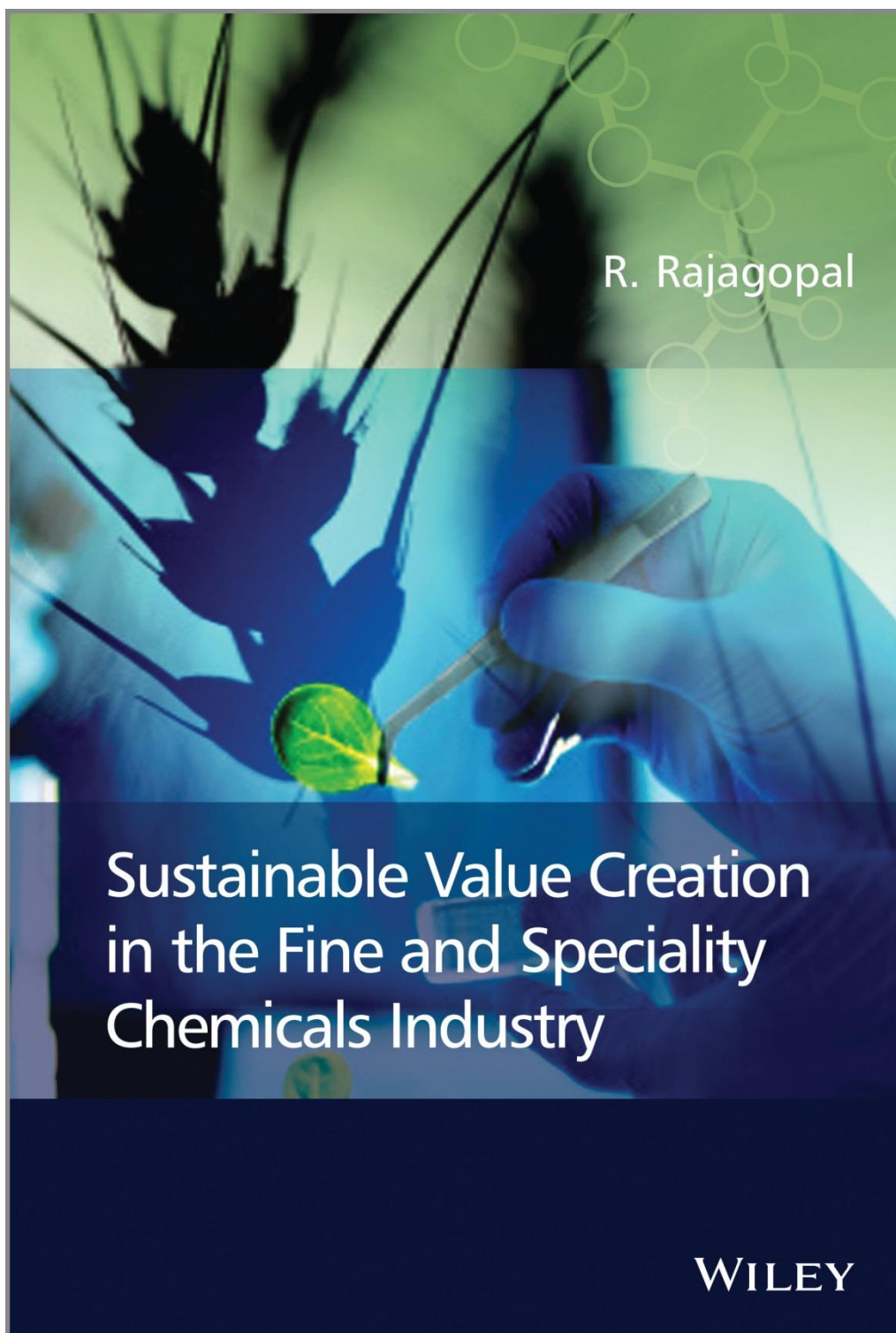


New Wiley publication for the fine and speciality chemicals industry addresses sustainable value creation strategies



R. Rajagopal

**Sustainable Value Creation
in the Fine and Speciality
Chemicals Industry**

WILEY

Book Release

In a select gathering comprising of industrialists, scientists, technologists and industry professionals at the Institute of Chemical Technology (ICT), on 23rd April, 2014, the book, “*Sustainable Value Creation in the Fine and Speciality Chemicals Industry*”, authored by ICT alumnus **Dr. R. Rajagopal**, published by Wiley was released jointly by **Professor M M Sharma**, FRS, Emeritus Professor of Eminence and ICT and **Prof. G. D. Yadav**, FNA, Vice Chancellor, ICT. The event was hosted by UDCT Alumni Association (UAA).

Ravi Raghavan, Vice President, UAA and Editor, *Chemical Weekly*, welcoming the audience mentioned that the title reflects the challenges before the fine and specialty chemicals industry. “Rajagopal, my colleague with who I have been discussing various strategies over 20 years has covered a subject that is close to my heart”, he said. He mentioned that the fine and speciality chemicals are an interesting marriage of chemistry and chemical engineering just like ICT and it is apt that the book authored by an alumnus is being released at this venue. He added that ICT has given birth to several entrepreneurs who have gone on to become industry leaders today in fine and speciality chemicals and this book covers several aspects of fine chemical technologies. On the efforts being taken by UAA Ravi mentioned that a key goal of the UAA is to create a corpus and that Rs 80 lakhs has been raised till date.

Dr Vijay Habbu, President, UAA and Sr. VP Technology and Product Stewardship, Reliance Industries Ltd, welcoming the audience said that this is a book release function for speciality chemicals for a special audience. “Our journey of 25 years has happened with immense support from our alumni and former Presidents of UAA. Though we have 15000 alumni only 5000 are registered as UAA alumnus and it will be our effort to bridge this gap this year,” he added.

“Like all alumni association UAA also started with providing services to the students and we have started several initiatives in this regard some of these are start-up funds, certificate courses in Chemical Technology Management for P.G. students, instituting life time achievers award, best student awards, to name a few,” Dr Habbu said. He mentioned that UAA has reactivated UAA chapters across the globe and has been continuously striving to be relevant. “All efforts are being made to make the 25th Silver Jubilee of UAA, on May 11, 2014 a major platform

for our alumni to come together. We have identified exemplar alumni and young achievers to be recognised at this event,” he added. Recollecting a quote he said, “more important than procedures is recognising talent and today we recognise the talent of our alumnus, Rajagopal, my class mate for having authored this important book”.

Prof G D Yadav, Vice Chancellor, ICT in his welcome address, wished Rajagopal for his contribution and reflected on his association with him since the 90s when they collaborated to bring out the UDCT Diamond Jubilee Commemorative Volume in 1994. Addressing a wide range of issues from raising funds for research and campus development to chemical engineering courses, he said that it is time to move on traditional domains and usher in new disciplines. He said, “we get funds from alumni, industry and wellwishers. Our goal is research and innovation. We need additional plot of 50 acres and the government has sanctioned some plots. Besides offering new courses we also need to differentiate our courses to make our students employable”.

Stressing on the need for good quality faculty, Professor Yadav said that quality faculty accommodation at ICT is on the anvil. He called for new centres in toxicology and hazard management and emphasized on the need to rename courses in innovative ways. Commenting on the research productivity he said that 118 ICT will graduate 150 PhDs next year and that ICT plans to leverage its IP of over 310 patents by starting an incubation centre for research and innovation.

Professor M M Sharma, Emeritus Professor of Eminence, ICT, in his Chief Guest address said, “the tradition of scholarly writing has been part and parcel of UDCT now ICT and we have many alumni who have written books both in traditional and non-traditional areas. This scholarly writing has been an integral part of any academic person. In this effort Rajagopal has been ably assisted by Chitra as he had taken up the daunting task of writing a book of this kind. Let me first profusely compliment him for having taken this extraordinary assignment and come out with such a superb book of international standard”.

Touching in the success of Active Pharmaceutical Ingredients (APIs), he said, “Fine and speciality chemicals have a special place in this country. Look at the spectacular success of the pharmaceuticals industry in the country where you have crossed Rs. 65,000 crore. This industry has done so extraordinarily well that in

every article whether it is in Chemical Engineering News or any other, when it comes to APIs they will refer to India and China as these two countries have become capital countries of the world in terms of APIs. One of these days you will also see NCEs coming out of India,”

Citing instances where ICT has been addressing the needs of the industry, Professor Sharma said that it all started first with textile auxiliaries and dyes where ICT had a strong position. He pointed out the pharma industry which in the last 10 years has done extraordinarily well with seven companies having more than a billion dollar per annum, one company is over \$3bn and another company is also racing towards \$3bn. “This needs expertise in the fine and speciality chemicals of various kinds - expertise in organic chemistry, chemical technology, chemical engineering and I am very delighted when I read articles in *Journal of Organic Process Development* from medical chemists to process chemists,” he added.

Touching on the breadth of coverage of the book, he said, “what Rajagopal has been able to do is orchestrate disparate subjects like process intensification, continuous operations, management of hazardous molecules and other related topics. If you see the table of contents the range of topics he has covered is extraordinary indicating that he has kept himself abreast with all these topics. He has given due coverage to value added chemicals from waste streams. He has also covered a spectrum of catalysis including phase transfer catalysis with due coverage to homogeneous and heterogeneous catalysis. What interested me individually is the range of topics. If you pick up any other book in a comparable field you will not find such a wide spectrum of themes. It is very difficult to find an assembly of such diverse topics very cogently and very clearly expressed. I strongly recommend this book to persons who are connected with this field and strongly urge this book to be kept in ICT library and people should read this book so that they get a proper insight into various interesting topics”.

Professor Sharma said that the title of the book is very appropriate and also like a song in the global context today. “Ultimately, until sustainability is combined with economics it will not go places. Sustainable part is very easy to say, but in chemical industry it is the competitiveness that will be the key. What will succeed is what is economically attractive generating the same quality product”, he added.

“Let me again tell you that this topic is very germane to India. I have seen the advance copy and Rajagopal has done a great job and needs a big applause. In the

course of many meetings he had with me his desire to improve the text was inherent but I warned him that *let best not be the enemy of good*. I am glad he put a finish to the work and the book is now out,” Professor Sharma concluded.

Dr. Rajagopal thanking the gathering for their support made particular reference to how Professor Sharma encouraged him throughout the venture from concept development to final manuscript submission. He expressed his gratitude to Professor G D Yadav, Dr Vijay Habbu and in particular to Ravi Raghavan who has supported him through difficult phases in his life, Professor Chitra Natarajan, Dean, Homi Bhabha Centre of Science Education, TIFR for her continued support and his mentors who were in the audience. In his remarks, he shared some of his observations and insights gathered in the process of researching for the book. Reflecting on the fine and speciality chemicals industry, he said, “this industry has a significantly large global footprint in seventy countries located in emerging and transition economies. While this large expansion in markets offers immense opportunities for the industry it also raises serious concerns about the high chemical intensity in these regions which have less than adequate manufacturing, infrastructure and regulatory systems needed for managing the complexities of this business”.

Touching on the structural shifts Rajagopal pointed out that this industry has been in a perpetual state of transition driven by profound shifts in feedstocks, R&D, new technology platforms, manufacturing and supply chains. He referred to the impact of asset recapitalization, how entry of private finance changed product portfolios and ownership patterns; how customer consolidation commoditized specialties; how regulations and aware consumers led to products being banned, and how growth stagnated.

Emphasizing that creating value is a very complex process when the process has to integrate economic, ecological and social sustainability components in its goals, Rajagopal mentioned about how this industry identified, evaluated and experimented with diverse innovation models to create sustainable value. Cautioning about the high risk and uncertain nature of the innovation process, he discussed how the focus of innovation shifted from loosely structured innovation to rigidly structured innovation pipelines; from company specific to collaborative innovations; from product and process to operational and non-technical innovations.

He referred to the preference for innovation in *Energy Efficiency* (EE) programs and trends in investing in product innovation that enable customer end EE and process innovation that enable on-site EE proved a better bet for many companies. He also explained why differentiated segment specific innovation models are key and the pressing need to resolve gaps in knowledge about linkages between regulations- innovations- markets. He referred to new pressure points arising out of managing new regulatory regimes, global value networks, innovation pipelines, technology shifts and in particular consumer-community engagement models.

Emphasizing that major innovations are needed to propel economy and societies forward, and these occur more often at the interphases of multiple scientific and technology domains, Rajagopal said that future chemical enterprises will be innovation based and will need multi skilled chemists and chemical engineers. “Practice of chemistry and chemical engineering is being fast reshaped by synthetic biology, biotransformation, molecular biology, etc., and the industry will demand a new breed of human resources trained to teach, research and operate in the interphases of several disciplines; act as resource managers; value creators and more importantly as interlocutors between the stakeholders. Clearly, a major task ahead for institutes like this and I am sure ICT will be addressing these issues,” he concluded.

Foreword

Dr David J C Constable

Director, American Chemical Society Green Chemistry Institute, USA

There are few industries in the chemical enterprise as foundational to modern life, as we have come to know it, or as diverse, as the Fine and Specialty Chemicals Industry. There is no part of modern society that is untouched by this Industry. And yet, despite the breadth, penetration and diversity of the sector, it is likely that relatively few people in modern society appreciate just how dependent their way of life is on the products produced by the Fine and Specialty Chemicals Industry. For those of us who have been a part of this Industry over the past 30 years, we have borne witness to an astounding degree of change within companies considered to be the major players. The pendulum has swung from a number of large, integrated, and diversified chemical manufacturers with a portfolio of

specialty chemicals, to a host of niche players in different and key areas of specialty chemicals manufacture. We have also witnessed a shift in the industry from the developed world to the developing world and a major recapitalization of the industry in those parts of the world. Implicit in that growth has been the growth of a supply chain that has increased the complexity of timely introduction of new products to market.

Layered over this structural change has been the equally astounding growth of a complex web of regulations promulgated in response to concerns about new and existing chemicals finding their way into humans and the environment. Chemicals management regulations like the U.S. Toxic Substances Control Act in 1976 paved the way for the Registration, Evaluation, Authorization and Restriction of Chemical substances (REACH) law enacted in the European Union in 2007. Meanwhile, there was an explosive growth of regulations to control emissions and waste entering the environment. The hazard-based approaches that underpin such government regulations for chemicals management continue to be actively debated by industry which prefers a risk-based approach to chemicals management. In turn, this has often led to an uneasy *détente*.

Beginning in the late 1980's, some in the Industry began to talk about the idea of sustainability, but most were working to come to some level of equilibrium with pollution prevention. Momentum has grown over the past 20 years, with a tipping point being reached in the middle of the first decade of this century. Most of the companies in the Specialties and Fine Chemicals Industry, at least those with an international presence, now routinely talk about sustainability and how it can be an engine for growth. This has not been an easy transition for some, and there are still those whose products, at best, are arguably less sustainable than others, or at worst, are unsustainable. In this respect, we are likely to see continual change on a comparable scale to what we have witnessed over the past 30 years or more as companies move into new chemicals that preserve or even better, improve upon, efficacy of function while becoming more sustainable.

That is why a book like this is important. As you will no doubt discover through reading it, the changes mentioned above are catalogued, described and expanded upon to give a comprehensive understanding of the Industry and how it has changed. These changes are put into the context of how the industry has positioned itself to move towards a future which is likely to be less dependent on non-renewable feedstocks and more dependent on feedstocks derived from

biological sources. As new technologies have become available there has been an evolution towards agriculturally-derived materials, or those that are beginning to harness the possibilities of new platform molecules offered through synthetic biology. This represents sustainable value creation from a renewable feedstock perspective.

There has also been an evolution in our understanding of what is green or sustainable in the context of the batch chemical operations that characterize the Specialties and Fine Chemicals Industry. While batch chemical operations are likely to be used for the foreseeable future, some have begun to explore alternate reaction spaces, separation technologies, and other unit operations that promise to be more mass and energy efficient than a traditional batch operation. Our vision of the centralized multi-purpose batch chemical plant is likely to move towards a plant with a much smaller footprint and one that sees smaller plants distributed in more locations. This represents another part of sustainable value creation from a technology perspective.

Implicit in sustainable value creation is the continuing need for innovation in all areas of the sector. On a micro scale, innovation can be unsettling, unpleasant, or disruptive, especially when competitors innovate their way to a new product or process that threaten each others' business. On a macro scale, it is innovation that moves the Industry and society forward. I encourage you to read this book and learn the lessons it provides through a comprehensive global picture of the Specialties and Fine Chemicals Industry and by describing a potential path for sustainable value creation

About the Book

Sustainable Value Creation in the Fine and Speciality Chemicals Industry

R. Rajagopal

KnowGenix, India

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The global fine and speciality chemicals industry is a vital segment within the chemical value chain, catering to a multitude of societal and industrial needs. Technological, regulatory, sustainability and consumer forces have been constantly

shaping the business fundamentals of this industry. Developing value creation strategies which embed economic, environmental and social sustainability components will need a comprehensive assessment of business, scientific and technological challenges facing the industry.

Sustainable Value Creation in the Fine and Speciality Chemicals Industry discusses sustainable value creation options against the backdrop of global mega trends that are defining the present and future course of the industry. It discusses innovative strategies in feedstocks, R&D, technology, manufacturing, resource management and supply chain as well as the significance of the bio-based chemical economy in enabling sustainable value creation in the fine and speciality chemicals industry. It covers the following topics:

- Transformations in the fine and speciality chemicals business
- Sustainable management: evolution, transitions and tools
- Research and technology directions
- Resource optimization strategies
- Bio-based chemicals, specialities and polymers
- Sustainable practices in the fine and speciality chemicals industry
- Sustainable value creation strategies

This book presents a comprehensive overview of strategic options for sustainability management in the global fine and speciality chemicals industry. It will be a valuable resource for chemists and chemical engineers involved in the design and development of economically, environmentally and socially sustainable practices for the future. Industry professionals involved in business strategy, policy making, manufacturing, regulatory affairs, supply chain and sustainability management functions in the chemicals and in particular, the fine and speciality chemicals industry will find it a useful tool.

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