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End of an Era?

The Chemical Industries' Future

Chemistry dominated much of the 20th centurie's discoveries and developments, both from a scientific and economic perspective. The chemical industry profited from growth in America and Europe. As GDP growth and chemicals demand in the "industrialized countries" is nearly stagnant, Asia is currently in the focus of investments and growth opportunities. But what follows afterwards? What are the long term options and opportunities of the chemical industry?

Many people already call the 21st century the "century of biology". What does this mean for chemistry and the chemical industry? Is chemistry an antiquated field? Definitely the industry and its techniques will change dramatically. But, have there ever been times when this was not true?

Does this mean that the era of chemistry is ending? Will other technologies take over? The answer is Yes and No. Biological methods – a broader term than "biotechnology" – will change especially the production and availability of many chemicals. However, the need for chemicals, regardless of their source, will always remain the same. In some countries it may even rise. The question is: Which companies will be able to adapt to these new processes? And which companies can develop new chemicals to satisfy new demands? Surely, and that will be one of the mayor problems for many chemical firms, the processes will change from classical chemical synthesis to combined interdisciplinary or purely biological methods. Chemistry will become more divers. Companies have to open their minds and people. One of those new emerging fields could be "business chemistry". The era of the "classical" chemistry is ending, but the era of "open" chemistry is about to begin.

In this issue of the *Journal of Business Chemistry* we address some of those questions and problems. A commentary addresses the future developments. The research and practicioners section focus on innovation and IP management and thus how to secure the future of the industry. We thank all authors and reviewer for their contributions and especially Nathalie Sick for her help in the editing process.

Now enjoy reading the first issue of the *Journal of Business Chemistry* in 2006. If you have any comments or suggestions, please send us an e-mail to contact@businesschemistry.org.

Stefan Picker

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Commentary

The Global Business of Chemistry: Prospects and Challenges

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Abstract: The global business of chemistry has faced numerous challenges in recent years. This article addresses the near-term business environment in which the industry will operate as well as the implications for the global business of chemistry during 2006 and 2007.

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Introduction

The business of chemistry is a $2.24 trillion enterprize, an enabling industry that is essential to our everyday lives, making possible many innovations and benefits for society. When the science of chemistry is applied, it helps make the lives of humankind world safer, healthier and more productive.

The industry faces considerable challenges (and opportunities) in the opening years of the 21st century. Included are rising energy prices, geo-political shocks, and globalization. The prime aim of this article is to present the short-term

outlook for the global business of chemistry as well as address some longer-term issues. It is oriented toward the decision-maker in business of chemistry or others interested in the interaction between changes in the global economy and industry dynamics.

The article is organized into three sections. A first section deals with the business environment for the global economy, with a particular focus on industrial activity, the prime end-use market for chemicals. The expected outlook is reviewed as are the potential risks. A second section deals with the the linkage between overall industrial activity and the business of chemistry and proceeds to the implications of rising industrial output for the global business of chemistry's outlook during the next two years, with a discussion of national/regional differences as well as opportunities by segment. In a third section, the prospects for the global business of chemistry during the 2005-2015 time frame are addressed as is a discussion of the effects on demographic change on longer-term demand for chemicals. A final section deals with sources of the data and methodologies employed.

Business Environment

Led by continued strong performance in the United States and China, the global economy recorded robust, albeit slower, growth in the first half of 2005. After averaging 5.1% in 2004[1], world economic growth (on a purchasing power basis) as presented in Table 1 will moderate to 4.2% in 2005 and is expected to further moderate to 4.0% in 2006 and 2007. These growth rates are in line with the historic averages reflecting a robust, healthy economic environment. This optimistic view of global prospects assumes that no major economic or political shocks that would alter the course of growth will occur. There are, however, a number of possible risks to the world economy.

A significant escalation in oil prices would pose a threat to world growth. Although the global economy has become significantly less dependent on oil since the 1970s, higher oil and natural gas prices continue to act as a downside risk to economic growth and as an upside risk to inflation. Inflationary pressures have risen. If upward pressure on core inflation measures intensifies, this will result in higher interest rates, which in turn could eventually engender the next downturn.

Large imbalances remain in the world economy, particularly in relation to the record US current account deficit, which increasingly strains the global financial system. Consequently, another significant drop in the dollar against other major currencies is possible. Weakness in the dollar could pose a threat by undermining export-driven economic growth in Europe and Japan. Threats aside, prospects remain strong for world trade into 2007.

Another source of global risk arises from the unsure economic recovery in Western Europe. Although there have been some signs of improvement, the recoveries in France, Germany and Italy in particular are still fragile and largely externally driven, making them especially vulnerable to any set-backs in the global economy.

Global growth could also be derailed by fresh geopolitical shocks. Further terrorist attacks in the major Western economies could depress confidence. There is also a specific concern relating to a possible global pandemic if Asian 'avian flu' spreads more widely within the human population. The impact of such risks is impossible to quantify with any precision at this stage, but in a worst case scenario it could be devastating in both economic and human terms.

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% change Y/Y	**2003**	**2004**	**2005**	**2006**	**2007**
United States	0.6	4.1	2.9	3.1	3.5
Canada	0.7	3.3	1.8	2.7	2.7
Mexico	-1.3	3.8	2.8	3.2	3.4
North America	**0.5**	**4.0**	**2.8**	**3.1**	**3.4**
Brazil	0.0	8.3	4.3	4.5	4.2
Other	6.8	11.7	7.5	6.7	6.1
Latin America	**3.7**	**9.4**	**6.0**	**5.7**	**5.2**
France	-0.5	2.3	0.9	1.7	2.2
Germany	0.4	4.2	2.1	2.4	1.9
Italy	-1.0	0.6	-0.8	1.1	1.2
United Kingdom	-0.5	0.7	-0.7	1.1	1.3
Other	0.4	2.2	1.0	2.1	2.2
Western Europe	**-0.1**	**1.5**	**0.7**	**1.8**	**1.8**
Russia	7.0	7.3	5.0	5.4	4.9
Other	8.2	9.8	5.4	6.6	5.6
Central & Eastern Europe	**7.8**	**8.4**	**5.3**	**6.2**	**5.3**
Africa & Middle East	**3.8**	**5.1**	**3.9**	**3.9**	**2.6**
Japan	3.3	5.2	1.5	2.9	2.4
Asia-Pacific (ex Japan)	10.8	11.7	9.2	8.6	8.8
China	17.0	16.7	13.2	11.8	12.6
India	7.0	8.2	7.9	7.2	7.0
Other East Asia	5.6	8.3	4.7	5.3	5.5
Other	6.2	7.0	6.5	6.4	5.2
Asia/Pacific	**8.4**	**13.8**	**6.2**	**6.1**	**6.2**
WORLD IP	**3.9**	**7.3**	**3.9**	**4.2**	**4.1**
WORLD GDP	**4.0**	**5.1**	**4.2**	**4.0**	**4.0**

Table 1: World Industrial Production (IP) Growth Outlook

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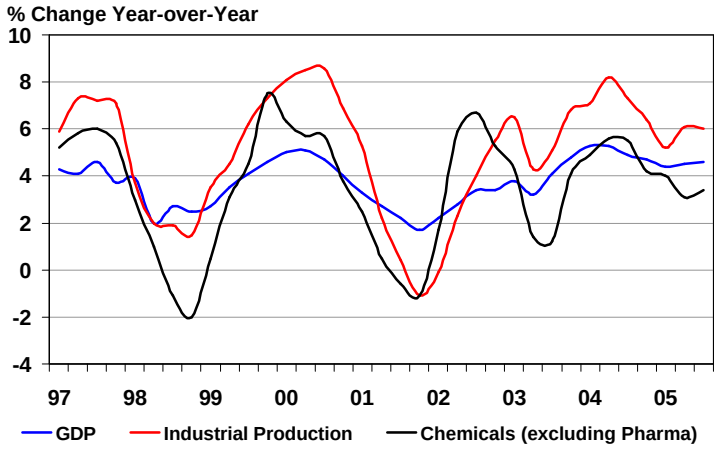
There are also some positive factors to bear in mind. First, despite headwinds from high energy costs, the US economy remains relatively strong, and the latest indicators are generally positive. The other major economic engine, China, still has significant upward momentum. In addition, there are signs that the continental economies of Western Europe and the Japanese economy are improving.

Industrial production is a more meaningful indicator than economic growth. On average, the industrial sectors purchase $43 worth of chemistry for every $1,000 worth of output (or revenues). In contrast, the services sectors purchase only $11 for every $1,000 worth of output. Moreover, the services sectors are more likely to purchase pharmaceuticals (for health care) and consumer products than basic and specialty chemicals, which are dominated by industrial uses. During 1st quarter 2005, year-over-year (Y/Y) growth in global industrial production slowed to 5.2%, down from a peak 8.2% Y/Y gain in 2nd quarter 2004. This reflected the soft patch in global manufacturing as high energy prices and a rush to trim inventories slowed manufacturing activity worldwide. The soft patch was rather short, with 2nd quarter Y/Y growth improving to 6.1%. The hurricanes during August and September, however, adversely affected US output, hampering 3rd quarter global activity. These patterns are illustrated in Figure 1.

Figure 1
World Economic, Industrial and Chemicals Growth



Note: 2003 through 2004 are actual historical growth rates while 2005-2007 are the author's estimations.

Global industrial activity appears to be recovering, which will aid final demand, manufacturing, and ultimately demand for chemistry. As Table 1 indicates, expectations are for a 3.9% gain in global industrial production in 2005, accelerating to 4.2% in 2006. This will still trail the gain in 2004, which likely represented the peak in growth. As expected, the strongest growth is occurring in China and other East Asian economies.

Global Chemical Industry Outlook

As seen in Figure 1, the global business of chemistry clearly parallels trends in broader industry. During 2005, the pattern clearly reflects the global soft-patch in manufacturing and summer rebound from the inventory-led correction of the 1st half. The data for the summer months provide signs that this ended and that growth returned. The negative impact of Hurricane Katrina on US production weighed on chemical industry activity in North America and the world. Outside North America, improvement has generally been broad-based and is particularly

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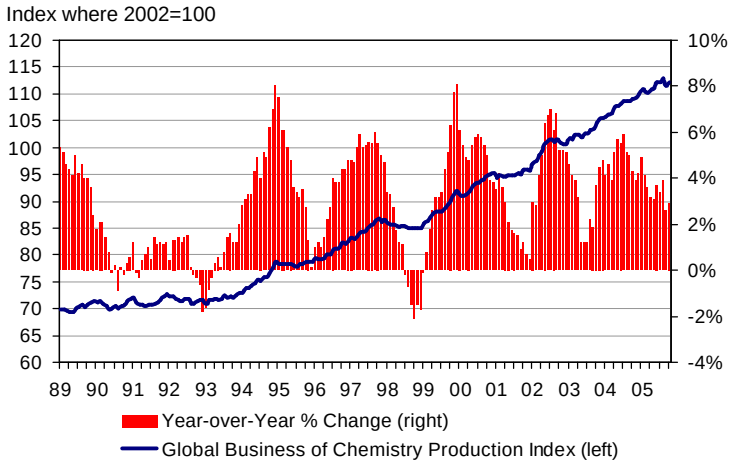
strong in Africa & the Middle East and in the Asia-Pacific region.

On a Y/Y basis, global chemical industry production was up 3.3% in the 3rd quarter, down from the peak Y/Y comparison of 5.9% last July. As Figure 2 illustrates, the past year was characterized by moderating Y/Y comparisons but also reflects the more mature phase of the cycle as well as the effects -- a soft-patch -- of high energy prices and the global inventory correction working their way through the global economy. Nonetheless, the global industry expects improved business conditions in 2006. Indeed, there have been a number of encouraging signals.

Figure 2
Global Business of Chemistry Production Index



The industry still faces some economic headwinds. The hurricanes in the United States negatively affected output for some producers but may have presented opportunities for other producing nations. The major risk to the global economy and the business of chemistry at this point in the chemistry cycle is high oil prices, the result of sustained global demand as well as supply-driven gains recently in wake of Hurricane Katrina. In North America, this is further complicated by high and volatile natural gas prices where the effects of Katrina and Rita were equivalent to a classic supply shock.

In parallel with renewed demand among industrial customers, the global chemical industry will continue to grow from its current base. As shown in Table 2, as global industrial production recovers it will pull worldwide chemical industry activity with it, with volumes improving from 3.3% in 2005 to 3.9% in 2006. During 2007, gains will improve slightly (to 4.0%) but will still be slower than the 2004 gain, which likely represents the growth peak. As would be expected, the largest gains are anticipated in China and elsewhere in the Asia-Pacific region (excluding Japan) as well as in Africa & the Middle East. Better prospects are expected in Western Europe during 2006 and activity is expected to improve in North America. Table 2 presents the global outlook for the business of chemistry on a regional basis, including several of the major economies.

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% change Y/Y	**2003**	**2004**	**2005**	**2006**	**2007**
United States	-0.3	3.1	0.5	2.7	2.9
Canada	2.2	6.5	1.2	3.2	2.9
Mexico	1.1	3.3	1.8	3.3	3.6
North America	**-0.2**	**3.3**	**0.6**	**2.8**	**2.9**
Brazil	0.7	8.6	6.7	5.0	4.4
Other	5.3	9.2	8.2	4.8	4.9
Latin America	**3.2**	**8.9**	**7.5**	**4.9**	**4.7**
France	3.0	3.4	2.9	2.5	2.9
Germany	0.3	2.5	5.8	2.0	2.5
Italy	-2.1	1.5	0.3	2.2	2.2
United Kingdom	0.9	3.1	0.1	2.3	2.3
Other	4.3	-0.5	-0.3	2.5	3.2
Western Europe	**2.1**	**1.4**	**1.7**	**2.3**	**2.8**
Russia	5.5	7.0	3.6	5.2	5.3
Other	8.3	8.0	4.3	4.6	4.8
Central & Eastern Europe	**6.7**	**7.4**	**4.0**	**4.9**	**5.0**
Africa & Middle East	**7.7**	**15.2**	**7.2**	**7.7**	**7.2**
Japan	1.1	1.7	0.7	1.7	1.9
Asia-Pacific (ex Japan)	9.5	10.2	10.0	9.0	8.2
China	18.4	13.5	15.4	12.7	11.1
India	3.4	17.0	11.9	8.5	8.1
Other East Asia	6.4	7.6	6.6	7.4	6.9
Other	3.0	4.0	6.0	5.5	5.3
Asia/Pacific	**6.3**	**7.2**	**6.5**	**6.2**	**5.8**
WORLD OUTPUT	**3.0**	**4.8**	**3.3**	**3.9**	**4.0**

Table 2: World Business of Chemistry Growth Outlook (by Region)
Note: 2003 through 2004 are actual historical growth rates while 2005-2007 are the author's estimations.

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	2003	2004	2005	2006	2007
WORLD OUTPUT	**3.0**	**4.8**	**3.3**	**3.9**	**4.0**
Pharmaceuticals	4.1	3.8	3.5	3.7	4.0
Total, excluding Pharmaceuticals	2.7	5.0	3.2	4.0	4.0
Consumer Products	1.2	3.0	4.9	3.2	3.3
Agricultural Chemicals	1.8	4.7	-0.8	0.8	1.8
Specialties	1.6	4.2	3.8	4.3	3.6
Coatings	4.1	6.3	4.6	6.2	4.5
Other Specialties	2.0	5.4	3.5	3.8	3.3
Basic Chemicals	1.0	4.0	1.3	4.8	4.4
Inorganic Chemicals	1.8	3.8	2.8	2.6	3.1
Bulk Petrochemicals & Organics	1.3	6.4	2.7	4.3	4.3
Plastic Resins	0.7	6.8	1.8	8.0	6.0
Synthetic Rubber	3.2	5.3	1.8	3.3	3.2
Man-made Fibers	-1.2	3.8	-4.4	1.5	1.8

Table 3: World Business of Chemistry Growth Outlook (by Segment)
Note: 2003 through 2004 are actual historical growth rates while 2005-2007 are the author's estimations.

The various segments of the chemical industry have been affected to different degrees by the global soft-patch in manufacturing as well as the slowing of the world economy. This year presented deterioration of petrochemical and downstream derivatives activity. Downstream customer and producer inventory de-stocking played a large role but the effects of the hurricanes on US activity has taken their toll on global output as well. Table 3 presents the global outlook for the business of chemistry on a segment basis. It appears that improving consumer and business confidence and sustained global economic growth along with rebounding global industrial output will aid most basic and specialty chemical segments. The recovery from the hurricanes will lift global

growth prospects for plasti resins and for bulk petrochemicals and organics. Improving light vehicle production and construction activity will aid the global coatings business.

Long-Term Trends in Chemistry

Looking to the long-term, global economic growth is expected to average 3.9% per year during the period between 2005 and 2015. Growth in global industrial output will average 4.6% per year, a pace 1.2 times that of global economic growth. As would be expected and as illustrated in Figure 3, growth prospects will be faster in China and the other East Asian nations. Indeed, China will account for about one-fifth of the incremental growth in industrial activity as the nation's industrial prowess further progresses. India and several nations in Latin America and Central & Eastern Europe will also experience strong industrial growth while North America, Western Europe and Japan will lag.

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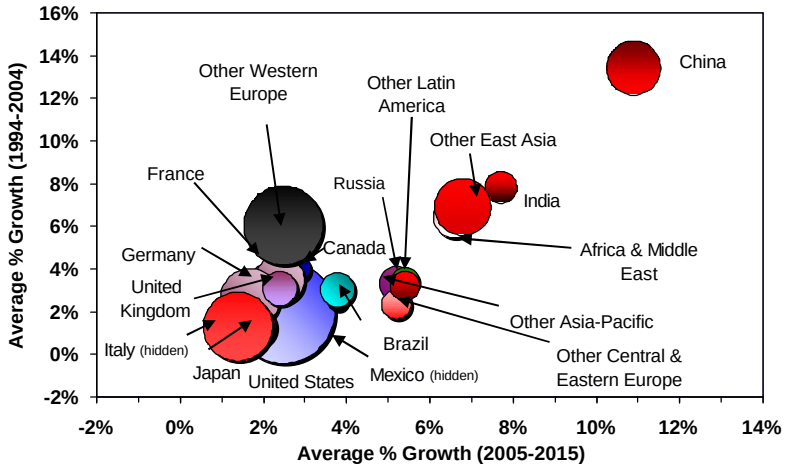
Figure 3
Long-Term Global Chemistry Outlook



During the period from 1994 through 2004, the global business of chemistry grew 3.7% per year, slightly lagging the 3.8% pace of average global economic growth. period included a still sluggish recovery from the early-1990s recession in Europe, the Asian crisis, and the most recession. During the next 10 years, the global business of chemistry is expected to continue lagging economic growth. It will lag global industrial output as well. Growth is expected to average 3.4% per year during the 2005-15 period. The best prospects will be found in Asia-Pacific (excluding Japan), where the business of chemistry's growth will exceed (by 1.2 times) that of overall economic growth. Because of advantages in feedstocks, Africa and the Middle East will also experience strong growth. In other regions, growth will be closer to the pace of economic growth.

Two long-term trends are apparent. First, the movement of end-use customer industries to China and elsewhere in the Asia-Pacific region (excluding Japan) will continue as illustrated in Figure 4. This was led by textiles and has spread to light vehicles and now electronics. A shift in light vehicle assemblies from Western Europe to Central & Eastern Europe is also occurring as companies take advantage of lower-cost, skilled work forces in close proximity. One long-term structural issue is the move of pulp and paper production away from the northern hemisphere toward nations such as Brazil, China, and Indonesia where trees grow faster or costs are lower. A shift in the geographical focus of rubber and plastics processing is now occurring and the high levels of capital formation in China and elsewhere in the Asia-Pacific region is engendering much stronger construction activity and associated chemistry demand.

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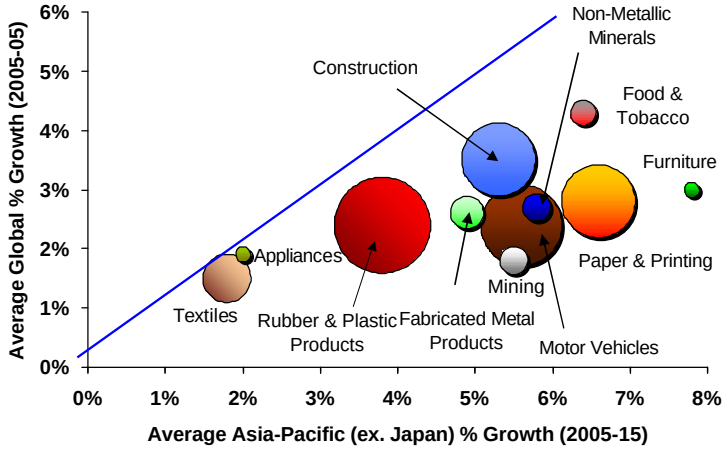
Figure 4
Customer Industries Drive Chemical Markets



Bubble Size = $ Size of Chemical Market

Second, there a number of nations with abundant hydrocarbon resources that represent advantaged feedstock locations. Most notable are Iran, Kuwait, Qatar, and Saudi Arabia. With strong low-cost advantages in petrochemical feedstocks, the Middle East is poised to obtain a larger share of global petrochemical capacity, the output of which will increasingly be exported to, Asia/Pacific, Western Europe, and possibly North America. Geo-political risks are high in this region but are balanced by significant feedstock advantages. With major investments underway, these nations have been adding significant capacity. Some delays in these projects could occur but rising demand from Asian markets will aid production gains.

Looking even longer-term, demographic issues will play a dominate role. Declining working age populations in Europe, Japan, and eventually even in China raise questions about economic growth potential. At the same time, aging populations will strain government programs. Through the year 2050, overall population levels will decline in most of Europe and in Japan, while slowing elsewhere. Assuming long-term chemistry demand is correlated with population (and incomes, technology, etc.) this has negative implications for market developments in these nations. Stronger population growth in Africa and the Middle East imply the emergence of this region as a growth leader. Continued strong economic growth will aid prospects in Asia-Pacific (excluding Japan) and in Latin America. As highly developed markets, the United States and Canada cannot be ignored as they will present opportunities as population continues to grow. Figure 5 illustrates the relationship between population growth, current development of the chemical markets in these regions (as measured by per capita chemistry sales), and the size of the business of chemistry in each major nation or region.

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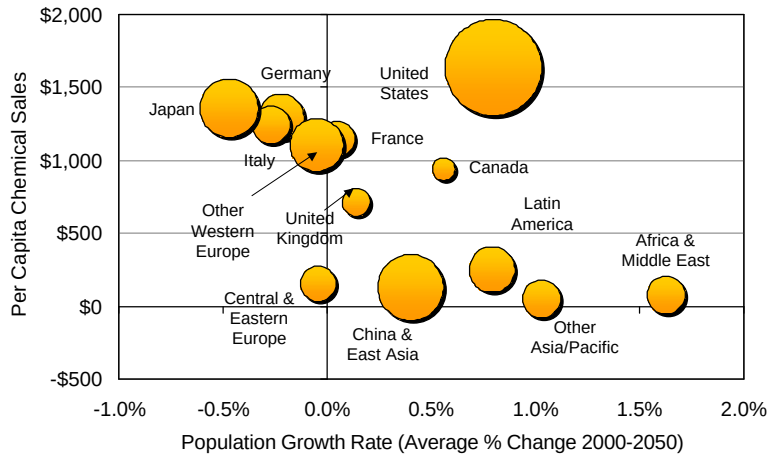
Figure 5
Regional Chemical Sales, Per Capita Chemical Sales, and Population Growth



Note: Bubble size represents chemical sales in billions of dollars

Summary

In summary, in the main short-term scenario there will be some moderation of global growth in 2006 in response to higher energy prices, higher US interest rates, and a gradual adjustment of global imbalances. The business environment for the global business of chemistry is favorable and improving. Reflecting a recovery in overall industrial production, the output for the business of chemistry will improve during 2006 and 2007. Growth prospects will be faster in China and the East Asian nations than in Western Europe or North America. From a segment viewpoint, strong growth is expected in plastic resins, petrochemicals, and coatings. There are, however, still considerable uncertainties that need to be taken into account including energy prices, exchange rates and possible geopolitical shocks. During the next 10 years, the business of chemistry will mature, with growth prospects centered in China and other East Asian nations as well as in Africa & the Middle East. Looking even longer-term, demographic change will adversely affect demand potential in Europe and Japan.

Appendix: Sources and Methodology

The source of data on chemical industry growth presented in the tables and cited in the text by is the ACC Global Index of Business of Chemistry Activity. The ACC Global Index measures business of chemistry activity for 23 key nations, sub-regions, and regions, all aggregated to the world total. The index is comparable to government production indices and features a base year where 2002=100. This index is developed from government industrial production indices for chemicals from over 55 nations accounting for over 96% of the total global business of chemistry. Some segment data is provided at the regional level.

Historical economic growth is from the International Monetary Fund but the estimations or forecasts for 2005-2007 were made by the author. Data on industrial production are from the various national statistical agencies and are aggregated by the author based on relative weight of the national economy. The assessment is based on economic data and publicly available information through early-November.

In looking ahead, a proprietary model of global output for the business of chemistry is employed. The author also takes into account the forecasts made by economists at the various national

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chemical associations, the expertise of whom he gratefully acknowledges. Also gratefully acknowledged is the macroeconomic and chemical industry expertise of Oxford Economic Forecasting Ltd. (OEF), one of the world's leading providers of independent economic advice and consultancy services. The long-term projections reflect on-going scenario development and modelling work by the author as part of an assessment of long-term demographic change and its effects on economic growth and the prospects for the business of chemistry.

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Research Paper

Systematically Creating Coincidental Product Evolution
Case Studies of the Application of the Systematic Inventive Thinking® (SIT) Method in the Chemical Industry

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Abstract: The article shows the need for an unconventional innovation methodology within the field of new product development (NPD). Systematic Inventive Thinking (SIT) is such a method which has been applied successfully in the chemical industry. An overview of the method, together with case studies from the industry, demonstrates the value of this departure from traditional thinking and other, more widespread, innovation methods.

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Introduction

You have, no doubt, heard the following story, or similar versions of it, numerous times. The story begins in 1938 with the inadvertent discovery by Du Pont chemist Dr. Roy J. Plunkett of a highly unusual new substance. According to legend, Dr. Plunkett had set out to invent a nontoxic refrigerant, but when his assistant, Jack Rebok unintentionally cracked the valve on the special bottle of Freon, surprisingly, no gas came out. Sawing open the cylinder, they noted that the frozen, compressed sample of tetrafluoroethylene, had polymerized spontaneously into a white, waxy powder form of polytetrafluoroethylene (PTFE). Trying to identify the properties of the substance, they found that it was absolutely stable: neither heat nor electricity nor acids, nor solvents would react to it. It was the slipperiest substance on earth.[11] The invention of Teflon® was, in essence, a product of accident and coincidence. But is there another moral to this tale? In addition to the understandable drive to find solutions to problems, there may be a benefit in looking at what you have and searching for the problems that it solves.

The present article begins with a theoretical review of the process though which the Systematic Inventive Thinking method is applied, a structured process similar to the accidental one described above. The review will demonstrate why there is a need for the SIT approach to innovation as a supplement to the way that companies typically go about innovating. The subsequent sections of the article show that the thinking tools that form the core of the SIT method are clearly relevant to the chemical industry, first by analyzing one recent innovation in the field. Later, we bring 2 case studies showing how different chemical companies are actively using the SIT method in order to invent new products and technological platforms, as well as a comparison between the two.

How do companies find ideas for new products?

Suppose you want to come up with a new product idea. Where do you begin? The challenge in product innovation is to create products that answer unmet needs, especially where a new product addresses a latent need of which even the market was unaware. Unfortunately, most new products tend to be of the former type, and, to make things worse, prone to competition. Why does this happen so often?

Three Sources

Most companies rely on three sources to develop new product ideas: 1) surveying competitors, 2) market knowledge and research [1, 2, 3], 3) and new technologies. The first one cannot result in a differentiated product. While being an important component in a company's portfolio, the second source – market research – has, surprisingly, been proven to not be conducive to product offerings that distinguish one company from the competition.[4, 5, 6]

To understand why, let's look at the following example:

Let's imagine you came up with a really funny joke and told it to a couple of your friends. Each of them would probably tell it to a couple of his or her friends and so on. However, it would take some time before a significant portion of your city's population would hear it, not to mention your country or state. If we tried to describe the connection between the portion of the population that has heard your joke and the time that has passed since you first told it, it would look something like Figure 1.

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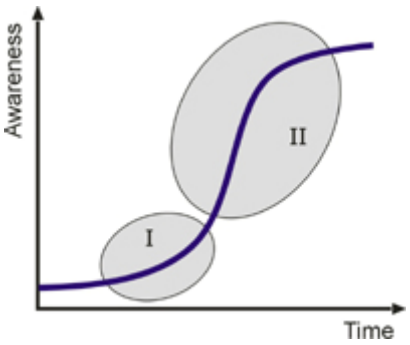

Figure 1: Diffusion of Awareness about a New Idea [6]

A very similar graph would describe the connection between the awareness to a new need in the market and the portion of the population aware of that need.[10] Observing this graph it is quite clear that any market research, conducted at the section marked I, would have virtually no chance of discovering the new need. It is only in the section marked II that market researches would have a good chance of stumbling upon the new need. Unfortunately, at that point in time it is pretty safe to assume that your competitors' market research would yield very similar results.[3]

Technology can be a source of differentiation, but only provided that your company has access to technologies that are not available to others.

Systematic Inventive Thinking – a fourth source – an alternative approach to innovation

There is, however, a fourth source for developing new ideas – using existing products as a basis for ideas. Based on internal company resources and expertise, it can serve as a strong differentiating factor between companies that know how to utilize it and those who do not.

Systematic Inventive Thinking (SIT), a novel approach to idea creation and innovation, is based on this source. The method has been used by hundreds of companies in more than forty countries, including several in the chemical industry – Univation Technologies and Bayer Environmental Science, for example – to help them "listen to the voice of their products." SIT provides a structured process to arrive at innovative ideas for new products and technologies.

At the heart of SIT is a crucial idea: inventive solutions share common patterns. It is evident that inventors unknowingly follow patterns when coming up with new product ideas - patterns that can be identified by observing thousands of products and their evolution. Surprisingly, a majority of new and inventive products can be categorized according to only five patterns.

One of these patterns is called, in SIT parlance, Subtraction. In opposition to the conventional approach to new product development whereby components, attributes or features are added in line with the perceived wants of consumers, with Subtraction, instead of adding components, you remove them - particularly those that seem most essential and indispensable. An example of the Subtraction pattern can be seen in the Pressure Sensitive Adhesives (PSA) industry with the introduction by Dow Corning of solvent-less silicone PSAs.[12] Solvent had been considered an essential component in delivering silicone pressure sensitive adhesives. Nevertheless, by removing it, a new form was conceived which had the performance benefits of typical silicone PSAs such as the ability to maintain adhesion at extremes of temperature and adhesion to low energy surfaces with the added advantage of being non-toxic and non-allergenic.

From Patterns to Tools

Subtraction is only one of the five patterns that form the core of the SIT method for product innovation. But in order to be able to proactively use the patterns to create future innovations rather than to simply categorize historical ones, a systematic process has been developed to apply them. Thus, the patterns become "thinking tools" which can be used to come up with new ideas; in a sense, they systematically create accidents.

This process is called Function Follows Form (FFF), a term coined by cognitive psychologist Ronald Finke.[13] Instead of innovating by identifying a "function" or need and then creating a product accordingly, one first manipulates the existing product and then considers how the new form could of benefit.

Using Function Follows Form, then, one develops products in the reverse order to the market research process. Applying FFF, one

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begins with an existing concept or product. A list of the product's physical components and its environment is constructed. Then one of the five thinking tools is used to mentally manipulate the product. These new forms, or "virtual products" in SIT-speak, are immediately assessed as to their business value and feasibility. If the virtual product has both market potential and falls within existing company and technological constraints, it undergoes whatever minor adaptations are needed and is considered worthy of following up. As market knowledge is used here as a filter rather than as the starting point, the ideas generated are likely to be different from those that competitors arrive at by searching the market for ideas.

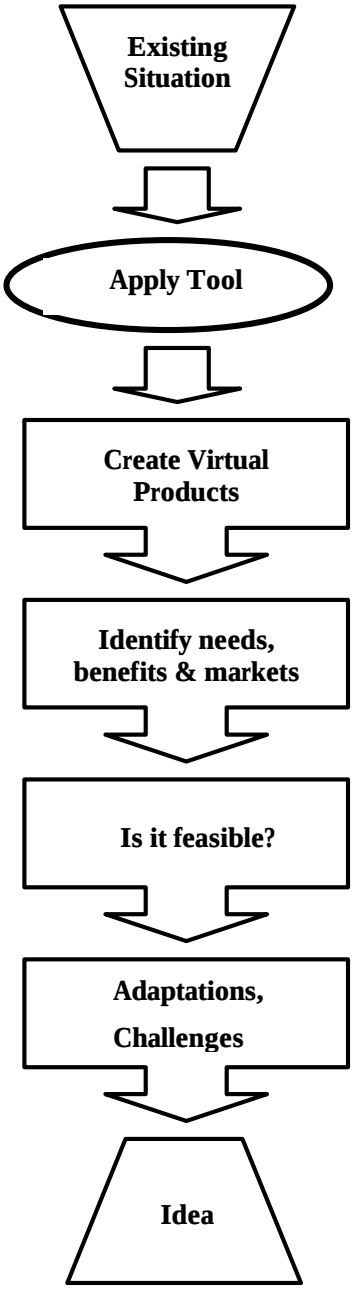

Figure 2: Function follows form

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The Tool	Definition	The Concept	Example	Especially Useful
Task Unification	Assigning a new and additional task to an existing resource	To view everything as a potential resource that has multiple uses.	One piece defroster + antenna in cars.	Cost reduction
Attribute Dependency	Creating a new relationship or eliminating an existing relationship between two variables of a product.	To create, change or eliminate dependencies between variables of a product and its environment.	Toothbrush that changes color once the child has brushed long enough	To segment in a saturated industry
Division	Dividing the product and/or one of its components and rearranging them in time or space.	To increase the degrees of freedom within a product so that it can be rearranged to create a new product or new uses for the existing product.	Detachable panel in car radio	For product packaging
Subtraction	Removing an **essential** component from a product.	To remove from the product a component thought to be so essential that it seems impossible for the product to exist without it.	Placebo	Highly complex systems
Multiplication	Adding to a product a component of the same type as an existing component in the product, but changing the copy in some way.	To transcend a mere change in quantity in order to achieve a qualitative change	Gillette razors in which the 2 blades are angled differently to provide a new advantage.	When there are few components in the starting product

Table 1: The 5 SIT Tools [10]

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The following sections describe case studies of the application of the SIT method, through the Function Follows Form work process, for the purpose of arriving at innovative product and technological solutions in the chemical industry. In each case, the benefit for the innovation was identified as a secondary step rather than as the starting point of the process, contrary to the conventional approach of first identifying a need and subsequently searching for solutions.

Case Study: Ahava Dead Sea Laboratories

Ahava Dead Sea Laboratories is a world leader in the mineral based cosmetics industry, functionalizing the effects of the unique natural elements found in the Dead Sea. Ahava has been working with the SIT method for two years and the tools can be identified in many of the company's recent patent registrations.

The Multiplication tool presents a very different, even opposite, approach to the Subtraction tool discussed above. Instead of removing components, as in Subtraction, you replicate or multiply existing components, but *alter the copies* according to some parameter. It is critical to not simply add more copies, but to change the copies in some way. For example, there are several magnetic minerals in Dead Sea salts and they have been utilized previously in many Dead Sea cosmetic products. In order to launch a new line of cosmetics, Ahava did not simply increase the amount of the existing metallic minerals in its products. Rather, they added other types of metals, to increase the total percentage [US patent application No. 10/519, 38]. This, they realized, would amplify the positive effects of increased blood flow to the areas to which the cosmetic is applied, and thereby give the user an added benefit.

Task Unification, a third SIT tool, is defined as "assigning a new and additional task to an existing resource". It manifests itself when one of a product's components – or some other object in the product's immediate vicinity – is given an additional task without losing its original one. Ahava's innovative new Gentle Body Exfoliator uses the body's own moisture to melt the active ingredients through a process of emulsification.

Figure 3: Gentle Body Exfoliator

Since the body's moisture is utilized for the task of activating the cosmetic's ingredients, Ahava was able to produce the product without adding water. Therefore, when applied, the product is of a rough texture, removing dead skin cells from the surface. However, the cosmetic, with the help of the body's moisture, shortly dissolves into the skin, to nourish it with the Dead Sea minerals [while not patent pending, this product is based on unique know-how of the company].

A second Ahava patent, a Purifying Mud Mask, demonstrates SIT's Attribute Dependency tool. Attribute Dependency involves the creation of new relationships between the different variables of a product or its immediate environment. Innovative ideas are often generated by creating new dependencies where they may not currently exist or by modifying or dissolving dependencies where they do. The Attribute Dependency pattern helps accelerate the discovery of products that seem in hindsight to be inevitable. The Purifying Mud Mask product is applied as a typical mud mask, but does not retain that function over time. In fact, the mask undergoes a chemical process that changes it into a "peeling" to remove dead skin. Unlike most 2-in-1 products that have multiple functions at the same time, this product

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provides both functions but at different times. The ability to imagine the same product changing its properties over time allowed for this breakthrough, as the functions of a Mud Mask and a Peeling would be physically impossible to occur simultaneously.

Figure 4: Purifying Mud Mask

Case Study: Vitco / Unilever

Now that we are familiar with some of the SIT thinking tools and the theory of the process used to apply them, we can review a step-by-step case study of such a process conducted with Vitco Detergents in 1996. That same year, Unilever acquired 60% of the shares of Vitco Israel at a consideration of $13 million, and changed the name to Lever. However, at the time, Vitco sold various products, among them a laundry detergent, and was looking to expand their offering.

Step 1: Define the existing situation by listing the product's physical components and its immediate environment

Components	Environment
Active Ingredients (detergents)	Washing machine
Perfumes	Water
Binders	Clothes…

Table 2: The product's physical components and its immediate environment

Step 2: Apply one of the five SIT thinking tools

In this case, we applied the Subtraction tool. Identifying the most essential component, we subtracted the Active Ingredients.

Step 3: Define and visualize the virtual product

What we had now was a "detergent" that contained perfumes and binders, but could not clean clothing, as this function was removed along with component that performed it (the Active Ingredients).

Step 4: Identify needs, benefits, and markets

The Virtual Product obviously sounds ridiculous – what is the use of a detergent that doesn't have an active ingredient? But, as one of the workshop participants noted, the Active Ingredients are very hard on the material of the clothes and actually wear them down. Removing them, would allow the clothes to wear less and last longer. Therefore, a potential market could be those individuals who launder their clothes frequently, not because the clothes are soiled, but because they were worn since their previous laundry cycle and are no longer "fresh".

Step 5: Identify feasibility

The technical experts believed that they could create a stable product that would contain very little Active Ingredient. It would also need to

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contain less of the binders that had been used to bind the Active Ingredients to the perfumes.

Step 6: Identify challenges and make adaptations

The main challenge that was raised was that legally, due to industry regulations, this product would not be allowed to be marketed as a "detergent" since it had no cleansing properties. The CEO, who was in the room, immediately gave an answer to the challenge – why not launch a new product that will define a new category- "Clothes Fresheners".

Vitco never introduced the product described above. Nevertheless, 4 years later (in 2000) Procter & Gamble launched a new category under their Febreze® brand, which they termed "Clothing Refreshers".[15] Several other companies sell similar products which they call "Laundry Fresheners" or "Laundry Refreshers". The concept is the same – detergents with substantially less cleaning elements. It is interesting to note that P&G market the category citing an additional benefit not raised in the Vitco process. Namely, clothing refreshers can be utilized in combination with detergents in a wash cycle to add a fresh scent to the clothing.

A Comparison of the Two Case Studies

Company	Vitco / Unilever	Ahava
Main Innovations and the SIT tool applied	**Subtraction** Clothes refreshener – a detergent with very little active ingredient used for "refreshing" non-soiled clothes.	**Multiplication** Cosmetics enriched with metals to increase the bloodflow **Task Unification** Gentle Body Exfoliator Using the body's own moisture to melt the active ingredients through emulsification **Attribute Dependency** Purifying Mud Mask A mask that undergoes a chemical process that changes it into a "peeling" to remove dead skin
Success in the market	The product was never introduced to the market by Vitco. However, a similar product created a completely new category, but needed to wait 4 years until it was launched by Procter & Gamble.	Three innovative patented or patent pending pending products. Considered to be a success based on the innovation criterion of surviving for at least 12 months on the shelf.
Main learnings from the case study	1. The process forces people to think counter-intuitively. It is easy to understand why no one had ever thought of creating a new detergent by removing the active ingredients (cleaning agents). 2. Oftentimes innovative ideas exist within companies, but are never launched to the public. Of the most important determining factors is the organizational situation. Perhaps the main reason that this product was never launched by Vitco was the disquiet that a Unilever acquisition had created.	1. Applying different thinking tools to the same starting point yields completely different concepts. Thus applying 3 tools to the Ahava product led to 3 new product technologies that have widespread application and are very different one from another. 2. As can be seen with the metal-enriched cosmetics, sometimes there is no need for a completely new product. It can be just as powerful to make a small adaptation to an existing product to emphasize a market benefit and create a line of products around it (New Promise Development as opposed to New Product Development)

Table 3: Comparison of Vitco / Unilever & Ahava Case Studies

Conclusions

The history of innovations includes many cases of simultaneous innovations, For instance, Edison was not the only light bulb inventor [7], and Bell was not the first to invent the telephone.[8] Even in science, theories and papers are concurrently published on common discoveries, despite the absence of communication between the researchers.

Market research, when applied as the single or preferred method for generating new product ideas, may lead firms to discover emerging needs when it is more than probable that other competitors also discover the same need.[4, 5, 6]

Thus, there is a clear need for an approach that can lead to exclusive discoveries that can take the marketplace by surprise. Such innovative ideas must be captured before the market submits strong signals to its needs, rendering market research methods (for eliciting ideas) less effective.[9]

Let us return now to the Teflon® example, which can now be clearly identified as a case of function following form. Dr. Plunkett and his staff were able to take an inadvertent creation and identify its potential benefits -- understanding the value inherent in an accidental discovery. By systematically creating "accidents" through controlled manipulation of the product's components and its environment, the SIT method, too, does not look to solve known problems in the market, but rather concentrates on what could be done to the present form, with the company's present resources, in order to create a new one that makes business sense. Accidents do happen, but rather than wait for the unexpected, it makes sense to exploit a systematic method to create these "accidents" in a structured way.

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Research Paper

The consumption of Sicilian red oranges: implications for firms involved in commercialization

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Abstract: We have carried out research at the University of Catania on the consumption of Sicilian blood oranges. In particular, the aim of our marker survey has been to assess the role of demand of these citruses, characterized by high health value and produced exclusively in Sicily (above all in Catania area), on commercial firms' trade strategies. This marker survey carried out an interview, administering an appropriate questionnaire to 20 groups of anonymous foreign consumers of several races (all European countries), during their holiday stays in Sicily. The main outcome regards worldwide interest in fresh orange juice because it keeps the raw materials unchanged in terms of original features and properties, in particular anthocyanins and vitamin C, especially now that the red colour of the Sicilian orange is no longer an off-limit factor to customer consumption. The widespread demand of Sicilian blood oranges has oriented the firms involved in their commercialization to keep or widen foreign markets, in which there are increasing needs for well-being and health.

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Introduction

This work is part of a research program of the firms involved in commercialization citrus fruit in the main area of production in Italy [21] – in particular, the province of Catania, Sicily– since 2001. It aims at pointing out the most important changes that occurred within the various aspects of company management - in terms of supply, production, marketing, etc.- and at orienting competition. These changes are the result of the new scenarios concerning the distribution system of agricultural and food products. Such scenarios are increasingly influenced by the qualities of products and also by changes in people's habits and consumers' new living styles. They are also influenced both by the various ways and places in which products are consumed, and the effect of the growing liberalization process of international exchanges. As far as orange production is concerned, this liberalization has negatively influenced Italian export trends, as its attendant volumes have been decreasing, especially since the beginning of the '90s. This is due to the abolition of the phytosanitary boundary at the Italian frontier, first towards other EU Countries (1993), second towards third countries (1997), by turning the home market from a "closed" into an "open" one (Sturiale, 2001). Moreover, this phenomenon has been influenced by the Multilateral Agreements on agriculture of the *World Trade Organization* and the foundation of a free exchange area within the Mediterranean – *Euro Mediterranean Partenariat* – between the European Union and some countries in North Africa and in Middle East overlooking the Mediterranean Sea.

Such crucial events have obviously affected the entire orange growing industry (and also the other types of citrus production, to different extent though) in Italy, and particularly the Sicilian one, although Sicilian oranges are mainly characterised by "red" (*blood)* oranges ("Tarocco", "Moro" and "Sanguinello"). [22]

Production and Health Effect

In fact, the best quality of the Sicilian orange supply is represented by the production of pigmented oranges, having some special flavor and organoleptic characteristics that cannot be found outside Sicily, and in particular outside the east side of Sicily and in the south and south-west of Mount Etna (additional information concerning this issue can be found in point 2). It is in this part of the island – nowhere else in the Mediterranean or in America – that these oranges have found the right environmental conditions to best show their genetic characteristics, such as their intense red colour and the perfect acid/sugar ratio.[17]

Red orange growing in Sicily (figure 1) is extremely important in some areas (figure 2), which are specifically suitable for their pedological and weather conditions. Temperature ranges between morning and night, sometimes of beyond 20° C, contribute to the synthesis of anthocyanins. The characteristics of the land and climate are essential for producing the pigments that give red oranges their characteristic colour in some Sicilian territories. The essential factor is, indeed, whether the above-mentioned sudden change in temperature occurs when oranges ripen. This phenomenon, a characteristic of the Mediterranean, does not exist in tropical areas from which citrus fruits come.

Figure 1: Typical red oranges

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Figure 2: Main production area

This provides fruits with valuable, unique organoleptic characteristics. The prevailing anthocyanin in blood oranges is the cyanidin-3-glucoside, which has a powerful antioxidant action and is therefore useful in preventing cardiovascular diseases and the development of some types of cancer. They also reduce the effects of ageing and help to prevent hypercholesterolemia.

Although not the focus of this paper, we would like to mention the health value of blood oranges, and in particular the so-called precious compounds and their functions. They represent necessary conditions for our detailed analysis on orange consumption. Among the most precious contents of pigmented oranges there are anthocyanins that do not exist in blonde varieties. Not only do these pigments give an essential sensory contribution, as they help typify the product and promote its image, but they also play a more important biological role. In fact, they are used in ophthalmologic therapy as active principles; they contribute to the regeneration of the visual purpura in the treatment of ulcers and in angiology, thanks to their epithelium-repairing and capillary-permeability modulating properties. They are also used in those physiopathological conditions characterised by an excessive production of free radicals. [14]

Besides, recent research has established that pigmented orange juice has greater antioxidant action than blonde orange juice. The latter seems to contain a high percentage of vitamin C, HCA (*acidi idrossicinnamici*) and an exclusive quantity of anthocyanins. [17] As it is known, vitamin C boosts the immune system while HCA are juice-exclusive antioxidant elements. Eating two blood oranges per day provides the right daily quantity of vitamin C, which is necessary for the human body. [14]

With respect to their peculiar biological characteristics and their unique geographical origin, Sicilian blood oranges have gained the PGI EU recognition (Protected Geographical Origin), according to the EC Regulation n. 1107/96 and the consequent "Disciplinare di Produzione *Arancia rossa di Sicilia*" (Circolare del Ministero per le Politiche Agricole – Gazzetta Ufficiale Repubblica Italiana n. 240 on 14th October 1997).

Problems and economic challenges

Basically, we are in front of an exclusive product, which however shows some economic problems; these are equal to those registered for some other less precious citrus grown commercially.

In this connection, remember that the citrus market, especially the orange one, is a gross market with a differentiated character (imperfect market), which includes fresh fruit as well as fruit juices in both supply and demand. It is to be underlined in any case that on a world scale and with reference to importation markets – involving European countries above all – fresh fruit is heavily affected by fruit juices coming from American-producing export countries, such as the USA, Mexico, Cuba, and Argentina, which are much more competitive than European citrus-producing ones, such as Italy, Spain, and Greece, for multiple reasons [5], including:

- The development of a process for the concentration of juice and cold storage of fruit juices that emphasizes the characteristics of oranges and meets final consumers' needs.
- Transportation and storage allow fruit juices to be transported at low cost in comparison with natural fruit juices and fresh fruit, and allow products reaching close and/or distant consumer markets, such as European ones and others.

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- The development of a low-cost, industrialized citrus production based on foreign consumer markets
- The potential supply of citrus fruits throughout the year, especially in Western Europe, where fresh fruit demand could not or at most partially met during the summer (see importation from the Southern hemisphere, especially South Africa).
- US Dollar weakness versus the Euro.

Another important aspect is that such exchange undergoes horizontal integration processes initiated by companies that are supported by local governments. These companies can be private or capitalistic or can include cooperatives. In Italy, with reference to the Sicilian territory, fruit juice producing companies are well integrated with each other and have come to simple agreements they respect. Nevertheless, they suffer from the above-mentioned reasons for competition, which affects importation markets from overseas.

Concerning fresh orange consumption, competitors for European importation markets dealing with Sicilian oranges are the same orange-producing and trading companies that belong to the European Union, such as Spain, Greece, Cyprus and others, as well as the third-world countries of the Mediterranean Basin, such as Morocco, Egypt, Turkey and others.

The production of "red" oranges in Sicily (Figure 3) brought back from Italian official statistics (National Institute of Statistics – ISTAT) has only recently overcome one thousand tons. Although a great increase in production has been registered, the product exportation seems to be very limited, as it is characterised by minimal volumes with a low percentage. Exportation growth seems to be stable or slightly declining (Figure 4). It can be traced back mainly to the growing presence of other countries (Spain, Greece, Morocco, Turkey) on main citrus markets. These countries are able to compete thanks to a price policy, which is fostered by their extremely low factor costs. On the other hand, there is no appropriate and effective policy aimed at promoting those productions, even if Sicilian productions have nearly unrivalled qualities. Our country has not done enough to develop organisation models fit for carrying out adequate policies for product differentiation.

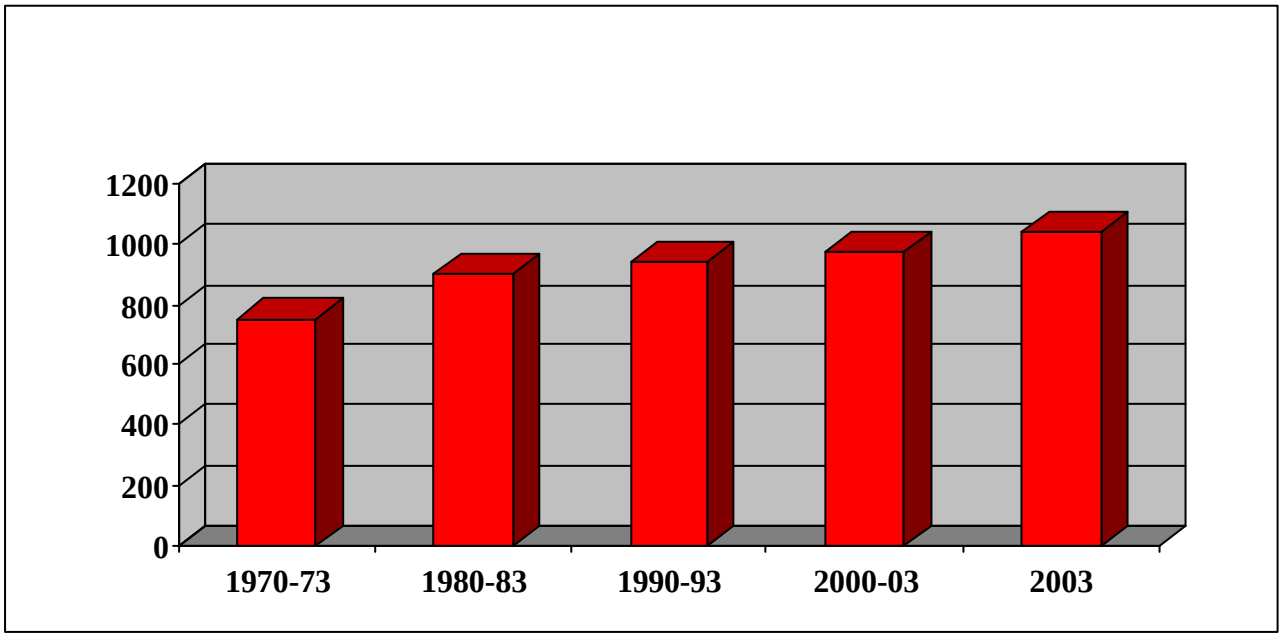

Figure 3: Red oranges production growth in Sicily (000.MT)

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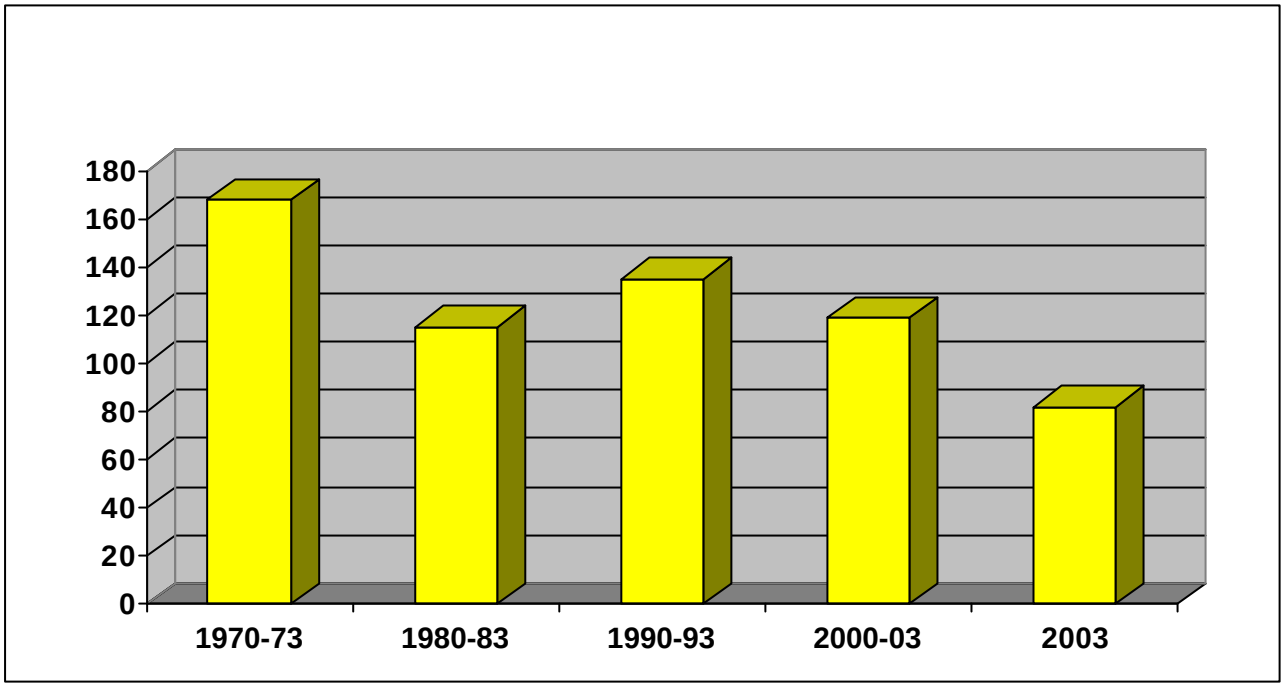

Figure 4: Exportation growth of oranges in Italy (000.MT)

Compared to blonde ones, red oranges have a lower penetration capacity into consumers' shopping carts. This is true for juice consumption, too, as shown by the surveys carried out in some European countries on Sicilian red orange juice consumption. [18]

On one side, this was due sometimes to the 'intense red' colour of the pulp of Sicilian oranges, which recall the colour of 'blood', and on the other side to the minimal knowledge people had about the higher nutritional characteristics of this kind of orange, to which consumers have only recently assigned a privileged role.

To this purpose, it is useful to remember that relationships with suppliers are extremely important, especially for those commercial firms that aim at quality and differentiation in terms of strategic placement. [1] Besides, we need to point out the existence in Sicily of a distribution system scarcely developed and made up of small and very small enterprises.

The length of the distribution channel affects profits as well, because costs are higher and include the purchase of raw materials, refrigeration, packaging, transportation, and mediation. The lower return are also caused by controlled and non-competitive prices compared to the ones offered by extra-European competing countries.

Blood oranges are one of the agricultural and food products mostly involved in competition within the nets of the modern-scale retail trade. In fact, among various points of sale, great relevance is given to reasonable prices, quality, customer service and an everlasting demand of these products, as they are considered essential factors in competition.

For this reason, it is to be hoped that fresh blood orange firms involved in commercialization take into account specific strategies aimed at promoting favourable competition, which will enable them to take advantage from an unrivalled position compared to their own competitors. [15] The Italian market is mature indeed. Here, in fact, is where most of Sicilian red orange production is consumed and where ad hoc market research hasbeen carried out. The most recent is that of Sturiale, 2001.

We wanted to analyze the different cultivators of red oranges, together with productions having those characteristics that consumers demand. Currently "Tarocco" definitely prevails among all

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the pigmented oranges with 58%, whereas "Moro" and "Sanguinello" come after with reduced shares at 20 – 22 %. "Tarocco", a probable mutation of "Sanguinello", takes its origin at the beginning of the century in Francofonte (Siracusa). Several clones (Tarocco Gallo, Scirè, Sciara e Cocuzza) due to the different pedoclimatic conditions of various growing environments give birth to a large ripening calendar from the beginning of December to April.

Aims and Scope

In such a situation, in which the demands for products have good requisites, including dietetic, healthy and sanitary ones, are increasing, this work aimed at locating hidden opportunities to enlarge the market of Sicilian blood oranges. That is to say, red oranges could take advantage from those market sections, which still have some great potential. They could, therefore, represent a remarkable commercial opportunity for those firms involved in the commercialization of fresh red oranges, and especially for those that pay more attention to changes occurring in product consumption and consumers' tastes.

This is why this work has been conducted. We have researched foreign consumers in order to verify whether it is possible to introduce the two typologies of Sicilian oranges – red and blonde - in different markets. In fact, they have been proven in scientific tests to have different organoleptic–sensory and chemical characteristics. As far as red oranges are concerned, our survey also aimed at measuring to what level the red colour can affect consumption of both fresh oranges and red orange juices, seen that somehow the blood-like colour of the pigmented pulp has been a prejudice.

Our research has been intended to provide analytical tools and information to trading companies for them to have a better knowledge about both the adaptation dynamics surrounding common strategy development for products, and strategy flexibility at individual and collective levels. Flexibility, in fact, is necessary to highlight the differentiation potential of red oranges to enter the market.

Among the different typologies of consumers we have deemed it interesting to alert foreigners, and have seen that field experts think the red orange market is expanding, especially as far as juice consumption is concerned. [19] The maturity phase for red orange juice, in fact, is longer in comparison with that of blonde oranges.

This survey was carried out among tourists visiting Sicily to highlight the purchasing behaviour and store problems of different European countries, taking into consideration the intensity of population in metropolitan areas and peripheral cities as well as the age of consumers, so to individualize the preferences with regard to the psycho-emotional approach. [12]

That research has been a valid and useful contribution to show orange consumption trends and what consumers prefer among existing product typologies, in order to explain critical points. In particular, it pointed out interesting factors for a successful and renovated Sicilian orange growing.

Materials and Methods

In the last few years, a phychological status called "subjective well-being" has spread among developed countries' populations. This is due, on one hand, to a remarkable improvement of socio-economic conditions and standard of living across social classes, and on the other hand to a progressive increase in life expectancy. In every single consumer, this situation gives birth first to an privileging of taste and product aesthetic appearance, then to a new interest in condition and body care measured for homogeneous groups in terms of race, sex, age. The shift from immaterial to material dimension of one's own subjectivity can take place within an actual pathological status, which can sometimes be treated by interventions regarding "nutrition therapy" domain. [9]

According to this presentation, consumption models are rather distinct among various agricultural and food products. Therefore, it is necessary to investigate people's tendency to eat such blood oranges, on the hypothesis that fact-finding elements could be implemented to identify new commercial logics based on competitive advantages. In this situation, if we look at foreign

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markets, where fairly small quantities of oranges are sent today, the Italian market represents the prevailing commercial outlet for blood oranges.

This inquiry was addressed to some tourists on holiday in the winter and spring of 2003-2004 (during orange-growing season) in one of the most important Sicilian tourist resorts (Ragusa), where, however, there is no blood orange growing. This inquiry was carried out by the use of face-to-face interviews by a questionnaire which was given in a public hotel-restaurant-bar in the town centre. This technique enabled us to obtain answers with a high level of reliability and to reduce to a great extent evasive ones.

The reason for choosing such inquiry in Sicily, apart from the lack of economic founds suitable to carry out a study with direct surveys in various countries, was also due to the fact that some tourists consider their holidays in Sicily an opportunity to eat typical and traditional agricultural products, which remind them of Sicily's "nature, sun and landscape" and the "authenticity, quality and taste" of its local products. Their most appreciated products are, therefore, "Sicilian blood oranges". [18]

The questionnaire was made up of some binary or multiple-choice questions referring to some aspects such as quality and quantity. This gave interviewees a great range of options, so that all evasive answers could be reduced. Such options were useful to understand how some special factors affect people's decisions in buying blood oranges.

In particular, this study let us gather some data and information concerning: 1) consumers' characteristics (social and demographic data); 2) knowledge about blood oranges (compared to blonde oranges); 3) level of perception of red orange characteristics, with special reference to healthy ones; 4) buying tendency; 5) type of purchase; 6) place to purchase; 7) consumption place.

The questionnaire also included some questions about people's tendency to have fresh red oranges more than orange juice, which has recently been increasingly drunk in its various versions available on the market. In particular, the orange juice types on which we acquired some information, thanks to this questionnaire, are the following [19]: 1) blood orange juice squeezed shortly before being consumed; 2) chilled fresh 100% blood orange juice; 3) long-life drink with blood orange juice; 4) blonde orange juice; 5) juice mixture (with blood orange).

These questions thus gathered consumers' opinions about the substitution of fresh blood oranges with squeezed juice, and collected opinions of those consumers exclusively interested in juice, in order to show their different perceptions towards various kinds of juice available on the market and those listed above.

Moreover, during the interviews, interviewees could taste fresh oranges and at least two kinds of orange juice among those above mentioned.

350 interviews were carried out on the whole to 20 groups of 15 people each on average, being at least 25 years old. They constituted a good representative of both their countries of origin (all European countries) and various social, demographic characteristics. They were certainly a plausible market portrayal.

Although we realize that it would have been more important for research purposes to get a greater number of consumers, we deem that the sample encountered by chance was nonetheless sufficiently significant to gather some information on consumer preference and blood oranges' consumption.

Finally, it is necessary to point out that, while processing data, we did not consider consumers' homeland as a privileged element in the statistical data collected, but only as a typical aspect of a larger feature such as "foreign country".

The aforementioned decision to unify our sample under the comprehensive meaning of "foreign" does not invalidate the result of our inquiry. In fact, all places of origin are included in a larger and more important international geographic area of agricultural and food products distribution. In this case, however, this area is characterised by a homogenous type of market, which can be ascribed to "imperfect market" (bilateral oligopoly).

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Results

In order to highlight the importance of oranges within the "big European agro food market", data from official FAO (Food and Agriculture Organization) statistics have been elaborated.

In particular we started from the four-year average commercial balance of orange-derived products (table 1, appendix) in the years 1980/83 and 2000/03. Working with averages levels production jumps, which often characterize yields from year to year, as well as possible perturbations over market trends.

We also applied some coefficients to the juice-related balance to convert juice quantities into fresh orange ones (tables 2 and table 3, appendix). It was then possible to highlight the dynamics trend of the average orange quantity available per person in the European Union, of which we include 15 countries.

Geographic areas	Orange juices equivalent to fresh oranges	1980/83	1990/93	2000/03	2003
European Union to 15	Oranjuice concentrated	114.660	-126.285	-1.079.669	-1.401.536
	Oranjuice single-strengt	-959.080	-839.573	-1.809.508	-2.788.638
	Equivalent total oranges	**-844.420**	**-1.965.858**	**-3.968.906**	**-4.190.174**
Europe	Oranjuice concentrated	65.235	-315.900	-1.504.264	-2.055.955
	Oranjuice single-strengt	-878.473	-2.169.773	-1.870.767	-2.796.195
	Equivalent total oranges	**-813.238**	**-2.485.673**	**-3.375.031**	**-4.852.150**

Table 2: Dynamics of orange juices equivalent to fresh oranges per geographic area (metric ton)

Elaborations of data taken form table 1 (appendix). To convert the quantities of orange juices into equivalent quantities of fresh fruits we refer to special coefficients used in citrus industry technology. The various ways of orange processing to obtain juices in the different countries we analysed were not available, so we adopted some coefficients used by Italian companies thinking these could lead t reliable results anyway. Concentrated juices were first converted in natural juices and then in equivalent quantities of fresh fruits. In particular, seen that in the mean while new technologies allowed improving the processing, coefficient 6 was applied to convert concentrated juice quantities into natural juice for quantities up to 1993; coefficient 2.5 was applied to convert natural juice quantities into the equivalent fresh fruit ones.For quantities dated after 1993, considering new technologies, before-said coefficients were respectively replaced with 4.5 and 2.8.

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Unfortunately, more recent data were not available, so we could not study this phenomenon with respect to the current situation, which includes 25 countries. In twenty years, there has been a progressive growth throughout the Continent, which except for a growth at the beginning, was quite steady during the following years (table 4) due to a heavy growth of population during 1990/93 and 2000/03.

Questionnaire Results

The socio-demographic profile of people interviewed is reported on table 5 (appendix). The characters depending on the geographic collocation, Sicilian origin and the regular consumption of red or blonde oranges are shown on table 6 (see appendix).

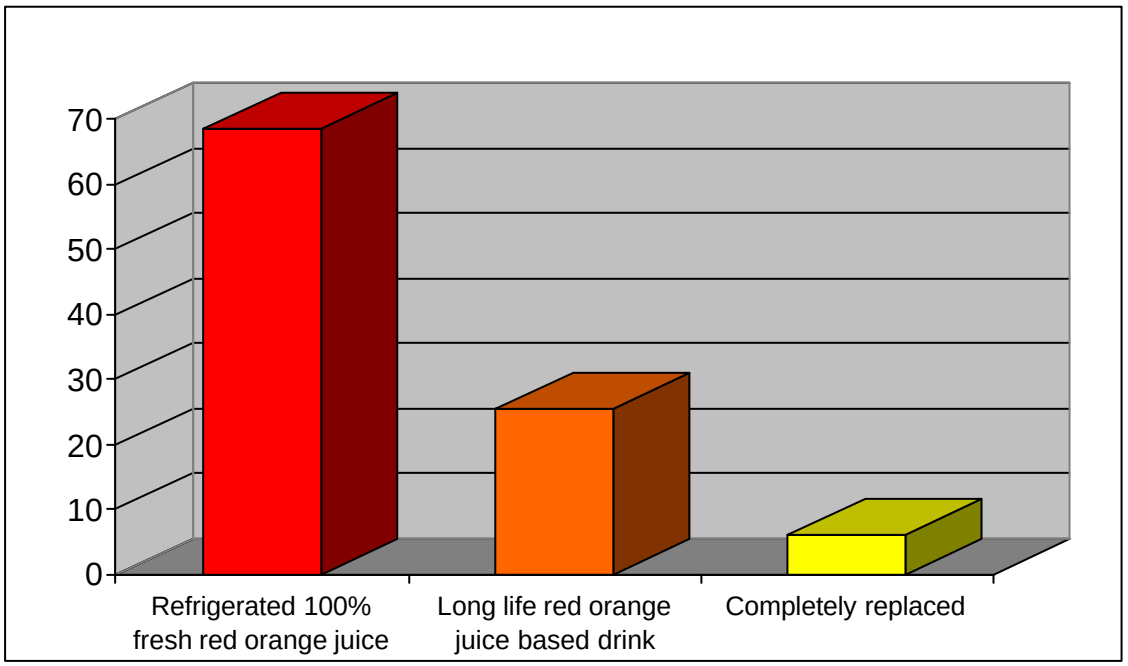
Questions made to establish the position of blood oranges compared to that of blonde ones had answers in favour of pigmented oranges. For the most part, people considered pigmented oranges a "typical product" and supported it for its contents; that is, anthocyanins and vitamins. Among others of their quality characteristics, there are "healthy value", "best taste" and nutrients.

With respect to this, we verified whether the preference towards blonde flesh oranges could be linked to a "prejudice" due to the intense red colour of Sicilian pigmented oranges.

Our questionnaire also included some questions aimed at analysing the replacement effect between the consumption of fresh products and orange juice. The latter turned out to be the biggest competitor of natural red oranges (table 7, appendix). People answered that they prefer not to peel. However, some people declared to prefer fresh oranges, but of the "Tarocco" variety, because they look typically Sicilian, their flesh is more consistent, and they are very easy to peel.

As far as fruit juice competitors of natural fresh products, people focused their attention on orange juice (*spremuta*) (table 8, appendix), that is, on the orange manually crushed and reduced to juice in the glass.

Concerning orange juices, people were asked to indicate which one of the two typologies they prefer, "100% fresh refrigerated blood orange juice" or "long life blood-orange-based drink". 68.6% said they prefer the first one, provided a wide shelf-life, while 25.4% prefer the second one. for the remaining 6% both typologies are the same. (graph 3).



Graph 3: Red orange juice consumption [%]

As regards the two typologies, "blonde orange" juice and "blood orange" juice, the first one is preferred as a refreshing drink. The same preference is for juice mix, that is, with blood orange (table 9, appendix).

As far as food habits are concerned, see table 10.

People who buy fresh orange-based products prefer small packs with graphic characterization of packages. Few like the self-service sale of great-scale retail trade. For juices, instead, no preferences concerning packaging came out. In this case, attention is paid towards seals, among which people prefer more the "save and close lid" and less the "screw top".

Our research helped us draw a picture of all typologies of usage involving blood oranges. This picture is not characterized by great differences in consumers' behaviour, even if they come from different places. In a word, answers appeared to be homogeneous, allowing our survey to obtain very significant results about Sicilian blood oranges' consumption.

Conclusions

1. The results of our research can be considered satisfactory because they showed a positive trend for red orange consumption, even if the research involved a consumer target that did not completely cover the scenario of red oranges' introduction.

In this regard, the survey highlighted the need to intervene to improve the knowledge extant on red oranges' characteristics, against the low perception of final consumers, and to increase the product range offered in points of sale.

This survey, even if limited to tourist-consumers on holiday in Sicily, allowed us to verify which factors play important roles in individual blood orange consumption, as well as realize the presence of distinct profiles in fresh or processed product consumption. For processed products, we refer to orange juices. It is clear that pigmented orange consumption depends on the characteristics of the group that tourist-consumers belong to, such as the place they come from, and their age and occupation.

Analysis of data showed two consumer profiles: a health-oriented consumption of blood oranges, characteristic of older people; and a juice-oriented one, with people preferring fresh-like juices.

Orange juices are preferred because they are timesaving. Time saving characterizes many commercial products, especially product typologies, commercial services and information sources. Consumption, in fact, is made up of different steps: "what" to buy and eat; "where" to buy, and "when" and "how" to consume (Belletti, 1995), including the "way" how to obtain information about products.

It is interesting to point out that the results of the survey carried out among tourists in Sicily led to the same conclusion. It used analogue research models over red orange juice consumption (Sturiale, 1995 and 2001) and established that the product was natural, healthy, rich in vitamins, and tasty, with a snappy colour and attractive specialty.

The results also confirmed the tendency to choose 'niche' products of those consumers living in well-to-do metropolitan areas. They prefer innovative products and are predisposed to favor typical Sicilian goods.

A negative factor for the development of the demand is the co-presence of numerous typologies of fresh oranges into the market in different sizes and of fruit juices that confuse final consumers. The appellation "IGP Arancia rossa di Sicilia" (*IGP Sicilian red orange)* aims at favouring and consolidating the privileged position in the preference scale of consumers.

In conclusion, it is necessary to point out that the qualitative aspect of our survey showed a limit as far as the spending capacity of the surveyed sample is concerned. In fact, sale prices of orange-derived products considered were not available, so that we could not individualize a relationship between the "taste" of consumers and the limits of their financial balance, including the relative consumption quantities. Notice that, research carried out directly on the spot can provide data on consumer preferences concerning red orange products. In such a context, fresh orange firms involved in commercialisation have to choose correct strategies, including on one side, a reduction of the number of firms, and on the other, a change of the market relationships with

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firms involved in the processing of products, aiming at carrying out a vertical integration between the two.

In other words, this means that the future of Sicilian firms involved in the commercialisation of citrus fruit is strictly bound to their ability to produce highly differentiated products and personalized services. It has to be considered that those firms involved in blood orange market, today in particular, aim at niche markets that force consumers to chose among smaller and smaller but also more numerous market scopes.

Thus, in the final analysis, for the Sicilian blood oranges, will be the most important one in the next years; this is also proven from some recent initiatives conducted in North America from private/public organizations and of the Sicily Region. We refer, on one hand, to a recent survey lead in Canada on the consumption of Sicilian agricultural and food products, which catalogued the presence of Tarocco blood oranges in supermarkets in Toronto and Guelph (Bellia, 2004); on the other hand, to the operation "Sweet Peel" that an crescent has activated flow of Tarocco oranges from the Sicily in the USA, and moreover to the initiative to valorize such citrus fruit in the international fair of agricultural and food products (Fancy Food, New York). In such contexts, Italian-Americans carry on an important role as a segment of consumers interested in the Mediterranean diet and the memories of their or their relative`s origins. Finally, other trade initiatives have been under way in Japan and Australia.

The trades, for the next citrus fruit campaign (2005-2006), preview a flow of Tarocco oranges from Sicily towards the North American Continent approximating 4.500-5.000 metric tons, while towards Japan the amounts are equal to 8.600 metric tons.

2. Sicilian orange growing plays an important role in health and nutrition. Its survival and development will depend on the ability of people involved in this field to carry out and evaluate the innovations that research provides (Bellia 2003), then modify their products' processing and organization. Basilar as well as some innovations involving cultivation on the field, such as the introduction of automated water distribution, mechanized pruning, antifrost system and other programmed treatments (Polyhuard), are needed. Antifrost carried out by means of automated devices, which has been dealt with in several studies (Pulvirenti, 1995), seems to be very interesting for the very preservation of pigmented flesh cultivars. It also allows for orange growing even in cold areas experiencing frost during winter, which, however, are the best for growing red oranges. The thermal limit—that is, the change in temperature between day and night—is the first cause of yield damage and can thus be reduced, allowing productions to still take advantage from the sudden change in temperature of these areas, which is particularly good for the "reds". Innovations are to be extended over the production phase. That means processing in order to provide new fresh products, such as fresh juices from juice-dispenser machines – Oranfresh, chilled or frozen ones—and distribution thinking of new packaging for fresh fruits and processed products (juices).

Last, but not least, the settlement of quality trademarks, geographical indications, and production details, specifying whether it is a eco-compatible production or an integrated one, all present important strategies to distinguish and differentiate products at market level.

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A.S. Zarbà took care of the entire study, to exclusion of "Production and Health Effects" and of point 2 of of the conclusion, which was done by Pulvirenti G.

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Appendix

Europian Union to 15												
Fresh oranges and oranjuice	1980/83			1990/93			2000/03			2003		
	Imports	Exports	Balance	Imports	Exports	Balance	Imports	Exports	Balance	Imports	Exports	Balance
- Fresh oranges	2.171.399	1.149.309	-1.022.090	2.420.446	1.936.661	-483.785	2.332.010	2.132.104	-199.906	2.430.591	2.169.533	-261.058
- Oranjuice concentrated	9.913	17.557	7.644	45.987	37.568	-8.419	351.384	265.696	-85.688	583.850	472.617	-111.233
- Oranjuice single-strengt	548.971	165.339	-383.632	1.176.465	440.636	-735.829	2.135.464	1.489.211	-646.253	2.407.301	1.411.359	-995.942

Europe												
Fresh oranges and oranjuice	1980/83			1990/93			2000/03			2003		
	Imports	Exports	Balance	Imports	Exports	Balance	Imports	Exports	Balance	Imports	Exports	Balance
- Fresh oranges	2.592.872	1.150.878	-1.441.994	3.157.549	1.942.201	-1.215.348	3.305.791	2.146.983	-1.158.808	3.512.986	2.190.747	-1.322.239
- Oranjuice concentrated	13.218	17.567	4.349	59.307	38.247	-21.060	397.824	278.438	-119.386	665.789	502.618	-163.171
- Oranjuice single-strengt	558.334	206.945	-351.389	1.320.417	452.508	-867.909	2.294.96	1.626.865	-668.131	2.579.907	1.581.266	-998.641

Table 1: Dynamics of commercial exchanges for fresh oranges and orange juices per geographic area (metric ton), data from: http//faostat.fao.org

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Geographic areas	Orange balances	1980/83		1990/93		2000/03		2003	
		Metric ton	%	Metric ton	%	Metric ton	%	Metric ton	%
European Union to 15	- Fresh oranges	-1.022.090	54.8	-483.785	19,7	-199.906	4,8	-261.058	58,6
		100		*47*		*20*		*26*	
	- Equivalent oranges	-844.420	45.2	-1.965.858	80,.3	-3.968.906	95,2	-4.190.174	41,4
		100		233		*470*		*503*	
	- ***Virtual total oranges***	***-1.866.510***	100,0	***-2.449.643***	100,0	***-4.168.812***	100,0	***-4.451.232***	100,0
		100		*117*		*199*		*212*	
Europe	- Fresh oranges	-1.441.994	63.9	-1.215.348	32,8	-1.158.808	25,5	-1.322.239	21,4
		100		*84*		*80*		*92*	
	- Equivalent oranges	-813.238	46.1	-2. 485.673	67,2	-3.375.031	74,5	-4.852.150	78,6
		100		*263*		*358*		*514*	
	- ***Virtual total oranges***	***-2.255.232***	100,0	***-3.701.021***	100,0	***-4.533.839***	100,0	***-6.174.389***	100,0
		100		*164*		*201*		*274*	

Table 3: Dynamics of commercial balances for fresh oranges and orange juices converted into fresh fruits per geographic area, data from tables 1 and 2.

Indications	Europian Union to 15				Europe			
	1980/83	1990/93	2000/03	2003	1980/83	1990/93	2000/03	2003
- Virtual oranges (a)	1.866.510	2.449.643	4.168.812	4.451.232	2.255.232	3.701.021	4.533.839	6.174.389
	100	*131*	*223*	*238*	*100*	*164*	*201*	*274*
- Production oranges (b)	2.171.399	5.694.751	5.979.671	6.094.734	2.592.794	5.959.133	5.987.964	6.103.477
	100	*262*	*275*	*281*	*100*	*230*	*231*	*235*
- Virtual oranges production available per domestic consumption (a)+(b)= (c)	4.037.909	8.144.394	10.148.483	10.545.966	4.848.026	9.660.154	10.521.803	12.277.866.
	100	*201*	*251*	*261*	*100*	*199*	*217*	*253*
- Population (000) (d)	355.613	365.956	378.441	380.051	484.273	500.296	727.578	726.339
	100	*103*	*106*	*107*	*100*	*103*	*150*	*150*
- ***Virtual availability for one-year consumption per person (Kg)*** (d) / c)	***11.3***	***22.3***	***26.8***	***27.8***	***10.0***	***19.3***	***14.5***	***16.9***
	100	*197*	*237*	*246*	*100*	*193*	*145*	*169*

Table 4: Change of the quantity of oranges available per inhabitant for each geographical area examined (metric ton), Elaboration of data from table 3 concerning orange productions, from site: http//faostat.fao.org

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Variables	Consistency	%
Sex		
Man	159	45,4
Women	191	54,6
TOTAL	350	100,0
Age		
25-40	70	20,0
41-60	115	32,9
61-75	160	45,7
>75	5	1,4
TOTAL	350	100,0
Family unit		
1 member	58	16,6
2 members	226	65,7
3 members	62	17,6
4 members and over	4	1,1
TOTAL	350	100,0
Occupation		
Retired	221	63,1
Employee	52	14,9
Professional person	62	17,7
Non professional condition	15	4,3
TOTAL	350	100,0

Table 5: Survey sample profile (2003-2004)

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Age class	Population class of countries of origin			Sicilian origins		Position of red oranges compared to blonde ones		Red orange consumption – Knowledge extent of red orange quality characteristics			Blonde orange consumption – Replacement extent of blonde orange with red orange		Blonde orange consumption – "Prejudice" extent for the red colour of oranges	
	< 10.000	10.000/ 50.000	>50.000	Yes	No	Yes	No	Healthy	Better taste	Nouri-shing	Yes	No	Don't care	Sensi-tive
25 – 40	1	25	11	2	35	21	16	9	11	1		16		16
41 – 60	6	31	78	11	104	74	41	39	21	14	15	26	9	17
61 – 75	8	71	81	38	122	148	12	127	16	5	5	7	6	1
> 75	11	15	12	27	11	24	14	7	9	8	10	4	4	
Total	26	142	182	78	272	267	83	182	57	28	30	53	19	34

Table 6: Distribution of consumers interviewed per age class, country of origin and orange preferences (*)

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Age class	When consumption			Where consumption		How many times consumption			Replacement extent of fresh red oranges with oranjuice	
	Breakfast	Lunch	Dinner	At home	Other	Daily	Weekly	Other	Yes	No
25 – 40	1	6	14	10	11		2	19	21	
41 – 60	10	15	49	58	16	21	19	34	43	31
61 – 75	4	71	73	138	10	76	48	24	111	37
> 75	6	15	3	22	2	5	8	11	13	11
Total	21	107	139	228	39	102	77	88	188	79

Table 7: Distribution of consumers interviewed per age class in relation to the consumption of fresh oranges

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Appendix

Age class	Replacement extent of natural "squeezed" juices with other variants		Preference extent among different juice typologies		
	Yes	No	Refrigerated fresh	Juice-based drinks	Don't care
25 – 40	16	5	13		3
41 – 60	35	8	26	8	1
61 – 75	99	12	64	30	5
> 75	9	4	6	2	1
Total	159	29	109	40	10

Table 8: Distribution of red orange consumers interviewed per age class in relation to the typologies of red orange juices present into the market.

Age class	Replacement extent of blonde oranges with orange juices		Blonde orange juices consumption				
			Preference extent among different juice typologies			When consumption	
	Yes	No	Blonde orange juices	Mix of juices	Don't care	Between Meals	During meals
25 – 40	16		3	10	3	16	
41 – 60	38	3	13	25		32	6
61 – 75	11	1	4	7		9	2
> 75	13	1	5	8		11	2
Total	78	5	25	50	3	68	10

Table 9: Distribution of blonde orange consumers interviewed per age class in relation to some ways of consumption

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Age class	< 10.000				10.000 – 50.000				> 50.000				Total	
	Red oranges		Blonde oranges		Red oranges		Blonde oranges		Red oranges		Blonde oranges		Red oranges	Blonde oranges
	Whole	Processed	Whole	Processed	Whole	Processed	Whole	Processed	Whole	Processed	Whole	Processed		
25 – 40				3		9		4		12		9	21	16
41 – 60		6			16	13		28	15	24		10	74	41
61 – 75	3	8		1	11	36	2	5	23	67	2	5	148	12
> 75	2	2		1	5	6		7	4	5	1	5	24	14
Total	5	16		5	32	64	2	44	42	108	3	24	267	83

Table 10: Consumption of oranges by age classes and size of home city. The word "Processed" refers to tout court orange juices, independently from the juice typologies present into the market

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Practitioner's Section

Intellectual Property: An underestimated and undermanaged asset?

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Abstract: Intellectual Property (IP) is becoming more and more important for competitive advantage and companies' success. We argue that making IP a key issue is essential and will be one of the main factors driving future business success. Nevertheless many companies have not yet managed to integrate IP into strategy development and all critical business processes and thus do not get the maximum value out of it. This article aims to show how companies can systematically develop and implement an IP strategy following a three-step approach. First, it is important for the management to get a more transparent picture about strengths and weaknesses of the current IP position. Modern IP database tools help to achieve this goal. In the second phase the management should evaluate whether the company is successful in realizing the full market and strategic potential of technologies with IP strength and how to cope with areas of IP weaknesses. After an in-depth evaluation an IP-strategy should be defined and implemented. In our experience strategy execution requires a clear commitment from the top management, clear roles & responsibilities, proper monitoring, a more intensive collaboration on IP issues between R&D, Marketing, Patent attorneys and often even changes in corporate structures and processes.

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Introduction

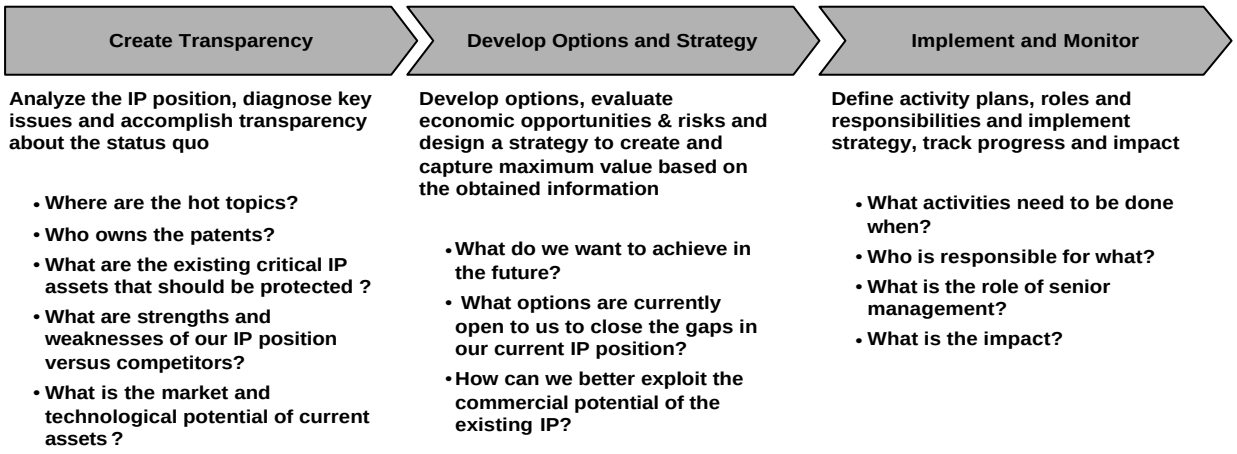
At leading companies in the pharmaceutical industry, patented products account for 80 to 90 percent of sales. Young sectors, such as biotechnology, are dependent on venture capital, and protecting knowledge is often the only collateral they can offer investors. In the chemical industry, patent protection is also extremely important; for example, BASF can primarily thank its patents for achieving a leading position in scratch-resistant paints. And in industries such as plastics manufacturing, process patents enable savings and create competitive advantage for those companies having them.

But protecting intellectual property is not patent management's only purpose: Properly used, patent management supports developing and implementing growth and innovation strategies, using intellectual property (for example, through licensing), evaluating acquisition candidates or cooperation partners, and entering new markets such as the Chinese. [1], [2]

Realizing patent management's payoffs, however, is only possible if economic considerations drive IP's creation and commercialization. In most companies, IP is still more an issue for the legal department rather than for management. Typically, legal departments maximize IP protection rather than IP value creation. [3]

In our experience, it is crucial to better integrate IP into strategy development and all critical business processes, and this article aims to show how companies can systematically develop and implement an IP strategy following a three-step approach (see Figure 1).

FIGURE 1: IP STRATEGY DEVELOPMENT PROCESS



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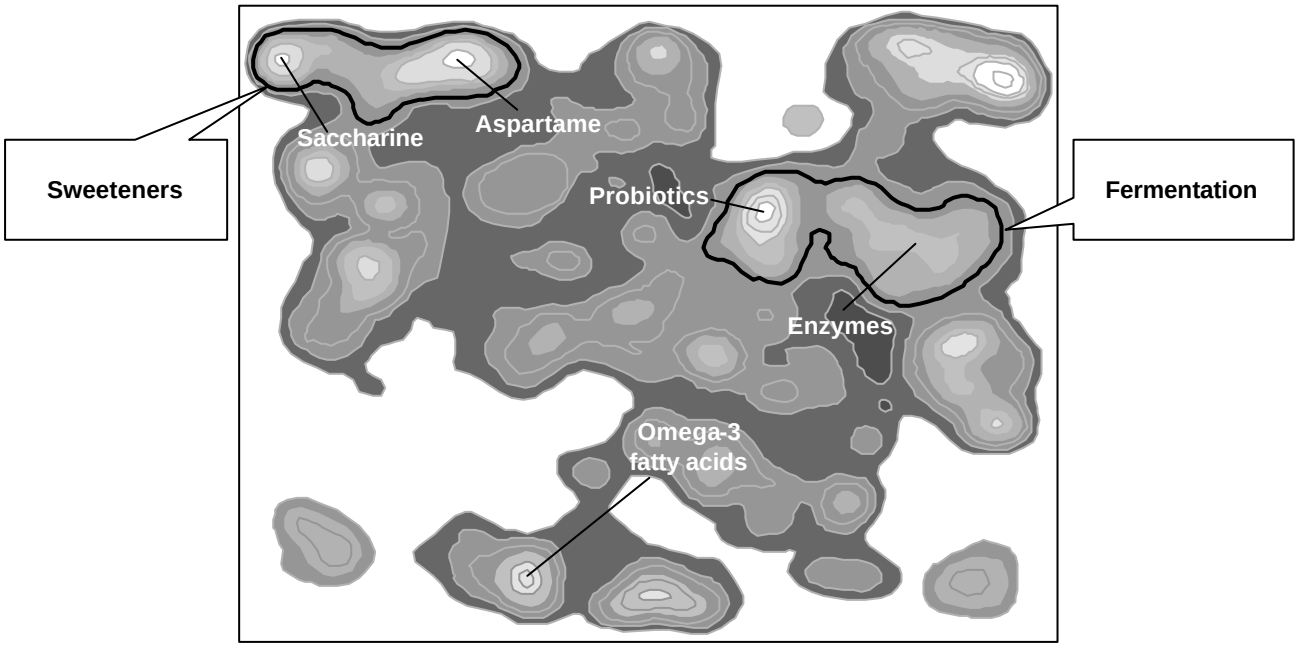
First, it is important for the management to get a more transparent picture of the current IP position. Companies typically have some knowledge on technology trends and competitors' actions but many of them show a lack of a comprehensive picture of the IP landscape. Analyzing patent data with modern database tools data can help companies to achieve this goal. Tools such as Aureka [4] allow to cluster patent data so that the management can easily get an aggregated view on technology fields. The management should then carefully evaluate the strengths and weaknesses of the own IP position versus competitors. This typically leads to the question whether the company has managed to leverage a strong IP position for commercial market success—or in case of a rather weak position—whether the company should try to catch up or abandon the field. This helps the management to develop several options. Based on an evaluation according to economic opportunities and risks promising options are selected. The next step is to (re-)design strategies to capture maximum value from existing IP and (possibly) to create new IP. Strategy implementation involves taking action, define activity plans, roles and responsibilities; and track progress and impact. Involvement of the senior management is as critical as the measurement of specific indicators. Implementation is very often the key hurdle in many companies.

Create transparency in the strengths and weaknesses of your IP position

A food additives manufacturer had to deal with stronger price pressure and lower margins for its traditional products over a long period of time, the company tried to bolster its traditional fermentation business with sweeteners. Management was aware that its main rival in this field was ahead of the game, but its estimates put it right behind the rival in second place. Despite patents from its own research, however, the manufacturer seeking to branch out had only achieved modest commercial success. When rumors began to circulate in the industry that the company's rival wanted to take over a smaller concern, management decided to rethink its strategy.

FIGURE 2: THE IP LANDSCAPE OF FOOD INGREDIENTS



Note(s): The Patent landscape is based on a search for "Food ingredients" in Patent documents in major Patent databases. For patents on Food ingredients we found 5,000 Patents for the period of 2000–2005. In a following step, the landscaping function clusters the patents according to a complex algorithm, which is capable of reading words and phrases. The more overlap in terms of content exist between patents, the closer these patents are allocated to each other on the map. Typically, the output generated by this clustering consists of a landscape with numerous hills reflecting the "hot topics" where many patents with a similar content occur. As long as there are at least some overlaps, patents are allocated with the same territory (green area). If there is no overlap at all, the space will be shown as an ocean (blue area)
Source(s): Aureka/Micropatent, BCG analysis

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The company began by analyzing its own IP position in food additives. With the help of Aureka's IP landscaping tool, the management generated an overview of the food additives IP landscape then took a closer look at fermentation and sweeteners. Analyzing the data behind each topic revealed that sweeteners have about twice as many patents as fermentation. The company then conducted a simple analysis to see how many patents had been published annually; doing so revealed that patent activity has been growing much faster in fermentation than in sweeteners. This was not surprising as sweeteners are considered a mature technology whereas recent discoveries of new applications for fermentation have led to a surge in R&D activities.

In the next step, the company ranked players (owners) by patent frequency, realizing it had many patents in the more mature field of sweeteners and that it was far behind its major competitor in the field of fermentation. The number of patents a company has is only a very rough indicator of IP position: one key patent can be far more valuable than having a hundred worthless ones. The next step for assessing IP position is typically, therefore, to assess patent quality.

Which technologies help a company to differentiate its current products from competitors'? Do patents protect those technologies? This assessment typically requires employing legal, technical, and business expertise. For the food additives manufacturer, it turned out that the company had a strong IP position in the area of sweeteners, and management identified a number of key patents important to their value proposition.

What technologies does a company need to successfully expand into new fields? As it turned out, high patent quality could not compensate for the quantitative weakness of the company's patents in the field of fermentation. On the contrary, the company's main competitor had the key patent, which it had codeveloped with a famous research institution.

Completing this phase helped management gain a much clearer picture of its IP position's strengths and weaknesses—and yielded direct implications for options and strategy development.

Develop Options and Strategies

Do you realize the full market and strategic potential of your IP strength?

Based on the transparency phase analysis, management revisited its marketing strategy for these core products. The analysis revealed that the company was not really using key patents to position its core products against competitor products lacking a unique positioning in the relevant technology. As the company did not integrate differing aspects of its value proposition, it was simply giving away its precious IP too cheaply.

In cooperation with marketing, management developed a new strategy that licensed out key patents. Taking this approach is attractive when the technology cycle is in a mature stage (or the cycle is very short) or when production is not a company's core competency. (The risk exists that if the licensing partner does not guarantee high quality, the company's reputation and brand name may suffer; finding the right partner is crucial, especially when expanding to new regions such as China)

Even if the idea and patent belong to the company's core segments, a licensing strategy can make sense. P&G is a good example of this. P&G owns the patent for a new chemical, let's assume that its name is "Soapacene", which a supplier produces. The "price" for the right to resell "Soapacene" to third parties is a licensing fee the supplier pays to P&G, who gives the supplier a (volume-based) discount on the volume it needs – so that P&G can generate a cost-based advantage over its competitors. [5]

The rest of the patents in sweeteners fell into two categories: patents that could become essential to the food additive manufacturer's business in the future—these should be kept but regularly revisited, and patents that did not create value at all—these could be abandoned (or donated to research institutions) immediately.

DuPont was one of the first companies to systematically sort out non-value-creating IP. By doing so they managed to save $64 million annually in patent and administration fees.

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How can you close identified gaps and protect your position?

Given the weakness in the emerging field of fermentation, the food additives manufacturer's basic options were to either strengthen its IP position or rid itself of the technology. In order to develop options, it is crucial to first understand the possible reasons contributing to this situation.

(1) Creating your own IP

One possible explanation is that the R&D department might have misjudged new technology trends and as a result steered R&D efforts in the wrong direction. An alternative explanation is that the legal department did not protect technology appropriately. Patent claims were either written so that other players could recognize their potential or patent lawyers did not recognize how to stake claims. Furthermore, business may not have systematically built and employed a patent portfolio to weaken the competition (blocking and tackling). Further investigation would then be appropriate to address these issues in future R&D and patenting processes.

(2) Get access to external IP

In a fast-moving technology like fermentation it may simply take too much time for a company to rely on its own efforts. More and more companies discover that cooperation, in-licensing, and even acquiring IP can be economically far more attractive and efficient.

Cooperation or in-licensing are usually preferred when M&A is not feasible, economically unattractive (for example, few synergies), or requires too much commitment (for example, high business risk). Still, many companies see ownership as the best way to capture value.

When P&G decided to focus on fast-growing business units, it quickly became clear that innovation activities would have to be expanded considerably. A review of in-house capacities and externally available technologies showed that it would be smarter to do more in-licensing. The current CEO, A.G. Lafey, formulated the objective by saying that about half of P&G's innovations should come from outside the company. [6]

Hitachi Chemical recently acquired a basic patent for resistant materials useful for manufacturing IC package substrates and the like. As a leading producer of resistant materials, Hitachi had to leverage its own technologies by acquiring the patent. They are starting to build a patent network of resistant materials to keep their currently advantageous position.

Robert Hirsch, head of the relevant department at DuPont, has said that IP management is currently undergoing a fundamental cultural change. He admits that acquiring outside technologies is not sufficiently mature, but points out that it was possible to raise licensing income by about a third, to over $400 million. Here, IP management at DuPont is taking a radically new course: To find new partners for licensing agreements, there is the online forum "yet2.com," an Internet-based technology whose establishment DuPont sponsored but which now acts independently. It was the source of no less than 15 new deals in 2004 (to compare: 2003 saw a total of 30 deals). [7]

Implement and Monitor

Define clear roles and responsibilities and take action

All previously mentioned tasks and decisions are fairly complex. It is therefore crucial that companies define specific action plans with clear roles and responsibilities for implementation and that top management—sometimes including even the CEO—systematically integrate IP into their strategy processes. Although most companies employ patent attorneys, in our experience most companies have not yet integrated IP comprehensively.

Successful implementation requires that employees understand the importance of IP issues to the company. It is crucial that the CEO make a clear statement on the company's general direction: When Joe Palmisano became CEO of IBM, he declared that the company would make much more of its IP freely available (open source).

Organizational structure and processes should facilitate collaboration on IP issues. This is both necessary for providing top management with relevant and aggregated data and for driving functional work (R&D, NPD, etc.)

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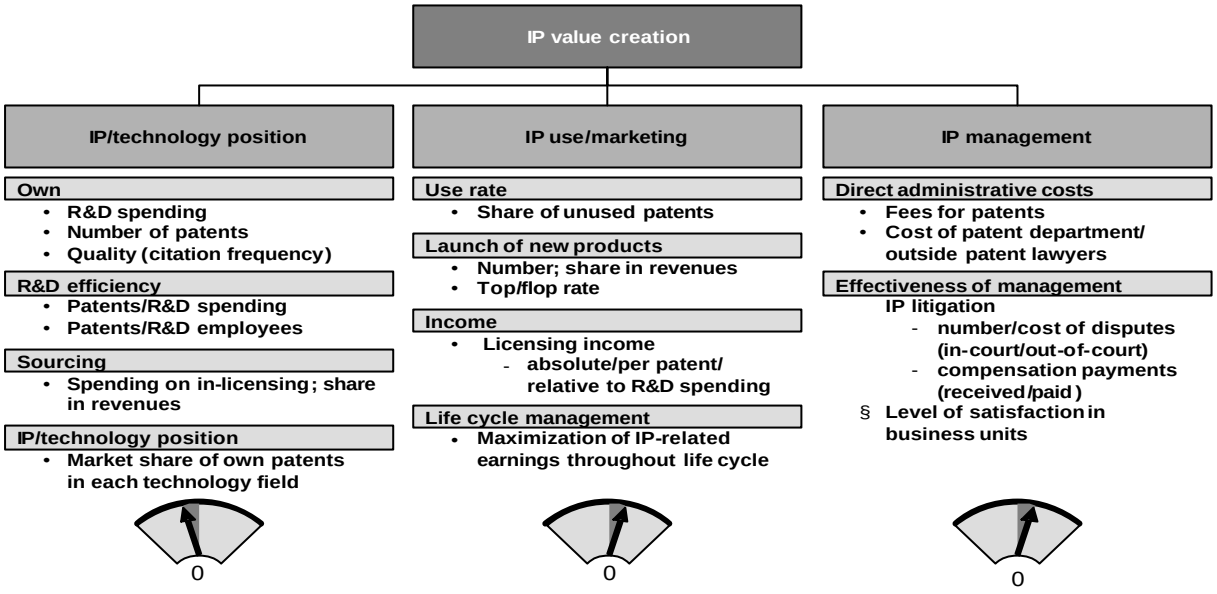
FIGURE 3: THE IP COCKPIT FOR CONTROLLING IP VALUE CREATION WITH METRICS



Very often collaboration on IP issues is difficult as experts from different fields use different languages about the same technology (patent attorneys, technicians, business managers). But when there are incentives to collaborate on a common IP project, they manage to overcome these hurdles. By the mid-1990s IBM had already created so-called inventor teams, motivating people by initially creating a common professional spirit (Hall of Best Innovations) and then providing monetary incentives. In particular, business-unit mangers were made accountable for IP projects.

Monitor progress

In order to ensure that IP is taken seriously and creates value, companies have to regularly quantitatively and qualitatively measure and report IP success. The following are standard topics that companies should report, discuss, and eventually translate into action on a quarterly basis:

- IP returns: How has IP created value for your company, for example, through instituting a price premium?
- Competitor actions: Has your IP created obstacles to competitor actions?
- Emerging threats: Do you see competitors moving into your territory?

Although there is no best-practice set of indicators that companies should employ, several indictors to measure IP value creation do exist (see Figure 3).

The above indicators are meant to track a company's IP-related value creation and the efficacy of its IP administration. So far, few companies really try to maximize their IP-related revenue over an IP's life cycle as a standard approach for tangible assets. In order to ensure collaboration, companies should also evaluate their business units' satisfaction with the IP department.

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Summary

Despite the importance of protecting IP in the chemical industry, IP management has thus far focused primarily on technical and legal issues. IP management, however, belongs to the strategy process.

We propose instituting a simple, structured, three-step approach to develop and implement a patent strategy: Create more transparency in companies' patenting behavior is an important first step in realizing successful strategy development. Once top management has understood the big picture as the IP landscape outline it, it is far easier to identify strategic IP options, evaluate their business value, and, ultimately, find the right strategy to capture value. Companies should evaluate and convert all options, economic opportunities, and risks using the knowledge gained. Specific action plans with clear roles and responsibilities are crucial for implementation.

Companies such P&G, Hitachi Chemical, and Henkel have successfully adopted more systematic approaches to IP management, some of them have even introduced fundamental changes. We strongly believe that more companies—from chemical and other industries—should follow and make IP a key issue as this will be one of the main factors driving future business success.

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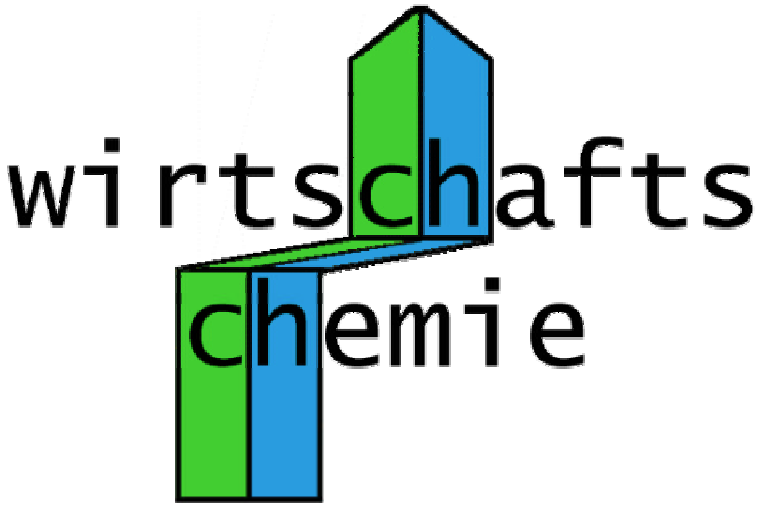

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