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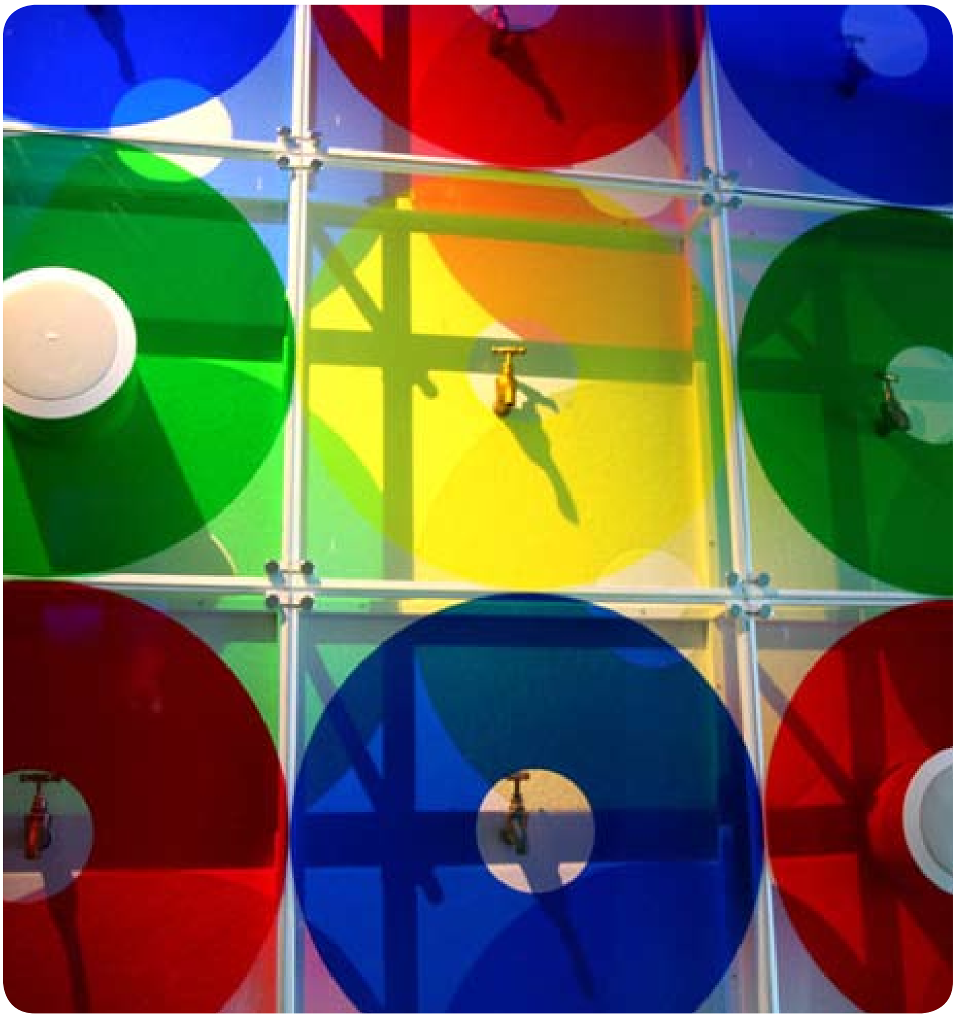
In this issue



IFRS 8
Operating Segments

On 23 December 2008, the Indonesian Institute of Accountants in its 50 years celebrations launched International Financial Reporting Standard ('IFRS') convergence program to converge the Indonesian GAAP into IFRS by 1 January 2012. In the convergence roadmap, IFRS 8 *Operating Segment* is one of IFRS that will be converged to in 2009. In June 2009, the Indonesian Institute of Accountants has issued Exposure Draft of PSAK No. 5 (2009 revision) that has fully adopted IFRS 8 except for the effective date of the implementation which under the Exposure draft set at 1 January 2011.

The IFRS 8 sets out requirements for disclosure of information about an entity's operating segments and also about the entity's products and services, the geographical areas in which it operates, and its major customers. The principles make it clear that the standard is primarily a disclosure standard.

Reporting on the performance of operating segments continues to be a critical area of focus for investors and regulators. As telecommunications companies, the adoption of IFRS 8 *Operating Segments*, may create challenges in defining and reporting segmental information. This write up is intended to bring up thought and identify some of the issues that companies may encounter as they apply the provisions of the standard; it is not intended to resolve all the issues that are raised.

IFRS 8 requires that companies implement a 'management approach' to the reporting of their operating segments financial performance, thus aligning segmental disclosures more closely with information contained in internal reporting packages. The standard aligns the requirements of segmental reporting with the US equivalent standard, SFAS 131 *Disclosures about Segments of an Enterprise and Related Information*.

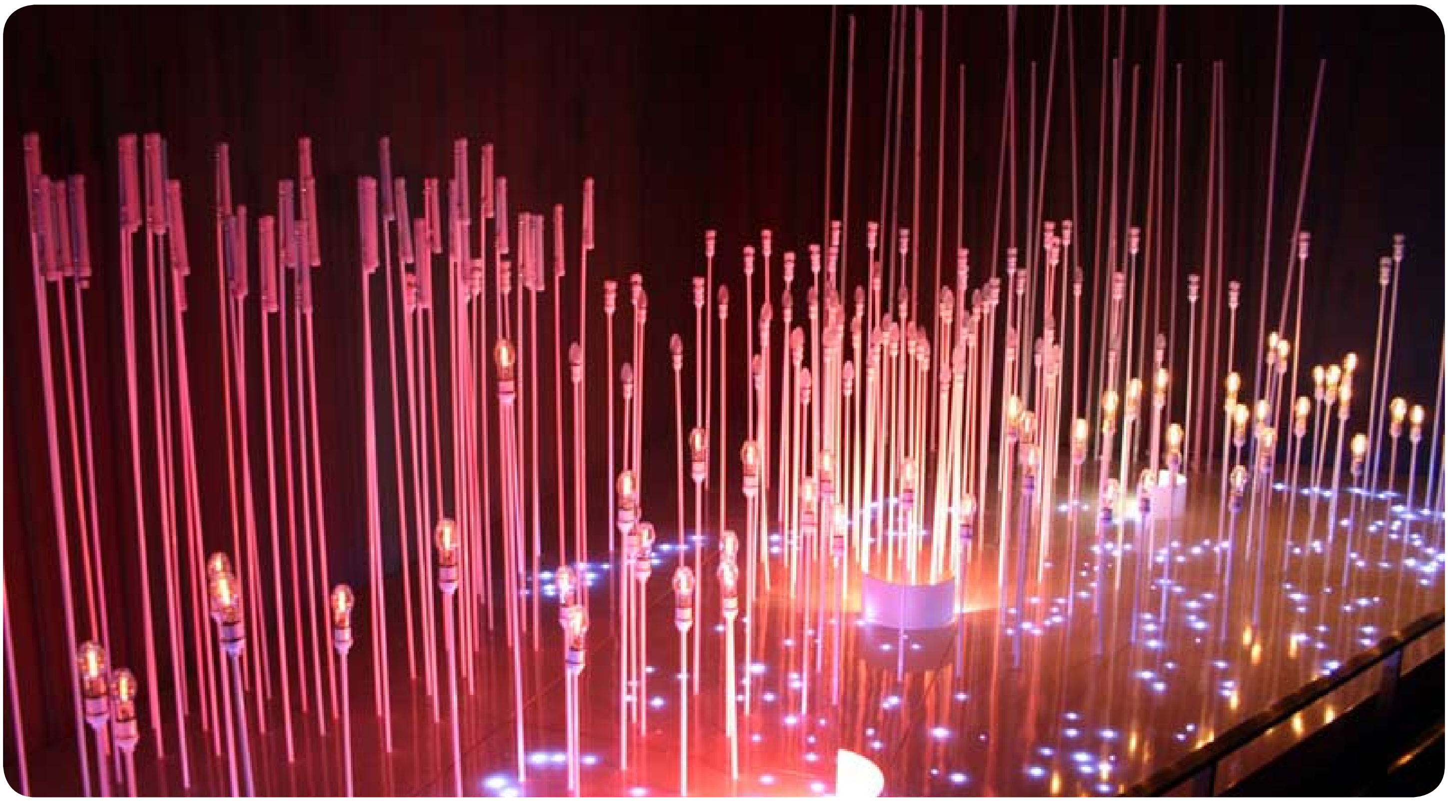
The standard requires companies to disclose segmental information in a consistent manner with the way that management regards the company ("through the eyes of management"). Companies can do so by focusing on information that management utilises to assess performance and to make resource-allocation decisions. Identifying the company's chief operating decision maker (CODM) appropriately, therefore, is imperative. Companies should carefully consider the following questions:

1) who is the CODM?
2) what information is the CODM reviewing? and
3) what is the company communicating to external parties, such as investors and creditors?

In identifying the CODM, a company should remember that those filling the role of the CODM could be either a group of individuals, such as the board of directors or one of its subcommittees, or a single executive or member of management.

The standard also sets quantitative threshold sets for an entity to report an operating segment if any of the following meets:

(a) Its reported revenue, including both sales to external customers and intersegment sales or transfers, is 10 percent or more of the combined revenue, internal and external, of all operating segments.
(b) The absolute amount of its reported profit or loss is 10 percent or more of the greater, in absolute amount, of (i) the combined reported profit of all operating segments that did not report a loss and (ii) the combined reported loss of all operating segments that reported a loss.
(c) Its assets are 10 percent or more of the combined assets of all operating segments.



Operating segments that do not meet any of the quantitative thresholds may be considered reportable, and separately disclosed, if management believes that information about the segment would be useful to users of the financial statements.

Adopting IFRS 8 may result in the identification of more operating segments, as the CODM may review more components of the business. For instance, a cost centre or new business activity that earns little or no revenue, such as WiMAX, FTTH, WiFi or managed services, could qualify as an operating segment under IFRS 8 if discrete financial information is prepared and reviewed by the CODM. Additionally, IFRS 8 carries over the requirement for external revenue from reportable segments to constitute at least 75 percent of the company's total revenue; otherwise, additional operating segments need to be identified as reportable segments.

IFRS 8 provides for certain aggregation criteria based upon similarities in the:

- Nature of the products and services
- Nature of the production processes
- Type or class of customers
- Methods used to distribute products and services
- Nature of the regulatory environment

The aggregation concept above is consistent with the guidance outlined in SFAS 131 under US Generally Accepted Accounting Principles (US GAAP). For example, it is common for integrated telecommunications companies to prepare a CODM package that includes financial information by network (fixed, mobile, satellite) and product line (voice, data, video) and that further disaggregates the information on a geographic basis (regions or markets). Historically, under US GAAP the aggregation criteria generally have allowed telecommunications companies to maintain segmental disclosures by network (fixed, mobile, satellite). Each company adopting IFRS 8, however, will need to consider its own circumstances, which includes analysing the information reported to the CODM.

The following table, illustrate how the segmental information presented by two telecommunication companies in Europe changed upon adopting IFRS 8 early, in 2007.

Company	Primary segments under IAS 14 in 2006	Reportable segments under IFRS 18 in 2007
KPN	• Fixed – Consumer • Fixed – Business • Mobile – Netherlands • Mobile – E-Plus • Mobile – BASE	• Netherlands – Consumer • Netherlands – Business • Netherlands – Getronics • Netherlands – Wholesale & operations • Mobile – Netherlands wholesale • Mobile – E-Plus • Mobile – BASE
Deutsche Telekom	• Mobile communications • Broadband / Fixed network • Business customers • Group headquarters & shared services	• Mobile communication Europe • Mobile communications USA • Broadband / Fixed network • Business customers • Group headquarters & shared services
COLT Telecom Group S.A.	• United Kingdom • Germany • France • Strategic Markets	• Major Enterprise • Small Medium Enterprise • Wholesale

Given the standard's focus on aligning internal and external information, the question could be raised as to whether companies may seek an opportunity to reorganise their existing internal reporting package, so that it is more consistent with segmental information as previously reported to external parties. On the other hand, internal reports need to be sufficient to enable management to run the business effectively. Organising such reports solely for financial reporting purposes may fail to achieve this objective.

Companies should consider feedback from analysts and others regarding existing disclosures of operating segment performance, as well as the investor community's expectations regarding segmental disclosures. Information in the company's website, articles, publications, press releases, business disclosures and other management commentary should also be considered, as inconsistencies between such information and segmental disclosure could weaken investors' trust in the disclosure, as well as trigger "questions" of regulatory bodies. In particular, non-GAAP management reporting policies will have to be explained to reconcile segmental information with GAAP figures: differences in revenue or cost recognition policies may be a challenge to robust, clear financial communication with investors.

In assessing the appropriateness and adequacy of segmental disclosure within a company's financial statements, regulators have long focused on a company's internal reporting package and other information provided to the CODM, regardless of whether the individual(s) uses the information regularly or not. For instance, in the US, the Securities and Exchange Commission (SEC) often requests registrants to provide a copy of their internal CODM package to supplement review of the company's segmental disclosures. Differences identified between a company's internal CODM package and external disclosures have led the SEC to require companies to amend existing or future filings to correlate with their internal reporting information.

Most telecommunications companies report earnings before interest, taxes, depreciation and amortisation (EBITDA) or a similar profit measure within their CODM packages; as a result, they will be required to disclose such measures within the segmental disclosures upon adopting IFRS 8. While this is a key difference between IFRS 8 and the superseded IAS 14, a similar transition was identified upon the adoption of SFAS 131 in the US. Historically, the SEC staff has accepted, and even required, such non-GAAP measures to be disclosed if reported within the company's CODM package. In such instances, a company should also explain the importance of the non-GAAP measure, how it is used in the organisation and how it reconciles back to GAAP.

The performance of operating segments must be reconciled to the financial statements, and resources that segments share must be allocated in a way consistent with the CODM Package.

Within any telecommunications company, it is likely that certain resources (assets and costs) will be used by multiple segments. Examples of such shared resources could include:

- Network assets and associated costs (e.g. depreciation, operating and maintenance costs)
- Customer care / call centres
- Distribution channels (company stores, sales force, agents and resellers)
- Pension costs and related liabilities
- Intangible assets such as licences or franchise rights

The assets listed above might be allocated to individual segments for internal reporting purposes, or they might be reported separately. Following the principles described above, the measures of profit and assets used in the CODM package form the basis of segmental reporting under IFRS 8. Hence, any allocation of jointly used assets to reportable segments cannot be arbitrary and must be presented in a manner consistent with the CODM package. Additional disclosure showing how certain costs, assets or liabilities are, or are not, allocated among the segments may be helpful.

Additionally, IFRS 8 requires a company to provide a reconciliation of segmental operating performance—primarily revenues, profit or loss, assets and liabilities—to the amounts in the company's consolidated financial statements. (Note that, presuming that a proposed amendment to the standard is finalized as drafted, assets and liabilities are disclosed only if they are reported to the CODM.) All material reconciling items must be separately identified and described. The explanation should be sufficient to allow users to understand any differences between the segment measures and the financial statements. Furthermore, as allocations should follow a company's CODM package, differences in allocation methodologies may be identified between comparable companies.

For instance, in the telecommunications industry, certain companies may choose to allocate network costs across multiple segments within their CODM package, while other companies may not allocate these costs. We have noticed a trend among European operators: a number either have or are in the process of restructuring internally to more of a customer focus, and are moving away from the traditional structure of running separate fixed line, mobile, internet etc. The internal reporting, and hence reportable segments, are thus changing. With this type of organisational structure, networks are more likely not allocable to individual segment, and with that a significant level of associated costs (operation and maintenance, engineering time and depreciation) may not allocable on a reliable basis. This trend could lead to additional challenges for investors when attempting to understand and compare similar businesses' performance.

Certain telecommunications companies report proportionately consolidated joint ventures and equity accounted associates, and questions have arisen as to how these joint ventures and associates should be reflected within segmental disclosures. We believe that where a company (1) manages its joint venture operations or associates separately and (2) meets the criteria of IFRS 8 for identifying operating segments, the joint venture operations qualify as an operating segment. In these instances, the asset and profit/loss information (reported to the CODM) regarding the joint venture or the associate's activities that comprise the segment are therefore disclosed.

As mentioned above, IFRS 8 requires disclosing segmental information on the same basis as it is provided to the company's CODM. Accordingly, if the CODM is presented with information prepared using proportionate consolidation, then that basis should be presented in the segmental information and reconciled to the primary financial statements.

Corporate reorganisations could have a direct impact on segment disclosures. As the CODM package directly impact segmental disclosures, companies should monitor changes in the CODM or the CODM reporting package and how such changes could affect segmental reporting.

Companies should understand the impact that reorganisations could have not only on existing segment disclosures, but also on goodwill. As operating segments change, the requirement of the standard to align cash generating units with operating segments may result in a triggering event that could indicate potential impairment of goodwill under IAS 36.

In the IFRS convergence project roadmap, the Indonesian Institute of Accountants will also adopt IAS 36 *Impairment of assets* and IFRS 3 *Business combinations*. The interaction of IAS 36, IFRS 3, and IFRS 8 could create challenges in evaluating impairment, particularly in respect of goodwill.

IFRS 8 amends IAS 36 to state that the highest group of cash generating units to which goodwill may be allocated is an operating segment as defined by IFRS 8. Companies should also carefully consider whether their cash generating units are consistent with this amendment in advance of impairment reviews under IAS 36, as well as during any initial purchase price allocation under IFRS 3 for future business combinations. This amendment of IAS 36 could lead companies to reconsider their historical determination of the level at which they allocated goodwill to groups of cash generating units, which in turn could impact the outcome of subsequent impairment reviews.

Impairment evaluations could differ between tangible assets and goodwill. While goodwill should not be tested at a level higher than an operating segment as defined by IFRS 8, certain tangible assets may be tested at a level higher than an operating segment. For instance, questions have arisen as to how an operator's network should be tested for impairment if it is not a separate operating segment monitored by the CODM, but rather is used by several other operating segments. In such instances, where the network does not generate sufficiently independent cash flows from other segments, it should be regarded as a corporate asset for IAS 36 impairment testing purposes. Where allocation of the network to operating segments is not possible due to the lack of a reasonable and consistent allocation basis, it is acceptable to treat the network as a corporate asset and to test it for impairment on a higher level than operating segments (for example, at the level of the whole economic entity). This could involve testing for impairment at multiple levels, which could prove complex.

What has changed in the 2009 VAT Law?

The amended VAT Law will come into force on 1 April 2010. The main changes that could have a significant impact on current telecommunications industry practice include:

(1) Exports of taxable intangible goods (TIG) and taxable services (TS) are to be zero-rated. Exports of TIG are essentially exports from Indonesia, while exports of TS are defined as the delivery of taxable services to outside the Indonesian Customs Area. It is not clear what services can be zero rated. The situation regarding TS will be further clarified in a Ministry of Finance (MoF) regulation. Currently, in practice, several telecommunications companies treat interconnection services (incoming calls) as deliveries not subject to VAT and therefore associated input VAT cannot be credited. If the interconnection services (incoming calls) are considered to constitute an export of taxable services, the services will be subject to zero-rated VAT, and input VAT associated with the service will be creditable.

(2) The article regarding simple tax invoices (or Faktur Pajak Sederhana) has been revoked. Therefore, tax invoices must be standard tax invoices and the minimum information needs to be stated (i.e. name, address and tax ID number of the buyers). VAT-able firms must now therefore issue standard tax invoices instead of simple tax invoices. An example of how this impacts the industry is the selling of prepaid pulses through ATMs, which are currently administered using simple VAT invoices.

(3) A tax invoice must be issued at the date of delivery of the taxable goods or the taxable services. However, if a payment takes place before the underlying taxable event, a tax invoice must be issued at the payment date.

Alternatively, a combined tax invoice can be issued for a month's worth of deliveries of taxable goods or services made to the same buyer at the end of the relevant month. An example of how this impacts the industry is the timing regarding when a supplier of a service must issue the invoices. For example, in the telecommunication network infrastructure projects, the milestones of construction-related work usually require that a work acceptance certificate be made available before the commercial and tax invoice can be issued by the contractor company. In this case, it is not clear whether the ITO will consider the issuance of this tax invoice as not being in accordance with the provision in the law?

(4) Tax refunds can only be applied for at the book year end. Unless it is fully absorbed by output VAT, the overpaid tax must be accumulated up to the book year end. If a company qualifies as certain designated company bearing low tax risks (such as the vendor of VAT-able goods and/or services for companies appointed as VAT collectors), then the company would be granted the privilege of obtaining tax refunds earlier.

(5) VAT in respect of the cancellation of a service provision can be deducted from VAT payable in the cancellation period. This is a long-awaited regulation as under the current VAT law, companies in the service industry are left uncertain as to whether or not they should follow the VAT credit-note administrative procedure related to the cancellation of delivery of taxable goods.

(6) Monthly VAT returns must be filed by the end of the following month and the relevant underpaid tax must have been paid beforehand. The new payment and reporting deadlines allow more time for companies to calculate and settle the amount of monthly VAT payable before the filing of monthly VAT returns.

Companies should assess the impact of the new VAT Law on their operations.

Recent transfer pricing developments

The Indonesian Tax Office (ITO) has made several moves in recent months which have increased the level of focus on enforcing compliance with transfer pricing rules. The steps the ITO has taken include:

- Increasing the focus on transfer pricing issues in tax audits and non-audit questionnaires issued to taxpayers.
- Introducing a new related party disclosure form to be filed with corporate income tax returns, which now requires the disclosure of a taxpayer's related party transactions and confirmation of whether transfer pricing documentation is available to test whether those transactions have been done at arm's length.
- Publishing a regulation for internal tax office use which contains profitability ratio benchmarking for a number of different industries.

These latest developments in transfer pricing compliance reinforce the ITO's continued focus in this area after introducing mandatory documentation rules in December 2007 and formally adopting the OECD pricing methods as acceptable methods by which to accept or review transfer prices into the Indonesian taxation law. We have commented on each of the recent developments in more detail below.

1. Increase in TP-focused investigations

The number of tax audits in which transfer pricing has been a key focus area has significantly increased in recent months. Transactions under particularly close scrutiny include payments of royalties and technical or management services fees to related parties. Where the taxpayer has no documentation available to substantiate these transactions, there is a strong risk that deductions for the payments will be denied in full. The pricing of exports to related parties has also been challenged by the ITO in many audits, particularly where there are internal comparable transactions or an external market price available against which the related party pricing can be benchmarked.

Due to the significant tax revenue targets, the ITO has recognised that non-arm's length transfer pricing arrangements may represent a significant threat to the Indonesian tax base. There are thus strong indications that the scrutiny of transfer pricing in tax audits is likely to continue to increase in the coming months.

In addition to transfer pricing audit activity, the tax office has also issued questionnaires which focus primarily on transfer pricing issues to several taxpayers who are not under audit. It is possible that the information gathered by the ITO from these questionnaires will lead to follow-up investigations or audits in some cases.

2. New corporate income tax return disclosure form

The new disclosure form is effective for financial years ending on or after 31 December 2009. It requires taxpayers to make detailed disclosures relating to transactions with related parties and the type of documentation held to support the arm's length nature of these transactions. The new disclosure form (Special Attachment 3-A) significantly expands on the existing disclosures, which were limited to simple disclosures about a taxpayer's related party transactions. Specifically, the new disclosures include:

- Business details of related parties with which the taxpayer transacted;
- Details on the nature and value of the taxpayer's related party transactions;
- Details on the pricing methodologies applied to set/review the price of the taxpayer's related party transactions, and the rationale for the selection of these methodologies;
- Details of what transfer pricing documentation the taxpayer has prepared to demonstrate that its related-party transactions adhere to the arm's length principle (documentation relating to business profile, functions and ownership structure; types of transactions and any similar transactions with independent parties; analysis of OECD comparability factors; and the application of the most appropriate transfer pricing method).

While the ITO is yet to release detailed guidance relating to the content of transfer pricing documentation, the new disclosure requirements for the corporate income tax return are in line with the analysis that would be performed under an approach consistent with the OECD's "Transfer Pricing Guidelines for Multinational Enterprises and Tax Administrations".

Taxpayers need to commence planning and preparing early if they want to make positive responses to the disclosures regarding transfer pricing, as a considerable amount of time and effort may be required to prepare documentation which satisfies the OECD standard. For the majority of taxpayers, the filing deadline for the first income tax return containing the newly required disclosures will be 30 April 2010.

Our experience to date indicates that the ITO is moving towards the systematic targeting of taxpayers for transfer pricing-focused audits and not responding positively to the new disclosure form will likely increase a taxpayer's risk of audit. The preparation of documentation in line with the OECD Guidelines that supports the arm's length nature of a taxpayer's transfer prices has proven to be an effective mechanism by which to manage and mitigate the risk of transfer pricing audits or assessments.

3. Industry-based profitability benchmarking

On 5 October 2009, the ITO issued a regulation which contains profitability benchmarks for 20 industries. The benchmarking is based on analysis conducted internally by the ITO and is intended to be used in assessing the risk profile of Indonesian corporate taxpayers. The benchmarking does not provide a basis for making transfer pricing assessments. Taxpayers with profitability that falls below the ITO's benchmarks for their industry may receive clarification request or advice from the ITO.

The benchmarking contains a range of profitability ratios for the industries examined, including gross profit margin, operating profit margin and corporate tax to turnover for 2005, 2006 and 2007. The ITO has indicated that further benchmarking regulations are likely to be issued in the future which cover other industries.

What companies should do?

In light of the ITO's current level of focus on transfer pricing, all multinationals with operations in Indonesia should review their readiness to respond to a transfer pricing investigation by the tax office. To be able to complete the new disclosure form and defend any future transfer pricing audit by the ITO, it is critical to prepare robust transfer pricing documentation which applies OECD principles to test whether the company's related party transactions have been done at arm's length.

Global Telecom M&A Insights

The financial crisis has had an impact on confidence and the telecoms sector has noticed a marked downturn in both the volume and value of deals globally. However, our research offers hope that the telecoms industry is relatively resistant to recession with consumers choosing other ways to cut back on spending.

The future outlook is promising with telecommunication companies learning from the previous downturn and building strong balance sheets. As an industry that requires a significant amount of debt, the result of less debt falling due is encouraging. It is expected to see cost reductions across the sector which will reveal the gap between the stronger and weaker businesses.

Recession will reveal winners

The lack of liquidity (particularly in debt) is likely to be a big barrier to Merger and Acquisition (M&A) activity across all sectors in 2009, but these cyclical issues are complicated by some telecoms-specific issues. We can expect cost reductions across the sector, but even the best prepared telecommunication companies will find refinancing harder and more expensive, while weaker businesses may be forced into disposals and mergers.

Even in a challenging environment such as this one, investors should take some comfort from the fact that telecommunication companies remain highly cash generative operations. Together with the famed relative resilience of the sector to withstand consumer downturns, the industry is well placed to stay stronger for longer, but the magnitude of the debt refinancing problem will inevitably define the nature and scale of M&A opportunities in 2010 and beyond.

We think the challenges of debt refinancing could then turn out to be something of a proving ground for the industry where the longer term winners will emerge. History tells us that, in a recession, not only do profit margins come under pressure, but the spread of results between firms widens.

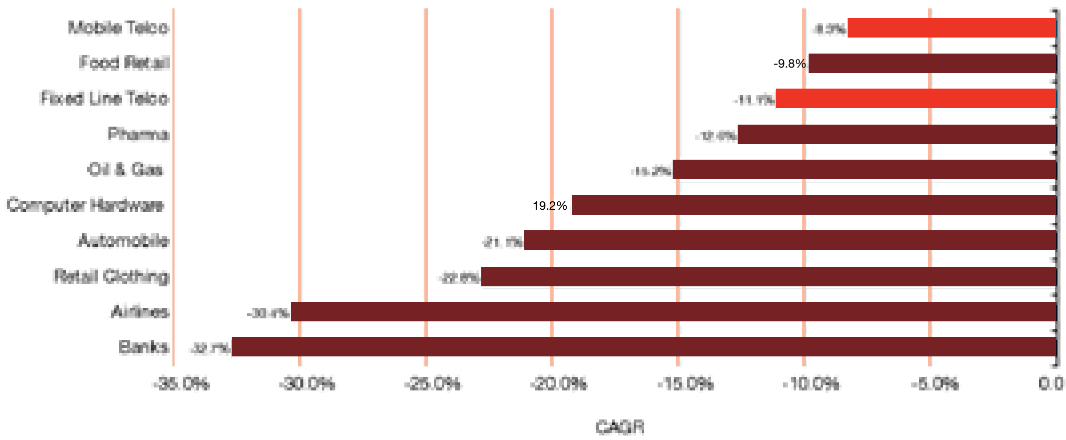
Telecoms stronger for longer?

During the last major UK recession in the early 1990s, telecoms proved to be remarkably resilient as the economy slowed, as consumers proved less willing to cut back on their fixed phone bills than other categories. Our UK consumer research shows that consumers seem to differentiate between usage (i.e. calls, text and browsing) and the device itself, which appears to be more sensitive to macro conditions. The continuation of this trend could have important implications for telecommunication companies and investors: as consumers defer mobile handset upgrades or switch to prepay/SIM-only offers, ARPU will fall as consumers are no longer effectively paying back the initial subsidy of the handset. The profit and cash impact however could be more muted or even positive as upfront handset subsidy levels fall.

Telecoms faring well versus other industries

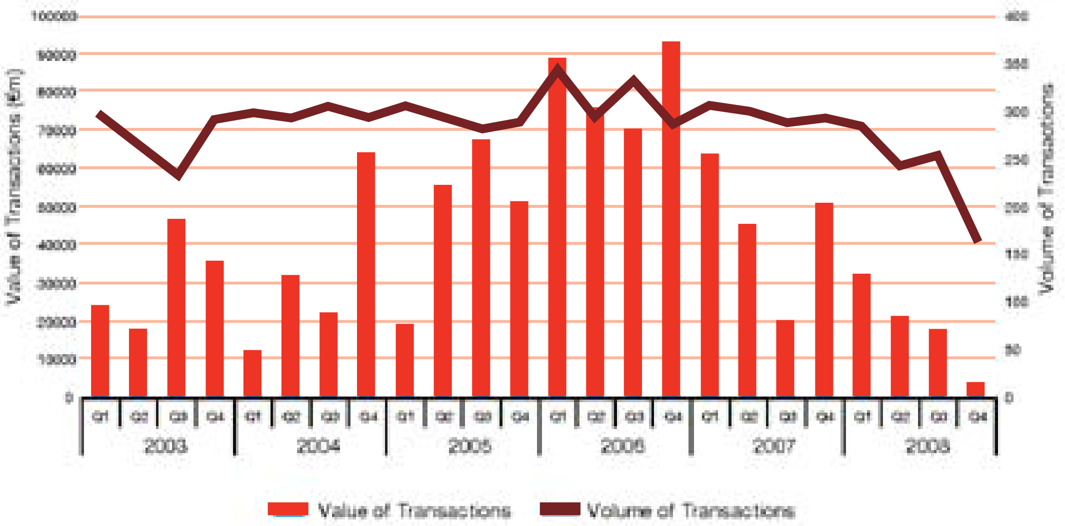
Capital markets have suffered through 2008, but telecoms less than most. Perhaps cognisant of its defensive qualities, both fixed and mobile stocks have held up well, affirming telecoms status as a relatively defensive play in recessionary times.

2008 Stock Market performance by Industry



As ‘recession resistant’ as telecoms may be, the market was unable to absorb the shocks of late 2008, and fourth quarter volumes were already at record lows. However, during the fourth quarter conditions had deteriorated to such a point that the market for telecoms transactions had effectively closed by November 2008.

Impact of the credit crunch: Global deal activity by quarter



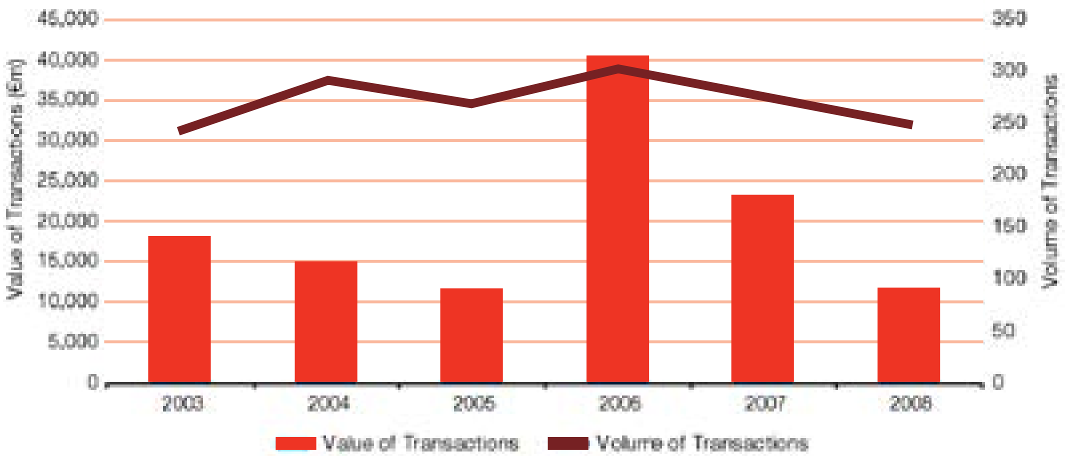
Source: Thomson Financial, PwC analysis

The value of deals transacted in the emerging markets of Central & Eastern Europe, Latin America and Middle East and Africa regions have grown rapidly as a proportion of global deal value, from 5% in 2003 to 17% in 2008.

Asia Pacific dominated by intra-region M&A

Asia Pacific (ASPAC) remains a region dominated very much by intra-region M&A: of the top 18 deals, all 18 were in-region and 8 were in-country. The largest Asia Pacific deal in 2007 was Vodafone's €9.3 billion acquisition of Hutchison Essar in India.

ASPAC deal activity 2003-2008



Source: Thomson Financial, PwC analysis

Conspicuous by its absence though in this data is the restructuring of the Chinese telecom market. Each of China Mobile, China Telecom and China Unicom now has separate fixed and mobile networks, with the three companies using different 3G technologies.

Largest ASPAC deals 2008						
Date	Value (€m)	Target	Target Segment	Target Country	Acquirer	Acquirer Country
Jun-08	1,315	Indosat	Telecom Services	Indonesia	Qtel	Qatar
Aug-08	1,249	Idea Cellular	Wireless	India	TM International	Malaysia
Mar-08	1,069	C&M Communications	Cable	South Korea	Kookmin Cable	South Korea

Source: Thomson Financial, PwC analysis

Outlook for 2010 and beyond

In addition to the wider macro-economic conditions, the prospects for Telecoms M&A will be determined in large part by some industry-specific factors, such as how the industry and investors respond to the impending upturn in Telecoms senior debt due and the limits of consolidation.

The cost of debt has risen even for the largest cash-rich telecommunication companies, and as a consequence the industry will need to be crystal clear about its ability to service the debt. telecommunication companies may be forced to clarify their thinking around divesting loss-making operations or segregate higher quality assets (such as local loop or towers) to investors. We can expect cost reductions across the sector, but even the best prepared telecommunication companies will find refinancing harder and more expensive, while weaker businesses may be forced into disposals and mergers. This though will inevitably drive opportunities for stronger operators to prosper.

Operators who demonstrate superior understanding of the drivers of cash, eschew forays into areas outside their true core business and learn how to partner with ‘over the top’ broadband application and content providers to crack the ‘dumb pipe’ problem will be doubly rewarded with opportunities to purchase some attractively priced assets.

Vulnerabilities of VoIP

In recent years, Voice over Internet Protocol (VoIP) technology has been a revolutionary development in telecommunications. The main reasons for the increased popularity of utilising data networks for telephone purposes are pricing and the ability to utilise high capacity telecommunication lines for many purposes.
This article discusses a number of security issues related to VoIP, and the measures that can be taken to address these issues.

VoIP - what is it?

VoIP technology is used to utilise Internet Protocol networks for the transmission of voice traffic. It became popular in the late nineties, and nowadays a significant amount of "phone" traffic utilises VoIP, both for business and individual purposes. Individuals have discovered the beauty of making international phone calls for free or almost for free, while business users gain efficiency by using their existing networks for VoIP voice traffic.
The advantages are obvious. We need to realise, however, that data networks are in general not designed for speech data.
When utilising networks for VoIP, security issues need to be addressed.
Two categories of security issues are discussed in the following paragraphs. These are:

- User agents.
- Networks.

User agents

Handheld phones, personal digital assistants (PDA) and older types of VoIP phones are vulnerable, because of a common lack of antivirus protection and a less sophisticated operating system. Furthermore, these devices often contain plethora of services, which makes open ports vulnerable to denial of service attacks or authentication bypasses.

In order to exchange configuration data, the TFTP protocol is often used. This protocol does not provide any possibility for authentication and encryption. Everyone who obtains (unauthorised) access to TFTP sessions will be able to retrieve authentication credentials.

Smart phones have a generic problem in that these devices contain applications other than VoIP application as well. Vulnerabilities in such applications may create a security risk for VoIP applications, and vice versa.

Networks

In data networks, voice traffic is vulnerable to eavesdropping. The same techniques as used for data eavesdropping apply, such as:

- Caller ID spoofing: using a false caller ID to mislead counterparts.
- Man-in-the-middle attacks: relaying messages between two parties, while these parties believe that they are communicating with each other.
- Registration hijacking: intercepting calls, and answering them on behalf of the targeted recipient.

Denial of service attacks may target VoIP devices as well: sending such a huge amount of communication requests to a target that its capacity is saturated and it cannot respond anymore.

VoIP protection

Effective measures to protect VoIP networks are:

- Hardening, taking maximum advantage of the security measures provided by suppliers.
- Encryption, either at message level or at communication channel level using a Virtual Private Network (VPN).
- Through identification and authentication: the identities of both users and devices need to be verified.
- Perimeter security, using VoIP-aware firewalls. Such firewalls can recognise voice traffic, and allow such inbound traffic without affecting the protection against other inbound data traffic.
- Logical separation between VoIP traffic and other data traffic. There are practical complications to realising this where workstations are used with telephone facilities.

Conclusion

The introduction and widespread use of VoIP have created new challenges in network security. The threats are, amongst others, caller ID spoofing, man-in-the-middle attacks, and registration hijacking. These serious attacks can lead to blocking, recording and other forms of manipulation of calls from and to your organisation. Furthermore, VoIP devices may be subject to denial of service attacks.

Besides the conventional security mechanisms, logical separation between VoIP traffic and other data traffic may be a solution to counter a number of risks. The realisation of such a separation, however, may face practical obstacles. In securing the perimeters, VoIP-aware firewalls can be used to reduce security vulnerabilities to an acceptable level.

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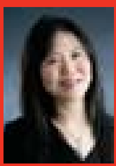
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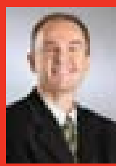
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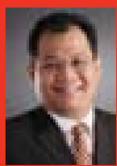
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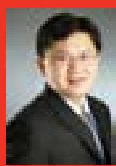
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