

Industrial Biotechnology & the Chemical Industry's Sustainability Challenge

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My talk today is entitled Industrial Biotechnology and the chemical industry's sustainability challenge. The talk is framed from the perspective of the Chemical industry. I will discuss the financial and societal sustainability challenges facing the industry. I will describe how Industrial Biotechnology can be an important part of the solution to the sustainability challenge. I will also touch on the obstacles Chemical companies face in realizing the potential of Industrial Biotechnology and the actions they must take to overcome these obstacles.

Despite history of innovation the chemical industry faces significant challenges

Financial
and societal
challenges

History of Innovation

- Long history of product and process innovation.
 - Continually improved its functionality and cost effectiveness and displaced many traditional materials
- Integrated into many economic sectors with history of collaborating with customers to find innovative solutions.

Key Challenges

- *Financial* – Mature; many products face commoditization pressure; needs to improve peak to peak returns to be competitive in international capital markets.
- *Societal* – Significant stakeholder impacts
 - Products provide enormous benefits to society
 - Products and processes also have unintended consequences; many are not well understood until years later

Source: Chemicals and long-term economic growth, Wiley 1998

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The Chemical industry has a long history of product and process innovation. However, despite this history the industry faces significant challenges.

With respect to innovation, since the late 19th century the industry has continually developed new products and processes, improved its functionality and cost effectiveness, and displaced many traditional materials. Its products are now integrated into many economic sectors and it has a history of collaborating with customers to find innovative solutions.

However, today the industry is mature and many of its products face commoditization pressure. Consequently the industry needs to improve its financial returns to be competitive in attracting investment capital in the increasingly global capital markets.

While the industry provides enormous benefits to society it also has significant societal costs. Its products and processes have unintended consequences. Many of these consequences are not well understood until years later. Consequently, the industry has resulted in the spread of toxic chemicals, the creation of large numbers of toxic waste sites and a range of other challenges such as climate change and risks to public health.

Asset based strategies will not solve the financial challenge

Financial
and societal
challenges

- Physical assets in the Chemicals industry only return their cost of capital and therefore do not create economic value¹
- All returns in excess of the cost of capital are attributable to intangibles such as innovation
 - Returns on R&D are well in excess of the cost of capital (17% after tax return)¹
 - The chemical industry invests less in innovation than other more competitive industries
- Cross industry studies show:
 - Changes in EVA explain only 35% of changes in market value²
 - Intangibles drive up to 75% of market value.³

New approaches are needed to drive value creation

¹ Research by David Aboody and Baruch Lev sponsored by the Council for Chemical Research, March 2001

² Analysis from Stern Stewart & Co., CFO Magazine, July 2003

³ Analysis from Baruch Lev, The Stern School, CFO Magazine April 2001 (adjusted for October 2003 market values)

Asset based strategies will not solve the chemical industry's financial challenge

Traditionally companies across a range of industries measured their success by their returns on their physical and financial assets. Strategies were built by finding favorable market opportunities, constructing plant and equipment and producing, selling and realizing a strong return on assets employed.

However research sponsored by the Council for Chemical Research shows that today physical assets in the Chemical industry only return their cost of capital – they do not create economic value. This same research shows that all industry returns in excess of cost of capital are attributable to intangible assets such as R&D. In fact industry returns for R&D are 17% -- well excess of the cost of capital.

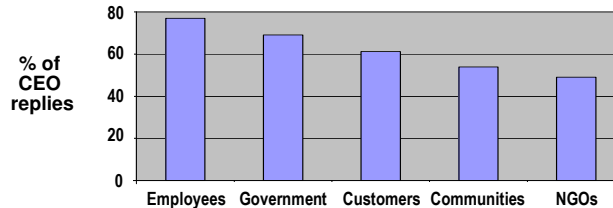
Cross industry studies provide similar results. For example, recent analysis presented last year in CFO magazine indicates that changes in Economic Value Added (the measure that has been associated with shareholder value) explains only 35% of changes in market value. Another study at New York University's Stern School of Business indicates that Intangibles drive up to 75% of market value.

The research is clear—asset based strategies will not solve the chemical industry's financial challenge; new approaches based on intangibles such as R&D are needed to drive value creation.

Societal expectations will continue to increase

Financial
and societal
challenges

- Excellent companies must perform socially as well as economically; the CEO's of leading companies understand this^{1,2}
- CEOs see stakeholder pressures as driving social performance; they cite the following stakeholders as most important²:



- Forces driving expectations
 - Education, knowledge, information, freedom of choice
 - Liberalization, globalization, privatization, and growing scope of corporate activity
 - Technology and communication
 - Increased role played by civil society

Notes: ¹Environics International 2001,

²World Economic Forum CEO Survey on Global Corporate Citizenship

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Societal expectations of industry will continue to increase.

A range of studies have shown that excellent companies must perform socially as well as economically and the CEO's of leading companies understand this as demonstrated through their responses to a recent World Economic Forum CEO survey on Global Corporate Citizenship

In that survey CEOs also saw stakeholder pressures as a key driver of social performance. As shown here they cite employees, government, customers, communities and NGO's as being most important.

There are a number of forces that are driving and will continue to drive the increase in societal expectations; these are shown in the dash points at the bottom of this slide and include

Education, knowledge, information, freedom of choice

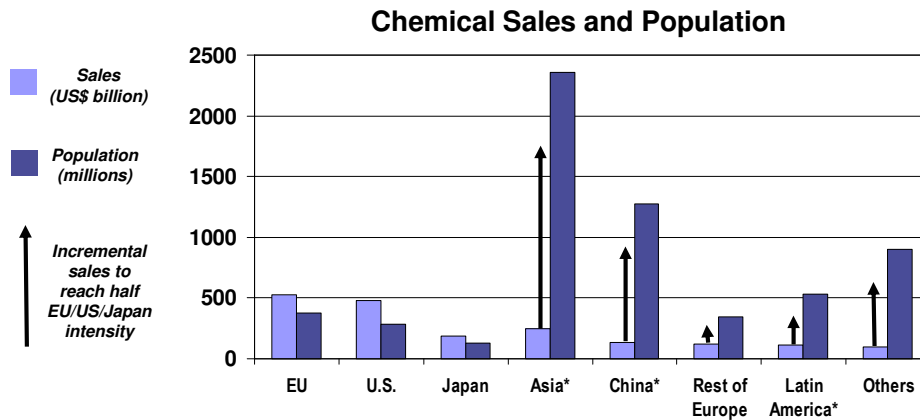
Liberalization, globalization, privatization, and growing scope of corporate activity

Technology and communication

Increased role played by civil society

Global growth will further compound the societal challenge

Financial and societal challenges



Industry output would be **2.8 times** today's level if other countries reached one half the chemical intensity of the EU, US, and Japan.

The global chemical industry is not sustainable using current technologies and business models

Notes:
Sales: Based on 2002 data. *CEFIC Estimates; Asia excludes China and Japan.
Population: Based on 2002 data; Population Reference Bureau.

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Global growth will further compound the societal challenge.

This chart shows current chemical sales in billions of US\$ and current population in millions by country/region of the world.

The arrows show the incremental sales that developing countries/regions would have if they were to reach on-half of the developed world's chemical intensity.

What the chart shows is that such an increase in developing country sales would push industry output to almost 3 times today's level.

Given this growth pressure the global chemical industry is clearly not sustainable using current technologies and business models. Such growth would compound the industry's environmental and health and safety footprint.

Solving the challenge

- **The Chemical Industry faces a huge sustainability challenge from both a financial and a societal perspective**
- **Asset based-strategies will not solve the financial challenge**

A systematic value-centered approach is needed to simultaneously address the financial and societal challenge

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So what can the Chemical Industry do to solve its sustainability challenge?

As we have seen the industry faces a huge challenge from the perspective of both financial and societal sustainability

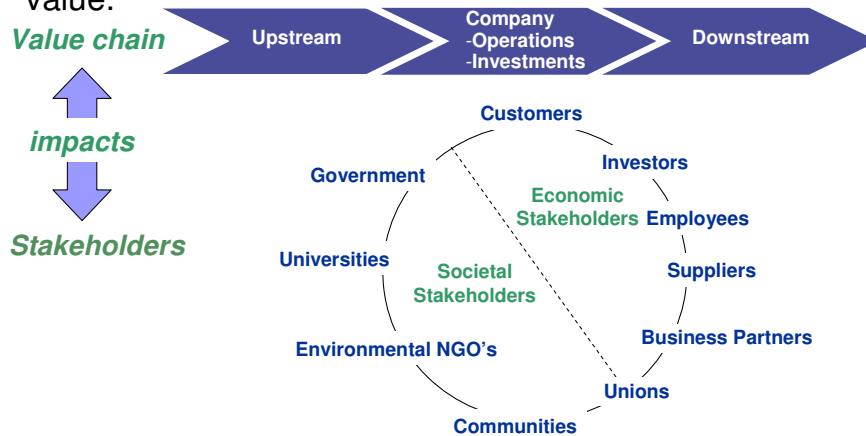
Traditional asset based strategies will not solve the financial challenge. So what can industry players do to address their individual challenges?

Winning companies must take a systematic value-centered approach focused on simultaneously addressing both their financial and their societal challenges.

I will now discuss how winning companies can pursue such an approach and the role that biotechnology can play.

Such an approach starts with an understanding of the company's stakeholders

Stakeholders are individuals and groups that are impacted by (or impact) the firm's value chain, participating voluntarily or involuntarily in the creation or transfer of value.



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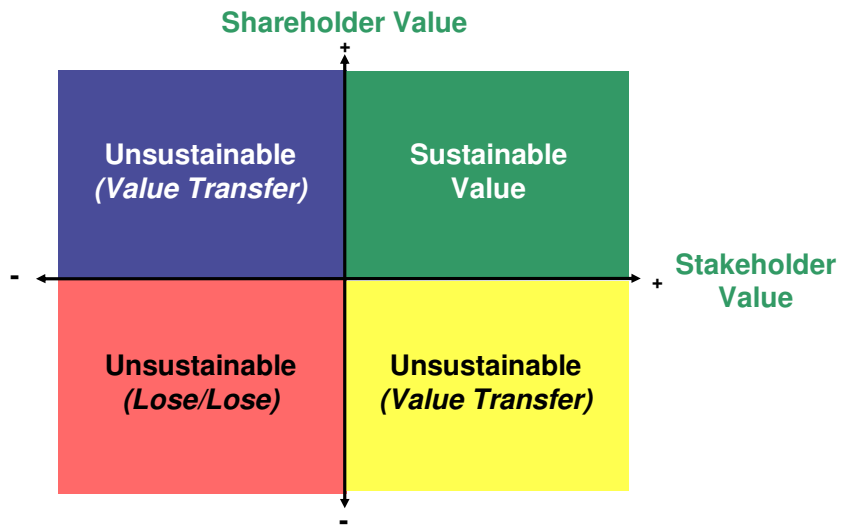
A value-centered approach starts with an understanding of the company's stakeholders.

Stakeholders are individuals and groups that are impacted by (or impact) the firm's value chain, participating voluntarily or involuntarily in the creation or transfer of value.

Stakeholders are a key to broadening the vision and driving innovation. A number of key stakeholder groups are shown on this side. Here they are divided into the traditional economic stakeholders and societal stakeholders.

Sustainable value is value that is positive for shareholders and stakeholders

Sustainable Value



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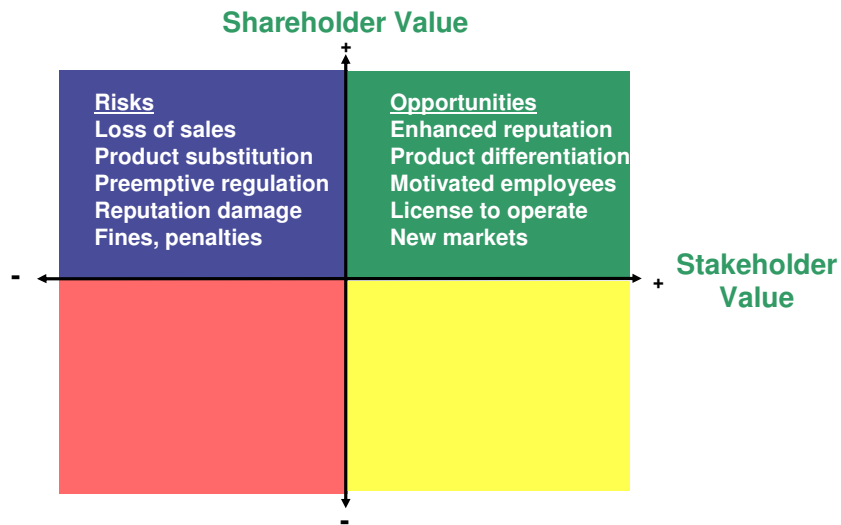
The value centered approach that I will discuss is called sustainable value. Sustainable value is value that is positive for shareholders and stakeholders.

This matrix shows shareholder value on the vertical axis and stakeholder value in the horizontal axis.

Sustainable value is represented by the upper right quadrant shown in green.

Stakeholders provide insight into hidden risks and opportunities

Sustainable Value



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Stakeholders provide insight into hidden risks and opportunities

When a company's product or business is operating in the upper left quadrant there are hidden (and sometimes not so hidden) risks. These could include loss of sales, product substitution, preemptive regulation, reputation damage, fines, and penalties.

When operating in the sustainable quadrant (the upper right) there are a number of benefits and opportunities such as enhanced reputation, product differentiation, more motivated employees, the license to operate, as well as new market opportunities.

Managers must systematically assess the situation for each business or product

Sustainable
Value

Shareholder value

- What is our **financial position**?
- What are our **financial imperatives**?
- What **opportunities** are we pursuing?
- What are our **threats** as we understand them?

Stakeholder value

- Who are our **stakeholders** and how do we impact them?
- What are **stakeholder issues** and interests and how might these evolve?
- What are **stakeholder-related business implications** today & in the future?



The result is foresight and “pressure” to create solutions to improve both financial and societal performance

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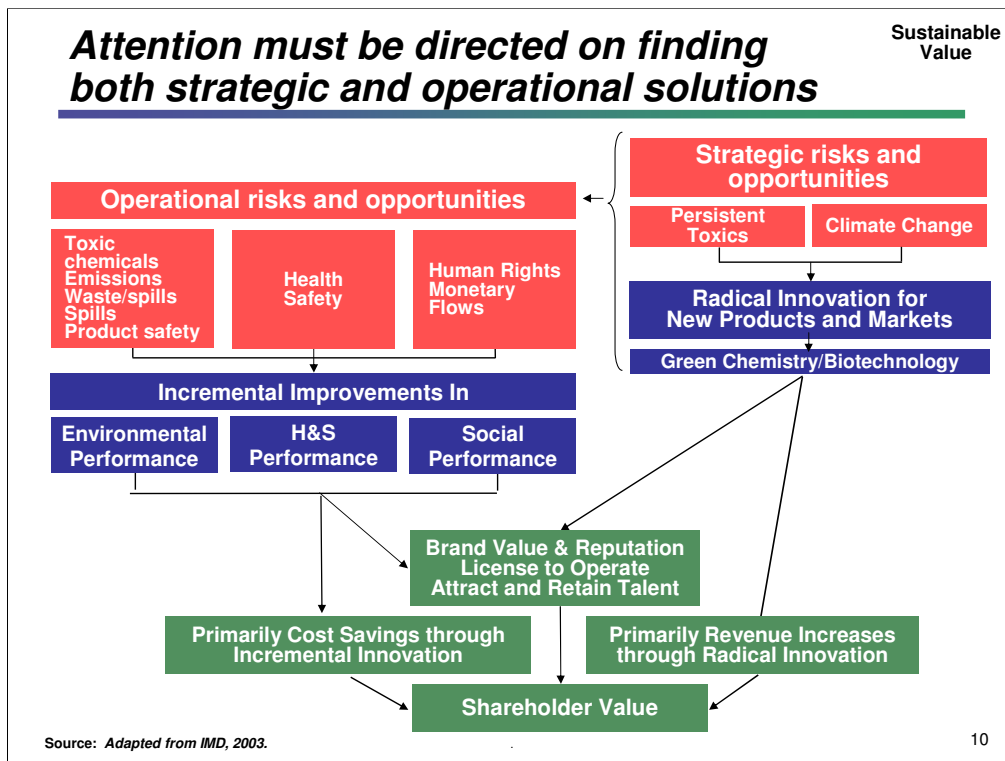
To get started with the value-centered approach, managers must systematically assess the situation for each business or product.

Most companies already do this for the shareholder value dimension by asking and answering the types of questions shown on the left side of this slide.

Few companies systematically assess their stakeholder value situation. This involves asking and answering the types of questions shown on the right including:

- Who are our **stakeholders**; how do we **impact** them?
- What are their **issues & interests**; how might these evolve?
- What are **stakeholder-related business implications** today & in the future?

Such assessments result in foresight and “pressure” to create solutions to improve both financial and societal performance. Through performing such an assessment chemical companies can begin to realize the full scope of their sustainability challenge and create the pressure to address it.



The pressure to create solutions should be directed at both the strategic and operational levels.

This page lays out the range of operational and strategic risks and opportunities that the chemical industry faces today. The left side shows the operational risks and opportunities, the right side shows the strategic risks and opportunities and the green at the bottom shows the benefits in terms of brand value and reputation, license to operate, attracting and retaining talent, cost savings and revenue enhancements.

The operational opportunities include incremental improvements in environmental, health and safety, and social performance.

The two major strategic risks are 1) persistent toxins such as dioxin and mercury that accumulate in the food chain and are now found in mammals and fish in even the most remote parts of the world. And 2) global climate change.

Green chemistry and biotechnology provide the potential for overcoming the two major strategic risks through radical innovation for new products and markets.

Biotechnology is a strategic solution with significant sustainability advantages

Sustainable
Value

- Agricultural crops displace fossil fuels
 - Green house gas reductions
 - Supports agricultural sector
- Performance benefits
 - Higher reaction rate
 - Increased conversion efficiency
 - Improved product purity
 - Lowered energy consumption
 - Decreased chemical waste generation
 - Reduced toxic emissions

Ultimately biotechnology will need to be part of the solution set

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Biotechnology is a strategic solution with significant sustainability advantages.

First, agricultural crops displace fossil fuels so benefits include: Green house gas reductions as well as supporting the struggling agricultural sector

Second, there are a range of performance benefits including Higher reaction rates, Increased conversion efficiency, Improved product purity, Lowered energy consumption, Decreased chemical waste generation and Reduced toxic emissions

Ultimately, in order to realize both financial and societal sustainability, biotechnology will need to be part of the solution set.

A successful biotechnology solution requires skillful focus at several levels

Sustainable Value

Levels of Focus	Sources of Shareholder and Stakeholder Value
Business Context	Changing the “ rules of the game ” so that sustainable strategies are both feasible and competitive
Reputation/Brand	Gaining stakeholder preference and recognition as well as employee motivation.
Market	Addressing new markets driven by customer and societal needs
Product	Using stakeholder value as a driver of product innovation
Process	Reducing energy, waste or other process costs and improving quality for customers and stakeholders
Risk	Managing known and emerging risks and protecting license to operate

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A successful biotechnology solution requires skillful focus at several levels. This slide shows six levels of focus for finding and shaping solutions to financial and societal challenges. The slide is best read starting at the bottom with risk.

- Risk - Any biotechnology solution will need to be formulated to reduce and manage known and emerging risks and protect license to operate
- Process - The output of biotechnology can be a new process that creates the same product, often at greatly reduced costs (e.g. The cost of L-lysine was reduced from 1.17 to 44 cents per pound).
- Product/Market - Products such as PLA can compete in current markets or can be used to help build new markets for environmentally favorable products.
- Reputation/brand – Strategies can leverage the societal benefits to help shape reputation and brand
- Business context -- to succeed industrial biotechnology strategies will need to address the business context or rules of the game from reconfiguring the supply chain, to gaining product acceptance with customers through changing tax incentives so that initial investments are more economically feasible

The disruptive attributes of biotech pose particular challenges

- Disruptive innovations fill new market needs outside those that current customers are asking for
 - Recent research explains why disruptive innovations fail

Dilemma	Challenges
<ul style="list-style-type: none"> ■ Poor success record in established firms <ul style="list-style-type: none"> – Decision processes work against it – When tried, usually focused at the wrong customers with wrong success requirements ■ Potentially one of best sources of growth and value creation 	<ul style="list-style-type: none"> ■ Identifying products customers will buy ■ Identifying best customers ■ Avoiding commoditization ■ Getting the organization right ■ Managing and funding start-up and experimentation phase

Business system alignment is needed to succeed with disruptive innovations

Source: *The InnovatorsSolution*; Christensen, 2003

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The disruptive attributes of biotech pose particular challenges within the chemical industry.

Recent work out of the Harvard Business School has uncovered a major dilemma that large companies face when it comes to disruptive innovation. Disruptive innovations are ones that fill new market needs or that current customers are not yet asking for.

Established firms almost never undertake disruptive innovations; rather they focus their efforts on innovations that improve the process or product performance within their current areas of focus. Disruptive innovations almost always come from outside the established industry.

When established firms do undertake disruptive innovations they almost never succeed.

Despite the poor success record, established players can succeed with disruptive innovations. However, they must skillfully overcome the challenges summarized on the right side of this slide. They must identify products customers will buy, identify the best customers, avoid commoditization, build the right organization, and manage and fund start-up and experimentation phases.

Success here requires alignment of the business system with the needs of the new venture.

Conclusion

- ***Industrial biotechnology offers great potential to solve the chemical industry's sustainability challenge***
- ***However, its disruptive nature will inhibit most players from taking the lead***
- ***Success will require foresight, skill and a systematic approach***

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In conclusion:

- Industrial biotechnology offers great potential to solve the chemical industry's financial and societal sustainability challenge
- However, its disruptive nature will inhibit most established chemical companies from taking the lead
- Success within the chemical industry will require foresight, skill and a systematic approach that identifies the right opportunities, overcomes the innovators dilemma, and engages a range of stakeholders to create winning solutions

About Sustainable Value Partners

Sustainable Value Partners is an international management consulting, research, and education firm headquartered in Washington D.C. Our mission is to help our clients create and sustain competitive advantage by focusing on shareholder value coupled with stakeholder value. We enable companies to reduce risks, drive costs out of the business, create new products, serve new markets, and position themselves to take advantage of industry change.

We believe that a corporation's primary responsibility is to deliver sustainable value to its shareholders and that the only way to do this is to create it rather than transfer it from other stakeholders. Further, we believe that the stakeholder approach is a relatively untapped source of innovation and value that will be a key source of business advantage in the 21st century.

SVP brings strategic perspective, financial rigor, analytic insight, proprietary tools and processes, and a collaborative spirit to these challenges. We apply the proven, well accepted methods of mainstream strategy and operations consulting to stakeholder issues, enabling organizations to focus attention and resources on the stakeholders and issues that really make a difference to current and future success.

Dave Sherman, Partner and co-founder of Sustainable Value Partners, Inc. has 25 years of general management consulting and chemical and environmental engineering experience. He served as Vice President with A.T. Kearney and as a Principal in the General Management practice of Towers Perrin and Cresap. His consulting experience includes assisting clients with strategy, operations and company transformation in more than a dozen countries in the Americas, Asia and Europe. Sectors served include: chemicals, consumer products, energy utilities, financial services, government, healthcare, hi-tech, oil and gas, and transportation. He has started up and run two consulting units within A.T. Kearney and Towers Perrin. His industry experience includes positions at Chevron and Exxon where he was involved in design, process engineering and environmental engineering/regulatory affairs. He holds an M.B.A. (honors) from UC Berkeley and a B.S. (honors) in Chemical Engineering from Purdue University.

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