

BACKGROUND TO THE STUDY

This paper is part of a series of PwC Papers in which the demands for companies to make more information available to the market on a voluntary basis is explored. Previous papers have addressed issues such as whether information focusing on historic cash flows and other performance criteria provide an understanding of how shareholder wealth is created, and whether there is empirical evidence to support claims that investors and analysts are demanding more information. This paper explores in greater depth, and for one particular industry, the type of information that flows outside of traditional financial reports, amongst whom it flows, through what channels it flows, and how it is perceived. It provides an empirical basis for examining the concerns highlighted by the PwC ValueReporting™ initiative which identifies the financial and other performance measures that create value for investors, and which analyses how this information is communicated to the market in an open, consistent and timely way.

Disclosure typically refers to a discrete event - the release by a company of financial information at a given moment in time, as required for regulatory purposes. This study set out to examine the accuracy of this concept of disclosure for one particular industry. By means of a detailed field-based study of information flows and disclosure practices relating to Intel Corp, we analysed in particular the type of information on which analysts base their evaluation of a company. We sought to chart the mechanisms through which analysts obtain information, and how adequate they consider this information to be. We sought also to understand how senior corporate officers perceive their company's disclosure practices, and what benefits they consider the company can derive from disclosing voluntarily more rather than less information.

Intel Corporation is the world's largest designer and manufacturer of microprocessors, the logic-devices that are at the core of personal, workstation and server computers. The firm built on its early success as the sole microprocessor provider for the IBM PC during the early 1980s, reinvesting profits to enhance its product and technology design capabilities, install capacity, and promote market growth. Intel now commands approximately 80% of the world microprocessor market. Its net revenues have grown by over 650% over the past decade, from \$3.9bn in 1990 to \$29.4bn in 1999, and the firm's stock price has risen over the same period by a compound annual rate of 48%, driven by gross and net margins as high as 60% and 25% respectively, and by a rate of new product introduction unrivalled by any of its competitors.

The fieldwork was conducted in two stages. An initial set of twenty-two interviews, covering primarily product and process development, and internal evaluation procedures, provided background information. A second stage consisted of nineteen interviews with financial analysts (sell-side and buy-side), industry/technical analysts, and senior corporate officers, focussing primarily on disclosure practices. The interviews were conducted between July 1997 and April 1999. The majority of interviews with financial analysts were with sell-side analysts.

The notion of an 'information ecosystem' is used to characterise the type of information flows and interactions that were observed in the study. Our findings suggest a more complex picture of information flows than is typically contained in the concept of disclosure. Our study shows that analysts base their evaluations of long-term value creation capacity on a broad range of information. Some of this information is financial, but much of it is non-financial. Some of it is based upon formal disclosure by the company, but some of it comes through informal channels. Some of the key information comes from the company, but much of it comes from industry-wide sources and third-party sources. The 'information ecosystem' is a complex and dynamic system, made up of a number of interacting elements and flows. Traditional financial reports are only one element of such a system.

Our conclusions can be summarised in four key points.

- Firstly, our findings suggest that the information flows within the ecosystem are more accurately understood as a process rather than a discrete event. Our research suggests that the information flows among a variety of participants, including firms in complementary industries, analysts of differing kinds, industry-wide forums and investors are more complex, differentiated, and continuous than is often implied. The firm in question is only one source of information for analysts. Information does not flow in a single direction and at a specified point in time between one firm and the relevant analysts, but circulates continuously among a variety of participants. The information flows relevant to assessing long-term value creation are embedded in the systemic nature of the industry, and extend far beyond conventional financial reporting mechanisms.
- Secondly, we argue that the category of analyst itself needs to be differentiated, at least in the context of the microprocessor industry. A very small group of independent technical analysts plays a pivotal role in the evaluation of products and processes in this industry. These analysts are entirely separate from the buy-side and sell-side analysts working within financial institutions. Within the information ecosystem we describe, this group of technical analysts functions both as a 'filter' and as a third-party evaluation and validation resource for

analysts. The existence of such a group is of particular significance in an industry which is heavily dependent on complex technical and operational data.

- Thirdly, we argue that non-financial information is of primary importance within the information ecosystem for evaluating long-term value creation in the microprocessor industry. Although the significance of non-financial information in the microprocessor industry is perhaps unusually high, we suggest that the role of such information within the ecosystem we describe is a phenomenon likely to be found in all knowledge-intensive industries characterised by short product and process life-cycles. Since complex and recurrent innovation is routine in such industries, the import of innovations and the impounding of their effects in stock prices depends to a significant extent on the circulation and interpretation of non-financial data.
- Fourthly, we argue that disclosure should not be understood as limited to public and formally sanctioned information released by the company. Instead, the disclosure process within the ecosystem should be regarded as a continuum ranging from the formal to the informal. Formal disclosure includes data disclosed by the firm under SEC rules through mechanisms such as annual and quarterly financial reports, interim announcements, analysts meetings and conference calls. Informal disclosure includes a range of mechanisms and sources such as: data disclosed to technical analysts under Non-Disclosure Agreements (NDA), data which remains confidential, but which in turn allows a more informed evaluation of other pieces of information; product and technology data disclosed to OEMs, which subsequently becomes publicly available; and information that circulates between the firm, buy-side and sell-side analysts, and members of the technical analyst community through personal contact. Examples of data that falls under the heading of informal disclosure are product and technology roadmaps, as well as product mix and product cost information. The existence of informal disclosure mechanisms is of considerable significance for the value reporting project, since information which is formally unavailable can nonetheless be assimilated by analysts and the investing community with a surprising level of accuracy.

SYSTEMIC INFORMATION FLOWS IN THE MICROPROCESSOR INDUSTRY

The conventional image of disclosure implies a single source of information (the firm), a single recipient (the market), and a discrete moment in time when information is disclosed. The information ecosystem we describe is characterised, in contrast, by a more or less continual flow of information among a number of participants. The participants in the particular ecosystem we have studied include: the firm, technical analysts, financial analysts, industry forums for information sharing, inter-firm investments, investors, customers, equipment suppliers, as well as firms in complementary industries. Information is embedded in the system, and shared among participants, rather than owned by one particular actor. Doing business within the ecosystem requires multiple and continuous disclosures between mutually dependent actors. As with a biological ecosystem, the information ecosystem is characterised by a chain of complex interactions, in which the survival and health of one particular organism is a function not only of the supply of information by the previous organism in the chain, but of the health of the system as a whole.

The complexity of the information ecosystem is such that it is not possible to study it as a whole. We address below the role of technical and financial analysts within the ecosystem. The remainder of this section is intended to provide a brief illustration of some of the other actors within the ecosystem.

Inter-firm co-ordination appears to be particularly important to the microprocessor industry. Forums for information sharing and development across the industry are one form this has taken. A striking example of an industry-wide forum or consortia is International Sematech, a non-profit research consortium of US semiconductor producers. Originally created in 1987 to reinvigorate the US semiconductor industry, the current aim of International Sematech is to encourage the development of semiconductor science in areas such as lithography, advanced technology, global manufacturing standards, and relationships between manufacturers and tool suppliers. Current member companies of International Sematech are: AMD, Connexant, Hewlett-Packard, Hyundai, Infineon Technologies, IBM, Intel, Lucent Technologies, Motorola, Phillips, STMicroelectronics, TSMC and Texas Instruments. International Sematech has 600 employees. Each of the member firms pays a fee, ranging from \$1 million to \$15 million, proportional to its annual semiconductor sales. Between 1987 and 1994, Congress appropriated approximately \$100 million in Research and Development funds for Sematech, with the stipulation that government contributions cannot exceed 50% of the organisation's operating budget.

In response to a question concerning the overall role of Sematech in the microprocessor industry, the President/CEO of Intel commented:

Sematech plays an interesting and significant role... Sematech is trying to make the industry as a whole more efficient [by] generating some of the new technologies, working between the producing industry and the equipment supply industry, and it just means that its much more economical for our industry to work as a whole to create some base technology...

Information sharing, between a firm and its suppliers for instance, is another important aspect of the information ecosystem. In response to a question as to whether Intel shares information such as technology roadmaps with suppliers, the Finance Director of Intel commented:

Absolutely, yes. We share a lot of volume projections. We share our time schedules, we show them what we are at.

Inter-firm investments provide another illustration of the extent to which information sharing, and multiple information flows, make up the information ecosystem. One example of this was given by the Communications Manager at Intel. The example was the development of a particular lithographic technology:

What Intel, Texas Instruments, and Motorola decided to do was each take a small equity position in deep ultra violet, and in Silicon Valley Group [...]. I think we took a \$10 million equity position. And the idea here was we will give them \$10 million, each of us, so now they have some money to continue real R&D, get this technology which we have all said we think is going to be the right one for the next round, and get it ready for production. At the same time, we start working with them on, here's what we mean by production. We set the expectations on how you have to manufacture it, what kind of uptime it needs, all of this kind of activity...

The sharing of information between Intel and its customers is another important link in the information chain that makes up the ecosystem. Typically this would be conducted under a Non-Disclosure Agreement. On the matter of sharing information with a customer such as Compaq in this manner, and information sharing across the industry more generally, the Director of Investor Relations at Intel commented that senior Intel executives:

...have a lot of meetings with customers that are often under non-disclosure and not open to the public. For example, we have a number of very large

customers, and the products we sell to them are a very big part of what they purchase, a company like Compaq, and so we have a very close relationship with companies like that. So, sometimes, we will present at their forums and they will present at ours. [...] We also give a lot of stuff to our customers under non-disclosure, things like price lists...

This voluntary sharing of information with customers has not always existed in the microprocessor industry. The information ecosystem has emerged over time. In the late 1960s and early 1970s, there was little or no voluntary sharing of information by Intel with customers prior to the launch of a finished product. In the increasingly competitive environment of the early 1980s, however, sharing of data with customers under non-disclosure agreements began. Reflecting on the emergence of this important link in the information chain, the President/CEO of Intel commented:

...when you're in that early euphoric stage of a driving industry you're absolutely convinced you know more than your customers, therefore you know what's good for your customer; therefore why bother to talk to them, they can only mislead you. So we went through that stage of adolescence and then, I think, got to be a little bit more sophisticated and recognised that we had to engage the customers earlier, and that led to sharing data under non-disclosure agreements with our customers.

This sharing on information by Intel with customers was a major step in the emergence of the ecosystem as it exists today. It enabled computer manufacturers and the software community to design their products in light of a knowledge of the technical performance and attributes of a new microprocessor which might still be 12-18 months away from launch. A tightening of the information chain brought benefits to all parties.

THE TECHNICAL ANALYST AS 'COMMUNITY ORGANISER'

The information ecosystem can be viewed as a community, within which the interests of the different participants need to be aligned. To this extent, it may benefit from an entity or entities playing the role of 'community organiser', particularly if this role can include the filtering and validating of the information that circulates within the community. This section examines the emergence, functioning, and perception within the information ecosystem of this role.

Previous reports¹ have addressed the information needs of analysts, and differentiated sell-side from buy-side analysts. One of the most striking findings of the current project is the identification of an entirely separate group of technical or industry analysts that were established across the late 1970s and 1980s. This is a very small group of no more than 10-12 firms, of which perhaps only about half have well-established reputations, as well as close and long-standing relationships with Intel. Two of the key firms in this category are Micro Design Resources, and VLSI Research Inc, both of which conduct commissioned research for companies, and produce publicly available reports which are sold at commercial rates. In addition, MDR organises annual conferences at which leading firms within the microprocessor industry give presentations. At least three distinct, yet interdependent roles for these firms within the information ecosystem can be identified:

Community Organiser
Filter for vast amount of technical information
Third party validator

The term 'community organiser' was used in an interview by one of the key technical analysts - Michael Slater of Micro Design Resources - to describe the work of his organisation:

...we are the community organiser. We have brought together this community of people who care about micro processors. And we collect information from various of them, and then disseminate it out to all of them, and then we get them all together for meetings where they can all talk to each other. And so, I think you could say the biggest picture thing we do is we provide a focal point and opportunities for interaction of that community.

The use of this benign term to describe the work of a firm of technical analysts allows us to understand the contribution of such an organisation to the ecosystem

1 'Pursuing Value: Reporting Gaps in the United Kingdom', Ian Coleman and Robert Eccles, Price Waterhouse, 1987; 'Value Reporting in the Banking Industry', Robert G Eccles and John K Fletcher, PricewaterhouseCoopers, 1999; 'ValueReporting™ Forecast 2000', PricewaterhouseCoopers, 1999.

we describe here: in such a system, much information is shared among a range of participants, to the benefit of each of the participants. The annual conferences organised by Micro Design Resources are one example of such information sharing. Microprocessor Report, the bi-monthly Report produced by Micro Design Resources, is another.

Technical analysts, such as Micro Design Resources, are treated by a firm such as Intel very differently from financial analysts. For instance, technical analysts may often be given information under a Non-Disclosure Agreement, and may even be appointed as paid and unpaid consultants. As remarked by the Director of Investor Relations at Intel:

They do that all the time with the Slaters and so on, with the consulting firms. [...] But we have not done that with the financial community. [...] As a rule, we have not used NDA. We have just taken the position, in our organisation, that it's not fair to ask the [financial] analysts to work under NDA.

The Communications Manager at Intel Corp commented as follows on how technical analysts might be treated:

... we communicate with them [industry/technical analysts] through forums, through e-mail, through NDA briefings, and then there are other occasions where we hire their services, so they provide counsel to us in helping us make our decisions. And, in that process as well, there is a certain give and take of information that flows, in order for them to be able to get enough knowledge about what we are doing, and where we are going, and what we are trying to achieve, that they can counsel on it. And so it's a little bit of both.

Technical analysts may, for instance, be paid to comment on how a particular technological solution (eg the use of a specific architecture available for multiple operating systems such as Unix and NT) might work out strategically. Or, as the Communications Manager continued, they may be offered:

...a look inside the company, how we work, how we think, why we have made particular decisions, and where it is going. And so [...] they will be under NDAs that last for a particular period of time so that, maybe, they don't just know about the product that's going to be coming out, but they understand what step it plays in maybe a six step program of product development that's all under way in Intel.

The use of NDAs, and the relatively recent development of this form of information sharing, was confirmed by one of the key technical analysts, Michael Slater:

What they [Intel] started doing about two or three years ago is, basically, for us and I suspect three or four other groups of analysts, I don't know how many they do it with, is they give us slightly sanitised versions of the briefings they give the OEMs, within a few days after they give them to the OEMs. So, stuff that's still under non-disclosure for sometimes as much as nine or twelve months. And I think this came from a recognition that the OEMs were going to leak this stuff to the press, that the press was going to call us trying to understand it, and that their messages were much more likely to get communicated through to the public if we understood what was going on, and could comment intelligently.

To find out whether the information provided by technical analysts is used by the financial community, and how it is perceived, we asked financial analysts at firms such as Bear Stearns, Merrill Lynch, Gerard Klauer Mattison, JP Morgan and SG Cowen for their views on one particularly prominent firm of technical analysts, Micro Design Resources. The following are some of the responses we received:

I find they [the reports of MDR] are very helpful. I tend to use them. [...] I have a very high regard for Michael [Slater], particularly as a technical analyst. [...] the technical information they do is excellent. He helps explain the implications of technical innovations.

Another prominent sell-side analyst focussing on the microprocessor industry was equally positive. Pointing to an issue of Microprocessor Report on his desk, he remarked:

Slater is one of my top sources on this industry.

The following endorsement was given by one of the financial analysts interviewed:

Micro Design Resources is actually pretty good, with a whole report on Intel.

A further strong endorsement of the significance of Microprocessor Report for financial analysts was given by another sell-side analyst. When asked whether he made use of the various services of Micro Design Resources, this analyst responded as follows:

I'm technical [by background] and I read Microprocessor Report every time.

These quotes from some of the leading sell-side analysts covering the microprocessor industry support strongly the proposition that technical analysts function as 'filters' within the information ecosystem. This role for technical analysts is closely connected to their role as third party validators. It was clear from our interviews that not only do people read Microprocessor Report, but they trust it too. Take for instance the following comment by one of the key financial analysts working on the microprocessor industry:

Microprocessor Report is the single best trade publication by an order of magnitude. I probably read three-quarters of every issue. These guys know the technology, they seem to have great contacts. They also seem to know the business. [...] I view Michael [Slater] as very damned objective. If Slater says something positive about Intel, I have to believe it. It has credibility, reputation.

To the extent that Microprocessor Report may be negative as well as positive towards Intel, it can function as a third-party validator of information disclosed by Intel. At the limit, MDR was described to us by one sell-side analyst as an 'Intel hater'. Somewhat ironically, the possibility that it can be perceived in this way helps secure its role as third-party validator within the information ecosystem. The Communications Manager at Intel confirmed this view and appealed explicitly to the notion that technical analysts function as third-party validators:

...sometimes what you are trying to achieve is somebody that's knowledgeable enough to comment, on the record, with some level of accuracy. Because, when people hear the message from us, they may view it as a message with a point of view, a particular bias built in. And so, reporters will be looking to try to understand if, in fact, it's true, and they will be looking for third party validators. So, a notable industry analyst firm will not compromise their position; if they do so on an ongoing basis, they will become an unreliable source, and the press won't use them. So, they have to maintain a certain amount of independence.

He continued, commenting on the balance that technical analysts have to establish between maintaining a good relationship with the company and preserving their independence:

... the balancing point for them is to maintain [a] good relationship, get information in advance, have a professional relationship with us and

common trust, and yet also not 100% agree with us all the time. If that's the case, then our competitors won't hire them, because they will say, oh, they are just bought and sold by Intel, they can't give us any good insight or input, because they can't be critical of Intel.

It is not only financial analysts that have a need for objective information. A firm such as Intel has a similar need. The Communications Manager used the following analogy to convey this point:

...having somebody from outside that can call your baby ugly, if in fact it is, wakes you up, and you can make a decision on whether or not this thing has the opportunity to be successful in the market place, or how it might be successful in the market place.

He continued:

Carrying the analogy further, we might all want our babies to grow up to be doctors, or whatever, but, if that's not in the calling, it may be OK that this baby grows up to be successful in some other way and, if you can identify what their strength is, you can maybe channel them over in that fashion. [...] ...that's one of the roles that industry analysts play for us is an outside sanity check, and then we try to make an adjustment if we think one is necessary.

Technical analysts thus play a number of distinct yet interrelated roles within the information ecosystem, roles which are fundamentally separate from those of the financial analysts. As 'community organisers', they co-ordinate expectations so that the pace of innovation can continue, and they do this by assimilating, filtering and validating the vast amount of highly technical information that is constantly flowing around the information ecosystem. For Intel, they provide an internal 'sanity check' on technical and strategic matters, and an external third party validating role for disclosures made by the company. Instead of a problem to be managed, which is how the financial analysts may often be seen by a company, they are a resource to be utilised. More generally, technical analysts facilitate the operation of the community as a whole, for whom co-ordination is preferable to speculation.

FINANCIAL AND NON-FINANCIAL INFORMATION WITHIN THE ECOSYSTEM

Diversity is as much a characteristic of the information ecosystem as it is of a biological ecosystem. The information ecosystem flourishes according to the number of types and species that exist within it. Our research shows that the demands and expectations of analysts are not met by one type of information only. An evaluation of long-term value creation is seen to need a range of financial and non-financial information. Our findings reinforce this conclusion, and demonstrate for one particular industry the diverse metrics seen as valuable by both analysts and the firm in question.

Our interview data produced comments on the following issues:

‘Die yield’ as a key non-financial metric

‘Roadmaps’ as co-ordination mechanisms

Average Selling Price (ASP) as a metric for assessing corporate performance

Financial models predicting income and cash flow data one to three years ahead
Information that analysts would like to receive, but which is currently not provided

Die yield, a measure that expresses in percentage terms the amount of good die produced from a wafer of silicon, was mentioned repeatedly by senior corporate executives as one of the more important indicators of manufacturing performance across different generations of microprocessors. Take, for instance, the following comment by a Director of Manufacturing:

...one of the more pronounced indicators we look at is the yield. And, specifically, what we call the die yield. It measures the health of the technology, and we have a very rigid benchmark on how well we are improving the technology. At the same time in a technology cycle, for the last six or seven generations, we have been consistently better than the previous generation in die yield. It is a very simple measure that we use: defect density as a benchmark, how many die you have got coming out of a wafer. [...] we look at the improvement [in die yield], and that is a very powerful measure, because it not only measures [die yield], it has many phenomena coming together: how well you are controlling the process in the factory, as well as how well you have designed it... It is an aggregative indicator that gets quite a lot of visibility.

Die yield provides an easily understood metric for comparing quality levels across generations of product and between firms. As an aggregate measure of defect rates, it gives insights into the quality of process control as well as the design of manufacturing systems and methods. Precise information on die yields is treated by the company as highly confidential, although considerable effort is invested by outside parties in estimating yield levels.

One of the sell-side analysts we interviewed confirmed the importance of die yield from a market perspective, commenting that he placed considerable emphasis on yield performance over a period of years, and efforts on the part of Intel to improve this. With increasing price competition in the industry, this analyst remarked that yield levels were becoming even more significant for Intel. Although such information is confidential, and therefore has to be estimated, this analyst remarked that yield-improvement practices were now seen by Intel as having a significant payback, which was less the case when the market was more receptive to price increases.

This emphasis on die yield as a key evaluation metric, for both the firm and analysts, is matched by a more general inclination to favour engineering and industry-specific metrics at the expense of more traditional financial evaluations. Take for instance the following remark made by the President and CEO of Intel:

Well, when you commit, you know, major capital expenditure... its relatively difficult to do detailed financial justifications... you spend 2 billion dollars, you don't have a designated product or even a customer for the product. [...] you do things on, I won't say a 100 per cent hope and faith, but we absolutely do rely on past history, we rely on a sense of where the technology has been, where its going, to make major capital bets either on manufacturing technology development or product design. And it's very much like the field of dreams. We build it and they will come. And its relatively difficult to do a classic financial analysis. [...] it's not that we ignore it, but spending an undue amount of time trying to polish financial analysis when its based on one assumption built on another assumption, we probably reach into our gut and say 'this feels right, this has worked before, this will continue to work; if it doesn't work we're in serious trouble anyway'. [...] ...the core decisions the company makes, the core decisions are basically technology roadmap decisions, driven also by a fundamental belief that Moore's² law will continue to be valid, that the purchasing community will continue to buy the technology, and that our main charter is to say ahead of the competition.

2 Moore's law states that the processing power of a computer chip will double approximately every 18 months.

Whereas die yield provides a cross-generational non-financial measure of the health of the technology, and one which can be externally benchmarked, 'roadmaps' provide a co-ordination mechanism for the different constituents of the ecosystem.

In contrast to conventional roadmaps, the distances given in roadmaps for a microprocessor firm are given in time-lines rather than physical distances. Roadmaps include, for instance, when a particular manufacturing process or product should be available, or what manufacturing capacity will be available at a particular point in time. To the extent that the ecosystem has to be planned, and different constituents within it aligned, roadmaps enable that planning and alignment process.

One of the key technical analysts interviewed for the study explained the importance of understanding the different roadmaps used by the company:

The core of what we do, that I think gives us a better understanding of where Intel is going than you can get anywhere is, that if you just understand the process roadmap, and not in any confidential sense [...] and you can count the facilities they are building and estimate how many wafers they can run in them, and if you can understand the basic business strategy, you can then sort of plot out in your mind what Intel's likely to do.

The information ecosystem is, however, made up of a range of types and items of information. Non-financial metrics such as die yield and roadmaps are complemented by financial metrics such as Average Selling Price (ASP), and the detailed financial models constructed by financial analysts. With regard to ASP, views held by analysts varied as to its relevance and reliability as an indicator of value creation and corporate performance. Some analysts viewed it as a useful micro-level indicator, but a number of the most influential analysts interviewed were sceptical about its use as an evaluation metric. One sell-side analyst remarked critically that, whereas knowing about imminent changes in ASP could be 'sexy for clients', and could make for 'great selling' in the short-term, such data did not help to figure out 'where the stock will be six months out'. Another analyst expressed much stronger scepticism, remarking that ASP 'can be a meaningless number, with Intel's move to a segmentation strategy'. When asked to comment on who might take ASP seriously, he said 'the Street does, I don't, but you have to... you don't ignore it'. He went on to comment that ASPs would be important 'if everything were equal', but 'you have to reckon with mix and segmentation'.

The President/CEO of Intel was equally sceptical about the significance of ASP as a useful metric for assessing long-term value creation:

The financial community, the financial analyst community, is preoccupied with things like gross margin and average selling price. We are driven, and have always been driven, by the fundamental belief that our job is to create more margin dollars for Intel. That is basically the equivalent of bottom line profitability. If we do that by having average selling prices come down, or gross margin percentages come down, through a different product mix or what have you, but the total margin dollars, total before tax or after tax goes up, I'm perfectly willing to ignore the financial community. They get preoccupied, you know, margins were at 52% last quarter, they're at 51% this quarter; they used to be 60, now they're 49... They write what they write, the say what they say, our task is in fact to continue to increase the bottom line profitability.

These concerns with respect to the ability of a single financial number to provide useful information on corporate performance extended to detailed financial models predicting income and cash flow data. All of the sell-side analysts interviewed kept such models, although they varied in the level of detail provided. These analysts clearly regarded the models as necessary. However, the emphasis they placed on them varied considerably. One sell-side analyst remarked that: 'the guys who have the detailed models, with detailed sales breakdowns, don't necessarily call the stock any better. I'm not convinced the detail is all that helpful'. Another analyst, when asked if he has a financial model of Intel, responded: 'I have to'. And another analyst, commenting on the work of a colleague, stated: 'for Intel, we have a basic model. I don't think he really relies on the model'. He continued: 'He does the company first, and if anyone wants the product numbers, he backs into that.' These comments suggest, at the very least, that detailed cash flow and income models do not play a central role in assessments by financial analysts of value creation in this particular industry.

Three further items were mentioned by most analysts, when asked what information they would like to receive, but do not receive currently:

- units sold and shipped
- product mix
- ramp rates (ie the move to high volume manufacture)

One analyst remarked, however, that if all this information were available there would be no mystery surrounding Intel, and little need for analysts such as himself!

A range of information thus circulates within the ecosystem. Not all participants use the same information, and nor do they place equal emphasis on different pieces of information. None the less, a clear picture emerges in which non-financial information is given greater emphasis by both the firm and by technical analysts. Financial information is not ignored, but the primary focus for these actors in seeking to assess value creation and corporate performance is on the drivers of that process. Die yield provides the most visible indicator of the health of a particular manufacturing process, and roadmaps provide the principal co-ordinating mechanism for the different constituents that make it up. Sell-side analysts, to the extent that they depend on technical analysts to filter and validate the information that flows within the ecosystem, also place considerable emphasis on such non-financial metrics as die yield and road-maps. But, due to their location within the ecosystem at the interface with the financial markets, sell-side analysts also feel a need to produce more traditional financial models. The information ecosystem thus sustains itself and its constituents, allowing differing types of information to circulate. The findings of this study suggest, however, that non-financial information is at the core of the information ecosystem.

FROM FORMAL TO INFORMAL DISCLOSURE

Financial analysts have access to a wide variety of information sources. The project sought to understand the value they place on different types of formal and informal information. Conference calls, and the role played more generally by Investor Relations, are typically regarded as a significant part of the information flows. The following quotes suggest, however, a mixed view of the value of conference calls, and a less than enthusiastic view of the information provided by Investor Relations

Intel was one of the first companies to organise conference calls. When these began, they involved as few as 50 or 60 people; now the number involved is in the region of 600-700. Reactions by sell-side analysts to conference calls, however, are mixed. One analyst was positive, remarking that 'You get a lot of information, and everyone gets it at the same time.' Another analyst, however, was less enthusiastic, stating that '... there is not a lot of incremental information in the conference calls'. Consistent with this rather negative view was the comment by another highly respected sell-side analyst that he does not make use of conference calls at all. This negative view was reinforced by another equally prominent sell-side analyst. Referring to a conference call held earlier in the week to discuss the recent quarterly profit announcement, he remarked that 'the conference call was so thoroughly orchestrated and planned that there wasn't a single piece of information disclosed that was not already contained in the printed announcement'.

If the views expressed concerning the value of conference calls ranged from positive to highly negative, the views concerning the role played by Investor Relations at Intel were consistently negative. For instance, one sell-side analyst commented that he had 'no interest in talking to Investor Relations.' He went on to say that this should not be interpreted as reflecting badly on any of the people in Investor Relations. Rather, it reflected how intently Intel's affairs are followed by a large analyst community, since Intel is 'one of the most analysed companies in the world'. Consequently, Investor Relations at Intel had to be extremely careful, in dealing with this analyst community, to do nothing that could be construed as selective disclosure of information. Unless they were very careful on this dimension, the company would be opened up to class actions by stockholder groups. 'They have to be more careful than the average company about selective disclosure of information', he added.

Another prominent analyst commented in similar terms:

...these guys give less than almost anyone else I cover of historical data. They won't even tell us what their total, average ASP is, quarter to quarter. These people give less data than almost any other company I deal with ...

When asked to suggest possible reasons, and to comment on disclosure practices of other microprocessor companies, one sell-side analyst remarked that:

AMD tells you how many processors they have done, what the ASPs are. If you have a less compelling story, to keep the investors involved you have to provide more information.

In addition to conference calls, analysts' meetings, and information provided directly by Investor Relations, analysts stated that they received regularly information from other 'informal' sources. One analyst commented that he:

... can get information from ex employees that current employees would be concerned about giving.

Another analyst remarked that he had 'internal sources' in different segments of the company, usually at middle management levels, from whom he could glean some 'internal anecdotal stuff'. But he added, cautiously, that these anecdotes did not determine his ratings of Intel. One analyst claimed to have as many as eight or nine contacts in the company who will comment on data. Rather than letting the company know formally that he has this information source, this analyst said that he will keep the information to himself, and wait until the right moment at which he can raise a question based on information that comes from elsewhere.

Reflecting more generally on the variety of information sources available to financial analysts, one of those interviewed commented:

Some people have better informal links than others. Mine are average. I think there are some networks evolving in this business.

The following comment by Michael Slater of Micro Design Resources summarises well the overall view that multiple informal sources of information are an important part of the information ecosystem:

Most of what we do is collaborative. And most of what's leaked comes not from Intel, it comes from Intel's partners who have been briefed by Intel. And they leak like a sieve.

The information ecosystem is thus a paradoxical entity. Its survival and health is dependent on a constant flow of information among a large number of constituents. The co-ordination of expectations this facilitates helps reduce the risk for those that have to invest heavily and recurrently to enable the rapid pace of innovation characteristic of the microprocessor industry to continue. Information sharing is a prerequisite for the existence of the industry in its current form. Yet formal disclosures are constrained due to regulatory pressures prohibiting selective disclosure. The important role played by technical analysts, discussed in the previous section, is thus emphasised further. Unlike financial analysts, technical analysts can be given information under Non-Disclosure Agreements, and as a result can have a privileged understanding of product and process development, as well as broader strategic issues. They can have a knowledge of such matters that is more or less comparable to that of Intel's corporate customers. And, importantly, the market believes them. The existence of informal disclosure mechanisms thus reinforces the significance this study has attributed to the value of technical analysts within the information ecosystem.

CONCLUSION

The purpose of this study was to conduct an in-depth analysis of information needs of analysts for assessing long-term value creation in the microprocessor industry. The research demonstrates conclusively that analysts already base their evaluations on a wide range of data, and that traditional financial reporting plays only a small part in their evaluations. A novel aspect of the study was the identification of a small group of technical analysts who play an important role in filtering and making accessible complex technical information, and in acting as third-party validators for future-oriented information provided by companies. This demonstrates that there is a clear market need for Value Reporting in the context of a heavily science-based and innovative industry. It demonstrates also that this need is already being met to a significant extent by parties based outside traditional financial reporting mechanisms. Additionally, our research demonstrates that a company such as Intel sees considerable benefit in disclosing as much information as possible. The ability to demonstrate value creation to investors is dependent on the health of the ecosystem. This, in turn, is dependent on the circulation of future-oriented information through the ecosystem.

The information ecosystem thus includes and extends traditional financial reporting. The information ecosystem has limits; however, particularly with respect to the ability of all actors to participate within it, and the difficulty of treating all actors within it in exactly the same way. Indicating the existence of these limits, when asked in an interview where such a policy on voluntary disclosure stops, the President/CEO of Intel commented:

When somebody sues you!

ABOUT THE AUTHORS

Peter Miller is Professor of Management Accounting at the London School of Economics, and specialises in field study research concerning investment evaluation.

Ted O'Leary holds appointments at University College Cork (National University of Ireland) and the University of Michigan (Ann Arbor). He also specialises in field research concerning investment evaluation.