Nanotechnology: Producer/Downstream user Guide to INSCX™ exhange
Integrated Nanoscience and Commodity Exchange (INSCX)

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INSCX™ exchange (The “Exchange”) is akin to other exchanges such as the Chicago Mercantile Exchange, the London Metal Exchange, and other commodity exchanges around the world. These institutions all have in common the feature that they allow standardized items to be bought and sold in a standardized fashion. Transaction costs (including those associated with price discovery) are thereby greatly reduced compared with the alternative mode of doing business, namely through bilateral contracts between supplier and buyer. Exchange also enable SPOT (Near term) and Forward (Term Contract) procurement and sourcing of listed commodities.

An exchange therefore constitutes the most perfect practical form of a market. A simple fruit and vegetable market is a rudimentary kind of exchange, with the same qualities of transparency and openness that make the exchange an attractive medium for doing business.

"Standardized items" means that the items (e.g., particular grades of copper or wheat) fulfil published specifications. "Standardized item" is synonymous with "commodity". An exchange will generally have the means for testing to ensure that items offered for sale on the exchange fulfill the specifications of the commodity listed for trade on the Exchange. In order to ensure smooth running, both sellers and buyers have to register (i.e., become members of the exchange). By doing so, they agree to abide by the rules of the exchange. These rules (such as the prohibition of "insider trading, front-running, declaration of open-interest and conduct of agents through whom commercial users instruct trade") are strict, in order to ensure that both seller and buyer are offered a neutral marketplace to get the best possible deal.

Forward Trade:

One of the most important commercial innovations ushered in by exchanges was the concept of forward selling, a concept dating from the mid 1800’s, in which the supplier is contractually bound to deliver a certain quantity of the commodity at a

certain time in the future and the buyer is contractually bound to pay for it. The more sophisticated the technology, the more important this is, because the preparation of the commodity demands more and more time and investment. Forward selling overcomes the often ruinous risk of production in advance of demand. A fisherman, for example, spends all night at sea but he does not know how many fish he will catch, nor does he know, when he returns to land, how many he will sell, although in both cases experience and learning strategies help to reduce uncertainty (e.g., [1]).

The exchange provides as nearly perfect a mechanism for adjusting supply to demand as is practically possible. If a good X (e.g., a certain grade of copper) is in short supply relative to the demand, this will be noticed by the suppliers and they will increase the price. The higher prices will attract more suppliers (e.g., those with more expensive means of production who would have been unable to sell at the previously lower price). It will also encourage forward selling, which provides the financial guarantee enabling investment to expand production facilities. (Nowadays, metal is nearly always sold when it is still in the ground as ore; as soon as the sale is agreed the miners rushed to dig it out and put it through the extraction and refining processes.) Conversely, if there is a glut the price will fall and suppliers will withdraw until a balance is again achieved.

Alternatives:

The alternative mode of business, such as is practised by the chemical industry, in which there is no exchange, even for the chemicals made in the largest volumes, is typically characterized by enormous price differences among suppliers, enormous price fluctuations, and extreme fluctuations of supply. Business has arranged itself to accommodate this endemic uncertainty, but a huge amount of effort is essentially wasted in the process, compared with organizing an exchange, exacerbated by the inertia due to the large capital investment needed for many chemical production facilities.

Presumably exchanges have never been organized in the chemical industry because suppliers believe they can command premium prices through the lack of transparency. The semiconductor industry has also traditionally eschewed exchanges for "chips" (very large-scale integrated circuits), perhaps because they were considered to be too sophisticated and special to be labelled "mere" commodities. This viewpoint is, however, based on a fundamental misunderstanding.

Just because a good fulfils published specifications and can be traded on an exchange does not preclude it from being sophisticated. (Indeed, food products

are, in terms of their internal structure, incredibly sophisticated -- so much so that it is still impossible for humans to mimic them artificially.) In fact, "chips" are produced to strict specifications and in effect we have seen to commoditization of a range of microprocessors (e.g., the 386), without which their ubiquitous introduction into the domestic appliances, for example, would scarcely have been possible.

Challenges:

The present era of ultrahigh technology provides the most interesting challenge to an exchange. It is easy enough to test a batch of gold, or copper, whether it fulfils its specifications. Similarly with wheat (the testing of which does not, of course, involve detailed structural investigation at the molecular level). But the more sophisticated the product, the more difficult it is to specify it and test it for fulfillment. Rising to this challenge is INSCX™ exchange [2], an exchange dedicated to nanotechnology: nanomaterials, nanodevices and, eventually, nanosystems which was founded at the end of 2010.

INSCX™ exchange lists both emerging materials and more traditional commodity materials for trade. In respect of the latter the Exchange provides a global platform for trade in Base oils, Polymers, Minerals and Titanium Dioxide, all sectors relevant to embedding of emerging nanomaterials. Nanomaterials themselves being the raw materials of nanotechnology face immense difficulty transcending to become commercially viable.

The main commercial difficulty of nanotechnology at present is there is a multitude of very small companies (many of them are university spin-outs), each making a different product, in very small quantities. This makes it a very difficult for a potential user with a large-scale application to do business. Take, as an example, carbon nanotubes as an additive to create conductive polymers. A polymer manufacturer would need large quantities of a uniform specification with regular deliveries guaranteed. At present, no manufacturer is able to give this. If, however, all the small suppliers joined the exchange and produced their nanotubes according to the exchange's specification, the polymer manufacturer might be able to meet his demands.

Furthermore, through forward buying some of the small suppliers would again the financial guarantees enabling them to invest in order to expand their production facilities. As well as the direct benefits to both suppliers and buyers, this process would also lead to a general increase in the vitality of the industry, resulting in further growth, etc.

In the absence of the exchange, we will either see nanotechnology remaining as an essentially academic activity with little commercial significance (excluding materials such as carbon black, which were traded in large volumes long before the emergence of nanotechnology) or it will follow the route adopted by the chemical industry (indeed, many large chemical firms are now actively pursuing nanomaterials, developing them both through their own research and through buying up small, innovative companies).

In the latter case, the industry will be characterized by the same problems of price and supply fluctuations experienced by the chemical industry. But in the case of nanotechnology, because its products are more sophisticated than chemicals, and as nanomaterials become smarter, becoming in effect devices (e.g., "sensorial materials" [3]), the difference between nanotechnology and the chemical industry will become more marked, and the commercial difficulties of coping with the fluctuations might simply become so great that the industry is not viable.

Key Considerations:

The model adopted by INSCX™ exchange is aimed at providing the tools required by producers to strive toward greater commercial dependence on nanomaterials whilst enabling a market-driven system to embed self-regulation in a commercial and societal context.

As regards regulation, the Exchange formally operates a definitive track/trace system (designed to ensure visibility as a nanomaterials moves through the supply chain) and supports individual NM producers to acquire conformity to good industry practice as defined by the AssuredNano www.assurednano.eu standard. Equally, supply of materials through the Exchange system are subject to mandatory independent characterization to establish conformity to the promoted specification. Thus in summary, trade through the Exchange offers the following assurance:

- The nanomaterials exchanged are inspected (characterized) so ast to establish conformity to specification.
- Nanomaterials producers are operating compliant with best industry practices as defined by the AssuredNano www.assurednano.eu programme.
- The nanomaterials exchanged can be track/traced for both commercial reasons such as insurance, and societal reasons.
- Finally, beyond such considerations, the exchange clearly reflects a democratic ideal for the equitable organization of human society, in which transparency and openness is a vital element to ensure universal

participation in society. As technology becomes more and more sophisticated and widely diffused, ensuring that all members of society participate and feel that they have a stake in its continuing development appears to be essential to avoid anarchy.

Commercial Considerations:

A brief summary of the commercial considerations relevant to nanomaterials producers is as follows;

- Producers are offered the means to finance upscale through listing materials with the Exchange for forward sale. (The financing of production is a fundamental role long associated with the commodity exchange system.)
- Producers can combine to work with the Exchange to set specifications that require collective supply to meet current and future industry requirements. (At present many NM producers lack the ability in isolation to supply in volume at economies of scale thus reducing many applications using nanomaterials to the novel as opposed to industrial.)
- The Exchange track/trace system enables insurers to identify risk as a nanomaterial moves through the supply chain from source to finished product, object or device.
- The Exchange trade reporting system is complaint with the basic requirement for commercial confidentiality while can function transparent to official regulation agencies.

References:

* http://inscx.com

[1] P.M. Allen and M. Strathern, Complexity, stability and crises. In: *Complexity and Security*, pp. 71-92. Amsterdam: IOS Press (2008).

[2] C. McGovern, Commoditization of nanomaterials. *Nanotechnol. Perceptions* 6 (2010) 155-178.

[3] M. Lawo et al., Simulation techniques for the description of smart structures and sensorial materials. *J. Biol. Phys. Chem.* 9 (2009) 143-148.

11 May 2012