

**DRAFT FOR DISCUSSION – DO NOT CITE**

# **Innovation and Technological Capability in Indonesia**

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**June, 2010**

## **(1) Introduction**

This paper is organized as follows.

Section 2 is scene setting and introduces the Indonesian context. It draws attention to the country's generally strong economic performance since the late 1960s. It highlights the disjuncture of 1997-98, including the deep economic crisis and the significant and durable changes in the country's economic policy environment. Since the industrial sector is the focus of much of the country's innovation activity and government policies, we also provide a broad overview of Indonesian industrialization and ownership structures.

Section 3 surveys the major factors shaping Indonesian innovation and technological capability. These include the country's openness to trade, foreign investment and labour; education policies and the human capital base; and the supporting infrastructure, both soft and hard. We also include discussion of the country's formal R&D policy.

Section 4 examines Indonesia's education sector and achievements in comparative international perspective.

Section 5 presents and interprets the results of the firm-level survey.

Section 6 provides a summary and policy discussion.

## **(2) The Indonesian Context**

### (a) Generally strong economic performance

Regarded as a ‘chronic economic dropout’ in the mid 1960s, the Indonesian economy has grown strongly since the late 1960s, averaging about 4% per capita growth, apart from the period of deep crisis in 1997-98.<sup>1</sup> Following the turbulent regime change of 1965-66, the incoming Soeharto regime adopted broadly orthodox policies, emphasizing macroeconomic stabilization, a moderately open economy, and a business environment in which the private sector was the key player. Inheriting a ramshackle economy, in which per capita income was below that of the early 20<sup>th</sup> century and inflation was about 1,000%, the 32 years of Soeharto rule saw per capita income quadruple, poverty incidence decline from over 50% to 15% of the population, and commensurate improvements in a range of social and infrastructure indicators.

This progress was brought to an abrupt halt in mid 1997. Although the Asian financial crisis originated in Thailand, Indonesia was the most severely affected: its economy contracted by over 13% in 1998, its financial sector virtually collapsed, its exchange rate fell by about 80% at the peak of the crisis, and there was widespread social distress. The economic crisis also triggered political instability, in which street protests resulted in the overthrow of the Soeharto regime in May 1998. The resultant power vacuum led to a several years of political instability and weak governments, with five presidents in six years. However, the development of democratic processes and economic recovery both occurred with surprising speed. National and regional parliamentary and leadership elections were successfully conducted in both 2004 and 2009. Economic growth resumed in 2000 and for the decade as a whole has averaged about 5%. Notably, Indonesia has endured the current global financial crisis quite successfully, with a growth deceleration of less than two percentage points from trend and a financial sector broadly intact.

### (b) The policy environment

The 1997-98 crisis did however result in a significant change in the economic policy environment and policy-making processes.<sup>2</sup> Indonesia swung quickly from a highly centralized and personalized authoritarian regime to an exuberant and unpredictable democracy. Power has been greatly diffused in several respects. There is a separation of power between the executive and the legislature; in the latter the party of the directly elected president does not have a majority. There is therefore a ‘rainbow cabinet’, comprising ministers of varying competence and allegiance, and resulting in ‘bifurcated’ policy outcomes, particularly between generally competent

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<sup>1</sup> For broad overviews of Indonesian economic development, see Hill (2000) on the Soeharto era and Hill and Shiraishi (2007) on the post-Soeharto era. Detailed running narratives are provided in the 4-monthly ‘Survey of Recent Developments’ published in the Bulletin of Indonesian Economic Studies since mid 1965.

<sup>2</sup> These developments are examined in detail in the annual political survey in the December issue of BIES. The broader implications for economic policy making are discussed in Aswicahyono et al (2009), on which parts of this section draw.

macroeconomic outcomes alongside frequently contested and politicized microeconomic policy. In the current cabinet, for example, the key economic portfolios of finance, trade and planning are held by non-political ‘technocrats’, while most of the other portfolios have been allocated to political parties.

The country also abruptly embarked on a ‘big bang’ decentralization program in 2001, in which significant administrative and financial authority was devolved to the 500 or so sub-national governments, both first tier (province) and second tier (kabupaten). This process has resulted in a considerable increase in business uncertainty, as the division of responsibilities between the centre and regions is still being clarified, and as a consequence of the continuing proliferation of new kabupaten.

### (c) Industrialization patterns

Until the mid-1960s, Indonesia had barely commenced the process of modern industrialization. No foreign capital was present, and the ‘commanding heights’ of the economy, such as they were, were in state hands. With the regime change in 1966, the country then experienced very rapid industrial growth and structural change through to 1997 (Hill, 1997). Annual industrial growth was at least 9% in all but two of the 27 years, 1970-1996. Foreign investment returned from the late 1960s in response to the newly liberal policy regime and generous fiscal incentives. Initially, catch-up and import substitution were the principal drivers of growth. From the mid 1980s, labour-intensive exports became a significant engine of growth. Accompanying this growth was rapid structural change, as the industrial sector evolved from the production of simple consumer goods and basic resource processing to a wide range of manufactures of increasing technological sophistication. Indonesia’s emergence as a significant industrial exporter from the mid 1980s was the result of a highly successful reform program involving the lowering of protection, a more open foreign investment regime, and simplified trade procedures, combined with effective macroeconomic and exchange rate management (Aswicahyono et al, 1996).

During the 1997-98 crisis, the industrial sector contracted at about the same rate as the economy as a whole, with import-substituting manufactures being particularly hard hit. Thereafter, industry recovered, but to growth rates a little over half those of the pre-crisis period. Thus, manufacturing has slipped from being a leading sector, to a growth rate at about the economy-wide average. Indonesia’s industrial growth rate over this period has also slipped to below the East Asian average.<sup>3</sup>

### (d) Ownership structures

Indonesian ownership structures are unusual. There is a sizeable state-owned sector in several key sectors of the economy considered to be ‘strategic’. These SOEs are mostly remnants of earlier policy episodes emphasizing nationalist development (prior to 1966), oil booms (mainly the 1970s) and the ambitious high-tech projects of the 1980s and 1990s. They continue to exist owing to the political sensitivities associated with privatization and the high levels of non-pribumi (ie, non-indigenous) ownership,

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<sup>3</sup> The crisis and its aftermath are discussed in some detail in Aswicahyono et al (forthcoming), with particular reference to the industrial sector.

principally by the small ethnic Chinese business community. Their financial performance is generally poor, and there is little evidence that they play the role of incubator for technological innovation.

Foreign-owned firms are major players in the Indonesian economy, in spite of the general ambivalence towards foreign ownership. Foreign investment laws were comprehensively liberalized in the late 1960s, became more restrictive for the decade from 1973, and have been broadly (and sometimes precariously) open since the 1997-98 crisis. There was a general capital exodus over the period 1998-2004, but the crisis also created attractive buying opportunities for the firms that did not exit the country (the so-called 'fire sale FDI phenomenon'). Foreign ownership is documented in detail only in the manufacturing sector, where the share of output produced by firms with foreign equity rose from 22% in 1990 to 37% in 2005. It rose more or less continuously throughout the period, but particularly immediately before and after the crisis, 1993-1999. Thus the crisis had no major impact on this secular trend of rising foreign ownership. The increase in foreign ownership is evident in most industries, except for paper and chemical products, where local firms have become more active. As expected, the foreign presence is greatest in the two most MNE-intensive industries, automotive products and electronics.

Reflecting its political economy structures and its still relatively small modern sector economy, Indonesia has high levels of corporate conglomeration and seller concentration. There has not been any detailed empirical research on these issues since the late Soeharto period, but it is probable that the general findings from the mid 1990s still apply. Bird (1999) estimated there were high levels of industrial concentration, with the simple average 4-firm concentration ratio about 54%. He also found it was declining over time, and that the ratio fell significantly once allowance was made for import shares. Regarding corporate conglomeration, Claessens et al's (2000) survey of nine East Asian economies in 1996 found that Indonesia had the most concentrated ownership patterns in 1996, with the top family owning 16.6% of listed corporate assets, and the top 10 families owning 57.7% of the total.

Competitive pressures have probably increased since the crisis.<sup>4</sup> First, the huge Soeharto-linked business empires have collapsed, while many of the major private sector conglomerates have experienced significant changes, either related to financial workouts, or the loss of crony privileges, or both. Second, levels of import protection are generally low and have remained so since the crisis. Third, there has been some, though limited, additional deregulation in key sectors, many of them SOE-dominated. Notable examples include domestic civil aviation and telecommunications. Moreover, the establishment of a Competition Commission (the KPPU) in 1999 has probably increased competition. The Commission has maintained an active scrutiny of collusive arrangements, and in general has operated in an apolitical manner, more effectively than many observers had expected.<sup>5</sup> Fourth although corruption is probably as serious a problem now as in the Soeharto era, there is arguably less entrenched, systemic, and blatant 'palace corruption' of the type which proliferated in the late

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<sup>4</sup> There has been very little change in industrial concentration since the crisis, as measured by the share of the four largest firms in each industry's output. These ratios are generally high, with figures of at least 60 in more than half the industry groups.

<sup>5</sup> See Thee (2006) for an early assessment of its operations.

Soeharto era. In effect, it has been ‘decentralized and democratized’, especially as a comprehensive decentralization program was introduced in 2001.

It is also important to draw attention to the pronounced ethnic schism in Indonesian ownership patterns. The Chinese community, comprising about 3% of the total population, dominates much of the nationally owned modern sector of the economy. This has always been a politically sensitive issue, with periodic outburst of anti-Chinese sentiment, and it also partly explains the political popularity of a large SOE sector. Indonesian governments have eschewed Malaysian-style affirmative action programs in business. However, the Chinese business community operates in an uncertain business environment. This is relevant to technology and innovation issues, since these investors generally prefer quick-yielding, short-term investment projects.

### **(3) Innovation in Indonesia: the general policy framework**

A country's technology policy is much more than the government's formal R&D program. This is especially so for a country like Indonesia, where public support for R&D is so small. We therefore discuss a range of factors that affects a country's innovation activities.

#### (a) A broadly open economy

Trade policy: Indonesia was a broadly open economy at the time of the 1997-98 crisis (Fane and Condon, 1995). Average levels of import protection had declined since the major 1980s reforms, and most sectors received quite low protection, except where politically influential lobby groups and individuals were able to resist the liberalization (see Basri, 2001). There was further liberalization as part of the LOI with the IMF. Although the country has exited this program, there has been no major backtracking since then. Thus the Fane-Condon effective protection estimates, surprisingly the most recent available, still provide the best summary picture.

Nevertheless, there are a number of serious trade policy challenges.<sup>6</sup> First, the principal source of protectionist pressure now emanates from the agriculture sector, in contrast to earlier periods when manufacturing was the main beneficiary (Fane and Warr, 2008). With democratization, rural votes matter, and politicians are able to exploit this factor along with appeal to sentimental notions of food self-sufficiency. Second, there is a range of 'trade plus' issues that remain largely unaddressed. These include the complex export-import procedures (here the sweeping 1980s reforms have been partially undone) and the uncertain investment climate. The latter is particularly important in rapidly expanding industries such as electronics, where vertically integrated MNEs dominate (Athukorala, 2006a; Kimura, 2006).<sup>7</sup> One consequence of these incomplete reforms is the growing popularity of export zones, which offer simpler administrative procedures and (sometimes) freer trade. Their proliferation should be interpreted as reflecting the difficulty policy makers have in achieving further first-best, economy-wide liberalization.

A third challenge is that trade policy-making occurs in an institutional vacuum, resulting in mixed trade policy outcomes: tariffs have continued to fall, whereas NTBs have increased marginally. Hence Indonesia is what Bird et al (2008) characterize as 'precariously open'. This arises because, while the Finance and Trade Ministries (the latter at least under the current minister) have generally favoured a lower, more even tariff structure with fewer NTBs, there is much opposition to such a policy setting. The line ministries (Agriculture, Industry) are philosophically protectionist, and also driven in that direction by their constituencies. The dominant discourse in Parliament is 'nationalist/populist', further facilitated by the funding requirements of political parties in a nascent democracy.<sup>8</sup> And there is very little independent scrutiny and

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<sup>6</sup> The following discussion draws on Bird et al (2008) and Basri and Hill (2008).

<sup>7</sup> Indonesia's performance in this industry has lagged its neighbours largely for this reason. As Athukorala (2006b) demonstrates, after the immediate post-crisis export response, most of the growth has come from favourable world prices rather than volume expansion.

<sup>8</sup> An illustration of the power of Parliament on trade policy is the recent vocal criticism of the ASEAN China Free Trade Area, signed in 2004 and promulgated from January 2010. It now appears that the government will be forced to backtrack on, or at least water down, some of the ACFTA provisions.

analysis of trade policy settings, either by statutory authorities or think tanks. A fourth challenge is that domestic trade barriers, in the form of arbitrary, ad hoc and often illegal charges to internal trade, have become significant, particularly following the 1997-98 economic crisis and the 2001 decentralization initiative (see McCulloch, ed, 2009).

Foreign investment and the investment climate: Indonesia's business regulatory regime remains complex, opaque and costly. Most comparative business surveys now rank Indonesia quite poorly, by East Asian and international yardsticks. Corruption levels are high, and licensing procedures lengthy and unpredictable.

For example, the World Bank Group's Doing Business 2010 ranks Indonesia at 122 out of 183 economies. While this is an improvement over its 2009 ranking of 129, it is below comparable lower middle-income developing economies. The country ranks particularly poorly in several areas: starting a business (ranking of 161), employing workers (149), enforcing contracts (146), and closing a business (142). By contrast, and consistent with the analysis above, one of its highest ranking is for trading across borders (45). It also ranks highly on protecting investors (41), from expropriation. The areas of poor performance have direct implications for innovation. Business dynamism is impeded by the high cost of starting and closing a business. Innovative firms with inherently uncertain business prospects are reluctant to hire new workers owing to the restrictive severance pay and related conditions. Weak contract enforcement, reflective of the general problems besetting the judicial system, provides little protection for intellectual property rights. Given the blatant commercial piracy that exists in the country, innovative firms can expect little protection from the legal system.

Senior government officials are certainly aware of these problems, and a major new Investment Law, submitted to the Parliament in March 2006, is in the process of implementation. There is also an attempt to undo some of the labour provisions that discourage employers from hiring new workers. According to all available (and admittedly patchy) evidence, corruption is just as serious a problem now as it was during the Soeharto era. In some cases it has been documented to be worse, as in illegal logging (Resosudarmo, ed, 2005). The key difference now is that this corruption occurs in the context of slower economic growth, and it is more unpredictable.

As a result, investment remains below that of the Soeharto period. This refers to all classes of investment, domestic, foreign and the state, the first two deterred by the uncertain business climate, the latter by the state's limited fiscal resources. Moreover, the composition of investment has changed, with investors preferring short-term investments that can be more easily liquidated over projects with a longer time horizon. This is reflected in higher levels of portfolio investment as compared to FDI, and the booming investments in real estate and shopping malls.

The negative implications for the more risky, R&D-intensive investments are obvious. FDI in other sectors with longer time horizons has also been affected. The government has had little success in attracting private sector interest in infrastructure, in spite of major summits on the subject. There are doubts concerning the proposed projects, ownership modalities, pricing, legal redress in the event of dispute, the attitude of local governments, and land acquisitions. Several high-profile disputes with foreign



infrastructure providers in the aftermath of the Asian financial crisis have also served as a deterrent (see Wells and Ahmed, 2006). Mining investment remains weak in spite of high commodity prices. During the Soeharto era, Indonesia regularly attracted over 5% of global mining exploration investment, whereas it now attracts less than 0.5%. International surveys of the mining investment climate (for example by the Canadian-based Fraser Institute) rank Indonesia among the lowest in the world, not far above Zimbabwe and Venezuela.

Labour: Indonesia is a latecomer to the rapid internationalization of labour markets. Since the 1997-98 economic crisis, it has emerged as a small but rapidly growing exporter of unskilled labour, principally to Malaysia and the Middle East. Historically, the employment of expatriate workers has been restrictive. Even foreign firms with the requisite investment registrations have experienced difficulty employing foreign workers, while direct hiring of foreign workers has been even more difficult (Manning and Roesad, 2006). Foreign workers are subject to a levy of \$100 per month and permitted only if suitably skilled nationals are not available. The latter requirement is so vague as to render the process uncertain and corruption-prone. It is thought that only about 20,000 foreigners are employed in Indonesia. Indonesia is thus considerably more restrictive than neighbouring countries, especially Singapore but also Malaysia and Thailand. In the process the country therefore limits this potentially important source of informal skill transfers and acquisition.

#### (b) Factors underpinning innovation

The financial sector was at the heart of the deep economic crisis of 1997-98, with many banks failing. Over the past decade, the banking sector has been essentially cleaned up, albeit at very high cost to the public purse, and it is now functioning reasonably effectively. Non-performing loans in the commercial banking sector remain high, but they have declined significantly from the post-crisis peak of 33% in 1999. Much of the sector was renationalized, and for political reasons the government has found it difficult to divest itself of these holdings. These banks continue to be bedevilled by the practice of 'command lending'. The share of foreign banks has risen gradually, but they have been constrained from playing a larger role owing to nationalist resistance to the sale of 'distressed assets' to foreigners.

One significant feature of the 1997-98 crisis was the effects in the financial sector were concentrated in the larger, formal sector units. Indonesia has had a history of experimenting with small-scale financial institutions. The 1980s reforms, under the auspices of the state owned Bank Rakyat Indonesia, which reduced subsidies but provided incentives for the economic provision of small-scale credit, provided a durable working model. As Patten et al (2001) pointed out, these institutions survived the crisis remarkably well. They were less connected to the collapsing urban economy, they were less highly leveraged, and unlike the larger units they operated independently of large business conglomerates.

Established firms that have a demonstrated record of operations are probably not significantly credit-constrained. Most business surveys rank other problems (labour, infrastructure, unpredictable corruption, etc) more highly. However, financial institutions are understandably much more cautious in their lending operations. This behaviour, combined with tighter regulatory supervision, has limited the access of SMEs and start-ups to formal sector financial institutions. A compounding factor has

been that, based on the questionable premise that larger financial institutions are less likely to fail than smaller ones, the country's small, community-based institutions have been instructed to merge with larger, centralized units. Among the latter, as Rosengard et al (2007) observe, '... innovative microfinance services were viewed with suspicion and hostility.' (p.87)

During the Soeharto era, the legal system was largely dysfunctional and highly corrupt, but the institutional arrangements governing the protection of property rights were more or less predictable. There was very limited recourse to the commercial courts, for example, with firms preferring to enlist the support of powerful backers, drawn mainly from senior echelons of the military through to around the mid 1980s, and from among the Soeharto family in its last decade of power. Foreign investors and creditors have traditionally had little faith in resolving disputes through formal legal mechanisms in Indonesia (Lindsey, 2004). For example, since the Asian financial crisis domestic parties in dispute with their foreign partners or creditors were able to use the legal system to thwart the latter's contractual claims. In some cases, this resulted in the temporary freezing of foreigners' assets in Indonesia, including even the imprisonment of the local representative of a foreign company. Indonesian partners have also often refused to go to arbitration, even when it was stipulated in their letters of agreement, and have rather used local courts to over-rule the arbitration provisions.

Thus, and probably inevitably, legal reform is a slow and complex process. Judges are career appointments, whereas in most modern legal jurisdictions they are appointed from the legal profession, based on experience and reputation, and are adequately remunerated. In addition, the commercial courts, which were initially regarded as an opportunity to overcome corruption and incompetence in bankruptcy cases, have proved to be disappointing.<sup>9</sup> These problems are further compounded by weaknesses in the commercial environment that in turn inhibit financial development and innovation. For example, land titles and ownership remain poorly defined, and this adversely affects the ability of small borrowers, in particular, to provide the collateral required by the lower interest formal banking sector (Rosengard et al, 2007).

### (c) Formal R&D policy

Indonesia's investments in formal R&D programs have always been very small. Total R&D expenditure as a percentage of GDP has never exceeded 0.2%. Most of it has occurred in the public sector, as domestic firms have never made any significant commitment to R&D. Moreover, MNEs do not regard the country as a suitable base for R&D activity, owing to the weak skill base, the limited protection of intellectual property rights, and the absence of any significant public support for R&D. As noted below, the major government support for R&D prior to 1997 took the form of a series of high-tech projects that collapsed during the crisis and have not subsequently been revived. The Indonesian Institute of Sciences (LIPI, Lembaga Ilmu Pengetahuan Indonesia) is a major government agency, but its funding and scientific resources are insufficient to support a major research effort. The government's agricultural

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<sup>9</sup> The link between corruption and the weak legal system is of course institutionally underpinned by powerful vested interests. See Butt (2009) for an Indonesian case study, and Fisman and Miguel (2008) for a generalized treatment of the issues, including some Indonesian material.

extension service has responsibility for the dissemination of new technologies and processes, but it too is severely under-funded. Government support for these activities was increasing during the 1990s, but funding was cut sharply during the 1997-98 crisis, and it has yet to recover.

Syahrul et al (2007) and Dhewanto and Uman (2009) provide a general overview of the government's recent R&D policy framework, centred on the various government institutions, R&D activity located within government departments, and the public universities. Indonesia's science and technology priorities over the period 2005-09 identified six major fields: 'food resilience', renewable energy, transportation, ICT, defence, and pharmaceuticals and health. Over the earlier plan period, 2000-04, some 243 patents were filed, of which 44 were commercialized. Although detailed analysis of resulting patent activity has yet to be undertaken, there have been a few achievements, such as the 'Marlip' battery-powered car developed in LIPI, and some software development. Within the public universities, the country's four pre-eminent institutions, University of Indonesia, the Bandung Institute of Technology, the Bogor Agricultural Institute and Gadjah Mada University are seen as the most likely incubators of technological development. We refer to one such case study below, in section 5 (c).

There is little support for innovation outside these meagre government programs. None of the country's major conglomerates has yet shown any inclination to support major innovation programs as for example is now occurring in other large Asian developing economies such as China and India. Nor has the SOE sector been able to play such role. These firms are typically saddled with uneconomic social responsibilities and subject to extensive political interference. In addition, two sectors where government programs frequently embody significant if indirect R&D support, defence and health, are under-funded by comparative international norms.

Moreover, Indonesia's experience with industry policy has not been a happy one. In the late 1970s, the then technology minister (and later president), B.J. Habibie, embarked on an ambitious program to develop the country's technological capabilities, with the strong support of then president Soeharto. For the next two decades, he dominated the country's technology policy, and absorbed most of the government's R&D budget.<sup>10</sup> The program supported several 'show case' projects, the most important of which was the Bandung aircraft factory, known by its acronym IPTN. In spite of the country's weak capital goods base, the vision was that Indonesia would become a significant producer of small jet aircraft, through an ambitious four-stage evolution from basic manufacturing capacity to mastery of leading-edge aircraft manufacturing technology. An estimated \$3 billion was spent over the life of the project, and some aircraft were produced, sold mainly to state-owned enterprises for domestic civil aviation. However, the 1997-98 crisis heralded the demise of the project, and of the dreams to be a major player in the international aircraft industry. There is little to show for this large investment, other than a useful scholarship program to train Indonesian engineers and some residual technology knowhow.<sup>11</sup>

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<sup>10</sup> This and the following two paragraphs draw on Hill and Thee (eds, 1998).

<sup>11</sup> See Goldstein (2002) for an analysis of this disappointing performance, compared to the stronger achievements in the aircraft manufacturing industries of Brazil and South Africa.

Similarly, the government's attempt at 'guided industrial policy' from the late 1970s was largely unsuccessful. Studies of the country's trade policy interventions and other programs to assist firms detect little correlation between these inputs and subsequent industry-level outcomes. That is, the government more commonly supported 'losers' rather than 'winners', even allowing for reasonable gestation periods that recognize infant industry and learning periods. In fact, as Basri (2001) clearly shows, most industries that received assistance were dominated by politically influential individuals, and the industries have tended to under-perform by the usual performance benchmarks.

Some of the most important cases of successful innovation were 'accidental industrialization' in the words of one well-known case study. They occurred among smaller enterprises and in agriculture where the government did little other than provide a conducive overall investment environment. Successful examples include garments, handicrafts (especially tourism related), furniture and cash crops. The common ingredients in most cases have been good general infrastructure, the availability of a local skill base, institutional mechanisms that quickly disseminated knowledge and provided collective goods, and a conduit to international knowhow and markets, most typically through informal, non-equity channels.

#### (d) Studies of FDI and 'Spillovers'

Owing to the relatively good enterprise-level, time series industrial data, there is now an extensive literature on the 'spillovers' from FDI in Indonesia. This literature employs the well-known analytical framework developed by Blomstrom and others to explore the productivity impacts of the entry of foreign investors. That is, foreign investment introduces a package of highly productive inputs of capital and technology, and compared to domestic firms they have higher productivity and exports, pay higher wages and faster employments growth. But the impact on domestic firms is theoretically ambiguous. For example, foreign firms may entirely appropriate the returns from their higher productivity. They may also drive local competitors out of business, thereby causing a loss in employment and reduced competition. Alternatively, local firms may reap some productivity benefits from the foreign entry, through a variety of diffusion channels including direct transfers to subsidiaries, sub-contractors and employees, and emulation. The presumption is that these productivity spillovers will be greater where host-country absorptive capacity is stronger, where the foreign investment climate encourages MNEs to make a durable commitment to the country, and where the commercial environment is competitive and more generally conducive to innovation.

This literature is at best inferential, in the sense that it observes the effects of foreign entry on local enterprise productivity but is unable to detect precise causal mechanisms. Lipsey and Sjöholm (forthcoming) provide a recent survey of this literature, to which they themselves have been substantial contributors. These studies apply varying methodologies, focus on a range of dependent and explanatory variables, and employ different time periods. But the main conclusions are reasonably robust. The authors conclude that:

'Almost all of the studies find evidence of positive spillovers: local firms benefit from the presence of foreign firms within the industry and region. Since the foreign plants also have higher productivity and pay higher wages than local

firms, the two factors together imply that higher foreign presence raises the general productivity and wage level in a province and industry.’ (p. 17)

#### **(4) The Education Sector in Indonesia<sup>12</sup>**

##### (a) The Structure of Indonesia’s Education System

Indonesia’s education system consists of four levels: pre-school; basic, which consists of primary and lower secondary; secondary; and higher education. The primary cycle is six years long, and students enter at age seven. Lower secondary is of three years duration, as is upper secondary. Within higher education, there are several possible degree and certificate paths. These include the diploma, the duration of which can be from one to four years, depending on the field, and the internationally standard bachelor, master, and doctoral programs. Technical and vocation education and training (TVET) provides an alternative to general education. Students can enter TVET programs at the secondary or diploma level. To enter higher education students must pass a secondary school graduating exam. For each level of education, there is a separate Islamic track available to students, which serves as an alternative to the general education system.

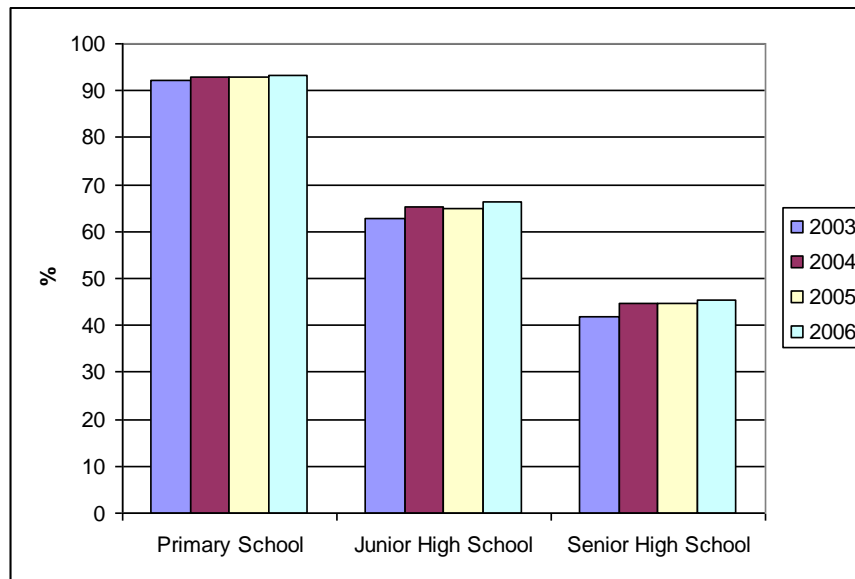
##### (b) Access to and Equity of Education

Indonesia has made impressive gains in enrollment at all levels over the past two decades, particularly in primary education. Enrollments have however leveled off in the past few years. At the primary level, net enrollment reached just over 90% in 2003 and has remained near that level since. At the junior secondary level net enrollment is approaching 70%, while at the senior secondary level it is approximately 45%. Figure 1 shows net enrollment rates at the primary, junior secondary, and senior secondary levels over the past several years.

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<sup>12</sup> This section draws heavily on World Bank (2010).

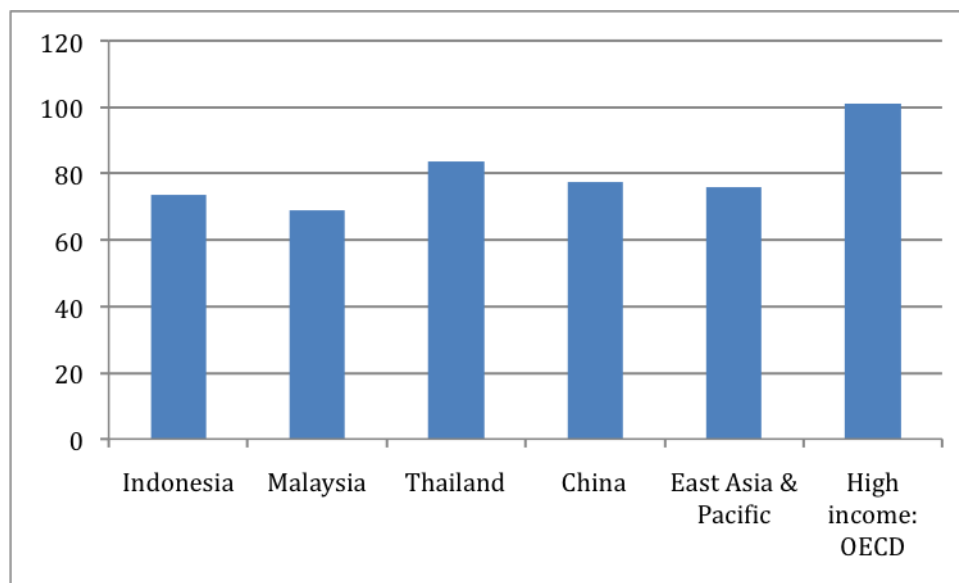
**Figure 1: Net Enrollment Rates at the Primary, Junior Secondary, and Senior Secondary Levels**



Source: World Bank calculations from Susenas data, as cited in "Chapter 1: Characteristics and Outcomes of the Education System in Indonesia," background paper prepared for the World Bank's Flagship Initiative on Skills, Productivity, and Growth

Despite these gains, however, Indonesia's gross enrollment rates at the secondary level lag most of its neighbours. Its 2007 secondary gross enrollment rate of 73%, while slightly higher than Malaysia's (70%), was below that of Thailand (83.5%) and China (77%). It also trailed the East Asia and Pacific regional average of 76% and the OECD average of 101%. See Figure 2.

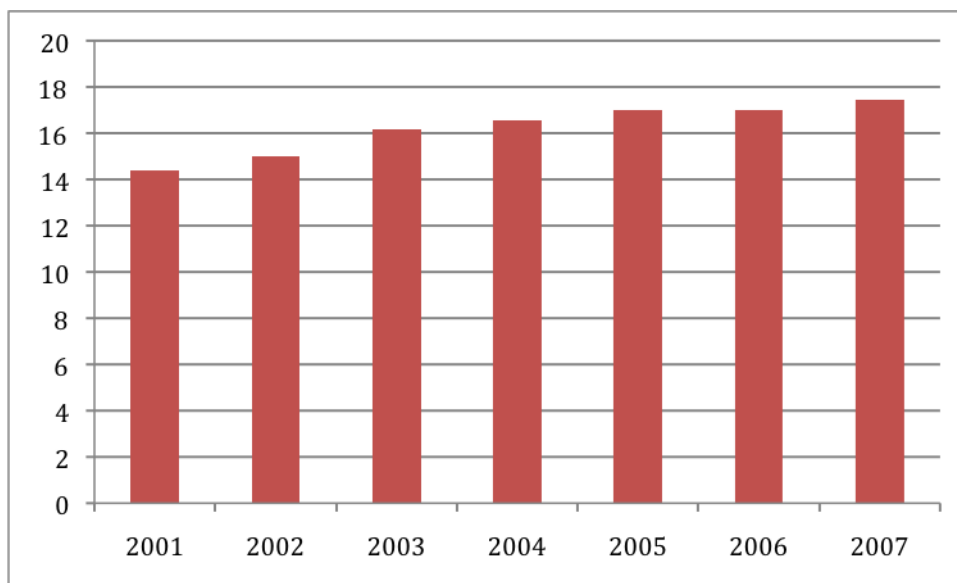
**Figure 2: Secondary Gross Enrollment Rates (%) in Selected Countries, 2007**



Source: Edstats, 2009

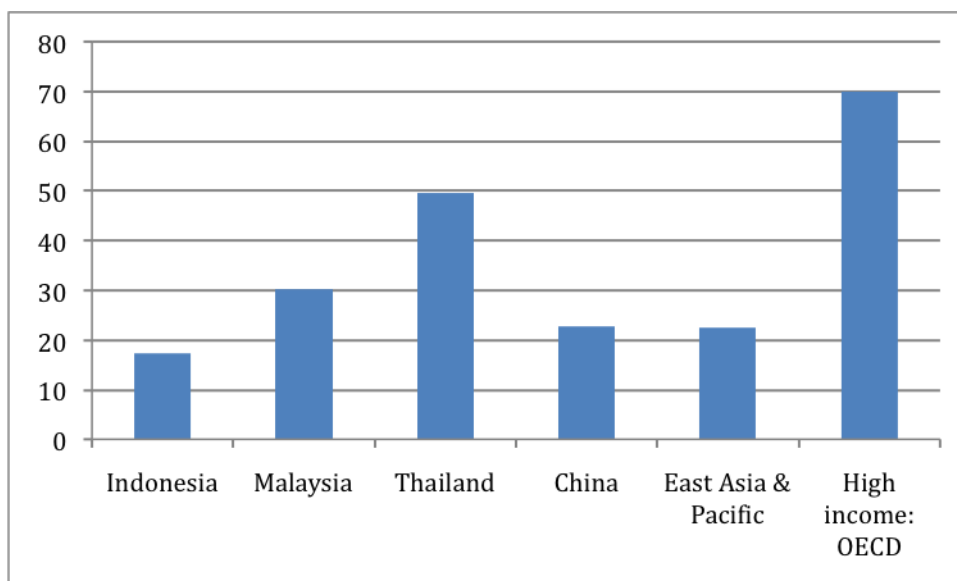
Indonesia has made relatively slow progress on increasing enrollments in higher education. The GER at the tertiary level has increased gradually over the past several years (Figure 3). In 2001, Indonesia's tertiary GER was 14.4%. In 2004, it was 16.5%. And in 2007, it stood at 17.4%. Like its GER for secondary education, the country's GER for higher education is lower than most its neighbors (Figure 4). Edstats 2007 data indicate that Indonesia's tertiary GER of 17.4% lagged China's (22.9%), Malaysia's (30.2%), and Thailand's GERs (49.5%). Moreover, Indonesian gross tertiary enrollment was below the regional average of 23% and far below the OECD average of nearly 70%.

**Figure 3: Tertiary GER (%), 2001 - 2007**



Source: Edstats, 2009

**Figure 4: Tertiary Gross Enrollment Rates (%) in Selected Countries, 2007**



Source: Edstats, 2009

Indonesia's enrollment gains over the past several years have done little to stem disparities in access for under-represented groups. There are gender, age, spatial, and income disparities in terms of access to education, especially higher education, though rural/urban disparities are significantly larger than gender ones. With regards to gender, it is encouraging that, overall, women have increased their levels of participation across all education levels. At the primary level, 53% of those enrolled are female, and at the diploma level, 56% of those enrolled are female. However, significant disparities remain. While women make up approximately 49% of the



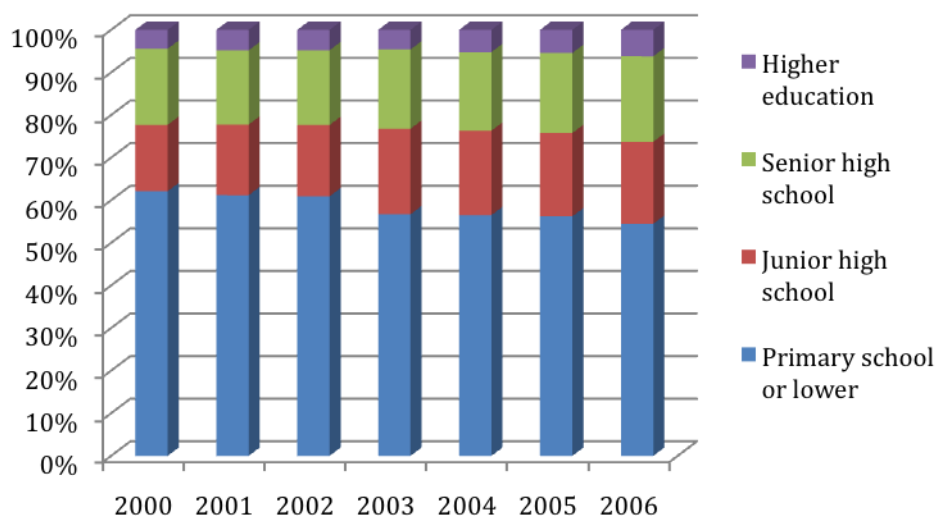
population, the proportion of women with bachelor's degrees is still much lower than that for men (43% compared to 57%). There is also significant gender disparity in the distribution of men and women without schooling: women account for almost 70% of those who are unschooled. Current enrollments at the secondary level suggest that these distributions may change over time, though, as more women continue to enroll in education.

In addition to these disparities of gender and age, there is also a significant disparity in education access between urban and rural populations. The urban population in Indonesia is significantly more educated, despite the fact that the population is roughly split between rural and urban areas. Of those without any education, 70% live in rural areas. Rural students make up only 30% of those studying at the secondary or diploma level. Only 15% of those studying for a bachelor, master, or doctorate are rural students.

As in many other countries, there are systematic differences in access to education between the rich and the poor across all levels of education, particularly at the tertiary level. At the university level, more than 70% of those enrolled are in the richest quintile of the population. At the diploma level, this figure is 60%. Students from the poorest three income quintiles make up only 10% of university graduates and 17% of diploma graduates. Scholarships for the disadvantaged exist, mostly from alumni associations and the private sector, but their number and scope are limited. Poverty and low educational attainment are strongly correlated in Indonesia. The poorest account for more than 33% of the unschooled and less than 1% of those enrolled in university.

Despite progress on enrollment and the increased emphasis on the vocational training sub-sector, the overall educational attainment of Indonesia's labour force remains fairly low. A 2006 analysis of Indonesia's labour force found that approximately 50% of Indonesia's working population (those aged 15 years and above who had worked in the past week) had only completed primary education or less. Some 40% of the working population had completed high school, and only 6% of the population had completed higher education (Figure 5).

**Figure 5: Educational Attainment of Indonesia's Labor Force, Aged 15 Years and Above**



Source: Nazara and Wicaksono, 2009

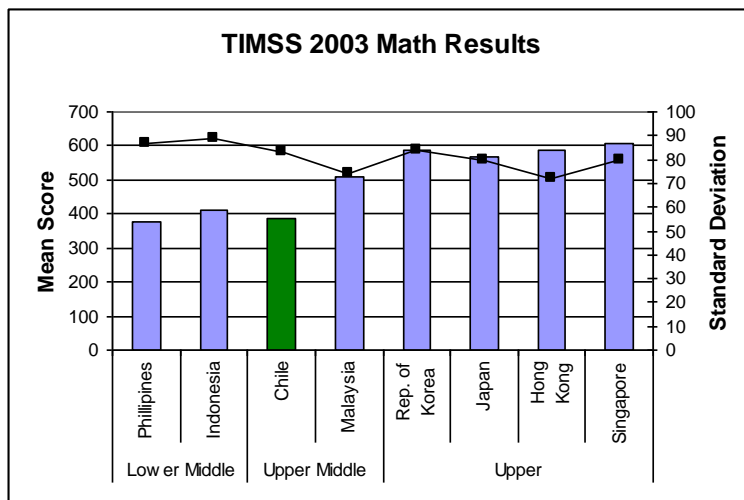
### (c) The Quality of Indonesia's General Education Sector

There is debate about the quality of Indonesia's education system, reflecting both the trade-offs between quality and quantity of education and more general difficulties associated with how quality should be measured. One can gain some insight by examining completion and repetition rates and the country's performance on international assessments.

Completion rates in Indonesia are quite high, with Junior High exhibiting nearly a 98% completion rate. Primary, general high school, and vocational high school completion rates also indicate the high efficiency of the system, to the extent that the former is an indicator of the latter. The primary level has higher repetition rates than all other levels combined. While this could be explained by the fact that there are higher proportions of low-income students, who could be vulnerable to shocks while enrolled at the primary level, it is nonetheless a cause for concern. As the proportion of lower income students are weeded out at higher levels of the education system, the repetition rate, on average, decreases by 85%.

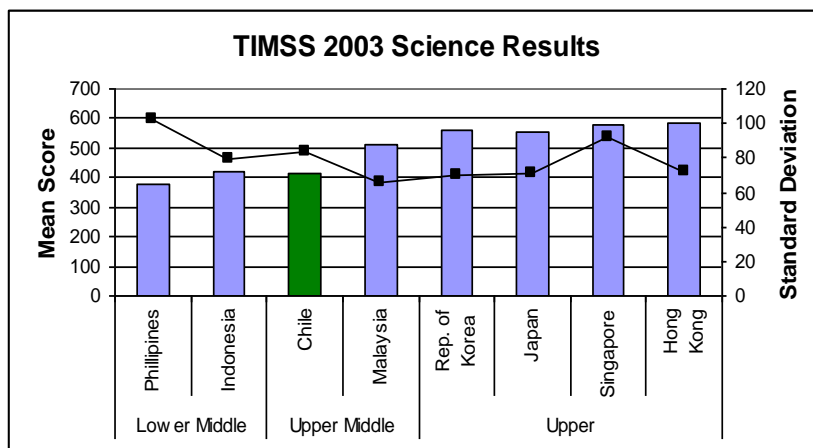
With regard to international assessments conducted at the secondary level, Indonesia's recent performances, though improving, show that the quality of secondary education in the country still lags behind many of its neighbours. Figures 6 and 7 present results from the 2003 Trends in International Mathematics and Science Study (TIMSS) and the OECD's Programme for International Student Assessment (PISA) from various years. On both counts, Indonesia performed behind its neighbours (with the exception of the Philippines) and is a significantly poorer performer than the top-performing countries in both mathematics and science.

**Figure 6: 2003 TIMSS Mathematics Results**



Source: *ESA Policy Note on TVET/Secondary Education*, World Bank, 2008.

**Figure 7: 2003 TIMSS Science Results**



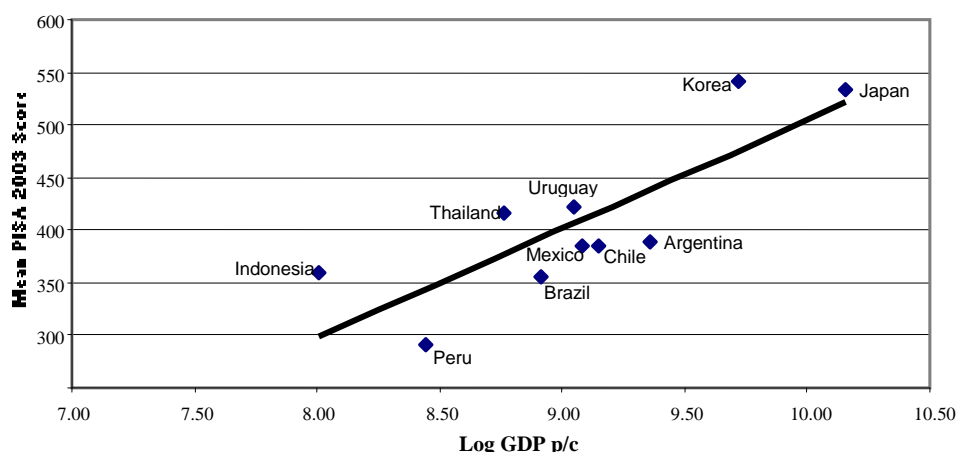
Source: *in ESA Policy Note on TVET/Secondary Education*, World Bank, 2008.

In both math and science on the 2003 TIMSS test, Indonesia performed significantly lower than the TIMSS mean score of 500. Though placing higher than the Philippines, other countries in the region (Malaysia, Korea, Japan, and Hong Kong) all performed better in both the mathematics and science portions of the test than did Indonesia.

While these test scores indicate that quality needs to be strengthened in Indonesia's general education sector, some positives should be noted. Historically, most developing countries have scored near the bottom of the scale in most international achievement tests. Until recently, there were few examples of significant improvement among developing countries. Indonesia's performance in the 2006 PISA mathematics exam is a case of a developing country showing significant progress. Moreover, when observing PISA scores against countries' income levels, Indonesia

does perform slightly better than the trend (Figure 8) – that is, Indonesia is a better performer than other countries at its income level. Nevertheless, these trends do not obviate the need for improving quality.

**Figure 8: Trend Line of PISA Test Scores against Log GDP Per Capita for Selected Countries**



(d) The Higher Education Sub-Sector

Structure, Governance, and Financing: There are five types of HEIs in Indonesia: single-faculty academies (known as Akademi), advanced schools (known as Sekolah Tinggi), polytechnics (Polteknik), institutes (Institut), and universities (Universitas). Academies are legally defined as higher education institutions that provide instruction in only one field; most offer either applied science, engineering, or art and offer Diplomas and Certificates for technician-level courses at both public and private levels. Advanced schools provide academic and professional university-level education in one particular discipline. Polytechnics are attached to universities and provide sub-degree junior technician training. Institutes are those HEIs which offer several fields of study by qualified faculty and are ranked as universities with full degree-granting status. Universities are larger than institutes and offer training and higher education in various disciplines.

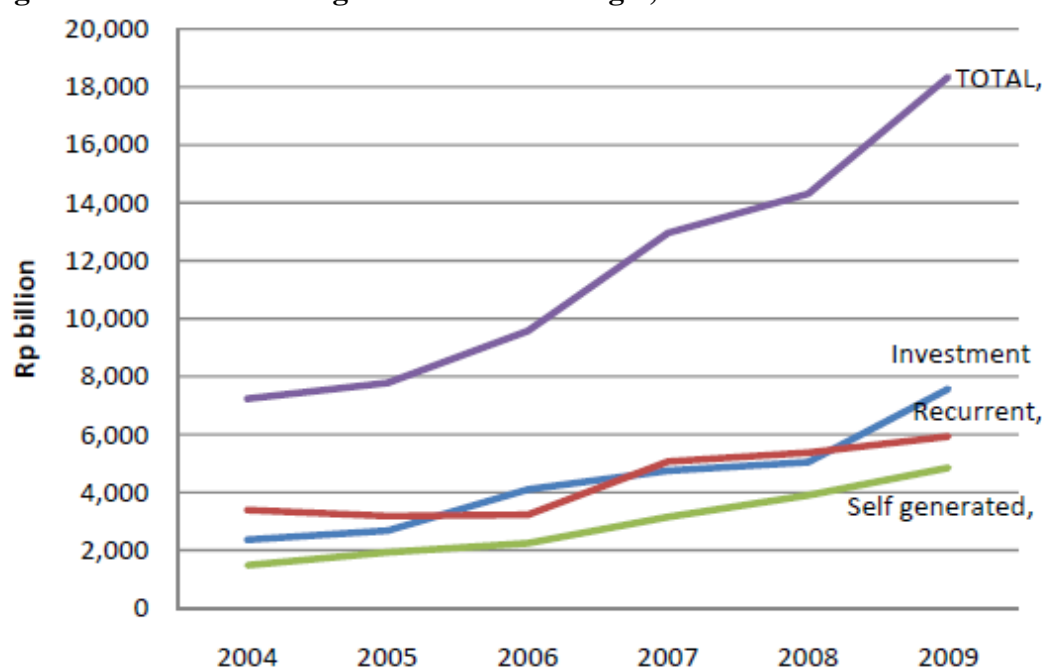
Structurally, Indonesia’s higher education sub-sector is notable for its high private sector participation. There are 81 public and over 2,000 private HEIs operating in the country. According the Directorate General for Higher Education, there are now 2,235 private HEIs in Indonesia (Table 1).

**Table 1: Indonesian Higher Education Institutions, by Type, 2006**

	Public	Private
Academies		715
Polytechnics	25	89
Advanced schools		1,043
Institutes	10	43
Universities	46	345
<b>Total</b>	<b>81</b>	<b>2,235</b>

In 2005 the Supreme Consultative Assembly passed an amendment to the Constitution that mandated that 20% of the Government budget be spent on education. Consequently, public spending on higher education has risen substantially during the last few years, and in 2009 it is estimated to be 20% of total expenditure. While Malaysia (at 25%) and China (at 23.3%) spent more on education as a proportion of total expenditure in 2008, Indonesia's increasing allocations are closing the gap. Figure 9 shows the upward trend in budgetary allocations to higher education over the last few years.

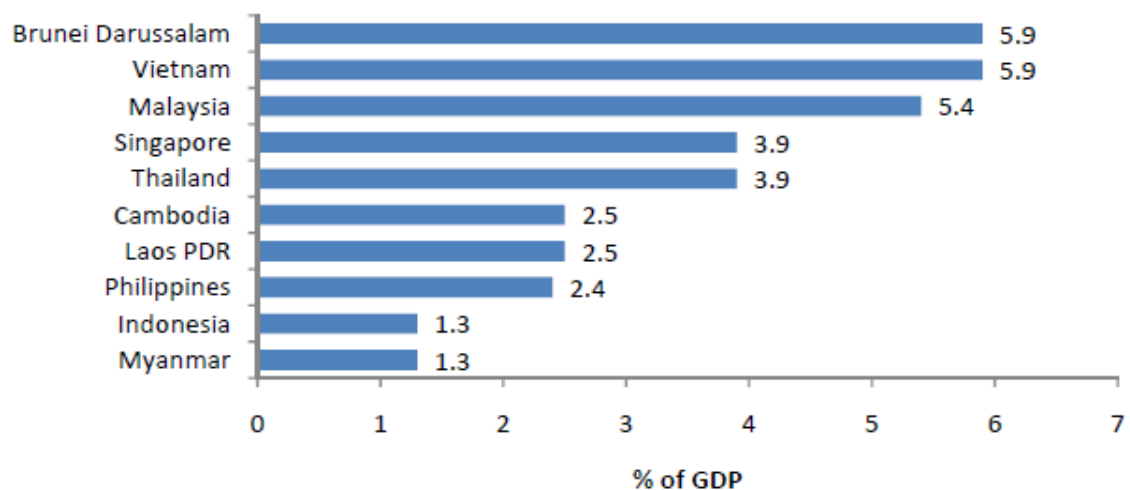
**Figure 9: Government Higher Education Budget, 2004 - 2009**



Source: Directorate General for Higher Education, as quoted in Higher Education Sector Assessment, 2008.

It is important to note, however, that overall education expenditure as a percentage of GDP is low. At only 1.3% of GDP, Indonesia's expenditure is far below that of Malaysia, Singapore, Thailand, and other neighbours (Figure 10). The low absolute volume represents a major constraint to improving the sub-sector.

**Figure 10: Education Expenditure, as Percentage of GDP, Selected Countries**

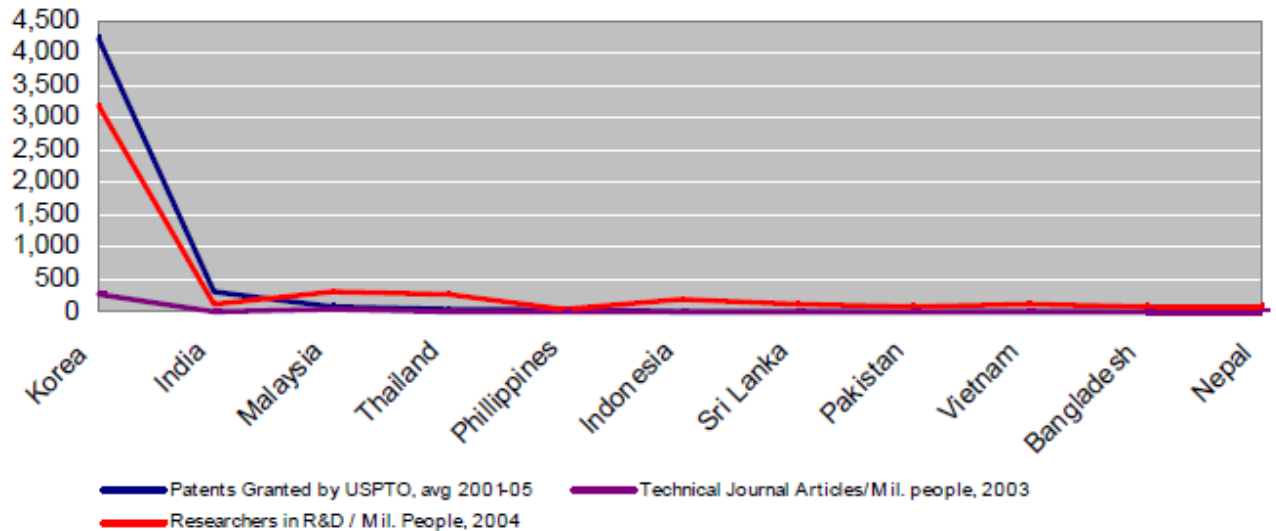


*Source: Higher Education Sector Assessment, 2008.*

Outcomes: While quality at the tertiary level is more difficult to measure, there are some indicators that can shed light on this aspect of Indonesia's HEIs. In the 2008 World University Rankings, only three Indonesian universities were among the top 400 in the world. The University of Indonesia ranked 287 (up from 395 in the previous year). Bandung Institute of Technology was 315 (up from 369 the previous year), and Gadjah Mada University was 316 (up from 360 the previous year). Research quality and research publications and citations in peer-reviewed journals are significant criteria in the World University Ranking tables, an area in which Indonesia is lagging. The relative lack of competitiveness of Indonesian HEIs was confirmed again recently: according to the Shanghai Jiao Tong survey, no Indonesian university is placed within the top 100 institutions in Asia.

In terms of innovation, available evidence indicates that the higher education system in Indonesia is being outpaced by many of its neighbors. Figure 11 provides information on patents granted, journal publications, and the number of researchers working in R&D in Indonesia, and shows that Indonesia is significantly behind the top innovating countries, such as Korea, as well as its more immediate neighbour Malaysia, particularly in terms of patents granted and number of researchers.

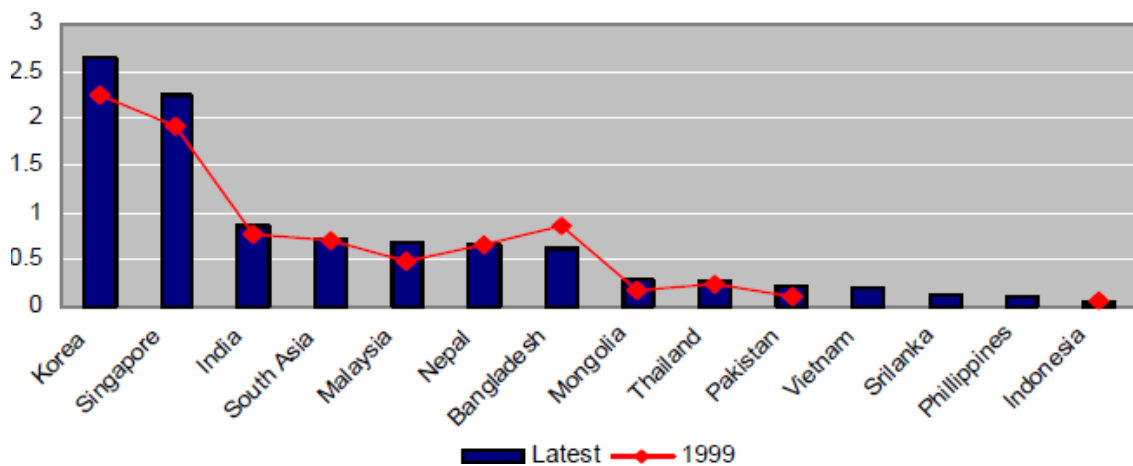
**Figure 11: Innovation Indicators, Selected Asian Countries**



Source: Higher Education Sector Assessment, 2008.

Indonesia also invests in R&D much less than many Asian countries, when measured as percentage of GDP. It invests less than 0.5% of its GDP in R&D. High innovators like Korea, on the other hand, invest over 2.5%. Singapore invests over 2%. Indonesia invests less in R&D as a proportion of its GDP than Mongolia, Thailand, Pakistan, Vietnam, and the Philippines (Figure 12).

**Figure 12: R&D Expenditure (as % of GDP), Selected Asian Countries**



Source: Higher Education Sector Assessment, 2008.

The data indicate that Indonesia has not prioritized R&D as much as some other countries, and the recent Higher Education Assessment has called for more investment in this area. The capacity to innovate and to leverage this investment is dependent, too, on the capacity of faculty and researchers in the higher education system who perform this work. Several universities in Indonesia have high

concentrations of Ph.D. holders, which indicates that these universities likely have strong capacities to innovate. The four top ranking universities in Indonesia in the University World Ranking tables have over 2,500 faculty members with Ph.D.s (Table 2). While these universities seem to have the capacity to innovate, the aggregate picture is more bleak. Only 5% of faculty lecturers in Indonesian HEIs have Ph.D. degrees. About 60% have bachelor or master's degrees. Innovation, then, is only likely to emerge from a few, select institutions.

**Table 2: Number of Faculty with Ph.D. Degrees at Four Leading Indonesian HEIs**

No	Name of Institution	#Faculties	Ph.D. holders	# Professors
1	UI	2,497	671	157
2	IPB	1,383	612	93
3	ITB	1,004	684	69
4	UGM	2,149	692	224

*Source: Higher Education Sector Assessment, 2008.*

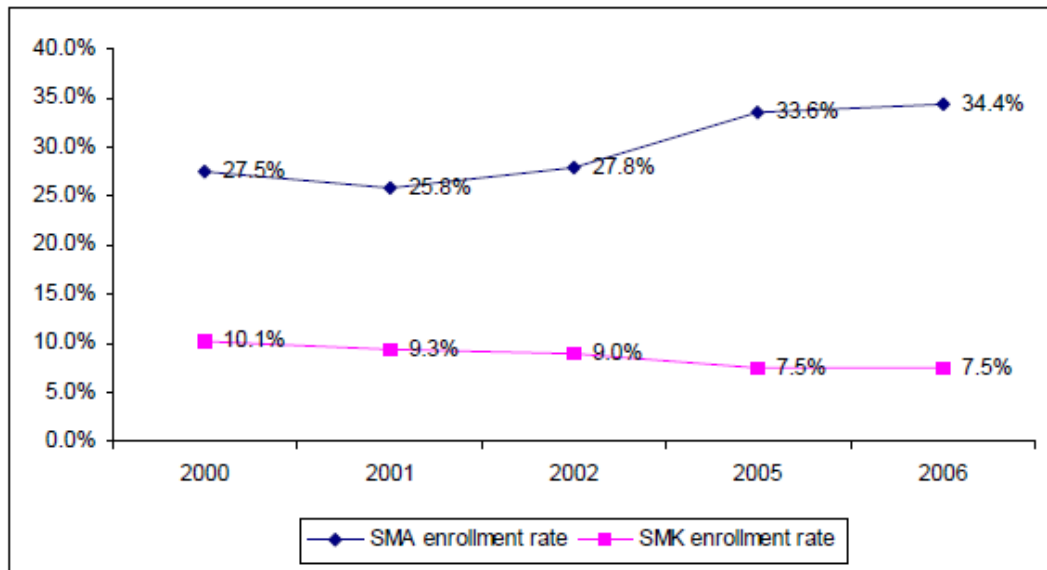
(e) The Pre-Employment Technical and Vocational Education and Training Sub-Sector

Perhaps the most striking development in Indonesia's education sector in the last decade is that it has significantly expanded its formal TVET offerings. Responding to rising unemployment rates and the lack of appropriate skills among workers, the Ministry of National Education (MoNE), which oversees and administers formal vocational education in the country, has made TVET expansion a priority and has ramped up investments in the formal TVET sub-sector. MoNE has set the formal and ambitious goal of shifting the ratio of students enrolled in general senior secondary education (SMA schools) to vocational senior secondary schools (SMK schools) to 30:70 by 2015. The current ratio is 75:25. In order to meet these targets, enrollments in SMKs will have to rise dramatically over the next decade.

The World Bank (2009b) has estimated that achieving the 2015 target will require increased public investments of Rp 5.8 trillion per year, as well as the shift of 4.1 million students from SMA schools to SMK schools. Given recent enrollment trends, achieving the shifted ratio appears unlikely. The gross enrollment rate (GER) at SMK schools declined between 2000 and 2006 (Chen, 2009). According to Susenas data, the SMK GER was 10.1% in 2000 and fell to 7.5% in 2006 (Figure 13). At the same time, the GER in SMA schools has increased: while it stood at 27.5% in 2000, the GER for SMA schools in 2006 was 34.4%. With the GER in SMK schools declining, and the GER in SMA schools increasing, the share of SMK enrollment as a proportion of overall secondary enrollment has consequently fallen. In 2006, it stood at 27%; it was 18% in 2000.



**Figure 13: GER at the Secondary Level, SMA and SMK, 2000 - 2006**



*Source: Indonesia National Social Economic Survey (SUSENA).*

*As cited in Chen, 2009.*

Not surprisingly, the supply of vocational schools reflects demand: the majority of vocational institutions specialize in Technology and Industry programs or Business and Management programs. Of the 6,422 vocational secondary schools in the county, over 5,500 (86%) specialize either in Technology and Industry or Business and Management.

These trends in enrollment can reasonably be interpreted as a response to labour market outcomes. Time-series data from 1994 to 2007 show that, while SMK graduates consistently experienced higher returns than SMA graduates, that gap has sharply narrowed. This, combined with the fact that more SMA graduates enter tertiary education (tertiary graduates have significantly higher returns than either SMA or SMK graduates), can go some way in explaining why more students are selecting SMA schools rather than SMK schools.

## **(5) Insights from the Firm Survey**

### **(a) The Survey**

Interviews were conducted with 12 firms, mainly Jakarta-based, in late 2009. The firms were located in the services and manufacturing sectors. The former included providers of mining services, education (three firms), financial services, research and logistics (two firms). The latter included pharmaceuticals (two firms), wireless technology, and palm oil processing. Some additional information on firm characteristics was provided, including firm size and ownership. Annex 1 provides a summary of the key responses.<sup>13</sup>

Respondents were asked questions related to the education levels of both the top manager and employees, R&D expenditure and staff training, relationships with universities and innovation activities. The latter included details of the innovation, the person who introduced it, the requisite education and skill levels, and the constraints encountered. Respondents were also asked to provide any general recommendations on innovation policy as it relates to Indonesia's higher education system. Owing to the small sample size and the qualitative nature of much of the information, the survey results are best presented in the form of an analytical narrative, linking back to the general observations in section 2 of this report.

### **(b) General findings**

**Education levels:** These firms had a well-educated workforce by Indonesian standards. In four of the firms, 100% of professional staff were university graduates, while the figure was 60-80% in four more. As expected, the four firms with a highly educated workforce were all in education and research. In only one of the firms was the percentage with at least a bachelors degree quite low, 20%, similar to the national average. Thus, these firms are atypical in this sense, and therefore might be expected to be among the more innovative. Similarly, the education of the top managers was generally high. Four had PhD's, while another five had Masters degrees (known as 'S2' in Indonesia). It was not disclosed whether these were foreign or domestic degrees.

**R&D, training:** Most firms were also R&D-active, at levels well above the national average. As would be expected, the pharmaceutical firms spent a significant proportion of their operating budget on R&D, in the range 15-20%. The wireless technology firm was the most R&D active, spending 25%, again to be expected. Perhaps surprisingly, the education firms did not record any R&D expenditures, but this presumably reflects the fact that this activity is embodied in its general research and training activities.

Staff training also varied considerably among the firms. Half had formal technical training programs of at least two weeks per year, and more if needed for new projects. As expected, these firms were typically in R&D-intensive activities, where such

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<sup>13</sup> It should be noted that, while containing some useful information, there is a significant non-response rate, in addition to other information that is rather general and vague in nature. Therefore, the results are at best indicative.

investments are essential to retain competitive advantages. Most of the others arranged training on an informal and ad hoc basis. Again, the education suppliers probably understated the extent of their training. There is no evidence of the extent of foreign training, either in-country or abroad.

Most firms had some sort of relationship with universities. Several offered internships, apparently as a means of informal recruitment and ‘talent spotting’. Some engaged university staff as consultants and guest lecturers. The wireless technology manufacturer had a formal, ongoing training relationship with a foreign university. This firm also spent the most on R&D, and was clearly the most innovative in the sample, a factor no doubt dictated by its location in an R&D-intensive industry.

Recent innovation activity: All but one of the firms reported some sort of innovation activity. As expected, these were typically ‘process’ in nature, modifying and improving existing activities, rather than more fundamental research work. Some of the innovations were embodied in recently established plants incorporating modern technology. This was the case with the mining services provider, one of the pharmaceuticals firms, and the palm oil refiner. These three sectors have been growing strongly in Indonesia over the past decade, and this growth provides the opportunity to invest in modern technology. Several firms reported IT-based innovations, including for product grading, accounting systems, output monitoring, company financial reports, and inventory management. Here also, the active innovators appeared to be those with higher levels of R&D expenditures, more highly qualified staff, and located in more R&D-intensive industries.

These innovations were typically ‘top down’ in nature. The CEO or deputy was directly involved in four of them. Staff with the relevant expertise (engineering or accountancy) were the decision makers in another four cases. International consultants were engaged by three of the firms. International sources of technology – arms length or from the company’s parent – were directly present in five cases, and probably indirectly in most of the others. This highlights the importance of connections to international technology sources.

Respondents varied as to the importance of education levels in the innovation process. Two firms regarded PhD’s as required, not surprisingly the wireless technology manufacturer and one of the pharmaceutical firms. The majority of the remaining respondents thought that a Masters degree was sufficient. Two of the firms reported that the requisite skills were obtained through out-sourcing. On-the-job experience was also mentioned, and was presumably relevant in most cases.

As to the skill levels required, all firms (except one non-respondent) emphasized the importance of relevant industry-specific technical knowledge, and an understanding of the company’s general operations. Some respondents provided additional information, for example knowledge of Indonesia’s mobile phone market and consumer preferences in the case of the wireless technology manufacturer. Several referred to the importance of understanding international best practice. Some respondents emphasized the importance of ‘curiosity’ and ‘creativity’; significantly, these remarks originated from firms with a general commitment to R&D and education.

The constraints to innovation were diverse and accord with our general understanding of the broader Indonesian environment for technology activities, as discussed above.

The more innovative firms drew attention to the difficulty of recruiting overseas workers, and the country's weak protection of intellectual property rights. Several firms mentioned a general lack of international exposure and knowledge on the part of staff; language barriers are presumably also relevant here. The poor technical quality of Indonesian university graduates was also highlighted, with the notable exception of the country's premier institute, the Bandung Institute of Technology. A lack of clustering opportunities was also seen as an obstacle. This is a common observation from Indonesian field research, and reflects the absence of scale in some cases. Financial constraints were reported in only one case.

The backgrounds of the CEO's varied across business and engineering, as would be expected, and most of them appear to have the requisite professional skills. Those of the middle-level executives were more mixed, although the subjective nature of the replies cautions against drawing strong conclusions. Where staff upgrading has occurred, the backgrounds and outcomes are also variable, with some firms reporting the relevant supervisory staff to have just a bachelor's (S1) degree. The upgrading activities occurred in a variety of departments, with no clear patterns.

The data on advertizing activities and budgets are inconclusive, with a sizeable non-response rate. As expected, the pharmaceuticals and IT firms spent heavily, in the range 10-35% of operating budgets.

Recent equipment purchases are a useful indicator of growth in the industry, and the scope for introducing best-practice technology. Here too there was a substantial non-response rate, and a positive correlation with the more progressive sectors and firms. The latter were also more likely to procure equipment from abroad. The information on which these investment decisions were made relied heavily on established supplier networks. Governments were useful in three cases, while for firms with foreign equity, the headquarters were actively involved. University expertise was not a major source of information. More than half the firms did not reply to the question on these linkages, while for the rest informal relationships appear to be the most relevant. The majority of firms did not reply to the question concerning the government's role in fostering these linkages.

These findings strongly confirm the presumptions both that enterprise/university linkages are still at the embryonic stage, and that the government is a largely passive actor. It was not clear from the interviews whether demand or supply factors are the major explanation for these outcomes. But it is reasonable to infer that the weak level of R&D activity in both the public and private sectors combined with the generally low levels of research orientation in practically all Indonesian universities explain such an outcome. Only half the firms responded to the question regarding their R&D budget, a likely indicator of the absence of formal R&D activity. Moreover, some of the positive responses appear to be implausibly high, and probably include that undertaken in the HQ. The high non-response rates to questions concerning current R&D priorities and constraints to increased activity also limit the usefulness of the survey findings. Significantly, the responses that were received appear to be heavily focused on immediate requirements, such as streamlining production, drug development, and ICT issues. Surprisingly, only one firm believed that incentives (presumably tax incentives) were a major barrier to innovation.

In general, the survey results:

- confirm how little R&D activity is undertaken in Indonesia;
- highlight how low is the general level of what may be termed ‘innovation conscientiousness’;
- point to the very weak linkages between universities and firms with regard to training and innovation; and
- portray the government as a largely passive player on all major innovation issues, ranging from the public supply of key inputs to the incentives regime.

Three factors that might have been expected to receive mention were not highlighted. One is the high level of turnover among staff. From surveys the author has conducted on other occasions, respondents frequently cited this factor as a reason for not undertaking more R&D and training activities, on the assumption that the firms would not be able to appropriate the return from this investment. Second, there was little mention of government programs, in the form of fiscal incentives or direct subsidies, to encourage R&D and training in-house. Although not part of the questionnaire, it is probable that respondents would have accorded higher priority to other policy issues, such as infrastructure, labour regulations and general business uncertainty, including corruption. As has been documented extensively elsewhere, governments have to be pro-active in technology policy, rather than merely responsive to business needs. Thirdly, only one firm mentioned financial constraints. It might have been expected that more firms would refer to this issue, since Indonesian financial services in support of innovation (eg, venture capital providers, R&D enterprises floating on the stock market) are generally regarded as weak. However, the fact that finance was not seen as a major constraint probably reflects the low general level of innovation activity.

Finally, the respondents had some very useful comments on how the resources of the higher education system could be more usefully deployed to foster innovation. A consistent theme articulated by practically all firms was the importance of greater international exchange programs for both faculty and students. This is consistent with the state of Indonesian higher education, which in contrast to the general economy is mostly inward-looking and ‘unconnected’ to the international world of learning and research. The contrasting experience of neighbouring countries such as Singapore and Malaysia with regard to both the labour market and education was noted. Most respondents were open to stronger relationships with universities, and looked to them to raise general community awareness of the importance of innovation.

### (c) Summing Up

A recurring theme among respondents was that innovation at the firm level was strongly dependent on the general skills among staff. Firms stated that innovative individuals need to be able to understand the nature of problems and possess the aptitude and creativity to address them. Managers indicated that employees are expected to move quickly between areas of expertise and to acquire new expertise to keep pace with changing knowledge. In particular, managers stated that increasing numbers of staff need skills for acquiring, using, and operating technologies at rising levels of complexity, productivity, and quality.

The firms interviewed suggested that the higher education system needs to become more relevant. Employers indicated that too many tertiary graduates were weak in

terms of critical general skills such as problem-solving, computer use, communication, and teamwork.

Indonesia's leading tertiary institute in this field, the Bandung Institute of Technology (known by its Indonesian acronym ITB) reports considerable activity at the aggregate level (see Supangkat, 2006). Through to early 2006, its Intellectual Property Management office reported that there had been 75 patent applications, of which eight had been granted, while three technologies had been licensed. Fields included probiotic microbe technology, with applications to agriculture, gas technology, and coal upgrading. Its Business Incubator Center had nine tenants, working in the fields of agricultural equipment, machinery components, fermented and health drinks, interactive CD software, software-hardware production, reverse engineering, and telecommunications.

Several firms identified the poorly developed system of intellectual property rights as a constraint to innovation. The lack of financial resources provided by the Indonesian government for the law enforcement authority was given as a factor that makes the enforcement of intellectual property laws ineffective. In some cases, respondents noted that police stopped their investigation on counterfeiter suspects as a cost-saving measure to investigate more serious criminals. Indonesian courts also sometimes could not continue their trials against suspects because of a lack of budget to bring expert witnesses to the courts. The other constraint to enforce intellectual property laws mentioned was a lack of qualified law enforcement officials who fully understand intellectual property laws. For example, many police officers, judges and prosecutors did not know the applicable laws or how to enact them.

## **(6) Summary and Policy Discussion**

The Indonesian economy has performed well since the late 1960s, with a long term annual growth rate of about 4%. It has recovered strongly from the deep economic crisis of 1997-98, while embarking on a major reshaping of institutions in the transition from authoritarian to democratic rule. It has also managed the global financial crisis adroitly, with only a small decline in its growth rate. It is now firmly established as a successful, democratic state with a per capita income towards the bottom of the lower middle income developing economies group.

Nevertheless, it is a latecomer in many respects, and this is reflected in its record on education, innovation, and technological development. In the mid 1960s, it was one of the poorest countries in the world, it had one of weakest human capital bases, and it was cut off from the international economy, with no private foreign capital in the country. Its current development record and policy priorities have to be understood within this context. Its low international rankings on most comparative indicators therefore reflect both its current level of development and its historic under-investments in these areas. It is moreover, some way off the 'turning point' in economic development in the transition from labour-intensive to skill and technology-intensive activities. There is still extensive under and unemployment of labour, and no indication of a generalized increase in real wages.

Government investments therefore understandably focus on more pressing development priorities, including universal primary and secondary education, and improved quality at these levels. Universities have responded to the market signals for a mass-based education system of indifferent quality. As a result, there is a strong preference for expensive overseas tertiary education, both on the part of parents and employees. On all comparative international indicators, Indonesian universities rank poorly. Strategic partnerships between universities and the corporate sector are weakly developed. Government R&D and extension services are poorly funded and lack strategic orientation. Following the Asian financial crisis, public debt levels rose sharply, and this has constrained public sector initiatives. The policy regime for foreign investors is in principle open and welcoming. But in practice the business environment is characterized by considerable uncertainty and high levels of corruption, underpinned by a continuing ambivalence towards foreign ownership.

Nevertheless, even given these constraints, there is much that the government could do to promote a more effective regime for innovation, the development of higher education, and the synergies between the two. In this concluding section, we highlight areas where reform would be effective and largely cost-neutral.

First, government investments in technology development and diffusion are minimal, and there is a tendency to concentrate on 'prestige' projects. Most of the major technology projects of the Soeharto era have been discontinued, and have had little durable impact, apart from the scholarship programs. Government extension programs in industry and agriculture are poorly focused, supply-driven (often with stop-gap donor support), lacking in strategic direction, and meagerly funded. Government policy needs a major overhaul in all these respects.

Second, basic education, which forms the foundation of the nation's human capital base, has achieved much in terms of quantitative expansion, but is generally poor quality, has high post-secondary drop-out rates, and is poorly targeted on equity grounds.

Third, the university sector needs major reform. The public universities need to be given greater autonomy. There needs to be a shift towards full-cost pricing, combined with scholarships for the meritorious and the needy. A contingent loans scheme might be considered, if the necessary taxation arrangements could be enforced. The government needs to provide greater incentives to universities to recognize and promote excellence in teaching and research. There is also a strong case for the provision of seed funding for collaborative innovation arrangements between universities and the corporate sector.

Fourth, within the recognized constraints of the political system, the government needs to provide a more conducive environment for foreign investment, with less uncertainty in regulatory, labour, and infrastructure policies. A more open international labour market would enable Indonesian firms to better access cutting-edge technology. The government's investment agency, the BKPM, needs to switch its focus from regulation and control to promotion and business facilitation.

Fifth, while recognizing that Indonesia is a large net technology importer, and will remain so for the foreseeable future, a simple, transparent program to protect intellectual property rights should be instituted. Within the constraints of the country's under-developed judicial system, such a system ought to be able to provide basic protection for local innovators, and for foreign investors seeking to introduce new technologies into the country.

In addition to these general recommendations, the results of the firm survey highlighted some specific areas of concern. These include the following:

(i) Providing incentives to innovate through the accreditation system. An accreditation system that incentivizes creativity can help transform a university to become a place where entrepreneurship is nurtured and innovation created. Specific structures and processes to consider are:

- Introduce mechanisms to support high-risk, high-return ventures.
- Establish forums for discussion of strategic directions with a broad range of stakeholders, including faculty, staff, students, alumni, and representatives from the public and private sectors.
- Nurture a system of leadership that empowers faculty, staff, and students to pursue innovative ideas, including those that originate outside the normal planning processes.
- Create open administrative structures that foster interdisciplinary dialogue and facilitate creation of interdisciplinary programs.

(ii) Improving quality and relevance of education and training. This includes attention to the following:

- Introduce mechanisms to respond to rapidly changing market needs, including career and job information, with input from employers.



- Update curriculum and teaching pedagogy with a focus on key competencies and “learning to learn”.
- Improved governance system with more demand-oriented input from employers, students, parents, workers.
- Better information: career counseling, job opportunities, quality of different providers, accreditation and certification of formal education institutions and trainers.
- Introduce more accessible international exchange programs for both students and faculty.
- Introduce easier methods of entry and exit into the higher education system.

Other suggestions include the following:

- Collaborate with the private sector to introduce entrepreneurial competitions at universities, akin to MIT’s 50K competition.
- Highlight strong examples of university-industry linkages through an annual innovation fair.
- Universities should hold more forums with small and medium enterprises to build social capital among firms, encourage clustering, the sharing and transfer of technology, and social learning.

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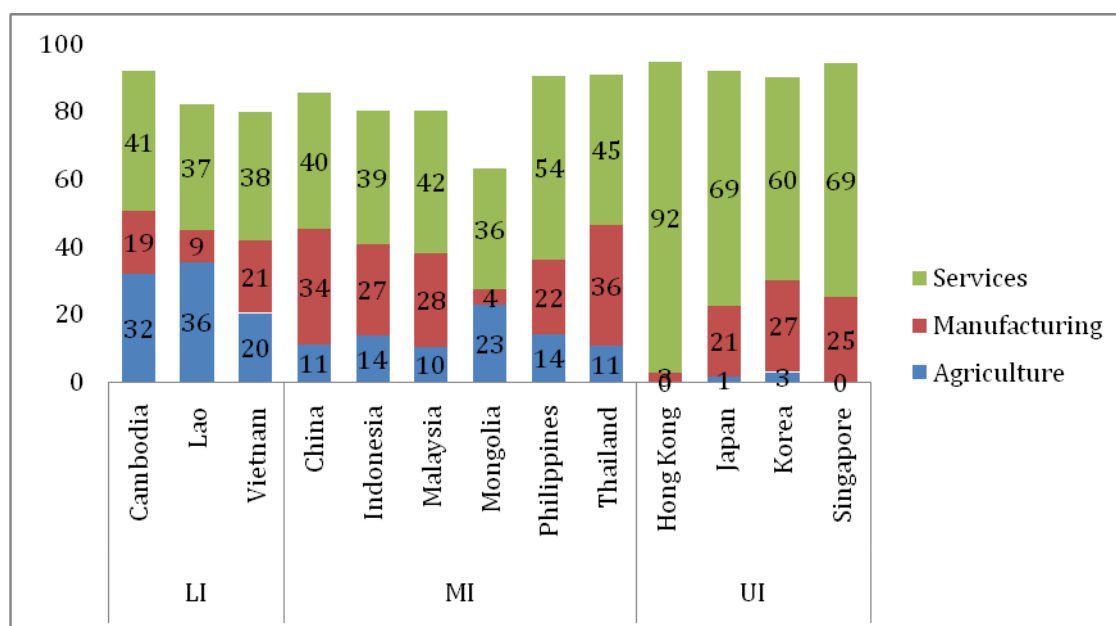
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Annex 1: GDP Composition and Employment by Sector

**Figure A.1 Sectoral value-added as a share (%) of GDP, East Asia**



Source: WDI, 2010

**Table A.1: Sectoral Employment as Percentage of Total Employment, Indonesia, 2007**

Agriculture	41%
Industry	19%
Services	40%

Source: WDI, 2010

## Annex 2: Results of the Firm Survey

Firm No.	1	2	3	4	5	6
<b>Sector</b>	Services	Services	Services	Services	Services	Services
<b>Sub-Sector</b>	Oil, Gas, and Mining	Education	Education	Financial Services	Education	Research Institute
<b>Proportion of Employees with S1 degree or above</b>	40%	100%	100%		100%	100%
<b>Education Level of Top Manager</b>	PhD	S1	S1	S2	PhD	S2
<b>Proportion of Operating Budget Spent on R&amp;D per year</b>	10%	0%	0%	0%	N/A	10%
<b>Training Offered to Staff</b>	2 weeks per year, Technical Skills	None	None	Ad hoc and informal	Ad hoc and informal	2 weeks per year, Technical Skills
<b>Relationships with Universities</b>	Internships for 10 students a year; 80% retention	N/A	N/A	Ad hoc internships (rare)	N/A	Several university faculty work as consultants on an ad hoc basis
<b>Recent Innovation Introduced</b>	New Production Facilities built for early-stage production	New scanner to help standardize grading	Computerized Accounting sytem	Computerized Accounting and Securities Trading Sytem	N/A	Web-based monitoring system for publications

<b>Position of Person who Introduced Innovation</b>	CEO and Deputy CEO	Technology Officer	Technology Officer; Accountant	International Technology Consultant from Hong Kong	N/A	International Technology Consultant from Vietnam
<b>Education Level Needed to be Innovative</b>	S1 minimum, plus at least 5 years on the job experience	S1	S1	S2	N/A	S2
<b>Skills Needed to Introduce Innovation/Be Innovative</b>	Broad-based understanding of all operations of company; pro-activity; curiosity; knowledge of international best practices	Technical skills and training	Technical skills and training	Industry knowledge and technical skills	N/A	Sector-specific knowledge and technical skills
<b>Identified Constraints to Innovation</b>	Lack of financial resources; lack of clustering opportunities with other similar firms; inadequate skills of workforce	N/A	Lack of training in new technology	Lack of well-trained Indonesian graduates; must rely on foreign specialists	N/A	Lack of international exposure among some workers
<b>Recommendations for HE System to Provide Useful Research for Firms and Produce Skilled Graduates Capable of Innovation</b>	International exchange programs for faculty and staff; More joint conferences/input from faculty on technical issues to facilitate cross-learning	N/A	N/A	More international exchange programs for faculty and staff	N/A	More international exchange programs among faculty and staff
<b>Total Company Sales</b>	1,178,572,000,000 Rupiah	N/A	N/A	117,000,000 USD	N/A	N/A

<b>Percentage of Professional Staff with Adequate Technical Knowledge</b>	50%	100%	100%	75%	50%	100%
<b>Name of Departments where Upgrading of Officers Took Place</b>	Advertising; Partnership Development; Upper Management	Teaching	Teaching; ICT	Research; Sales; Upper Mangement; ICT	N/A	N/A
<b>Educational Background of Top Officers of These Departments</b>	MBA; PhD	S1	S1	S1; MBA	N/A	N/A
<b>Percentage of Operating Budget Devoted to Advertising</b>	5%	N/A	N/A	Unknown	N/A	N/A
<b>Was an Advertising Agent Hired? Local or Foreign?</b>	Internal	N/A	N/A	N/A	N/A	N/A
<b>How much has been invested in Equipment over the Last 5 Years</b>	1,500,000,000 Rupiah	State Budget Support	State Budget Support	5,000,000 USD	Unknown	Unknown
<b>Was New Equipment Sourced Locally or Internationally?</b>	Internationally	Locally	Locally	Internationally and Locally	Unknown	Unknown
<b>Was there difficulty in finding suppliers of new equipment?</b>	No	No	No	No	N/A	N/A
<b>List of Products that have undergone technical innovation in last three years</b>	New Production Facilities	Scanner	Accounting System	New Trading Facility	N/A	Web Applications
<b>Type of Innovation for These products.</b>	New Machinery	New Machinery	New software from foreign firm	New software from foreign firm	N/A	New Software and licencing from local firm



<b>Source of Information that led to Innovation.</b>	Prior Relationships with Suppliers over many years	Municipal Government	Municipal Government	Company Headquarters in Hong Kong	N/A	Internet
<b>Was executive and professional staff technically competent to initiate and implement innovation?</b>	Yes	Some professional staff	Some professional staff	Some professional staff	N/A	No
<b>Educational Background of Staff who initiated innovation</b>	S1	S1	S1	S1	N/A	S2
<b>Does your firm have strong collaboration with Universities? Local or foreign?</b>	Internships for 10 students a year; 80% retention; Local Universities	No	No	No	N/A	Ad hoc with Local Universities

<b>How do you rate the expertise of research insitutes and universities in helping your firm adapt or adopt new technologies?</b>	N/A	N/A	N/A	N/A	N/A	Relatively good in identifying issues and providing quality control
<b>Describe Innovative assistance your firm received via a consultancy with a research institute or university.</b>	N/A	N/A	N/A	N/A	N/A	N/A
<b>Does Your firm have relationships with universities outside of Indonesia? If so, how do these relationships differ from those with Indonesian universities?</b>	No	No	No	No	N/A	No
<b>What role does the government play in connecting your industry to universities?</b>	N/A	N/A	N/A	N/A	N/A	N/A
<b>Annual R&amp;D budget</b>	2,750,000,000 Rupiah	N/A	N/A	N/A	N/A	Total Operating Budget
<b>Number of full time staff working on R&amp;D</b>	10	N/A	N/A	None	N/A	100% of staff

<b>Number of full time staff working on R&amp;D</b>		10	N/A	N/A	None	N/A	100% of staff
<b>Education Level of Head of R&amp;D Department</b>	S2		N/A	N/A	N/A	N/A	S2
<b>Educational Level of Mid-level Managers of R&amp;D Department</b>	S1		N/A	N/A	N/A	N/A	S1
<b>Education Level of Professional R&amp;D Staff</b>	S1		N/A	N/A	N/A	N/A	S1
<b>Current Priority Subjects for R&amp;D</b>	Streamlining Production Processes		N/A	N/A	N/A	N/A	Economic and Social Policy
<b>Constraints to Innovation</b>	Poor access to international information; absence of local expertise in local universities		N/A	N/A	N/A	N/A	Cost constraints
<b>Level of Satisfaction with Top Executives</b>	Very Satisfied	Very Satisfied	Very Satisfied	Very Satisfied	Very Satisfied	N/A	Fairly Satisfied

<b>Level of Satisfaction with Office Workers</b>	Fairly Satisfied	Very satisfied	Very satisfied	Very satisfied	N/A	Fairly Satisfied
<b>Level of Satisfaction with Production Workers</b>	Fairly Satisfied	N/A	N/A	Fairly Satisfied	N/A	Fairly Satisfied
<b>Reasons for Dissatisfaction with Staff</b>	Lateness to work; Poor industry knowledge of new hires	None	None	Poor English skills	N/A	Lack of international experience
<b>Assessment of Quality of Typical Undergraduate in terms of technical knowledge?</b>	Fairly good	Fairly good	Fairly good	Not good	N/A	Fairly good
<b>Assessment of Quality of Engineering Graduates.</b>	Fairly good	N/A	N/A	N/A	N/A	N/A
<b>Assessment of Quality of Computer Science Graduates.</b>	N/A	N/A	N/A	N/A	N/A	Fairly good
<b>Assessment of Quality of Management Graduates.</b>	N/A	N/A	N/A	Not good	N/A	N/A
<b>Assessment of Quality of Social Science Graduates.</b>	N/A	Fairly good	Fairly good	Fairly good	N/A	Fairly good
<b>In which fields, if any, is there a shortage of qualified workers?</b>	Natural Sciences	N/A	N/A	Management; Computer Science	N/A	Management; Social Sciences

Firm No.	7	8	9	10	11	12
<b>Sector</b>	Manufacturing	Services	Manufacturing	Manufacturing	Manufacturing	Services
<b>Sub-Sector</b>	Pharma	Logistics	Wireless Technology	Pharmaceuticals	Palm Oil Processing and Refinery	Logistics
<b>Proportion of Employees with S1 degree or above</b>	80%	20%	80%	60%	50%	60%
<b>Education Level of Top Manager</b>	PhD	S1	PhD	S2	S2	S2
<b>Proportion of Operating Budget Spent on R&amp;D per year</b>	20%	15%	25%	15%	5%	10%
<b>Training Offered to Staff</b>	average of 4 weeks per year, Technical Skills for engineers and manufacturers, depending on project	Ad hoc and informal	2 weeks per year, Technical Skills; more for new projects as needed	2 weeks per year, Technical Skills; more for new projects as needed	Ad hoc and informal	2 weeks per year, Technical Skills; Intra-company rotational program for outstanding staff members
<b>Relationships with Universities</b>	Informal relationships with engineering professors; staff provide guest lectures occasionally; Engineers in Europe have close contact with several university labs	None	Informal relationships with selected faculty in Indonesia; Engineers in Europe, USA, and China have stronger relationships with several engineering departments	Internships for 15 students a year; 50% retention; Collaboration with Monash University for leadership training of staff	Internships for varying number of students per year, as needed	Internships for 20 students a year; 90% retention
<b>Recent Innovation Introduced</b>	New streamlined manufacturing process for several generic drugs	Online tracking system of packages	Introduction of new software applications for mobile devices	Introduction of "Balanced Scorecard Framework" to measure company results	New production facilities established	New computerized method of monitoring inventory control and automatic replenishment of inventory when low

<b>Position of Person who Introduced Innovation</b>	Company engineers from Merck Headquarters	CEO and Deputy CEO	Engineers from Company headquarters	International Management Consulting Firm	CEO and Deputy CEO	CEO and Deputy CEO
<b>Education Level Needed to be Innovative</b>	PhD	(Innovation was outsourced to local IT firm)	PhD	S2	S2	S1/S2 (Outsourced to management consulting firm)
<b>Skills Needed to Introduce Innovation/Be Innovative</b>	Technical skills; knowledge of production cycles and processes in local plant	Broad-based understanding of all operations of company; pro-activity; curiosity; knowledge of international best practices	Technical knowledge; local knowledge of Indonesia's mobile market and consumer trends	Organizational and management expertise; local knowledge of firm; creativity; international experience	International experience; broad-based view of company operations	Energetic, results-oriented, motivated; International exposure and experience; Broad understanding of company operations
<b>Identified Constraints to Innovation</b>	Lack of motivation and energy among some staff; poor quality of engineering graduates (except ITB graduates)	motivation and energy among staff; lack of financial resources; lack of clustering opportunities	Difficult to import skilled workers; Intellectual property rights are not well-established	Lack of well-established and enforced Intellectual Property Rights; Lack of local, motivated talent	Lack of energetic staff with international experience	Lack of energetic staff with international experience and good general cognitive skills
<b>Recommendations for HE System to Provide Useful Research for Firms and Produce Skilled Graduates Capable of Innovation</b>	More relevant curriculum in engineering departments; more industrial input into curricular design; more on-the-job training opportunities that are endorsed by universities	Universities could facilitate linkages among companies in the same industries to build social capital and facilitate cross learning	More international exchange programs for students and faculty; more career guidance counseling at universities; greater labor market mobility for internationals, a la Singapore	Universities could provide more leadership on setting adequate international property rights and raise awareness regarding their importance	More on-the-job training opportunities	More international exchange programs for students and faculty; more career guidance counseling at universities

<b>Total Company Sales</b>	24,000,000,000 USD	N/A	50,700,000,000 Euro	167,000,000 USD	2,604,000,000,000 Rupiah	N/A
<b>Dominant Field of Specialization of Top Executive</b>	Business; Management	Business; Management	Production Engineering	Business; Management	Business; Management	Business; Management
<b>Dominant Field of Specialization of Mid-Level Executives</b>	Engineering	General Studies	Engineering; Business Management	Engineering	Engineering	Business; Management
<b>Dominant Field of Specialization of Professional Staff</b>	Engineering	General Studies	Engineering	Engineering	General Studies	General Studies
<b>Percentage of Top Executives with Strong Technical Knowledge</b>	50%	25%	75%	50%	75%	100%
<b>Percentage of Middle Executives with Adequate Technical Knowledge</b>	50%	10%	50%	75%	50%	50%
<b>Percentage of Professional Staff with Adequate Technical Knowledge</b>	75%	5%	75%	50%	75%	10%
<b>Name of Departments where Upgrading of Officers Took Place</b>	R&D; Government Relations; Plant Management	Upper Management	R&D; Partnerships; Accounting	R&D	Accounting; ICT; Business Development	None
<b>Educational Background of Top Officers of These Departments</b>	PhD; S1; S1	S1	PhD; S1; S1	PhD	S1; S1; S1	N/A
<b>Percentage of Operating Budget Devoted to Advertising</b>	25%	10%	35%	15%	5%	7%
<b>Was an Advertising Agent Hired? Local or Foreign?</b>	Internal Department at HQ	Local Firm	Internal Department at HQ	Local Firm	Internal	Local Firm
<b>How much has been invested in Equipment over the Last 5 Years</b>	2,000,000,000	N/A	Over 5,000,000,000 Euro	30,000,000 USD	1,000,000,000 Rupiah	N/A
<b>Was New Equipment Sourced Locally or Internationally?</b>	Internationally	N/A	Internationally and Locally	Internationally and Locally	Internationally	N/A
<b>Was there difficulty in finding suppliers of new equipment?</b>	No	N/A	No	No	Yes	N/A

<b>List of Products that have undergone technical innovation in last three years</b>	New Production facilities and processes	Web Applications	New Technologies or Patents in Power, Medicine, Transport, and Lighting	New internal process	New production facility
<b>Type of Innovation for These products.</b>	New Machinery/equipment; new formula developed by own personnel;; formulas licensed from foreign partners	New Software package from local firm	New Machinery or equipment; new formula developed by own personnel;; formulas licensed from foreign partners	Formula licensed from foreign partner	New machinery/equipment
<b>Source of Information that led to Innovation.</b>	Prior Relationships with Suppliers over many years; Technical/professional journals; Consultaitons with foreign experts	Internet	Prior relationships with suppliers over many years; technical/professional journals; Consultations with foreign experts; Licensing agreements with foreign universities	Prior relationship; Internet	Internet; prior relationship
<b>Was executive and professional staff technically competent to initiate and implement innovation?</b>	Engineers were competent to execute innovation; Management was competent to propose it	No	Yes	After receiving training, yes	Yes
<b>Educational Background of Staff who initiated innovation</b>	MBA; PhD	S1	PhD	S1	S1



<p><b>How do you rate the expertise of research institutes and universities in helping your firm adapt or adopt new technologies?</b></p>	<p>Strong with universities or departments, particularly those that receive company financial support</p>	<p>N/A</p>	<p>Strong with engineering departments, particularly those that receive company grants to work on issues pertinent to company</p>	<p>N/A</p>	<p>Poor</p>
<p><b>Describe Innovative assistance your firm received via a consultancy with a research institute or university.</b></p>	<p>One example: European chemical engineering lab designed prototype for new chemical composition, that was licensed by the company; other licenses received at no cost; Adjunct professorships at foreign and local universities</p>	<p>N/A</p>	<p>Worked with ITB to develop "pre-paid" ICT applications, as well as a GSM test operating center that can test GSM applications from anywhere in the world</p>	<p>N/A</p>	<p>N/A</p>
<p><b>Does Your firm have relationships with universities outside of Indonesia? If so, how do these relationships differ from those with Indonesian universities?</b></p>	<p>Yes; more advanced technological knowledge is generated overseas; more easily replicated in Indonesian universities</p>	<p>No</p>	<p>Yes; country- and university specific relationships; in developing countries, relationships center around Corporate Social Responsibility</p>	<p>No</p>	<p>No</p>

<b>What role does the government play in connecting your industry to universities?</b>	Identifies opportunities for collaboration in strategic planning (MoNE)	N/A	Tax incentives to partner with local university is being discussed	N/A	N/A
<b>Annual R&amp;D budget</b>	5.3 billion USD	N/A	5.2 billion euro	64,000,000 USD	2,000,000,000 Rupiah
<b>Number of full time staff working on R&amp;D</b>	1,200	0	1,800	450	5
<b>Education Level of Head of R&amp;D Department</b>	PhD	N/A	PhD	PhD	S2
<b>Educational Level of Mid-level Managers of R&amp;D Department</b>	PhD	N/A	PhD	PhD	S1
<b>Education Level of Professional R&amp;D Staff</b>	PhD	N/A	PhD	PhD/S2	S1
<b>Current Priority Subjects for R&amp;D</b>	Process Chemistry; Pharmacology; Medicinal Chemistry	N/A	ICT; Automation and Control; Power; Lighting	Drug Development	Production streamlining

<b>Constraints to Innovation</b>	High cost of innovation; Lack of incentives for certain sectors	N/A	Global economic downturn; decreased annual revenue	High cost of international linkages with partner institutions; lack of local partners	Poor access to international information
<b>Level of Satisfaction with Top Executives</b>	Very Satisfied	Fairly Satisfied	Fairly Satisfied	Very Satisfied	Fairly Satisfied
<b>Level of Satisfaction with Office Workers</b>	Very satisfied	Very satisfied	Very satisfied	Fairly Satisfied	Fairly Satisfied
<b>Level of Satisfaction with Production Workers</b>	Fairly Satisfied	Fairly Satisfied	Fairly Satisfied	Fairly Satisfied	Fairly Satisfied
<b>Reasons for Dissatisfaction with Staff</b>	Weak work ethic; lack of continuous learning about technical subjects	Lack of motivation among employees; Lack of initiative or new ideas from staff	More pro-activity needed in identifying opportunities;	Inadequate technical knowledge; better non-cognitive skills needed	Need better inter-personal skills
<b>Assessment of Quality of Typical Undergraduate in terms of technical knowledge?</b>	Fairly good	Not good	Fairly good	Fairly good	Fairly good

<b>Assessment of Quality of Engineering Graduates.</b>	Fairly good	N/A	Fairly good	Fairly good	Fairly good
<b>Assessment of Quality of Computer Science Graduates.</b>	Fairly good	N/A	Not good	Fairly good	N/A
<b>Assessment of Quality of Management Graduates.</b>	Not Good	N/A	Not good	Not good	Not good
<b>Assessment of Quality of Social Science Graduates.</b>	Not good	Fairly good	Fairly good	Fairly good	Fairly good
<b>In which fields, if any, is there a shortage of qualified workers?</b>	Engineering; Computer Science; Management	N/A	Management, Social Sciences; Engineering	Management; Engineering	N/A