International Insurance Society
Mentorship Program

Risks Of The New Era

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Introduction

Emerging technologies present fascinating opportunities, but as with all new developments, they also create challenges. Throughout human history, we have always been able to learn & adapt & these new technologies afford us the chance to do so once more.

Technological progress is accelerating at a rapid pace across all businesses & as technology evolves, so do potential risks in different segments. to name a few of those risks, we can say: exposures to cyber-attacks are increasing; medical advances & pharmaceutical breakthroughs, the focus on having a healthy lifestyle & prolonged life span, which increases exposure for annuity or pension plan providers; new materials being used in new products could lead to new diseases that are not yet recognized & quantifiable which creates unknown implications for any number of product lines.

The emergence of these transformations are challenging the way insurance industry evaluates, analyzes & manages new exposures.

Two areas of focus

In addition to the existence of risks which are to some extent known to experts & scientists, there are new unknown risk due to the emergence of new technologies. Here I'm going to talk about two of them; one of them-3D printing- although its longer existence compare to the other one, it's not yet known thoroughly; & Artificial womb Technology (AWT)- as you may hear about in the news, announced officially on March,2nd ,2017.

3D printing: A technology that is Additive, disruptive & creative

Traditional manufacturing has been a subtractive process whereby an object is shaped by removing material through cutting, edging, sawing and drilling. 3D technology uses the completely opposite approach – material is added layer by layer to produce the object. This sequential layering – technically known as additive manufacturing (AM), offers a higher degree of creative flexibility, allowing the use of multiple materials in the course of construction, as well as the ability to print multiple colors and color combinations simultaneously.

In support of the topic (3D printing)

Zurich published "SMEs & risk in 2020" looking at new technologies that UK small businesses might be using in 2020, & this predicted that one of the biggest potential growth area is additive manufacturing or 3D printing due to its almost unlimited design possibilities & lack of waste.

Most companies are not ready for everything that is coming. 3D printing also known as the harbinger of the "third industrial revolution", is still not even on some risk managers' radar.

Our general awareness of the value and opportunity of 3D printing is relatively nascent and so many risk managers aren't prepared for it. All these notions highlight the importance of recognizing emerging technologies in order to be able to monitor their associated risks.

It's noteworthy to say that not all these technologies are necessarily disruptive; for instance, according to company's approach, 3D printing can be either sustaining or disruptive; it can be managed either as a sustaining innovation that you can use to improve your business or as a disruptive innovation that overtakes an existing market and puts companies out of business. Those companies that get on board early on with the new technology can use it in a sustaining way to enhance their product and become industry leaders. In other words, the timing of potential disruption is difficult to estimate; it depends on early adoption or late adoption. Question whether the risks of leveraging this new technology outweigh the benefits is of concern.

The double-edged sword technology

Clearly, 3D technology also known as "the next trillion dollar industry", is not just for industrial engineers or science hobbyists anymore, in virtually all industries – architecture, consumer products, construction, industrial design, automotive, aerospace, food, engineering, bio-technology and fashion. Everyone can be a manufacturer today, creating and selling a variety of products in the marketplace and without the type of safety and regulatory oversight that is imbedded in traditional manufacturing. The 3D printing industry is radically changing the business and personal lives of millions of people, and will do so for decades.

The risk landscape of 3D printing

In addition to design & intellectual infringements, 3D printing presents many types of risks, including product liability risks & environmental liability risks to name a few.

The following hazards associated with using 3D printers & in return cause some risks:

- Various hazards of 3D printer use as a result of highly combustible powders, flammable thermoplastics & high temperatures involved in the process of 3D printing.
- Rather than traditional "ink", 3D printers generally use plastic filaments comprising Acrylonitrile Butadiene Styrene (ABS) or Polylactic Acid (PLA), which are heated & passed through a fine nozzle, layer by layer, to print a solid object. The heated thermoplastic extruders have been shown to release significant aerosol emissions into the environment, which may cause serious harm to one's health, absent adequate ventilation.
- Available desktop 3D printers emitted between 20 billion & 300 billion Ultrafine Particles (UFPs) per minute. When these UFPs are inhaled, they can end up in the lungs &, in high concentrations, cause inflammation in the respiratory system. Emissions, such as in the workplace, present an increased risk for health issues because 3D printers are often sold as stand-alone devices without ventilation or filtration accessories.
- Another potential hazard in the 3D printing industry is combustible dust explosions. Dust explosions may pose a risk where there is 1. Combustible dust, 2. An ignition source, 3.

Oxygen in the air, 4. The dispersion of dust particles in sufficient quantity & concentration, & 5. Confinement of the dust cloud.

The risks facing those in the 3D printing space & those whose industries will be impacted by this new technology are as follows:

Product risk: since 3D printing changes the traditional manufacturing model, industries will need to determine who owns 3D printed product & in the event of an accident how will liability be apportioned? In an adverse incident, liability will be apportioned among participants in the manufacturing & distribution stream: product manufacturer, printer manufacturer, software designer, feedstock supplier, distributor & retailor.

Possible scenario: assume an auto parts manufacturer that makes a computer-aided design (CAD) or an image file available to auto part stores so that they may print 3D print replacement auto parts on demand & on-site in response to customer needs. An auto parts store sells the 3D printed part to a customer, who later is involved in an accident & blames the 3D-printed part for causing the accident. Those potentially sued for which insurance coverage might or might not have been obtained in the new world would include the auto parts manufacturer, the store, & the 3D printer manufacturer. Variations on this theme are what if the end user sells the part to someone else who is involved in an accident? Or, what if the individual printed the part on their own 3D printer? What coverage would the individual have as a supplier or indeed, a 3D manufacturer?

Technology risk: who owns the software & designs used to create products, particularly when users can make endless customization?

Cyber-security risk: as adoption of additive printing increases, companies face a dramatic shift from physical risks to cyber risks; manufacturers must deal with a new reality; there is little physical equipment to handle or inventory to store. The point is that how do you protect your designs & formulas? How do you prevent counterfeiting? Counterfeiting may become a pressing concern because 3D printing will simplify the manufacture of counterfeit goods.

Environmental risk: how do you address exhaust & disposal issues?

Contract risk: what kind of risk transfer or licensing agreements do you want to have in place?

Insurance risk: do you have the appropriate coverage & where will it be coming from?

Strategic risk: how do you handle reputation & intellectual property issues? What happens to your product lifecycle management?

Supply chain risk: does your supply chain risk increase or decrease?

Market risk: what differentiate your product? What happens to your geographical risk?

Risk management issues; Analyzing externalities

It is important that employers understand the risks posed by 3D printing in the workplace &, where appropriate, implementing preventive & mitigating measures. One of the keys to provide a safe workplace in the 3D printing environment is training employees on how to identify potential hazards, maintain clean & well-ventilated workspaces, & control dust & ignition sources to prevent explosions. Given the risks associated with 3D printing, it is also imperative for businesses to obtain appropriate insurance to protect against potential liabilities arising from 3D printing.

Brought together technical 3D expertise from various industries spanning medical to aviation application, to help industries understand technical assessments that should be considered for 3D printed products as part of a transparent evaluation process for future submissions of novel & unique products resulting from additive manufacturing techniques.

Topics that can be argued here can be categorized in 3 parts (like what FDA did for bio-printing):

1. Preprinting considerations (i.e. materials used, physical properties, recyclability, & part reproducibility & process validation)

2. Printing considerations (i.e. printing process characterization, process software & post-processing steps)

3. Post-printing considerations (i.e. cleaning/excess material removal, final device mechanics & needed verifications).

Given the fact that AM processes include both digital & physical components, a combination of strategies focused on both IT systems & physical objects may provide the most comprehensive initial approach.

3D printing & cyber-security

The shadow of cyber risk also lurks around 3D printing. Downloading, storing and transmitting 3D models creates a lot of opportunities for security breaches. Hackers can also modify components and sabotage a company with the intent to profit from cyber espionage, ransomware or simply in retaliation. The only people more excited about the capabilities of 3D printing than designers and manufacturers are counterfeiters. Counterfeiting and IP concerns continue to be one of the most cited challenges posed by additive manufacturing.

The use of AM is likely only going to grow in importance as its potential benefits for mass customization in health care, design innovation in automotive, aerospace, defense & supply chain impacts in all sectors continue to be realized. Therefore, proactively addressing cyber risk is critical. There is much work to be done in terms of identifying comprehensive & sustainable AM cyber practices & promulgating them through standards & where appropriate, additional regulations. Immediate steps such as conducting security risk assessment, developing mitigating

plans, protecting printers, & educating stakeholders can go a long way toward understanding & addressing AM cyber-security concerns. Those using AM need to monitor the development of new standards & solutions closely, also government & trade groups need to work diligently to identify concerns, develop & promote the use of leading standards to address these concerns.

Steps manufacturers can take as they work to establish a robust AM cyber-security strategy:

1. Conduct a thorough risk management

One of the first steps any organization can take is to conduct a security risk assessment. By doing so, it can identify the risks most prominent to its particular AM scenario, as well as any additional threats that might come into play as it explores other AM applications. This approach can, in turn, enable the organization to focus initial cyber-security efforts on the highest-risk areas, & identify & prioritize the various points of vulnerability throughout the digital thread or digital supply network. AM-specific applications of risk assessment can include examining the entirety of the digital thread, from scan/design to build & monitor, from test & validate to deliver & manage.

2. Adopt the existing regulations

3. Protect the design from the start

The AM process & the flow of digital information begins at the scan/design phase, when the object is either designed using computer modeling or scanned via 3D scanning. During this stage, the design is vulnerable to outright theft, locking of the file to prevent its use. Adopting an approach toward protecting files from theft or tampering is an important part of an AM cyber-security strategy.

4. Build protection into the print process

Look for standards & developments such as the use of chemicals to apply unique identifiers to AM products. To ensure an AM printer prints only approved objects, the printer may be isolated on the network, with controls in place to make sure only approved designers can submit files directly to the printer.

5. Remember the most vulnerable asset: people

By conducting a stakeholder analysis, manufacturers can identify parties involved in their AM efforts, both throughout the digital thread & the supply chain. Manufacturers can then work to educate these stakeholders about the importance of cyber-security, emphasize the risks & the importance of vigilance. Basic awareness building & ongoing education can go a long way toward mitigating security risks, encouraging individuals to exercise care & take precautions, recognize the importance of using security systems. The point is to encourage AM participants to use leading security practices, not to discourage use of AM technology or appropriate security practices.

Advantages & disadvantages

- Robert Weireter, vice president and senior underwriter at Swiss Re, " When you print out something in a small-scale environment, you have a lot of control over the process, and therefore over the quality of the finished product, " he said.

On one hand, 3D printing is not mass market yet. With 3D printing, questions arise when you increase the scale to a commercial level, Can you still ensure the quality of the finished product? The biggest danger to companies is failing to understand their exposures. Products that require customization are prime candidates for additive manufacturing. The ability to print items that are less expensive and more customized is already changing the fashion landscape and could have a significant effect on business strategy and risk management. When demand is uncertain, through customization of 3D technology, a business can make a few products on the 3D printer or engaged in a pilot program to test the market (market timing).

On the other hand, As companies begin to see small-scale 3D printing as a threat, they'll try to restrict it by expanding intellectual property protections and "in doing so, they will point to easily understood injuries to existing business model[s] (caused by 3D printing or not) such as lost sales, lower profits, and reduced employment.

- The real disruption about this technology is its higher accessibility; AM span numerous industries, as well as both the public and private sector & is currently an area of great interest. Due to the breadth of objects produced using AM across different industries, the technology is also beholden to a broad array of industry regulatory standards – as well as IT regulations that conventional manufacturers may not yet have to deal with, due to AM's reliance on digital technologies.

- The piracy of digital design files will likely be widespread and difficult to police. 3D-Printers are much more vulnerable to hackers than traditional manufacturing processes, and the incredibly short production time, magnifies the risk of counterfeits.

-There are more opportunities for obtaining banned products with 3-D printing.

- This technology raises tricky issues for the insurance industry. 3D printing blurs boundaries between the different roles in the production chain and makes it harder to trace the responsible party. Determining who is liable for the defect will be an issue since there are many participants involved in the production – printer manufacturer, software designer, materials supplier, distributor and retailer. Product liability does not always flow right back to the manufacturer, sellers also have a product liability risk. It may be the risk shifting from one part of the supply chain to another; even to the end consumer. To date, we are not aware of any case law regarding 3D printed product liability, so this is unchartered territory for users.

- A business using traditional means of ordering supplies or equipment can wait several days, weeks, or months to receive the materials needed to continue normal business operation. With

3D printing, the same object that would usually take a long period of time to order and receive from a manufacturer could possibly be printed on-site and significantly reduce the length of business interruption periods.

- Optimizing product designs, printing at or close to point of use, streamlining inventory management, and saving resources and costs throughout the product life cycle.

Rush to seize this business opportunity may cause manufacturers to overlook the potential risks found in the multiple applications of this process. We are not aware of any case law concerning it. Therefore, understanding how a loss will be defined in a court of law is still unclear. A manufacturer should work closely with its risk advisors, including legal counsel and insurance brokers, to keep anticipating any future risks that could spoil the rewards of this new technology.

Recommendations

- Some AM manufacturers have also considered tagging products with markers to indicate that products have been manufactured by design files, machines, and ingredients that have not been tampered with.

- Understanding risk exposures should be one of the first steps in determining whether it's a worthwhile investment. Companies should work closely with their IT and manufacturing colleagues to understand the risks, and then tap into insurance experts, their broker and underwriters to ensure that insurance coverage is properly crafted to address many risk exposures.

What can insurance do?

It's critical that insurance companies understand which technologies will matter most & prepare accordingly. In the case of 3D printers, some machines use higher level of heat, some machines are bigger & some require more or less interaction with the operator. Then there are the insurance risks associated with the design & end use of the product. As 3D printing is a multiple layering of materials, there is also the potential for a multiple layering of risks.

Not only does the finished 3D printed object present risks requiring insurance, but the 3D printing process itself also calls for environmental liability insurance because of the potential for raw materials being used to print 3D objects to release fine toxic particles into the atmosphere.

General liability insurers will be hit with coverage challenges as to what is & what is not a professional service when it comes to the design of a product?

Who is the designer, manufacturer or vendor of the object that was created? Is product liability coverage being afforded, & to what entity? Would, or how would, the "your work" or "your product" exclusions apply?

In terms of homeowners' insurance, if an insured produces a part of a machine at home, & it fails & causes damage, is this a business pursuit captured by the business pursuits' exclusion?

From an insurer standpoint, the onus will be on the agents, underwriters & risk managers to make sure they are asking the proper questions & are considering the implications of 3D printed objects. At the end of the day, understanding these risks will allow legislators & departments of insurance to better regulate these risks and insurers to better create corresponding products & coverages.

The duty of brokers

From the broker perspective, 3D – printing is unlikely to provide a new business bonanza. It is hard to see there is an enormous latent commercial opportunity waiting to burst out and have a significant impact on the bottom line. However, there will be demand for brokers who are up-to-date with cyber technology and for those, there is the potential for additional business. Brokers need to be aware of this technology as there are many risks, but it is not likely to lead to a particular line of insurance on offer in future. Despite this, brokers need to be careful when it comes to 3D-printing to ensure their clients do not lose their cover. For many businesses a shift to 3D manufacturing may represent a business operating drift, which needs to be reported to the insurer. Brokers need to identify the existence of this technology in a client's premises.

Existing or new coverages?

Although the risks are still being debated, insurers are considering whether existing products provide sufficient cover. There will more likely be a tweaking of policy wording than new covers. These are traditional risks relating to a new technology, rather than a completely new risk no one has ever thought before. Most agree that risks related to 3D printing fall under existing coverages. Aren't there already insurance products in place that deal with those issues regardless of whether they are related to 3D printing or not? Is there anything truly different about 3D printing from other manufacturing processes that will require entirely new insurance policies or is it simply a matter of expanding already existing insurance?

The insurance industry is addressing some disruptive technologies with new policies & products, while other technologies, such as 3D printers, fall within existing coverages. But it’s important to distinguish between the two.

Here are some metrics that seems reasonable for evaluating coverage for policyholders:

- Whether there are any increases in the risk to the insured as a result of the manufacturing process (e.g. additive manufacturing is not heavily regulated & poses the risk of counterfeit goods being printed & sold, arguably more so than traditional manufacturing)

- Any supply chain issues

- Complexities associated with the ability to trace the parties responsible for the defects in manufacturing & its potential impact on subrogation/recovery rights

- The number of jurisdictions in which the insured operates & their regulators

- Discussions with product developers that the policyholder uses

- The risks at each stage, from manufacturing the products to testing & distributing to the end user, including the risks associated with the quality of the raw materials being used & potentially new combinations of materials, which may not have been properly tested.

What can we do as policyholders/insurers to reduce the risk?

- Managing the product risks through greater traceability of designs, raw materials & components (including physical identifiers on products)

- Have an open dialogue with the insurer's risk manager to implement a risk-management solution

- Consider the need for product recall insurance

- Consider the need for worldwide coverage where products are sold globally

- Take mitigating actions & have contingency plans in place

- Include non-liability clauses, or caps to limit one's liability such as warranties, hold harmless or shared defense clauses to apportion risks.

- Review risk-management processes & show underwriters that key issues, such as maintaining quality control, have been addressed since the evolving technology of 3D printing means that companies (here known as policyholders) have to continually adapt their risk management models.

- The importance of understanding how a new technology is being used in order to minimize risk exposure.

3D printed product manufacturers and their insurers also need to keep a 3D perspective or any product liability regulatory developments, to ensure compliance and minimize the risk of potentially expensive defense litigation. The possible scenarios & what could be done to address insurance for them are numerous, & present interesting risk management concerns.

What regulatory body can do?

The point is that, technology often moving more rapidly than the law. The internet has now further complicated these issues. Or the inter-connectedness of these new technologies complicated the process.

As 3D printing continues to disrupt traditional manufacturing, products liability law will likely evolve to accommodate the new technology. Given the challenges associated with asserting a strict liability claim in the context of 3D printing, plaintiffs seeking to recover for personal injuries caused by 3D printing may be left having to pursue negligence claims. To prevail on a negligence

theory, a plaintiff must prove the existence of: Duty of care, breach of that duty, proximate causation & Resulting damages. But the question is that, who owes a duty of care to the plaintiff?

Here the legal meaning of terms determine the applicable laws. Thus, whether a policyholder receives coverage for claims for bodily injuries caused by a 3D printer, may depend on the particular jurisdiction's interpretation of these terms.

Some regulatory terms under strict liability theory

1. What counts as a "product" when it comes to 3D printing? 3D printing requires CAD models & code to operate the printer. Are these "products" as well? It can be argued that purely electronic data, at least under some tort laws (restatement third of torts), which defines a product as "tangible personal property distributed commercially for use or consumption". Courts for purposes of strict liability or negligence already have held that computer code does not constitute a "product" in other context (US versus Aleyniko,676 F. 3D 71 (2D Cir. April 11th 2012)). Similarly, courts consider that electronic StereoLitography "STL" files- the standard file type used by most additive manufacturing systems- would not constitute a product under the Restatement (Third) of torts, which defines products as "tangible property", potentially barring strict liability claims. If STL files are not considered products because of their intangibility, injured parties will not be able to pursue strict liability claims, which require proof of a manufacturing defect, design defect, or failure to warn with respect to a product, plus causation & injury. Such definition of "product", of course, would not preclude negligence or warranty liability, assuming that the other elements of such causes of action were present. On the other hand, whether or not something is tangible does not necessarily dictate whether it qualifies as a product for strict liability purposes. For example, courts have held that certain non-tangible items, such as electricity, qualify as products for purposes of imposing strict liability. Aeronautical maps & charts have also been held to be products. On the other hand, information in books generally has not been held to be a product. In addition, courts across the country have held that publishers may not be held liable for "informational defects" in published materials.

2. The defendant must play an "integral role in the overall production or marketing enterprise". To the extent that 3D printing is considered as a service, or as producing products for service providers, consumers may not be able to recover under a strict liability theory against 3D printing services. Courts often decline to impose strict liability on defendants whose primary objective is providing services- for example in the case of bio-printing, doctors & hospitals, entities that will be operating medical device 3D printers. The majority of courts view hospitals as service providers, not sellers of products, as they are neither affiliated with drug or device manufacturers nor marketers in the commercial sphere.

3. In order to prevail on a product claim, a plaintiff must show that the product, which allegedly caused the injuries, was placed on the market, with knowledge that the product would be used without inspection for defect, that the product was defective, & caused harm. Whether an end-user can recover for injuries under a strict liability theory will depend on a number of factors,

including whether the “seller is engaged in the business of selling products for use or consumption”, such as product manufacturers, retailers, & distributors, & it does not apply to the “occasional seller” of product “who is not engaged in that actively as a part of his business” (Racer VS. Utterman).

4. Whether a designer of a CAD file has a duty may depend on whether the plaintiff suffered personal or economic loss; rule have held that software developers do not have a duty of care to avoid intangible economic loss or emotional distress, & thus cannot be liable for negligence unless their software caused physical damages.

5. When a manufacturer or seller knows or should know of unreasonable dangers associated with the use of the product, & such dangers are not obvious to the user, there is a duty to warn of the dangers.

6. Product designers, inventors or patent holders, & similar entities that gave input into design, but not manufacturing, may be liable, if at all, solely in negligence. A final possibility, the manufacturer of the 3D printer itself, is unlikely to be held strictly liable because it only made a tool, & did not sell the actual injurious products, or its design software, to the plaintiff.

The key is not that 3D printing is so different from other types of manufacturing, the concern comes from situations where an insured is using 3D printing & the broker & underwriter are unaware of that. The real unknown surrounding 3D printing stems from the fact that there’s no case law on the books at this point, making it difficult to tell where/how fault (liability) will be assigned. So, underwriters can only give thought to what the exposure might be & anticipate potential coverage disputes.

3D printing is more than just a new technology. It has the potential to change how we work and live and influence the risks we face every day. With 3D printing come health exposures, security risks, intellectual property concerns, and fears of potential market dislocation.

Artificial Womb Technology (AWT)

The journey to ectogenesis had already started in 1880 when a wooden box for infants, outfitted with a compartment to hold a hot-water bottle. This simple box reduced the mortality of premature babies by nearly a half, but the design did not become much more technologically sophisticated until the 1950s. By the 1960s experiments began on incubators that would function smarter – almost like the womb itself. A truly artificial womb would need to replicate all the placenta’s functions, not just the womb’s fluids, bacteria and other stuff essential to the making of life. These 1960s experiments ultimately always failed, due to contamination or the catastrophic problems of maintaining circulation to the foetus’s hearts. While the incubators can provide warmth and humidity, they still cannot give any of the nutrients necessary for growth. About 22 weeks of pregnancy is the earliest any baby has survived birth. But 80% of babies born at 23 weeks and younger do not survive; and for the 20% who do – kept alive in incubators – there can be significant health issues, a result of their immature organs. Underdeveloped lungs

are a major battle in sustaining the very premature, for whom respiratory failure is the most common challenge. But the fragile state of the lungs is not the only concern for the parent of a premature baby; the brain also needs a great deal of medical attention. It is only at 37 to 40 weeks of gestation – full term – that the brain passes certain key milestones that allow it to provide support for life outside the womb. Because the brain is relatively immature at birth, it is more susceptible to injury from premature arrival in the outside world. For this reason, up to 95% of extremely premature babies born at 24 weeks will have issues – including blindness, profound deafness, cerebral palsy, and learning and other motor disabilities. Remaining in the womb just one month longer, to 28 weeks, dramatically lowers the rate of health complications to between 38% and 46%. Inspired by the way a foetus naturally relates to its mother, the device is comprised just of fluid and oxygen-carrying circuits (that allow a continuous removal of waste fluid and flow of nutrients), and an artificial placenta connected to a "Bio-bag" containing artificial amniotic fluid. Having matured outside their mothers' wombs, lambs, once were able to breathe independently, with no significant abnormalities of the lungs, brain or heart: or, interestingly, of the liver or kidneys – organs to which a pregnant mother is normally required to contribute nutrients so that they function correctly.

Ethical & legal issues

Over the years scientists wary of the ethical tangles involved have become silent (or been silenced) on its creation. Surprisingly, many religious groups that are strongly against abortion & stem cell research have come out in favor of artificial wombs.

If an artificial womb being developed, the government could pass a law that required people who have a termination of pregnancy to put the fetus into one of these wombs but the point is that if we put all these in artificial wombs & then put them up for adoption we could have more babies & that would be a nightmare if not being planned for properly. At the very least, if women were given the option of transferring their embryos to an artificial wombs to be carried to full term it might dissuade them from having abortions. The danger is that, this would leave the adoption services over-burdened & put many more children into flawed foster care systems.

It's more politically correct to help people get babies than do the reverse, but it's important to have a balance.

According to related codes' of conduct, mother is the woman who gave birth to a child. What about the woman who didn't give birth to a child may request the denial of motherhood without any consequences, even if she is a biological mother. It is unclear what thinks to society about subrogation, artificial wombs or uterus transplant, because knowledge of these subjects is really low.

Women – even young women – without wombs (some from birth, others as a result of disease) are no small minority. During pregnancy up to 15% of women are believed to use alcohol, and about 5% use illegal drugs. Drug use, illegal or not, is known to have potentially disastrous

consequences for an unborn child. For many women who use IVF to become pregnant, the time, pain and expense are wasted when their babies fail to implant in their own wombs.

If an artificial womb is created, it will mean that women will be freed from the dangers of pregnancy, and create a more equal distribution of “labor”, with women able to work throughout gestation.

Artificial wombs might become so popular by 2074 that only a small minority – fewer “than 30% of children” – would then “be born of woman”.

What should insurance do in this area?

For years scientists have explored this technology but just recently it has borne fruit. Unfortunately, during these years, insurance industry has not taken needed steps toward analyzing & identifying its associated risks & the required coverages. This is now that this technology come to success & there’s no proper rules & regulations in this respect. Generally speaking, insurers’ strategy toward emerging risks is to hold on & let some time passes in order to be able to attain at least a claim history of the risk, commercialization of these new technologies finalized, then take the needed actions. In other words, they take a conservative approach although it is somehow in contrast with the initial principles of insurance such as precautionary or loss minimization. One important but maybe in an aura of ambiguity thing about the works of innovators, inventors or knowledge-based companies is that they need someone to sponsored them. As their inventions have no longer commercialized, if an unexpected event occurs, as they don’t have the needed sponsorship, it can cause a disaster & all they have done turn out to be nothing; in other word, they reach to zero point in their progress. What can insurers do in these type cases, is to offer insurance coverages at least for running the project on pilot. This is the government’s responsibility & insurance industry at the second stage to prepare the needed supports for these people & their inventions. It’s not a good idea to offer coverages at higher levels of premium because when the innovator even has nothing to commercialize his inventions, let alone to be able to pay the high premium rates. However, that doesn’t mean that the insurance industry become a sponsor, instead it can provide needed coverages to these innovators at fair rates in order to prevent disasters. In this case these innovators are more willing to spend their excess funds buying insurance coverages in order to stay in peace. Otherwise & in the case of high premium rates, they may prefer to spend their excess money on the development of their research project.

Another point that is noteworthy to say is that maybe such technologies cause risks which can have adverse impact on more than one industry at the same time & this makes it hard for quick & timely response.

Insurance as a utility

Imagine oil lamps previously lit streets & someone had to light them, put them out every day & they required regular maintenance. Moreover they had the risk of catching fire during transport.

As it became possible to improve lamps, it was difficult for oil lamp manufacturers to comprehend that what the society needed was light, not a better lamp. Light with all the fundamentally wonderful things that it enabled: joy, safety & productivity. We are at the age of oil lamp of insurance while electricity is being invented in our backyards. The only way forward for insurance is for it to become a utility, akin to electricity. In fact, as a consumer we want insurance for precisely the same reasons you want electricity as an enabler for joy, safety & productivity. Just as electricity expanded from the original purpose of lighting to power everything from our homes to Internet & transportation, once basic insurance becomes a utility there's a world of opportunities for it to improve society on a much broader scale.

Some strategies for insurance to become a utility

1. Those with non-insurance degrees but who are top researchers in their own field, would be recruited in insurance companies; Then insurance companies have to hold insurance workshops for them in order to make them familiar with what's going on in insurance in theory & practice. The result is what is known as "interdisciplinary studies". In this way we can foster analytical insight into the insurance industry.

2. Recruiting futurists in order to use their expertise for both forecasting the future & attracting needed specialties in insurance.

3. There are insurance colleges with applied courses but we, as insurers should look for those who are research-concerned; no matter they study in whatever field of science, as they have the concern for research, they always monitor new innovations, emerging technologies & disruptive trends in their own field & are always up-to-date. In this way, we will have doctors, engineers, entrepreneurs, computer experts who are research-oriented, the same as "Geeks" in computer technology. Their major concern is to know what goes around the world. If the insurers make success to recruit these people, then it's up to them to plan insurance related programs & workshops in order to provide conditions to make them familiar with insurance. In this way, these latter experts can mix their technical knowledge with whatever they learn about insurance & offer useful solutions that have the potential to transform the industry & the economy as a whole.

The point is that all of these strategies should be planned for in the long-run. Government & private sector should get hand in hand, cooperate with each other to sponsor innovations & those ideas that have economic justification, i.e. leading to job creation, bringing positive externalities to the insurance industry, paving the expansion path of the countries.

Conclusion

Technology's advance as "the unknown ". It lacks standards, lacks controls, & lacks certifications - that's the risk. The big risk for companies is not necessarily the products themselves, but their blueprint. However, insurance doesn't typically cover a company involved in an illegal activity – whether or not it was intentional. Moore's law tells us that computing power doubles every 18-

24 hours, but even that seems to be irrelevant compared with the power of emerging technologies, because they are coming faster, & they are more formidable than ever before. These emerging technologies are expected to drive new business models & foster the formation of companies from unexpected combinations of companies & industries- capturing the customer relationship & revenue. The astounding influence of these technologies over a relatively short period will begin to delineate a new generation of market leaders within & outside the insurance industry. Insurers that have not begun to pilot these technologies are already lagging behind & will struggle to keep up with this accelerated pace of adoption, not just from today's competitors, but from tomorrow's competitors, as well as their customers.

The question is, will you as an insurer influence the future or to be a remnant of the past?

Endnotes

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