, most of the business in the Penang factory in 2008 was with the automotive industry. PCBs that entered the electronics industry were at a small scale and supplied to one American customer.

Supplier 4 has a trained chemical health risk assessor and a CSR officer. Given its larger size, Supplier 4 has a Safety and Health Committee and a certified SHO. It has been ISO 14001 certified since 2004. According to our respondent, obtaining ISO 14001 was motivated by a desire “to promote our image as [an] environmental[ly] friendly company.” In 2007, the firm obtained OHSAS 18001 certification to meet a customer requirement. This was the only supplier among the group in compliance with OHSAS 18001. However, the EICC did not feature in any customer requirements despite one of its customer firms being an Electronic Industry Citizenship Coalition founding member. Customers did not audit the firm on its OHS performance. Customer audits were only conducted before a contract was awarded, focusing on quality and other business related matters:

They come to do the pre-award survey, I mean, before they give us business. Of course the first pre-award survey is looking at our financial account. Not more . . . you know the details. That we got a nice building, a good computer system, financially strong, that is for award survey. And of course when you have a severe quality [problem] they might enter the building to do a site audit.

The company was RoHS compliant at the time of the interview in 2008 and was planning to meet the EU's REACH Directive, which reportedly every European customer had insisted on. Supplier 4 stated that it had not received assistance from customers, other firms, or the Malaysian government on meeting international standards, including the RoHS. Instead, it used KPMG, an international audit, tax, and advisory firm, to conduct an annual assessment of its conformance to standards and to advise on the requirements of the RoHS and REACH. When it came to government assistance over standards compliance, in particular for the RoHS, our respondent noted: “The whole of Malaysia do not know what's going on.”

Supplier 4 was the largest second-tier supplier interviewed and the only one that had acquired other companies (in the Netherlands). Like Supplier 1, it was relatively more engaged on OHS standards. It also expended the most resources to OHS governance. It employed an international private and independent auditor to conduct certification verification, and SIRIM to audit its ISO 14001 and OHSAS 18001 certifications. According to our respondent, it spent around 15,000 to 20,000 Malaysian Ringgit (around US\$ 4,200–5,600) per year on audits to maintain its certifications.

As with all second tier suppliers interviewed, Supplier 4 did not receive assistance from its customers regarding the governance of OHS. Despite this, Supplier 4 had to meet the RoHS to maintain orders for the European market. Again, as with other second tier suppliers, it met this requirement on its own.

While our sample of four second tier firms is limited, we can draw some illustrative observations. First, firm size matters. Larger second tier suppliers were not only able to address OHS standards, but were also required to do so by Malaysian law. Second, there is a distinct pattern of implementation between the private industry code, the EICC, which was largely not enforced on second tier suppliers despite many of them supplying Electronic Industry Citizenship Coalition members, and the publicly regulated RoHS, which was met by most second tier suppliers. Third, RoHS compliance was mainly achieved through suppliers' own resources without support

through GVC ties with first-tier suppliers or links to government agencies. While some firms stated that their customers (first tier suppliers) required them to meet the RoHS it did not, however, lead to closer relational ties between first and second tier suppliers, nor closer inspection and monitoring by first tier suppliers. These findings are especially intriguing given earlier literature on RoHS implementation (Calder 2007; Goosey 2007), and the argument that the RoHS has resulted in closer buyer-supplier linkages (Rock *et al.* 2009). Our study suggests that while better buyer-supplier ties may be desirable, they were not necessary for ensuring RoHS compliance among second tier suppliers. Rather market access conditions, and the linked demand of customers trading in one of the largest global consumer markets, were the main driver for compliance. RoHS compliance also did not imply that second tier suppliers were necessarily more aware of, or engaged with, OHS concerns. Nevertheless, for the production lines geared to EU markets where RoHS compliance was necessary, these firms had, through their own efforts, eliminated the use of harmful chemicals and processes (including lead based soldering), with potentially positive implications for their workers' health.

## 7. Conclusion

Current research on the governance of labor standards in GVCs fails to investigate lower tier suppliers. This paper has sought to address this gap by analyzing how two different standards that impact OHS permeate down the computer industry GVC. The standards are the EICC, which is a private industry standard covering a wide scope of social and environmental conditions, including OHS, and the RoHS which is a publicly regulated market access standard that essentially prohibits the use of certain hazardous substances in electronics products. While the EICC is a process standard and the RoHS a product standard, both have a direct and potentially positive impact on the OHS of workers in factories.

Our findings show that the EICC is weakly implemented further down the value chain. The RoHS, on the other hand, given its mandatory legal stipulation and associated regulatory mechanisms, has been effectively pushed down the GVC to second tier suppliers, and, hence, become a condition for entry into value chains geared to EU markets. However, lower tier suppliers have not implemented the RoHS through strong value chain support or linkages to key first tier firms, but as a consequence of market access demands alone. Hence, GVC governance linkages were a relatively weak element in ensuring effective OHS compliance by second tier firms. Our study, by focusing on the challenges confronting compliance at lower tiers of the GVC, problematizes our current understanding of GVC governance measures around labor standards even further. Our findings question the view that close buyer-supplier relationships are a necessary condition for cascading standards down the GVC.

Further, in contrast to the emphasis on private standards governing labor conditions in GVCs, there has recently been a swing back toward the potentially important role of public regulation on, and enforcement of, labor and environmental standards. This recent literature suggests a "regulatory renaissance" where public actors assist firms to fill gaps left by private labor standards and codes of conduct (Piore & Schrank 2008; Amengual 2010; Locke 2013). Others have noted that public agencies may be incapable, disinterested, or unwilling to engage with firms on labor standards (Bartley 2011). Similarly, Malaysia, which has extensive public agencies geared to formulating and implementing product and process standards, including improving OHS and factory labor conditions, was found to provide no assistance to second tier suppliers in meeting the RoHS. This was the case despite acknowledgment by public officials interviewed that meeting the RoHS was challenging for local SMEs. Our findings underline the need for further

inspection of the “regulatory renaissance” premise that developing country states can play a critical role assisting firms with meeting standards and regulations. The key questions are: first, under what conditions, and how, can public policy be motivated to this end? Second, what does this imply for the relationship between public *and* private measures to improve labor conditions?

Identifying ways to reach the lower tiers of the computer industry GVC with governance instruments is important given that the numbers of suppliers and workers increase further down the computer industry GVC one travels. Lower tier suppliers are usually smaller, with fewer technical, managerial, and financial resources, often located in countries with weaker government agencies and yet facing greater challenges on labor standards. The ability of EU Directives to reach second tier suppliers suggests the strength of market access regulation over voluntary initiatives.

Market access linked regulations are clearly areas of major policy debate. Market access standards (especially pertaining to labor and the environment) have been difficult to implement at a global or multilateral level (given World Trade Organization restrictions). Yet measures at the regional, national/bilateral, and even local levels have been possible (Salem & Rozental 2012). Alongside the EU, China, Japan, South Korea, Turkey, and California have all implemented versions of the RoHS. This underlines the importance of bilateral and regional trade regimes. Furthermore, might such market access regulations be more effective if they are linked to product standards, such as the RoHS? This requires further enquiry. From a manufacturing and firm perspective, market access product standards can have a harmonization effect for the industry. PCB suppliers, for example, have found it more costly to produce two types of PCBs – one that is lead-free and complies with the RoHS and another that does not (National Research Council of the National Academies 2005). Consequently, brands such as Apple and Dell now require all of their products globally to comply with the RoHS. Yet compliance with process (labor) standards has been successfully tied to market access in other sectors. This was seen in the Cambodian garment industry where duty free access to the US was contingent on ILO inspections (Polaski 2006), and in South Asian football manufacturing clusters where market access (namely sourcing by global brands) was effectively (if not “de jure”) linked to ILO monitoring of child labor (Lund-Thomsen & Nadvi 2010).

Market access legislation (including labor standards linked to trade agreements) may improve compliance through the “stick” of public regulation. Our findings support arguments for complementary public-private governance (Weil & Mallo 2007), but go further by stressing the importance of public *over* private regulation. This does not imply that private standards initiatives or public inspection are unimportant, but that achieving public-private “complementarity” may require greater emphasis on the regulation of market access. At the same time, such an approach has its limitations because the “stick” of market access can only be enforced on production geared to markets that have such trade regimes in place. Thus, it may not always result in universal improvements in OHS and workplace practices if other foreign and domestic markets (especially larger ones) are not similarly regulated. Our findings suggest the need for policy actors and researchers to further investigate how to better integrate private regulation with public regulation and public enforcement in order to improve working conditions at lower tiers of the GVC.

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## Notes

- 1 Evidence from three second tier suppliers was excluded because of insufficient data.
- 2 See: [http://www.hp.com/hpinfo/globalcitizenship/environment/supplychain/supplier\\_list.pdf](http://www.hp.com/hpinfo/globalcitizenship/environment/supplychain/supplier_list.pdf) [Last accessed January 2015].
- 3 Five firms were interviewed in Penang and one, CS5, at its Western European headquarters.
- 4 The number of second tier suppliers in the personal computer global supply chain runs into the thousands. The majority of second tier suppliers supply into a large pool of various components (Kraemer & Dedrick 2003; Sturgeon & Kawakami 2010). First tier suppliers source from numerous second tier suppliers and as a result it is not always possible to verify which second tier supplier's component was used in a particular brand product. It is easier to identify which first tier suppliers are being supplied by a particular second tier supplier. Thus, while our second tier suppliers interviewed do not view HP as their ultimate client, however by producing components for HP's first tier suppliers that were likely used in HP products, we can be reasonably confident that we "followed" the HP value chain.
- 5 For further discussion on distinctions between product and process standards see Nadvi & Wältring 2004; Gereffi *et al* 2005.
- 6 We refer to EICC version 3.0, which was in force during firm interviews in 2008.
- 7 HP interview 2008.
- 8 HP interview 2008.
- 9 RoHS work in conjunction with the EU Directive on Waste Electrical and Electronic Equipment (WEEE) to reduce safety and health risks to workers in recycling plants (Directive 2002/95/EC).
- 10 Each supplier had a number of leading brands as customer firms.
- 11 China has its own RoHS type regulations for sales in their domestic markets (see Hsu & Hu 2008).
- 12 Website accessed 2013.
- 13 Website accessed 2008.

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