Fostering Green Start-up Success

Unleashing Sustainable Innovation, Navigating Business, and Pioneering a Greener Future

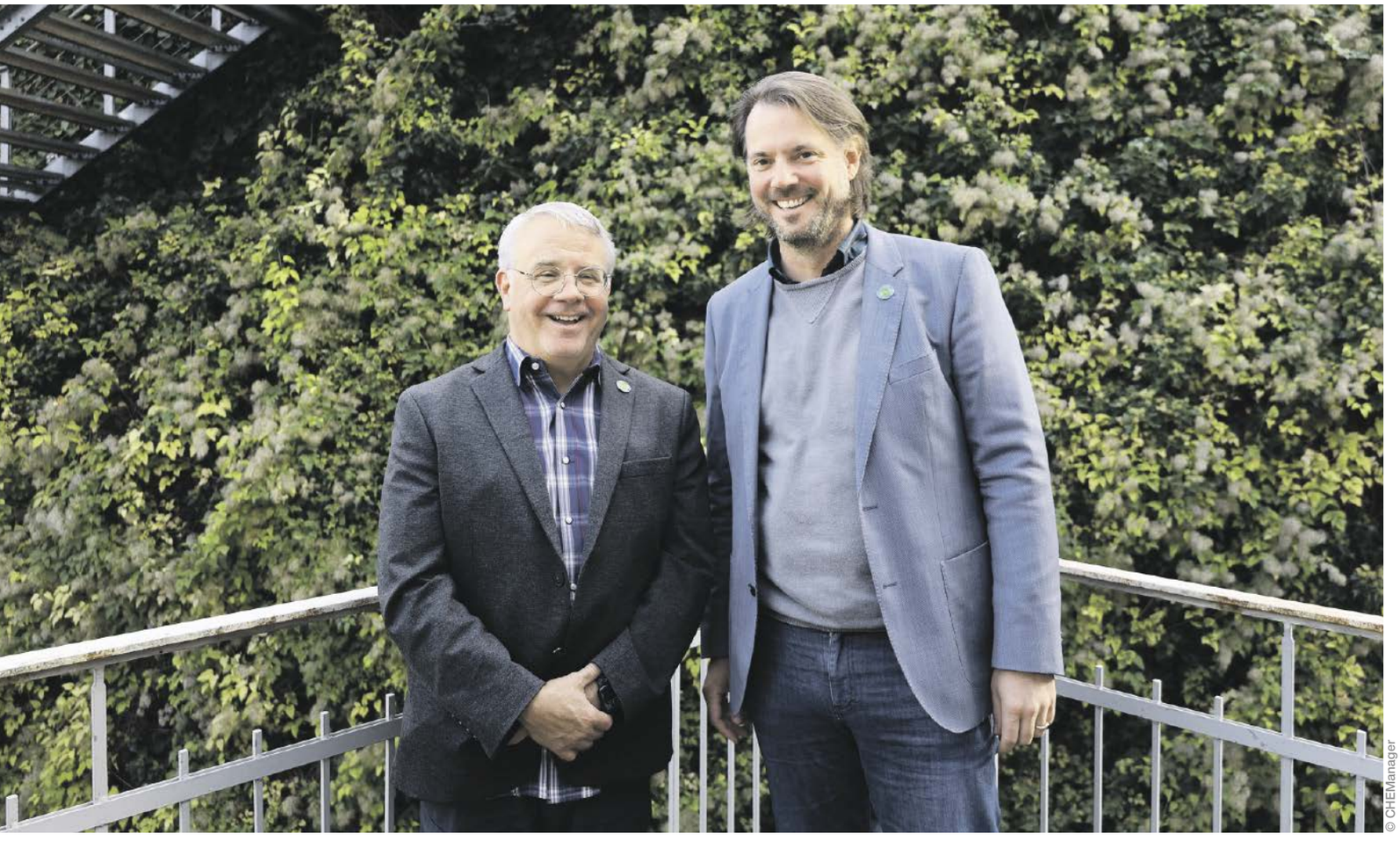
In today's world, where environmental sustainability is at the forefront of global concerns, green chemistry stands as a beacon of hope. This field focuses on inventing sustainable solutions that mitigate the harmful impact of traditional chemical processes. Translating these innovative ideas into successful businesses, however, can be a daunting task. That's where the John Warner Center for start-ups in Green Chemistry — Chemical Invention Factory (CIF) and innovation ecosystem GreenChem step in. At this ecosystem for green chemistry visionary scientists find the necessary infrastructure as well as support to evolve chemical inventions towards innovations. John C. Warner, the eponym of CIF, is one of the founders of the field of green chemistry and a passionate advocate for green chemistry start-ups. Together with Martin Rahmel, Managing Director of CIF and GreenChem, they hope to change the chemical industry landscape. Christene Smith spoke with John and Martin to hear more about the challenges of tech transfer in the green chemistry space.

CHEManager: Green chemistry is often described as a transformative approach to chemical design and production. In your view, what does green chemistry entail and what is an example of how it has revolutionized traditional chemical processes and products in recent years?

John C. Warner: Green chemistry enhances chemists' skills with essential knowledge to create safer, eco-friendly materials. It shifts the focus from cleaning up problems created by the use of harmful materials to designing products that do not have the harmful materials in the first place. Most universities lack training in toxicology and environmental mechanisms, making it challenging to ask scientists to produce non-toxic or biodegradable products. Green chemistry integrates this knowledge, helping chemists meet various criteria while aligning with regulations and societal pressures for ethical and profitable industry practices. While progress has been made, there's still much to achieve in the field. I estimate that 60 – 70% of necessary innovations are not yet being invented!

How has the chemical industry's perspective on sustainability and environmentally friendly practices evolved over the years, and how does the concept of green chemistry fit into this evolution? What is the difference between overall sustainability and green chemistry?

J. Warner: Initially, scientists both created and studied things. Then, in the mid-1800s, the chemical industry emerged, splitting scientists into makers of materials and knowledge seek-



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John C. Warner and Martin Rahmel, GreenChem

ers. Making materials became a lucrative business while making knowledge received less funding. Around 1950 – 1960, the modern environmental movement began, and the makers of knowledge embraced it. The maker of materials did not reject environmentalism, they just were not part of it. The aim of green chemistry is to unite the makers of knowledge and the makers of materials so that we can make products that are safe for humans and the environment. It differs from sustainability, which focuses on measuring and quantifying eco-friendliness. Green chemistry is more about inventing and creating environmentally friendly technology, filling the gap in sustainability.

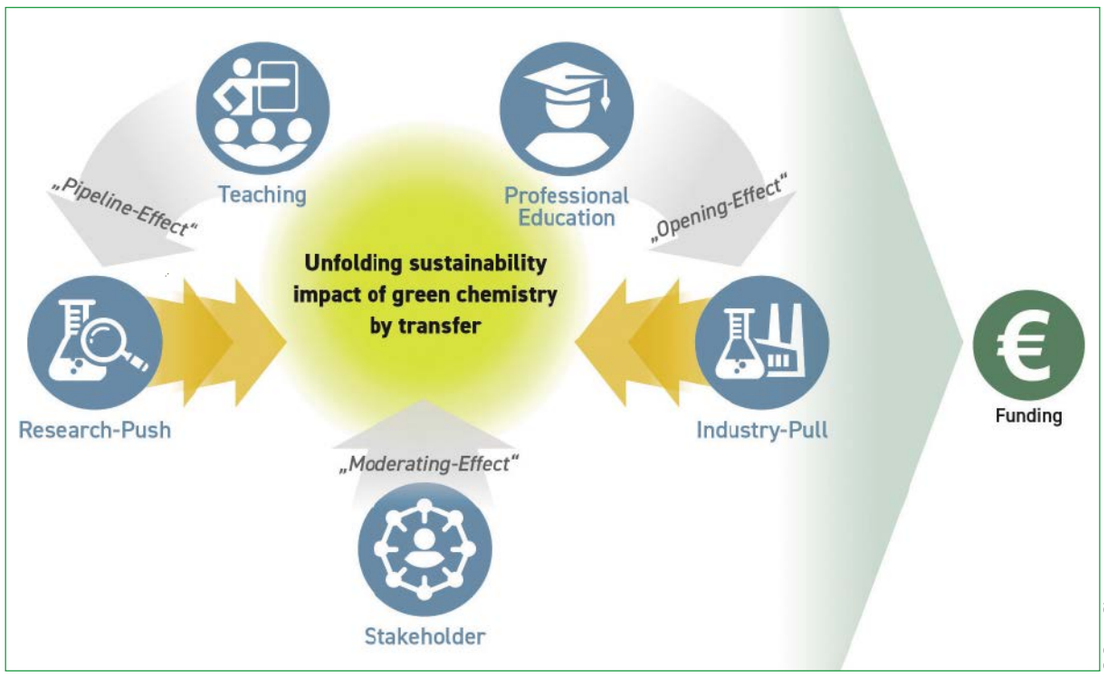
Martin Rahmel: Achieving sustainability is undoubtedly the primary goal. However, our current material-based scientific practices, coupled with our excessive resource consumption – 1.7 planets according to world overshot day –, show we're far from being sustainable. Green chemistry is the path to achieve desired sustainability, offering chemists the principles and strategies to make this crucial shift.

What is necessary to accelerate the green chemistry transformation — and what are the obstacles, is it the lack of technologies or the lack of willingness?

J. Warner: We face various challenges, including untapped technologies and the need for both entrepreneurial and technical expertise in fields like green chemistry. The gap between industry's shift away from fundamental research and academia's emphasis on publishing metrics has created difficulties in technology transfer. Current efforts, while well-funded, often yield a high failure rate of successful commercialization, (around 90 – 95%). It's crucial to focus on improving technology transfer to provide better outcomes, as society deserves.

M. Rahmel: I totally agree. While new technologies still must be developed, I specifically in Germany see a shortage on the human factor, that is people who want to bring new technologies to market. Technologies have no value whatsoever without the persons doing something with it.

Start-ups are seen as critical innovation partners by big chemical companies. What role does industry pull play in fostering start-up creation, and how does this collaboration benefit both established companies and start-ups?



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Holistic transfer approach of GreenChem: 5+1 target areas and it's mission in the center.

M. Rahmel: There is nothing more practical than a good theory! Disruptive innovation theory teaches us, that disruptive change is led by newcomers, not established corporations. In the chemical industry we are at the beginning of a disruptive transformation.

> *"The aim of green chemistry is to unite the makers of knowledge and the makers of materials so that we can make products that are safe for humans and the environment."*

Hence, start-ups must play a significant role in industrial policy. Large corporations increasingly understand and see the needs as well as the benefits of partnering with start-ups, of practising open innovation measures to secure their future with external innovations. However, this is a challenging task due to differences in speed, risk-taking, culture and many more aspects. The purpose of GreenChem and CIF is to bridge these gaps, offering a neutral playground for successful and effective collaboration between start-ups and corporates. Our guiding belief is, that success in innovation requires a shared vision of sustainability combined with a culture of mutual respect.

What role does the Chemical Innovation Factory (CIF) play in promoting innovation and collaboration within the chemical sector, and what makes it unique?

J. Warner: In the GreenChem innovation ecosystem, we collaborate across three Berlin universities, targeting five key areas to transform the chemical industry through innovation. What sets us apart is our holistic approach, addressing multiple challenges simultaneously. Moreover, our uniqueness lies in the blend of people, technology, and essential infrastructure, including cutting-edge laboratories. I've traveled to over 75+ countries and even more cities and can say that Berlin is genuinely unique. Its creative, excellence-driven, and sustainability-focused culture, especially among its youth, is apparent. Berlin really seems to be the perfect overlap of all these three things that we need to bring these green innovations to market. It's really unique!

Could you share some success stories of start-ups that have emerged from the ecosystem and their contributions to the industry?

M. Rahmel: Certainly I could, but I don't want to in terms of being unfair towards teams I couldn't mention. In Berlin, we currently have a diverse community of over 38 teams at different stages of development in various chemistry fields. While the numbers might seem large, there's still room for growth. A recent study compared the number of chemistry spinouts to those in other fields and found that we could have ten times more if chemistry were on par with the average. This order of magnitude highlights the untapped innovation potential in our industry. Lots of great work ahead of GreenChem.

The new CIF building, set to open in 2026, to be named after John Warner, is generating excitement. What are the key features of this new facility, and how will it support innovation?

M. Rahmel: Being the flagship-building of the GreenChem ecosystem, the Chemical Invention Factory has several key features. First of all, it's a brand new building, which will provide laboratory space for at least 12 start-up-teams. The location in the center of Berlin on the campus of TU Berlin is unique giving teams' access in walking distance to both, scientific infrastructure like analytics and knowledge as well as the innovative vibe of Berlin in general. Moreover, we will welcome spinout teams in their pre-foundation stage from all over the world with only two selection criteria: (1) their technology and business-idea must be based on a positive impact for our planet and (2) our infrastructure and ecosystem must have a positive impact on their success.

John, can you share your personal involvement and contributions to the CIF, and how your expertise in green chemistry has influenced its initiatives?

J. Warner: I would like to label my position as the "Chief Cheerleader" or the "Number 1 Fan" of GreenChem and CIF. I've had the pleasure of meeting with young start-ups, providing mentorship, and giving technological suggestions and ideas on where to go next.

"Green chemistry is the path to achieve desired sustainability, offering chemists the principles and strategies to make this crucial shift."

Their energy is just great! Hence, I learn, I get inspired and I get fulfilled by supporting and encouraging the innovators that come through these initiatives.

Martin, as the managing director of GreenChem and CIF, what trends or innovations in the chemical industry are you excited about, and how are you positioned to embrace them?

M. Rahmel: Right now, I see a few major trends that need immediate action. Number one of course is eliminating

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the use of fossil carbons in exchange for renewable carbon sources. This "defossilization" needs to happen if we want to master climate crisis. Another is focusing on the loss of biodiversity, which has the potential to cause more harm than excess CO_2. Accordingly, biodegradability as well as circularity are the major concepts chemistry as to integrate into innovative solutions. How are we positioned? Just one word: unique! If only looking at the needed infrastructure, GreenChem enables us to combine different infrastructure in a complementary fashion: IRIS at HU Berlin, CIF at TU Berlin and the Scale-up Lab at FU Berlin — the accompanying analytics not being mentioned yet. Together with the benefits of Berlin as a start-up, sustainability, research and creativity hotspot, we are perfectly positioned to unfold the impact potential of green chemistry inventions.

Green chemistry encompasses a wide range of industries and sectors. In your opinion, which areas within the field offer the greatest potential for new start-ups?

J. Warner: Again, for me, it's not necessarily about what specific sector or something like that but ensuring that starting with education that all chemists get the tools to think about their processes with green chemistry. We want to start young so that when these students make it to industry, they can incorporate these principles directly into their work. So that a researcher in batteries or in another area can start developing products that are inherently more sustainable because they understand the process and what to keep in mind when innovating.

Looking ahead, what are the long-term goals and aspirations for your two initiatives, and how do you envision their role in shaping the future of the chemical sector?

M. Rahmel: In my vision I clearly see GreenChem being the European ecosystem of innovation in Green Chemistry, where numbers of start-ups have multiplied. In the CIF innovative minds from industry, universities and start-ups regularly discuss and meet at an eye level and creating a huge impact with innovations.

J. Warner: I really see organizations like GreenChem popping up around the

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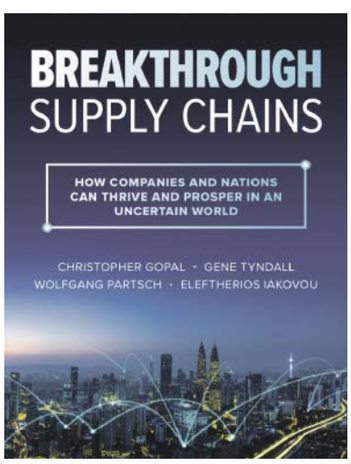
world. I imagine having one in south America, one in Australia, one in Asia, around the world. All work and network with each other, but also have a little competition. That would not only show that the concept really works. Furthermore, having competition is a really great thing for innovation, and innovation is key for mastering the current transformation.

■ www.unisyscat.de/career/transfer/greenchem

Breakthrough Supply Chains

Goods, information, and capital travel around the globe through different cultures and languages. Supply chains have therefore become very complex, and terms have different meanings in different languages. Therefore, they are often "lost in translation", and are defined in different ways and, most important, their dynamics from end to end are often misunderstood. This book sorely needed to define and re-define the supply chain in this new technologically driven, multi-national and "weaponized", talent-focused and sustainability environment. That is the main reason why four proven experts have written this book, one being the co-founder and pioneer of Supply Chain Management, one specializing in industry and trade, one specializing in government and defense, and the fourth representing the academic side.



The book is essential reading to understand the future of supply chains and clarifies, among other things, what supply chains really are and why we need them.

■ Breakthrough Supply Chains
Christopher Gopal, Gene Tyndall, Eleftherios Iakovou and Wolfgang Partsch
McGraw-Hill 2023
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Convincing Political Stakeholders

In the new edition of his standard work, Klemens Joos, bundles experience acquired over more than three decades to form a scientific theory on governmental relations. It focusses on the insight that, in view of the increasingly complex decision-making structures of the EU, the most precise possible knowledge of decision-makers and decision-making processes is at least equally as important to success as the content aspects of interest representation. In a new chapter, the author sets out the formula for science-based interest representation developed by him from his practical experience: The likelihood of success can be increased exponentially if success is achieved, firstly, in committing to the concern of an affected party through a change of perspective such that the positive effects on the common good are shifted into the foreground and, secondly, in successfully integrating the concern into the crucial decision-making processes at the political level.

■ Convincing Political Stakeholders
Klemens Joos
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