



[learning](#) + [networked society](#) + [dossiers](#) + [extra](#)
[home](#) + [what's new](#) + [index](#) + [comments](#) + [rss feed](#)

*The following interview of **Professor Ron Sanchez** took place prior to a meeting organised by the [Geneva Chapter](#) of the Internet Society at which Ron was a speaker. Ron Sanchez is Professor of Strategy and Technology Management at [IMD](#) - International Institute for Management Development - Lausanne.*

Modularity: upgrading to the next generation design architecture

Ron, what exactly is mass customisation?

It is increasingly possible both to design products that have the ability to be configured to meet the preferences of individual customers and to produce those products at costs that do not differ significantly from the cost of mass producing a single product design. In other words, in a number of businesses the economics of providing product variations for individual consumers on a large scale are approaching the economics of producing a single product for all consumers.

Are you talking about the products of the Information Society?

Information technology has brought three breakthroughs that enable mass customisation: low cost communication between firms and customers via the Internet; the production of customer-specific assemblies of components on IT-driven flexible assembly lines; and door-to-door distribution channels (like Federal Express) driven by information technology. This is, however, only part of the story. You can't just take components and mix and match them to suit the preferences of individual customers unless you've designed a product architecture that will allow that. That is where the critical enabling role of modularity comes in: mass customisation requires creating modular architectures that allow plug-and-play, mix-and-match compatibility of components to configure product variations to meet specific customers' preferences.

Designing the architecture

That must substantially change the design process.

Product development is no longer about creating a product but about creating a platform, or more precisely a modular architecture. The notion of product architecture is a key concept in product development which is no longer just a technical issue. Creating appropriate modular architectures to support new kinds of product strategies is now

central to business strategies. Businesses need to create product and process architectures that are capable of providing the flexibility to customise products for individuals and to upgrade them when better components come along.

How would you define such an architecture?

An architecture has a two-part definition. The first part of an architecture is a decomposition of the overall functionality of a product into a set of defined functions and the component parts of the product that are going to provide those functions. The second part of the definition is the specification of the interface between the components, in other words, how components are going to interact together in the product as a system. The specification of the interface is critical to the design of flexible architectures that allow you to substitute component variations within a product without having to make adjustments in other components. For example, the architecture of most PCs allows you to easily replace an older hard disk drive with a new one, because the interfaces between the hard disk drive and the rest of the computer have been defined to allow a range of variations in hard disk drives.

The challenge of modularity

The notion of modular architecture must be quite a challenge to management.

My view is that we are living in the early years of a third revolution that will transform strategies and management processes. The first was the Industrial Revolution, the second was the information revolution, and the third (now underway) is the design revolution. The design revolution is basically about realising that there is not a direct trade off between product variety and product cost. Through modularity you can achieve very high levels of product variety, while at the same time achieving low cost for development as well as cost savings in production. Modularity is pushing out the productivity frontier in product creation and is changing the rules of competition. What some companies today are already doing with modular design is changing a lot of assumptions in management about what is possible. The first company in an industry that understands how modularity lets you approach the market in new ways and implements a modular strategy can rewrite the rules of competition.

Does modularity change the relationship with the user?

With modular architectures users can become the drivers of the product variety a firm offers in the market. In effect, the advent of modularity allows the locus of product definition to shift from producers to consumers. What producers have had to do for decades was to try to figure out what product variations-what "bundles" of product functions, features, and performance levels-would sell and then offer those bundles to the market, hoping that you have guessed right. What modularity makes possible is strategies in which producers define architectures that will accept a range of component variations that provide different functions, features, and performance levels-and then offer a menu of choices to consumers. Modularity is already beginning to happen in a number of industries-and not just with products like PCs. Modularization is the norm, for example, in the global bicycle industry. You can configure your bicycle the way you want

with the components from the different suppliers who are all making their components to fit in a standard architecture. This is also happening in clothing.

Doesn't a modular approach require a different mind set on the part of companies?

Yes, in part. When a firm uses modular architectures to support what I call product personalization strategies, consumers can choose among component variations, but the decision about the kinds and extent of component variation to be designed into the architecture is still the firm's decision. That is where company skills differ. Modular design is not necessarily hard, but the firms that have learned how to do modular design are now taking advantage of the increased flexibility they get from the modular approach.

Perhaps the greatest impact on management thinking, however, is that the modular approach raises the decision-making process in product development to a more strategic level, which means a higher level of abstraction. Rather than committing the design process to creating a single product design, management must now decide about developing a "platform" for a broad approach to the market, and often including plans for future upgrading of products when new component technologies become available. Managing product creation in modular product markets calls for more strategic inputs and leadership from management.

Reusability

In the software industry, when a break with a former design proves to be the best way forward, backward compatibility proves to be a major problem.

Backward and forward compatibility is always an issue in software because people have an installed base of equipment, programs, and files they don't want to sacrifice. Those issues also apply to other products. Giving backward and forward compatibility to the consumer is a major benefit that a producer can choose to provide through a modular approach. It is really a question of business strategy. Modularity can facilitate a proprietary architecture strategy in which only your company knows the critical interface specifications that make components plug-and-play compatible, and then you can use the fast upgradability of a modular architecture to create an advantage for yourself in the market place. In an open architecture strategy, we open up that modularity and transfer many of the benefits to configure product variations and upgrades to customers.

Reusability is a central factor here, especially for the user, who saves money.

It is important both for the user and the producer. Reusability of components and processes has become a central issue for a lot of companies in their design strategies. There are a number of reasons for this. The relative cost of development versus production is shifting more and more to greater investments in development. If you can go through one component design process and create a component design that can be used in a number of product variations or across product generations, or preferably both, you save tremendous amounts of money on development costs. You can also be very fast in bringing improved products based on selectively upgraded components to the market in the future. A second benefit of reusing components is that there are

economies of learning and quality improvements at the component level. With time we learn how to make reused components cheaper and better. One of the keys to improving the reliability of products is reuse of components. The more you reuse a component and the more you work at incrementally improving that component and its production process, the more reliable that component becomes.

Business-to-business competition

Does this imply that competition shifts from the interface to the components?

Yes. When markets "go modular," competition expands. You still have competition at the final product level, but there is a new possibility that some suppliers of critical, key components can begin to establish brands for their components, like we have seen with "Intel Inside." The real danger for final product producers is that certain components may become more important to consumers than their own brand on the final product. A lot of consumers today care less about the brand of their computer than they do about whether or not it has an Intel microprocessor in it. This creates new intensity of competition among component makers. Competition in a lot of industries is now becoming just as important and intense at the component level as it is at the final product level. Look at consumer electronics, for example. Most people think of the competition between the final product brand producers like Philips, Sony, and Panasonic, because those are the names they see on products like televisions. Final product brands are still important in such product markets because there is value added in the way a producer configures a product and distributes and retails it. At the same time, there is very important global competition in the components themselves. A television that you buy today will contain an assortment of the best performing components from any of a number of producers of components, including components from companies that compete directly in the final product market.

That is business to business competition (B2B)...

Yes. There's B2B competition to be a supplier of components to the final product producers. At that level of industry, your products are components. This can lead to some strange situations. You may find that a company is having mixed success in the final product market, while it may be a very successful global player in the component market. This is not necessarily a favourable situation for the component producer. The economics are very advantageous, however, if you can be an effective final product firm while having a significant global share in related component markets which means in most cases that you are selling components to your direct competitors in consumer markets. Philips is a prime example of a company that has achieved global success in both component and product markets. That may be a win-win situation for all concerned. Costs of both key components and final products go down because some component producers will achieve significant economies of scale. Modular architectures, when they become industry and global standards, enable a cost rationalisation process that can create benefits for producers and consumers alike.

Standardisation

So standardisation of components becomes essential in some industries...

Sure. If you look at TV sets or CD players, each final product player will have its own architecture. However, around certain key components you will find standardised interfaces, especially around the most cost-intensive components, because there are advantages to using the same component design in many final products-so long, of course, as the customer does not differentiate the product on the basis of that component. Getting the reliability and performance of a component up and the cost down is in everybody's best interests. And in that situation, over time, a component producer who has the best component will begin to attract a very large share of the market, creating a de-facto interface standard for that kind of component. Sometimes there are even industry agreements to establish interface standards so all firms in the industry can buy the same components.

Doesn't that lead to a monopoly situation?

No. In fact, it has the opposite effect. When an industry standardises all or part of the interfaces in a product architecture-but not the components themselves-that opens up competition. Standardising interfaces creates an island of technological stability around that interface. Companies that are interested in getting into the component business are able to be creative in the way they design a component once they know the interfaces it has to fit into. Before interfaces are standardised, the uncertainty about what the interfaces will be in the future and the need to create many different components to serve many different proprietary architectures create risk and cost barriers that keep out a lot of potential component makers. So the lack of standardised component interfaces actually can serve to limit competition.

The impact on management

Let's come back to the impact on management...

From a management point of view, adopting a modular architectural strategy changes the level of management input you have to have to manage product creation, and it also changes the kind of input you need from management. The main change is that top management needs to be more involved in product creation because modular architectures are really just a means to an end, and the end is a successful business strategy. Once you start to create modular architectures in organisations, that raises issues such as the range of consumer preferences that are going to be catered to, and which component-based functions we may want to maintain market leadership in. Such issues force management to define the firm's market strategy more precisely than they are used to. This will precipitate a greater involvement of higher levels of management in product creation decisions than before. On the other hand, one of the powerful benefits of standardising interfaces is that it enables concurrent development of components. The standardised interfaces essentially define the required outputs of the development process for a component. So once you have defined the interfaces, you don't have to spend a lot of middle management energy in managing the process of component development. In that regard, the move to modular development processes is consistent with the emergence of flat, empowered organisation structures with relatively

thin layers of middle management and a more strategic orientation in decision making of top management.

That requires new skills from top management.

It requires top management to realise that for decades, very important constraints on the flexibilities of their organisations to meet diverse and changing market demands have-by default-been decided at the technical working level by engineers making architectural decisions without inputs from top management and without discussion with top management about the implications of such decisions. Top management now needs to realise that deciding interfaces is not a low-level engineering or technical decision. Decisions about interfaces-and the flexibility you can either gain or lose through the interfaces in your product architectures-are a central strategy issue for the organisation. The flexibility of the organisation to offer product variations, upgrades, and technology improvements in the future, is in fact being decided by those interface specifications. That has to be a strategic decision, not just a technical one, because it decides the future options of the company.

To what extent is there a realisation of the potential impact of this change on the part of companies?

Let's put it this way: In the companies I have worked with, the conversion to modular architectures did not happen at the working level in the engineering function. The conversion to modular design and modularity-driven strategies has to be understood and supported, one can even say sponsored, by top management, because it changes the way the organisation works. My experience has been that technical and marketing people at the working level grasp these concepts very readily. In fact, in many cases they have been trying to implement modularity ideas as best they can without full management comprehension of what is to be gained by doing this. Until top management realises that there is now a new set of strategic possibilities and a powerful new economics of product creation, thanks to the combination of modular architectures and information technology, and until top management makes it a corporate objective to go after those new possibilities, there will be a lot of talk at the working level, but no real change in the company. Only when top management realises the new possibilities and decides that they are going to be one of the companies that takes advantage of the modular revolution in product design, only then can real changes start to happen. In my experience, the companies that have made this conversion to modular strategies and ways of working have undergone a profound transformation that quietly but greatly changes the performance of the organisation.

Professor Ron Sanchez, IMD Lausanne.

Interview, Alan McCluskey.

Share or comment

| [More](#)

[learning](#) + [networked society](#) + [dossiers](#) + [extra](#)
[home](#) + [what's new](#) + [index](#) + [comments](#) + [rss feed](#)

ISSN: 1664-834X Copyright © , [Alan McCluskey](#), info@connected.org

Artwork & Novels: [Secret Paths](#) & [PhotoBlog](#) - LinkedIn: [Portfolio](#) - [DIIGO](#): [Links](#)

Created: May 12th, 2000 - Last up-dated: May 12th, 2000