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# Paradigm shifts in academia and the food industry required to meet innovation challenges☆

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Open innovation (OI) has made significant inroads in the last decade. OI utilization by the food industry and academia could become viable by adopting innovation partnerships and a new mindset coined as 'Sharing-is-Winning' model. Academia and the food industry need a mutual vision and thrust that includes paradigm shifts toward reforming the 'old' systems of teaching, learning, student involvement, industry's role, and increased social responsibility. Four paradigm shifts are specifically recommended: i. breaking down the walls between academia and industry; ii. a revised intellectual prosperities model; iii. cardinal management's role in driving the innovation process; iv. enhancing social responsibility.

## Introduction: open innovation

Europe's competitiveness, its capacity to create millions of new jobs to replace those lost in the current economic crisis and, overall, its future standard of living depend on its ability to drive innovation in products, services, business and social processes and models. This explains why innovation is at the heart of the Europe 2020 strategy. Innovation has also been identified as the best means for successfully tackling major societal challenges, such as climate change, energy and resource scarcity, health and aging, which are becoming more urgent by the day (European Commission, 2010). Innovation provides a unique opportunity to address global economic pressure, unstable business environments, accelerated growth of scientific knowledge and technological complexity, and the ever growing need to meet consumer demands and expectations. Innovation is the application of ideas, technology and processes in novel ways to gain a competitive advantage and create value. Innovation plays a vital role in all facets of modern life. It is also a major driving force toward creating new solutions for coping with bottom-line pressure, sustaining a competitive advantage, and developing new products and services. Innovation is paramount for survival and meeting the challenges of the future.

Innovation is defined in many different ways. We define innovation as: the process of transforming a discovery (i.e., idea, invention) into a good(s) or service(s) that consumers/customers are willing to purchase. It is a multi-aspect process, in which science, technology, marketing and organization, as well as other key aspects such as partnership, risk and social responsibility, play a role. For society to benefit, discoveries must be translated into products, services or processes that are diffused and integrated into the economy. It is important to note that to be defined as innovation, an idea/invention must be replicable at an economical cost, and should satisfy a specific need(s). In addition, the ultimate test of innovation is not the number of ideas, but their implementation. Innovation is essential to gaining a competitive advantage and creating value, and its outcomes can be both tangible (e.g., new products, designs, expertise) and intangible (e.g., new processes and ways of conducting business).

The mantra 'innovate or die' no longer applies, insomuch as open innovation (OI) and innovation partnerships (INPs) constitute the new leitmotif for today's companies. OI has been defined as "*a paradigm that assumes firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology*" (Chesbrough, 2003). A more recent definition of OI is: "*the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively*" (Chesbrough, Vanhaverbeke, & West, 2006),

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highlighting the fact that OI has become a widespread practice. OI is founded on the reality that, in a world of vastly distributed knowledge and accelerated development, companies can no longer afford to rely on their own research, and consequently must utilize outside sources and buy or license processes, technologies, inventions and solutions (Traitler, 2009; Traitler & Saguy, 2009).

OI has seen massive expansion in recent years (e.g., Chesbrough, 2010; Gassmann, Enkel, & Chesbrough, 2010; Raymond & St-Pierre, 2010). Two special issues of R&D Management Journal have been devoted to the topic (Enkel, Gassmann, & Chesbrough, 2009; Gassmann *et al*., 2010). The goal set back in 2000 by Proctor & Gamble (P&G) for their OI model of 'Connect + Develop'—that 50% of their innovation be acquired from outside the company—has made significant inroads (Lafley & Charan, 2008). A recent report (http://www.15inno.com/2010/06/02/criticalfactslessons/ visited Dec. 13, 2010) projects the following points: P&G works proactively with more than 85 networks and over 120 universities; 75% of their searches within these networks result in viable leads; P&G's 'open door' for unsolicited innovation submissions generated nearly 4000 leads in 2009; P&G site is now available in five languages; P&G invests in relationships over time, and has become the preferred partner for OI, with 40% of their relationships resulting in repeat deals; more than 50% of the innovation is sourced externally (up from less than 10% in 2001). P&G is externally recognized as one of the leaders in OI space; today, $3 billion in other companies' sales are powered by P&G assets, and P&G has 1000 contracts under management.

OI has mushroomed to include numerous industries (e.g., pharmaceuticals, Allarakhia, Kilgour, & Fuller, 2010; chemicals, Sieg, Wallin, & von Krogh, 2010; biotechnology, Rampersad, Quester, & Troshani, 2010; drugs, Munos, 2010; Talaga, 2009; software, Muller-Seitz & Reger, 2009). The food industry has followed suite (e.g., Bellairs, 2010; Erickson, 2008; Fortuin & Omta, 2009; Juriaanse, 2006; Kuhn, 2008; Sarkar & Costa, 2008; Traitler, 2009; Traitler & Saguy, 2009; Traitler, Watzke, & Saguy, 2011; Wolfert, Verdouw, Verloop, & Beulens, 2010). It is interesting to note, however, that even though the paradigm of OI is of particular interest to the agri-food sector because of its many chain and network ties, its potential has not been fully utilized. In fact, there is hardly any evidence of the use of this potent tool in this sector (Fortuin & Omta, 2009).

Despite OI's general widespread applications, numerous small and medium-size enterprises (SMEs) and others operating in traditional sectors are struggling with its implementation due to their relatively low level of absorptive capacity (Spithoven, Clarysse, & Knockaert, 2010), perceived management challenges (van de Vrande, de Jong, Vanhaverbeke, & de Rochemont, 2009), and lack of adequate resources and collaboration with other firms (Lee, Park, Yoon, & Park, 2010). Other barriers, such as focused business portfolio, specialized knowledge base, and limited financial resources that can be devoted to innovation activities have also been cited (Bianchi, Campodall'Orto, Frattini, & Vercesi, 2010). Many SMEs perceive P&G's OI model as prohibitively expensive. Some of this cost is associated with the substantial upfront investment in human resources required for assessing, selecting, and negotiating the external innovation contributions, and/or the paramount organizational changes required for implementation.

The untapped potential and full adaptation of OI is particularly relevant for the EU Food and Drink (F&D) SMEs, as its implementation is not straightforward, and for some it remains a struggle (Bianchi *et al*., 2010; Lee *et al*., 2010; Raymond & St-Pierre, 2010; Traitler *et al*., 2011; van de Vrande *et al*., 2009). It is important to note that according to official EU figures for 2009 (http://www.ciaa.be/documents/brochures/annual%20report%20CIAA%2009/pdf; visited Nov. 14, 2010), the F&D industry is the largest manufacturing sector in Europe (annual turnover of €965 billion, representing 13% of the manufacturing sector's turnover). It is a key player in food chain purchases and processes, with 70% of EU agricultural production serving 500 million consumers who spend 13% of their household income on food. It employs some 4.4 million people, generating 14% of the total jobs in EU manufacturing. It is important to note that although the SMEs comprise 99.1% of some 310,000 companies and 63% of F&D employment, they generate only 49% of the F&D turnover. The fact that SMEs are struggling with OI calls for immediate consideration and specific action. This topic is now under deliberation by various EU bodies, as well as EFFoST, ISEKI and IUFOST.

Despite OI's numerous benefits, it has become an overexploited buzzword. Nevertheless, in its true sense of openness, OI is mainly applied in open source software (Melese, Lin, Chang, & Cohen, 2009; Muller-Seitz & Reger, 2009). Typical examples of open code are: Mozilla's Firefox browser and PHP, a widely used general-purpose scripting language that is especially suited for Web development and can be embedded into HTML.

The overall objective of this manuscript is to describe some of the important paradigm shifts required to meet mutual innovation challenges for industry and academia and to project possible opportunities. More specifically, the following goals are addressed: i. highlight some of the benefits of implementing the Sharing-is-Winning (SiW) model; ii. discuss academia/industry innovation challenges and the required paradigm shifts to meet them; iii. promote new thinking and ideas that will facilitate the implementation of innovation and encourage partnerships and networking; iv. increase social responsibility.

## Sharing-is-Winning model for academia and industry

Collaboration is a key piston in the engine driving economic growth. The SiW model is built on the fundamental principle that in order to initiate a collaboration, the solution seeker has to let the potential solution provider know

its precise needs and requirements in their initial dialog (Traitler *et al*., 2011). This indispensable prerequisite step is imperative to sharing needs/gaps/requirements openly and clearly with the proposed partner (defined as innovation partner). Subsequent to this step, the SiW model includes four essential additional stages: winning respect, building goodwill, establishing trust, and creating value along the value chain. Value creation is the ultimate goal of any partnership: without it, the concept holds no real merit for either partner. The main principles of SiW are (Traitler & Saguy, 2009): i. partner selection; ii. co-creation of intellectual properties (IPs); iii. joint creative problem-solving teams; iv. implementing best practices; v. sustainable and continuous processes affecting people, mindset, metrics, culture, and education. Ultimately, the overall objective of SiW is alignment of the value chain with consumer-centric innovations. Hence, SiW extends the definition of OI, namely, a new avenue for collaboration in all areas of discovery and development with external partners who bring competence, commitment and speed to the relationship, and also share the risk of innovation (Traitler *et al*., 2011). This roadmap, which was originally developed for Nestlé (Traitler, 2009; Traitler & Saguy, 2009; Traitler *et al*., 2011), has also been implemented in the drug discovery industry (Talaga, 2009), and fits the OI scheme of 'outside-in' as the coupled process but not 'inside-out'. A coupled process refers to co-creation with (mainly) complementary partners through alliances, cooperation, and joint ventures that are vital for success (Enkel *et al*., 2009). However, most food companies feel that they are not ready to share their IPs and to date, the inside-out process has not materialized.

The major benefits of achieving SiW's goals in the industry are (Traitler, 2009; Traitler & Saguy, 2009; Traitler *et al*., 2011): acceleration obtained by co-development of a sustainable innovation process; removing the burden of resources and time pressure from the shoulders of a single partner by sharing human and physical resources and postponing out-of-pocket investments until the project has been launched; gaining critical mass; collaborations with motivated, talented and highly skilled experts; embracing culture openness, networks, social impact and risk-taking. However, in considering collaborations with academia, these goals are not fully shared. The main barrier to such collaborations is academia's long history of working in isolation and its different value chains. For instance, some ethical conflicts threaten academia itself by distracting it from teaching and basic research, undermining collegiality, encouraging secrecy, preventing or delaying publication, and devaluing the human component (Tyler, 2009). However, this simplistic expose furnishes only a partial explanation for why the industry and academia continue to 'stay at arm's length'.

The most traditional conflicts in academia–industry collaborations are: confidentiality, publishing, and IPs rights and ownership. Additional concerns about potential conflicts of interest arise when members of the academic community interact with industry as consultants, scientific advisors or in other capacities. However, these concerns should not undercut the development of mutually beneficial collaborative relationships. Organization, culture and funding have been identified as the constraints which most often have a substantial influence on the negotiations, sometimes undermining the primary purpose of the collaborative relationship (Melese *et al*., 2009). Another important factor is related to the main focus of the research: while most of the effort at university centers is invested in fundamental research (defined as R), the industry focuses mainly on development (D) and the typical ratio of D to R in the food industry can be 4:1 or higher. This difference also reflects fundamentally different needs and mindsets.

Another basic difference between academia and industry is the value chain. While industry is driven mainly by its bottom line (e.g., maximizing a profit function, market share, consumer acceptance), and its quest to gain full IP rights, academia is driven mainly by the pursuit of basic science and knowledge dissemination, student education and publications (e.g., 'publish or perish'). In addition, academia often seeks full IP rights as well. Nevertheless, with the progress in OI, it is generally recognized that academic freedom and biased company-sponsored research are becoming a myth. Hence, the metaphorical model of two completely separate identities divided by a wall (real or perceived), for which the only means of communication is through a Liaison Office for Technology Transfer with IP, is no longer feasible or possible. Some of the main driving forces that have had a significant impact on pushing the parties together are dwindling resources, research complexity and the prohibitive exponential rise in its cost. Consequently, no company or university is immune to these global changes or the pressure.

It is generally accepted, especially by EU countries, that university innovations have underutilized and unrealized potential that continues to lie dormant (Anonymous, 2010). Consequently, sustained efforts to advance university innovations are needed. Building bridges between university researchers and businesses is critical for knowledge transfer—this is no longer an option but a must, and SiW model can pave the way. To make a significant change, however, several paradigms shifts are necessary, as described further on.

A word of caution is also warranted. A recent study examining 4.2 million papers published over the last three decades has shown that teamwork in science is spanning more and more university boundaries, producing a dramatic shift in knowledge which now generalizes across virtually all fields of science, engineering, and social science. Moreover, elite universities are playing a dominant role in this shift. Multi-university collaborations: i. are the fastest-growing type of authorship structure; ii. produce the highest-impact papers when they include a top-tier university; iii. are increasingly stratified by in-group university

rankings (Jones, Wuchty, & Uzzi, 2008). These findings are quite alarming as they suggest a concentration of the production of scientific knowledge in fewer rather than more centers of high-impact science, counterproductive to the core values of SiW.

## Paradigm shifts

To significantly change academia–industry innovation outcome, it is suggested that the SiW principles be adopted and in conjunction, that selected four paradigm shifts be implemented: i. breaking down the walls between academia and industry; ii. revising the IP model; iii. cardinal management's role in driving the innovation process; iv. increasing social responsibility.

### Breaking down the walls between academia and industry

As already defined, innovation is about taking an invention and turning it into a product or service. It should be re-emphasized that the first and foremost step in this process relies on fundamental research. Such research is carried out mainly in academia and selected R&D centers. Fundamental research will continue to define the main goal of academia: only those who excel will be able to lead and attract the necessary human and financial resources. However, this is only the first step toward innovation. The road between a discovery generated from basic research to a commercial product, process or service is long and rife with significant obstacles. Typically, a 'funding gap' or 'Valley of Death' (VoD) exists between basic research and commercialization of a new product (Auerswald, Branscomb, Demos, & Min, 2005; Beard, Ford, Koutsky, & Spiwak, 2009; Branscomb & Auerswald, 2002; Markham, 2002; Markham, Ward, Aiman-Smith, & Kingon, 2010). More recently, the VoD has been defined as the: "*gap between the formal roles, activities, and resourcespoured into research and the existing formal new product development (NPD) roles, activities, processes, and resources that lead toward commercialization*" (Markham *et al*., 2010).

The phrase VoD was originally used to refer to the challenges of transferring agricultural technologies to third-world countries. The phrase was also applied to describe the resource gap between R&D labs or units and commercialization within organizations (Markham *et al*., 2010). The VoD is also described as the place where good lab discoveries 'go to die', because they lack the necessary funding to become commercial products (Heller & Peterson, 2005). A VoD can only exist if innovation is viewed as a sequential process. Another term that has been suggested to express the disjuncture between basic research and the business world is 'Darwinian sea'. This term refers to the metaphor for science and technology being on one shore, and enterprise, business and financial enterprise on the other, while between them lies a sea of life and death for business and technological ideas, of big fish and little fish in competition, with survival going to the creative, the agile and the persistent (Auerswald *et al*., 2005; Branscomb & Auerswald, 2002). To simplify the concept of VoD, the innovation sequence can be typically depicted in three stages: Stage 1 is basic research—providing what is known as the 'front end' of innovation. Typically, for the academician, this 'front end of innovation' is the 'back end' of fundamental research. Stage 1 is also termed pre-NPD, which includes the 'fuzzy front end'. Stage 2 describes the transformation from basic research outcome into a potentially marketable product or service. Stage 3 is commercialization and diffusion of a new product or service. It is worth noting that only projects reaching Stage 3 have economic value (Beard *et al*., 2009). More recently, a four-stage process has been suggested to realistically describe the business arena. The process includes (Markham *et al*., 2010): i. basic R&D; ii. pre-NPD; iii. development; iv. commercialization. It is important to note that VoD is not just an impassable gorge where numerous inventions are buried; it is also a productive tool for identifying and understanding a critical area of development that has not been adequately addressed. Moreover, it generates a dynamic interplay between roles to accomplish tasks that are not well understood. It has been suggested that companies must understand the challenges in the VoD, develop the necessary skills, and make resources available to master the front end of product innovation (Markham *et al*., 2010).

The role of 'non-economic' investments (such as government expenditure on basic research), which are made at a very early stage of the research without sufficient attention to the likely investment decisions at later stages of the innovation process, was recently described (Beard *et al*., 2009). The particular practices of the government in R&D support may be the most significant contributor to the emergence of a VoD. Intervention at early stages of the innovation process can exacerbate the problem of underinvestment in intermediate-stage research, suggesting that government activity (or that of other non-economic agents) in basic research contributes to the creation of a VoD in (at least) two ways: first, by creating a rift or 'valley' in the innovation sequence by inflating the output of basic research above the funding level that will be invested at a later stage, and by altering the cost of funds at intermediate stages. Therefore, a government that is concerned about generating economic value from its basic R&D efforts should enhance its support of intermediate-stage research (Beard *et al*., 2009). These findings should be carefully considered by EU authorities when assessing if and how to shift their resources in order to enhance SMEs innovation. The remote possibility that EU funding (e.g., 7th Framework Programme) has contributed to the creation of the VoD, and negatively affected innovation is striking and warrants in-depth analysis.

To build the bridge required to implement SiW model, academia also needs to recognize that its role does not end with conducting and excelling in basic and fundamental research. It should cross the VoD by learning the

industry's needs and driving the invention at least over the pre-NPD stage until the industry can pick it up. Typical pre-NPD includes these steps: i. affirming the technical viability of the invention as a product or service; ii. formalizing the product concept(s); iii. validating the concepts with market research; iv. developing a business case to gain commercial support, again using consumer research, marketing (Markham *et al*., 2010). While the invention is the initial major driving force, market research and the business case take the lead at later stages. Therefore, a sustainable partnership is required. This partnership calls for a proactive role and participation of both academia and industry in each step of the innovation. It calls for a new and different mindset on both sides.

To pinpoint the changes required to meet the challenges, let us first consider one of the biggest clichés of creativity, namely, 'thinking outside the box'. Indeed this is generally recommended for innovative thinking. Another approach is: "*If youre serious about innovation, you have to get serious and systematic about forgetting*" (Peters, 1999), "*abandon yesterday*," or organized abandonment (Drucker, 1999). We strongly disagree with this latter approach: one needs to challenge old assumptions, break away from conventional thinking, and actively take off the blinders formed by past experiences. Hence, it is suggested that a different attitude be adopted, defined as an 'inside/outside the box' approach. While academia should continue to focus on excelling in fundamental research ('inside the box'), it should simultaneously adopt an 'outside the box' approach by utilizing SiW principles. This requires a new mindset, so that knowledge, technology and solutions can flow smoothly in both directions across universities and industry boundaries. In addition, it would be extremely effective to lower the barriers of the amplified VoD, mainly during Stage 2 which is marked by the transformation from basic research into a potentially marketable product or service. Some of the specific recommended changes are:

1) Elevating the status and role of applied research. Enhancing the importance of applied research in academia is a crucial requirement. This will lead to a significant improvement in teaching quality by bringing the focus to relevant topics. It will also attract students who will be able to interact directly with industry, working on topics of commercial importance. Hands-on research opportunities increase knowledge and marketability. Such a change will also create a magnet for resources and enhance collaboration with industry. This relationship will ultimately enhance the university's reputation, thereby allowing it to recruit higher-quality faculty, who attract more research funding which in turn may yield breakthrough advances in research, perpetuating the cycle—all to the benefit of faculty, students and the university (Tyler, 2009).
2) A new role for the professor. The deep-rooted characteristics of the professor also need to be assessed. While in the past, a few professors were called upon for consulting, in today's environment, this is no longer sufficient. It is obvious that academia and industry need each other to create the afore-discussed partnership. Academia needs to play a proactive role, driven by the synergistic power of working together, and become a full member of the industrial team. This could require devoting ample time (e.g., 1 day per week or longer) in the particular industry to demolish previous barriers (real or perceived), and become an 'organic' member of the OI industrial team. The enhanced presence of academicians in industry and advanced collaborations will create many new avenues for students to carry out their complete research theses (Ph.D. or M.Sc.) in the industrial setting, as they will have their professor and his or her colleagues simultaneously at the industry and university. This model could have significant results, such as opening the door to industrial internships, fellowships, advanced education, etc. Last but not least, with the ballooning cost of equipment, access to sophisticated industrial laboratory equipment and resources is a huge and very significant benefit. Encouraging academic researchers to supervise joint theses carried out partially/fully in the industry is very strongly recommended, as is encouraging them to become full members of industrial teams.
3) Industrial involvement. The new model also calls for industrial involvement, mainly of its experts, to transform their role into becoming proactive in teaching graduate courses, mentoring research, serving on university committees and boards, and contributing to the strategic thinking of the universities.

## Revised IP model

In general, the fact that innovation cannot exist without IP rights is a given. In the past, most companies were driven to own all IPs, which very often led to endless and fruitless discussions, with no real satisfactory solutions for either party. The IP question is a 'Gordian knot' that needs resolving. Some IP rights are regulated by law, such as when considering research supported by federal or state funds. The technology transfer office (TTO) acts as a broker between academia and industry by providing expertise and managing the commercialization process related to technology transfer, patenting, licensing and the creation of start-up companies. They also typically function as boundary spanners and translators, by bridging cultural and value-related barriers (Ambos, Makela, Birkinshaw, & D'Este, 2008). One would expect that the existence of a TTO would increase the likelihood of commercial outputs from academic research projects. However, the TTO seems to have emerged without adequate consideration of how it fits within and serves the academic mission, the numerous IP strategies available in addition to patenting and

licensing, and the financial and personnel resources necessary to operate such offices most effectively (Tyler, 2009).

In many cases, focusing only on IP rights has become an impassable and sometimes even crippling barrier for innovation success. This concern is even more salient in an OI ecosystem. It is worth noting that even among many industries, some patents are known as 'kiss of death' patents that remain non-commercialized. For instance, Siemens and P&G recently reported that they only use 10% of their patent portfolio (Alexy, Criscuolo, & Salter, 2009). Non-utilization of the other 90% highlights a real opportunity for creating value from the possibility of sharing IP rights, as well as from other avenues, based on the OI roadmap. Proactive management as well as SiW seek to identify opportunities for sharing IPs to create real value (Hunter & Stephens, 2010), as well as new IP business models.

To avoid stagnant situations, the complex IP issue requires special attention and new business models for co-sharing. An example of IP management can be taken from the University of California at Berkeley, which ranks seventh in the world in biotechnology patenting (DeVol *et al*., 2010). UC Berkeley's Office of Intellectual Property and Industry Research Alliances (IPIRA) overviews the university's transactions, which must be varied and flexible to achieve an array of outcomes that match the mutual goals of industry and the university. This array spans an entire relationship continuum. IPIRA supports Berkeley's research enterprise and its goal of deploying research results for social impact and public benefit. When universities elect to make academic discoveries proprietary by obtaining IP rights, and when they license those rights, they demonstrating good stewardship (Mimura, 2010).

We can conclude that revenue generation from IP rights, although very important, should sometimes be considered of secondary importance. Network collaborations and partnerships are key. To achieve maximal social impact and optimal accessibility, multiple and diverse IP-management strategies are required. Adapting increasingly shared approaches and developing best practices for maximizing social responsibility are still required. This social responsibility should be practiced by all TTOs and academia. A special burden rests on the shoulders of the academician to lead this movement, and to provide his/her leadership by personal example.

Another cliché that is frequently used in describing innovation is that "necessity is the mother of invention." Although in many cases this may be justified, the existence of too many constraints does not drive innovation; in fact in most cases, it does just the opposite. Innovation needs people, commitment, resources, structure and a suitable culture. More innovation typically occurs in times of abundance than in times of hardship. Therefore, in considering IP rights, we should also include the topic of adequate funding, especially that defined as 'unrestricted grants' and 'blue sky' research. Industry needs to take a more proactive role in developing this area.

## Cardinal management's role in driving the innovation process

Value creation is the ultimate goal of any partnership. To drive value creation, organizations must apply a disciplined approach to their innovation process. Management commitment is vital for integrating the INP approach, as it demands an "opening of the innovation process", nourishing and embracing the participating partner(s), sustaining and managing its progress. OI and INP rely heavily on the support of senior management throughout the process (Traitler *et al*., 2011).

Random collisions and interactions among innovation contributors is not an option. The new mantra has changed from 'innovate or die' only a decade ago to 'partner or perish' today—a new tune and way of life. To thrive, management should institutionalize alliances/partnerships (i.e., inside–inside, outside-in, and possibly also inside-out) to enhance cross-fertilization and synergy. Aligning university and industry co-development of sustainable innovation is not straightforward: it requires considerable planning and management. The role of management in both industry and academia is to provide the leadership and cultural openness that will sustain the co-development. This calls for the development of a new and fresh way of thinking. We suspect that this will rely heavily on the personalities involved and the cultures of the organizations taking part. Moreover, it will require truly new thinking at both academia and industry levels. Real change does not come about through simple incremental developments, and conventional stepwise improvements do not suffice. The change has to be bolder, requiring novel thinking and new leadership (Moskowitz & Saguy, forthcoming).

Management's foremost role is to recognize that they are the "gatekeepers" of the flow (Watzke & Saguy, 2001) and must promote the required organizational changes in industry. At the level of academia, management should develop a strategy that promotes collaborations and elevate the academic importance of applied R&D as outlined earlier. In specific terms, management must actively create a new climate for academia-industry collaboration. However, this is not enough: until academia undergoes a significant change in which it will consider applied research, social contributions and overall impact of its research and inventions, this could be a real stumbling block that needs further consideration.

Openness cannot simply be wished for: it must be engineered into the new system. Academia and industry need a mutually shared vision, a coordinated thrust toward reforming the "old" systems, not only of relationships between industry and academia, but maybe more importantly, of teaching, learning and studying. Academia must bring students into the new corporate reality that has emerged in the last decade and will continue to develop in the foreseeable future. Perhaps the first task is to inculcate a recognition of the new reality into students, namely that science, technology, knowledge, business and social

responsibility are all part of today's new world requirements (Moskowitz & Saguy, forthcoming).

Management faces unresolved problems of changing environment, skills and expectations and consequently, it needs to embrace change, even if this change sometimes lies outside its boundaries. Managements in industry and academia need to mutually adapt a SiW mentality fostering collaboration, facilitating OI inside/outside approaches and reducing constraints (either real or perceived), in order to foster innovation. This mindset does not come easily and requires considerable adaptation on both sides. However, management's role is to lead and in this, innovation plays a very important role, as clearly projected by the citation (attributed to Steve Jobs): "*Innovation distinguishes between a leader and a follower*."

Worth noting is the unique tension between academic and commercial demands, a tension which is found to be more salient at the level of the individual researcher than at the level of the organization. A recent study has shown that it is possible to achieve ambidexterity at the university level through a combination of excellence in scientific research and the provision of a 'dual structure' to facilitate the commercialization of academic inventions. The tension between academic and commercial demands is typically managed through this dual structure (Ambos *et al*., 2008). Our experience indicates that the creation of two different 'camps' should be avoided as ultimately this will lead to enhancing the separation between applied and fundamental research. We believe that avoiding separation while enhancing the importance of applied research is the only way forward. Last but not least, an integrated framework is needed to manage the innovation process. To facilitate partnerships and improve the chances for innovation outcome, industrial management, academia and TTOs have to be aligned so that all stakeholder can share the efforts and benefits.

### Increased social responsibility

For a business to create value for its shareholders over the long term, it must also bring value to society. Since the first emergence of Corporate Social Responsibility (CSR) in the 1950s (De Bakker, Groenewegen, & Den Hond, 2005), this concept has developed from relatively uncoordinated and voluntary practices to more explicit commitments in response to stakeholder pressure and, recently, ongoing and future commitments. CSR has moved from ideology to reality and represents an important dimension in contemporary business practices (Maon, Lindgreen, & Swaen, 2009). CSR has also been implemented in OI to promote innovation (e.g., Jenkins, 2009; Rama, Milano, Salas, & Liu, 2009; Zwetsloot, 2003).

Worth noting is Nestlé's move to the contemporary term Creating Shared Value (CSV), defined as: "*Creating shared value is not about philanthropy. It is about leveraging core activities and partnerships for the joint benefit of the people in the countries where we operate*" (Nestlé Chairman and Chief Executive Officer, 2010). This approach deserves additional consideration so that it can also be adopted by academia. Universities have an important social responsibility and therefore should play a major role in maximizing research impact while simultaneously considering CSV. This should include scientific merits as well as overall contribution to society. Metrics for quantifying scientific contributions have been developed over the years (e.g., journal quality, impact factor, number of citations), as have measures of financial success (e.g., patents, licensing, royalties). The social impact-associated with CSR and CSV are still vague concepts. The development of suitable metrics to assess and evaluate research's overall contribution lies at our doorstep, and it is our responsibility to address this complex topic. Metrics have a spectrum of important dimensions. On the one hand, metrics should continue to promote the high quality of fundamental research, reward scientific breakthroughs, enhance OI and partnerships. On the other, they should also facilitate and enhance contributions to society. A genuine concern for society in all actions and decisions should become the norm and an integral part of the innovation process.

## Conclusions

Herein, selected four paradigm shifts are recommended: i. breaking down the walls between academia and industry; ii. revising the IP model; iii. cardinal management's role in driving the innovation process; iv. enhancing social responsibility. The recommendations for paradigm shifts call for real, measurable, meaningful actions. They constitute what is envisioned as a blueprint for jump-starting the process that is required to meet the innovation challenges facing academia and the food industry. Although significant changes are recommended, we realize that, in addition to moving forward, a consensus needs to be created, requiring open deliberations and further discussion. To effectively cope with the accelerating development of science and technology, universities and industry need each other. This need is amplified by the quest for highly qualified human resources and the ever-increasing cost of research and equipment. The innovation process creates value and should also include implicit social responsibility. SiW offers a win–win approach to addressing these topics but it requires additional input from all key players. It requires passionate and committed leaders, academicians, human resources and organization. Partnerships offer an opportunity to co-innovate the future. Integrating the whole innovation process should therefore take into consideration the social contribution. That which has been the norm is no longer sufficient; together we can make a difference and we must not fail to try.

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