Strategies for Success as an Industrial Chemist[1]

by Carolyn Ribes

Chemists find careers in the chemical industry very rewarding. The focus is on applied chemistry and in delivering solutions that meet customer needs, whether the customers are other industrial companies or individual consumers. Chemistry provides solutions to the global challenges facing our society, including the need for clean water, nutritious food, improved healthcare and wellness, affordable housing, and sustainable infrastructure. Within industry, chemists serve in a wide variety of roles. The largest fraction may be in research and development (R&D), although opportunities in manufacturing, technical service and development, supply chain, marketing, intellectual property protection, sales and commercial functions, and many other options are also open to chemists who want to apply their skills [1]. I was drawn to a career in industry because I'm results oriented and I wanted my work to be applied immediately and have an impact.

Brilliant technical skills and an outstanding dissertation are great assets when graduates look for their first job. However, a successful career in industry requires strengths in three areas: business acumen, technical skills, and interprofessional skills. This has been described as a three-legged stool, and each leg must be strong for a successful career. "Interprofessional skills" defined as the combination of interpersonal and communication skills required for effective teamwork [2]. Most formal education programs emphasize the development of technical knowledge and skills; the focus is on cognitive development. Skills in the other areas are either learned through specific training courses offered by the employer or developed informally as on-the-job training.

Since each of us has a different definition of a successful career, it's important to understand yourself and how you define success. As an industrial chemist, you should have an individual professional development plan that outlines your skills, experiences, vision, and desired career path. It is more effective if you can describe particular roles you want to achieve at future stages, skills you want to develop, and opportunities or experiences you seek [3]. Keep that development plan updated; share it with your leader, your mentor, and others that may be able to help you achieve your professional goals. Understanding your strengths is critical as is identifying how you can fully utilize your strengths in a given role. Formal and informal feedback as well as self-assessments [4] are very useful for this. Your unique combination of strengths and skills will distinguish you from others.

Business acumen

Business acumen implies understanding what value you provide towards impacting the profitability bottom line. Chemical companies exist to bring value to their stakeholders, including customers, shareholders (for public companies), employees, and their communities. Competitive advantage may arise from having advantaged technology over competitors, superior or differentiated products, lower prices due to scale of manufacturing, operational excellence that results in lower operating costs, or access to lower cost raw materials. Chemists in industry need to understand the value proposition for the projects they are working on and how the project will impact the bottom line for the company [2-6]. Not all research projects are successfully commercialized and R&D chemists need to understand the risks involved in reaching their final goal and be prepared to modify projects to ensure a strong return on investment. A basic understanding of financial principles, awareness of global markets, and appreciation for the entire process (from ideation to delivering a product to customers) is recommended. Industrial chemists should be aware of the importance of intellectual property and ways to protect ownership of innovations in products, processes, and applications. Awareness of global drivers and trends and how this impacts your business and market is essential for growth. Understanding and appreciating the differences in markets and applications across geographic regions may be critical for evaluating opportunities for your products [2]. As an example, since materials of construction for residential housing in the US are often different than those for houses in Europe, developing products for residential infrastructure may require a different approach in these geographies. Learn how to define and utilize work processes to drive standardization and efficiency when needed, and simplify and streamline when appropriate.

Chemistry students interested in a career in industry would be well served by a course or two in business or

1. First published as *Pure and Applied Chemistry*, vol. 91, no. 2, 2019, pp. 327-330; https://doi.org/10.1515/pac-2018-0718, part of the special issue titled 'Distinguished Women in Chemistry and Chemical Engineering'

economics during their undergraduate years. Earning a MBA degree (Masters in Business Administration) is one way to expand business acumen and is sometimes recommended for advancement in industry, especially along the commercial or managerial career paths [7]. You may find this more useful for roles that require understanding market trends, business development, strategic portfolio management, finance, or innovation management. There may be specific roles within a corporation that require both formal business and technical education credentials. There are a variety of options available, including executive, part-time and Open University programs. Some employers provide tuition support or flexible work schedules for employees that pursue a MBA as part of the development plant. For part-time students who are earning a degree while working, you may identify a thesis project that relates to your role or provides information relevant to your employer, and demonstrates the value of your new knowledge to the employer.

Another aspect of business acumen is being able to understand, appreciate, and communicate the value you, as an individual, contribute to the company and how your contributions impact the strategies and goals of your organization. You will be accountable for setting and achieving goals and articulating how your accomplishments impact the bottom line. You may need to consider the short-term and long-term consequences of decisions and the broader impact they may have. Even if you don't pursue any formal education, take the time to learn as much as you can about the businesses you support, the markets, and how your work/function contributes and interacts with other functions within your organization.

Technical knowledge and skills

Most chemists will expect that their technical expertise is key to success in industry. In addition to technical and general knowledge learned as an undergraduate and the focused knowledge developed doing research, we also learned how to practice the scientific method: how to formulate hypotheses, investigate relevant literature, design and conduct experiments, evaluate results, draw conclusions, document our work, and develop recommendations for the future. These skills are highly transferable to any business project or situation. The research we performed in graduate school may or may not be relevant to our industrial responsibilities initially. Over time, chemists must either continue to develop deeper knowledge in a particular subject matter or broaden their knowledge to become a generalist, perhaps with an emphasis in a particular area. However, success either way depends on the chemist's ability to continue to learn throughout their careers, keeping up with technological advances and leveraging developments in other areas so that their skill sets continue to be relevant ten, twenty, thirty, or perhaps forty years after graduation [5, 6, 8]. Your industrial role may require that you keep up with literature across diverse areas, participate in conferences both focused on your sub-discipline and broad in nature, and perhaps take short-courses or continuing education courses. Learning concepts and principles from other disciplines, such as engineering, statistics, or information technology may be beneficial [2]. Enhance your ability to move up the knowledge pyramid by having the right data, converting that to information, developing knowledge from that, and finally creating wisdom. Knowledge management and transfer are also important skills since they ensure that the expertise and knowledge of one individual can be communicated, leveraged, and sustained across an organization. That's required for successful commercialization of a product, global implementation of a technology, or for training your successor so you can move to new challenges or roles.

Industrial chemists will need than just technical skills. Collaboration, communication, networking, mentoring and working with people from around the globe are all important as well.

Interprofessional skills

These skills, also called interpersonal skills, are probably the most important and highly prized skills in industry [1, 13]. They are a critical part of determining your career trajectory. Surveys of industrial employers have reported that over 90% value "soft skills" over technical skills when making hiring decisions [6, 10]. It is less common for academic programs to include specific training or development opportunities within their curriculum. Many industrial employers provide their own in-house training or hire consultants. Teamwork, the ability to work collaboratively with a group with diverse expertise, experience, and backgrounds in a way that enhances the outcome is a very important skill in industry [10, 11]. Some university programs may include projects that involve a team of people contributing to a combined outcome, but the work is often done individually and the pieces combined at the end. That may be the first step in learning teamwork, but the ability to synergistically work together, developing ideas, approaches, and solutions beyond what an individual can do, is much more valued. This requires that the team members, who may have very diverse educations and experiences, be able to communicate and collaborate across functions and disciplines.

As the chemical enterprise has become global, the ability to work across geographies has become another required skill. Understanding the cultural differences and strengths, and the ability to communicate effectively regardless of language, time zone, or other barriers is a necessity. There are multiple ways to gain cultural awareness, including books, workshops, and international work experiences [12, 13]. Opportunities to develop these skills are becoming available in graduate and undergraduate research programs [2].

The value of strong communication skills, written and verbal, cannot be overemphasized [6, 9]. This includes understanding your audience, how they want to be communicated with, what they want to hear, and the frequency they expect. Consider the purpose and desired outcome of your message since you may structure your presentation differently if you want to share information or influence a decision [11]. Realize that your audience may have a different background and will filter your communications through their own experiences; they may not have any technical training. You will need to assess if the audience is internal to the company or external stakeholders, including customers, suppliers, or regulatory agencies. Recognize the amount of detail that you should provide with each communication; an executive summary followed by a more thorough explanation may be better received by some audiences. The reality is that a poor presentation may mask the excellence of the work described [5].

Two skills that have been important for decades, and continue to be important, are networking [14] and mentoring [15]. Since most successful industrial projects require collaboration across multiple functions, developing a broad network is vital. Employees with strong networks may be considered as "hubs" since they can connect problems and challenges with solution providers within their company. They may develop

a reputation as the go-to person and be drawn into a wide range of projects. Mentors are trusted advisors outside of your leadership chain. They may serve as a listening board, ask probing questions to help you better assess a decision, or provide career guidance. You may want to have a few methods for different aspects of your career. An inner circle of trusted colleagues is extremely important. They listen when you are having problems, provide authentic feedback, help you recognize hard truths, and celebrate your accomplishments.

Most industrial chemists begin as individual contributors. However, after a few years, you may have the opportunity to take on a leadership role, either as a technical leader or organizational (people) leader. As an organizational leader, you'll still be involved with technology but not as a hands-on practitioner. That role will likely include some managerial aspects. However, true leadership is focused on people, not things. You'll need to define a clear vision, develop a strategy to achieve it, and communicate the vision and strategy [8]. Emotional intelligence may be more important than IQ or technical expertise in these roles [16].

The sweet spot

Be sure to take the time to develop financial acumen, technical skills, and interprofessional skills and invest in your own professional growth. While your employer may provide courses or support, it's your career and you should own your development. A job that you are very good at and provides value to the company, but you don't enjoy easily becomes a chore. If you enjoy the work and do it well, but it is not valued by the company, then you really have a hobby. The best advice I've received is to aim for that sweet spot: a job that makes the most of your strengths and skills, provides value to the company, and is a job you really enjoy.

References:

1. A. E. Kondo, J. D. Fair. *J. Chem. Educ*. 94, 304 (2017).
2. D. Dierking. *Chemical Processing* (October 7, 2004), last accessed at https://www.chemicalprocessing.com/articles/2004/105.
3. B. L. Benderly. *Science* (May 3, 2013), last accessed at https://www.sciencemag.org/careers/2013/05/how-succeed-industry-really-trying, doi: 10.1126/science.caredit.a1300090.
4. D. M. Burland, M. P. Doyle, M. E. Rogers, T. M. Masciangioli. Preparing Chemists and Chemical Engineers for Globally Oriented Workfoce: A Workshop Report to the Chemical Sciences Roundtable, National Academies Press, Washington, DC (2004).
5. J. W. Pellegrino, M. L. Hilton. Education for Life and Work: Developing Transferable Knowledge and Skills in the 21st Century, National Academies Press, Washington, DC (2012).
6. L. Rider, C. Klaeysen. Employer Perspectives on Soft Skills: 2014 Survey Report, Washington State Human Resources Council, Seattle (2015).
7. Peace Corps, Culture Matters: The Peace Corps Cross-Cultural Workbook, U.S. Government Printing Office, Washington,D.C. (2012).
8. E. Meyer. The Culture Map, Public Affairs, NY (2014), ISBN 1610392760.
9. R. Wedin. Career View: Networking – How Chemists Form New Bonds, Chemistry, 13 (Autumn 2003), accessed at www.wedincommunications.com
10. R. Wedin, Women in Industry: A Formula for Success, *Today's Chemist at Work* 26 (September 2003), accessed at http://pubs.acs.org/subscribe/archive/tcaw/12/i09/pdf/903wedin.pdf
11. R. Wedin, The Meaning of Mentoring, *Today's Chemist at Work* 41 (March 2003), last accessed at http://pubs.acs.org/subscribe/archive/tcaw/12/i03/pdf/303workplace.pdf
12. A. Hinkle, L. Krannich. *Chem. Eng. News*. 90, 39 (2012).
13. T. M. Thorpe, A. H. Ullman. *Anal Chemi*. 68, 477A (1996).
14. S. Kerr, O. Runquist. *J. Chem. Ed*. 82, 231 (2005).
15. T. Rath. Strength Finders 2.0, Gallup Press, NY (2007).
16. D. Goleman. Working with emotional intelligence, Bantam Books, NY (1998).

Carolyn Ribes <cribes@dow.com> is the Business Analytical Leader for Industrial Intermediates and Infrastructure at Dow Chemical. She earned her B.S. in Chemistry at the University at Buffalo, SUNY, and a Ph.D. in Chemistry at the State University of New York at Buffalo in 1989. She joined the Dow Analytical Sciences R&D group in Plaquemine, Louisiana where she developed and implemented on-line analyzers for process control and monitoring. In 1997 she relocated to Freeport, Texas, as part of dual-career move within Dow, and expanded her responsibilities in process analysis to global projects. In 2006, Carolyn moved to Terneuzen, the Netherlands, as the process analytical technology leader for Europe. In 2009, she became a Business Analytical Leader; in this role she defines and implements the business manufacturing analytical strategy to support quality control and manufacturing operations. Carolyn is active in WIN, Dow's Women's Innovation Network. She was a member of the IUPAC Committee on Chemistry and Industry (COCI) from 2008-2019 and Chair of COCI in 2018-2019, and a member of the US National Committee to IUPAC 2005-2011. She served as Co-Chair of the IUPAC Distinguished Women in Chemistry and Chemical Engineering Award Committee from 2012-2019. Carolyn has been a volunteer leader in the American Chemical Society, serving local sections, the Analytical Division, and several national committees and task forces. She was recently elected to the ACS Board of Directors. She is a Fellow of the American Chemical Society (2014), received the 2019 Award for Volunteer Service to the American Chemical Society, and was named one of the 2011 Distinguished Women in Chemistry and Chemical Engineering by IUPAC.