



STRATEGIES FOR HORIZONTAL INTEGRATION AND INTELLECTUAL PROPERTY  
PROTECTION IN THE AGE OF INDUSTRY 4.0: A STUDY IN ENGLAND

INDÚSTRIA 4.0: ESTRATÉGIAS DE INTEGRAÇÃO HORIZONTAL E DIREITO DE  
PROPRIEDADE INTELECTUAL NA INGLATERRA

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**ABSTRACT:** Intellectual Property (IP) is increasingly recognised as a paramount intangible asset influencing the companies' value, corporate strategies and its management. This paper focuses on the impact of implementing Industry 4.0 (I4.0) on the management of IP in inter-organisational interconnected collaborative networks. Such interconnected networks will allow groups of companies, often competitors and/or customers, to share data and to collaborate in the design, development and manufacture of complex products and/or services, exchanging large amounts of proprietary technical data. Furthermore, this paper explores how companies can benefit from the interconnected network capabilities whilst, protecting from any risks regarding the vulnerability of IP assets to misappropriation, unauthorized use or leakage. The focus of this study is the UK manufacturing industry, where formal contractual tools are being deployed to support IP management in collaborative projects. It relies on an in-depth study of IP management practices in the UK manufacturing supply chain to critically assess the current state of practice in order to provide answers to the risks emanating from IP management in this new and complex collaborative setting. This paper concludes that IP and contractual tools deployed in this new environment must be underpinned by the business strategy and the business model. In addition, changes to organisational structures are necessary to bring together functions that typically operate in silos in many manufacturing businesses, namely: engineering, Information technologies, commercial and legal departments.

**Keywords:** Fourth Industrial Revolution; Intellectual Property; Business Strategy; Intellectual Property Strategy.

**RESUMO:** A Propriedade Intelectual (IP) é cada vez mais reconhecida como um activo intangível primordial que influencia o valor das empresas, as estratégias corporativas e a sua gestão. Este artigo enfoca o impacto da implementação da Indústria 4.0 (I4.0) no gerenciamento de IP nas redes colaborativas interligadas inter-organizacionais. Tais redes interligadas permitirão que grupos de empresas, muitas vezes concorrentes e / ou clientes, compartilhem dados e colaborem na concepção, desenvolvimento e fabricação de produtos e / ou serviços complexos, trocando grandes quantidades de dados técnicos proprietários. Além disso, este trabalho explora o modo como as empresas podem se beneficiar das capacidades de rede interconectadas, protegendo de qualquer risco a respeito da vulnerabilidade de recursos IP a apropriação indevida, uso não autorizado ou vazamento. O foco deste estudo é a indústria de fabricação do Reino Unido, onde ferramentas contratuais formais estão sendo implantadas para apoiar o gerenciamento de IP em projetos colaborativos. Baseia-se em um estudo aprofundado das práticas de gerenciamento de IP na cadeia de fornecimento de manufatura do Reino Unido para avaliar criticamente o estado atual da prática, a fim de fornecer respostas aos riscos que emanam do gerenciamento de IP nesta configuração colaborativa nova e complexa. Este artigo conclui que o IP e as ferramentas contratuais implantadas neste novo ambiente devem ser sustentados pela estratégia de negócios e pelo modelo de negócios. Além disso, as mudanças nas estruturas organizacionais são necessárias para reunir funções que normalmente operam em silos em muitas empresas de fabricação, notadamente: engenharia, tecnologias da informação, departamentos comerciais e jurídicos.

**Palavras-chave:** Quarta Revolução Industrial; Propriedade intelectual; Estratégia de negócio; Estratégia de Propriedade Intelectual.

## 1 INTRODUCTION

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The fourth industrial revolution also known as Industry 4.0 (I4.0), is described as a “digital revolution” in which the deployment of the Internet of Things (IOT) and the interconnecting of all things and businesses in the manufacturing industry leads to “blurring the lines between the physical and digital spheres” (SCHWAB, 2016) Such change in paradigm comes along with the prospect to disrupt global manufacturing industry and lead to substantial economic growth and prosperity (RANA, 2016).

The available literature indicates that the I4.0 levels of integration and data exchange between businesses will lead to extensive organisational consequences resulting in risks and opportunities to manufacturing business (BAUERNHANSL et al., 2014; BOTTHOF, 2015). Furthermore, it also recognises that established manufacturers will be required to re-evaluate and innovate their Business Models (BM) in order to stay competitive (JONDA, 2007; KAGERMANN et al., 2015; LOEBBECKE & PICOT, 2015), as the phenomenon will lead to new ways of creating value disrupting the current supply chain structures (KAGERMANN et al., 2015). Finally, the literature also points out that there is backlog in business management research regarding the impact on current business (BRETTEL et al., 2014; EMMRICH et al., 2015).

Therefore, as manufacturing businesses embark in the Fourth Industrial Revolution and go digital, the key questions troubling many practitioners and businesses managers is:

What will be the impact on business? How will intellectual property (IP) and IP strategies be affected by the new interconnect environment associated with I4.0?

This paper proposes that in order to answer these questions business leaders, academics and IP law practitioners must understand the changes taking place and then adapt their practices and strategies in order to mitigate any risks and capture and secure value in the form of IP. Furthermore, it is also argued that failure to recognise and adapt to the new industrial paradigm will result in a failure to secure a sustainable future and long-term business growth.

This article aims to contribute to the literature by assessing the concept of industry 4.0 and its impact on manufacturing business and its Intellectual Property Strategies.

## **2 INDUSTRY 4.0**

Despite the popularity and focus given to I4.0, which since the conception has arguably struggled to achieve a clear definition as even the “Industrie 4.0 Working Group” (KAGERMANN et al., 2015), which have been created by the German government with the objective of promoting and developing I4.0 only provides a description of the I4.0 vision and the basic enabling technologies and applications, but not a clear definition.



Furthermore, even though the I4.0 has since its conception, moved up in the agenda for universities, companies and governments, the definition provided by the myriad of publications in both academic and practitioner domains has varied massively and accomplished little (BAUERNHANS� et al., 2014).

Thus, whilst this article scope falls outside the engineering disciplines involved in the technology behind I4.0 enabling technologies, it will attempt to provide a brief overview of I4.0 from an engineering perspective in order to form a business strategy and IP strategy view of its impact.

Therefore, we begin with an overview of a key concept at the core of I4.0, the Internet of Things (IOT). A simple way to explain the IOT is to use the wide spread well understood technological concept known as the Internet.

The Internet is comprised of a global network of interconnected computer servers which can be accessed simultaneously by multiple users via a range of endpoint devices (mobile phones, laptops, tablets, PCs, etc.). These connected users, (almost 4 billion) add source, access the internet and utilise the information contained in those servers.

The next step then, is to expand the concept of connecting these users and imagine that everyday objects containing embedded sensors capable of communicating information, are also connected to networks and to the Internet.

Such objects can include mobile phones, wearable devices, washing machines, light bulbs, electric cars, etc. Furthermore, in industrial settings these include robots, machines, jet engines, etc. All of these “things” are now “smart” objects which are capable of communicating and exchanging data with the wider network about itself (e.g., what, where, when, temperature, pressure, acceleration, speed, status, etc.), making this network the Internet of Things.

In the same fashion as the concept of I4.0, there is still no consensual definition for IOT. Nonetheless, the one of the most enlightening definitions was present by the ISOC report as:

Internet of Things” and “IoT” refers broadly to the extension of network connectivity and computing capability to objects, devices, sensors, and items not ordinarily considered to be computers. These “smart objects” require minimal human intervention to generate, exchange, and consume data; they often feature connectivity to remote data collection, analysis, and management capabilities. (ISOC IOT OVERVIEW, 2015, pg. 12, *online*).

Thus, with a basic understanding of IOT, one can relate to the concept of I4.0, which can be characterised as a form of “Industrial Internet of Things” (IIOT) (Leber, 2012). Therefore, alluding to the IOT applied in the industrial context, as already mentioned above in the form of connected robots, machines, jet engines, other equipment, etc.



This characterisation similar to the one made by KIRAZLI & HORMANN (2015, p. 864), which provides the following definition for I4.0:

Industry 4.0 is the systematic development of an intelligent, real-time capable, horizontal and vertical networking of humans, objects and systems.

Therefore, I4.0 is the deployment of IIOT within the boundaries of an individual business, also known as “Vertical Integration”, as well as, the deployment across and value chain, industry or even cross-industry, also known as “Horizontal Integration” (KAGERMANN et al. 2015).

Concluding this section, it is proposed that the deployment of IIOT within individual businesses, whilst undoubtedly leading to operational gains and other benefits such as increased speed, control and overall productivity, would not lead to major implications regarding the way businesses generate, protect, distribute and capture value. This is due to the fact that the knowledge and integration of all “things” and any data and knowledge exchange would remain under the control of a single entity.

On the other hand, the deployment of IIOT across value chains and/or industries, crossing individual business boundaries, will pose particular challenges, especially with regards to the strategic sharing, or not, of data and knowledge. To this end, the next few sections will explore the key implications to manufacturing businesses as well as the need for the businesses to adapt their models and IP strategies in order to mitigate risks and secure value.

### **3 THE IMPACT OF I4.0 ON BUSINESSES**

Having clarified the concept of I4.0, this section will turn to what is changing for current businesses? Why does these changes matter to businesses? And, Why should anyone care?

The vision of I4.0 is that integrating products, operations, businesses, supply chains and industries via the IIOT, will result in a seamless product or service lifecycle and the potential to perform exploit data emanating from the smart devices connected and scattered in all industrial dimensions, which in turn will lead to new insights into the products, operations, businesses, users and services.

Such vision, also called the “digital transformation” is already taking place in many industries, where businesses are gravitating away from just selling hardware (e.g. parts, jet engines, robots, motors, etc.), and heading towards a model focused on commercialising solutions which provide a combination of hardware with embedded sensors and



communication capability generating field data and software solutions that enable users to utilise analytics to operate, monitor, control and maintain the hardware in a new way (e.g. preventative maintenance).

There are various estimations regarding the volume and impact on businesses and the wider economy if such a vision is achieved. These estimates demonstrate a substantial importance to businesses and wider society:

In 2015, there were 10 billion devices connected. (BUSINESS INSIDER, 2015). IoT will generate between US\$3.9 and US\$11.1 trillion by 2025. (MANYIKA, 2015, pg 2.)

To illustrate the impact of the digital transformation, imagine the change in how various forms of navigation technology have evolved. The first devices for satellite navigation (Sat Navs) were simple digital versions of the old style hardware (paper maps), which in turn replaced other methods of navigation, (celestial navigation with stellar maps).

The original Sat Navs offered its users a massive improvement on the way the hardware was used due to its ease to operate, to search for a destination and to track your progress to the destination. Nevertheless, the early Sat Navs were disconnected from the real world, in the sense that its core information was static and the parameters were never adjusted to reflect live condition such as traffic or roadworks. As such, the estimated time of arrival was almost always inaccurate.

Along came the new generation of Sat Navs, powered by the IOT and big data analytics which combines for example the information from the driver's mobile phones with traffic cameras and wider emergency services information in order to accurately estimate the arrival time for each route. Furthermore, it very often also analyses the all the alternative routes to your destination and provides the most effective option.

This analogy demonstrates a simplistic example of the transition from the first industrial revolution all the way to the fourth. The key point in this analogy is that the driver using the latest, fully connected Sat Nav will inevitably have an advantage in comparison to drivers utilizing the older systems as he will have a dynamic and efficient way to travel, which in turn will lead to faster journeys, lower fuel costs and higher reliability.

In conclusion, as in the analogy above, businesses that stay out of I4.0 are likely to be left behind and be less competitive. Furthermore, it is argued that as the benefits estimated above begin to be realised across industries and sectors, businesses will quickly embark in their digital transformation and business leaders and IP practitioners will need to use the



existing structures, models and devices to generate, distribute and capture value and to stay competitive in the face of I4.0.

Having discussed the wider impact of I4.0 on businesses, attention now turns to an assessment the implications of this transformation to Intellectual Property.

## **4 INTELLECTUAL PROPERTY**

According to the World Intellectual Property Organization (WIPO), Intellectual Property (IP) can be characterised as creations of the mind (WIPO, 2011). These include inventions, literary and artistic works, symbols, names, images, and designs used in commerce. IP can be categorised, according to the subject matter it covers, into two main categories: industrial property, which includes inventions, industrial designs, integrated circuit topographies, trademarks, and geographical indications; and copyright, which includes literary, dramatic and artistic works. IP-based innovation covers a wide spectrum of innovations, including drugs, machines, processes, business methods, software, maps, designs, computer chips, etc. Within this broad scope, IP can be found in any drawings, songs, books, a logo, invention an inventor makes and many others. IP Law provides for exclusive rights for the creators of IP. Such rights are referred to by the term intellectual property rights (IPR) (WIPO, 2011).

This section explores IP protective measures and the difference between formal and informal protection measures. Protecting IP can be understood as a prohibition which is intended to ensure that no one uses IP in a way that is contrary to the owner's will.

The protective measures can take effect in various forms, form a trade secret, copyright protection which forbids someone to reprint a book, remix a song, or patent protection which prevents the use an invention, or trademarks which protect the use of logos, among many other possibilities. As these examples show, the protection of IP can mean quite different things. However, all the possible protections of intellectual properties fall into either of two categories: formal protection measures and informal protection measures (Howells et al., 2003).

### **4.1 THE IMPLICATIONS FOR INTELLECTUAL PROPERTY**

Historically, the focus of IP practitioners has been to use IP rights as the traditional "Shield and Sword" to protect the physical things, devices, structures, or the configuration of physical systems, physical outputs, or the operation of physical systems, physical connections, etc.



However, with the implementation of I4.0 the focus need to be expanded in IP protection for intangible things such as methodologies, the configuration of virtual systems, data ownership, handling and storage, processing algorithms, brand recognition, etc.

The implementation of I4.0 challenges the current understanding and use of IP protection and commercialisation strategies, justifying the development of new approaches better suited to the rapidly changing, highly integrated business networks.

As a result of the implementation of interconnected communications and the utilization of application programming interfaces (APIs) to more inter-company collaborative models, businesses must carefully consider how to protect their IP, whilst at the same time facilitate the interoperability of connected businesses.

The sub-section below presents a non-exhaustive list of challenges for IP strategy in the face of this new highly collaborative and interoperable environment emanating from I4.0.

#### 4.2 THE INTEGRATED LIFE CYCLE – MODEL BASED DEFINITIONS

In order to achieve the levels of integration across the product life cycle from design to recycling, the I4.0 will require a change in the nature of proprietary files. This will undoubtedly impact manufactures who due to efficiency and market pressures will be pushed, whether they like it or not, towards migrating to a “Model Based Enterprises” (MBE) (<http://www.lifecycleinsights.com/tech-guide/model-based-enterprise-mbe>) where manufacturing businesses will move away from utilising 2D engineering drawings and specifications, to utilising digitalised 3D product drawings and definitions (i.e., Model Based Definitions “MBD”; VEZZETTI et al., 2011). These files can be shared across the supply chain (HEDBERG, 2016).

In fact, as highlighted by Hedberg on pg. 12, studies have demonstrated that manufacturing businesses could save millions and reduce their time to market and new product introduction time by almost 75% in average by utilising MBD.

Thus, the MBE digital files, also known as the “digital thread” or “source of truth” as referred to by Siemens (Richer 2017), will be produced by 3D Computer Aided Design (CAD) software which will contain the specifications for components and final products including dimensions, tolerances and materials, as well as, bills of materials and manufacturing information.

It is not difficult to imagine the potential damage caused if such files fall in the wrong hands, as this confidential information would enable rapid copying of the product. As such, the



potential loss of valuable IP obviously increases as manufacturing businesses migrate to the integrated life cycle model of I4.0 and begin to utilise the MBD files.

#### 4.3 DIGITAL BUSINESSES AND THE HUMAN CLOUD

Despite the trend towards digitalization of businesses, one part of the organizations will remain unchanged, that is the reliance on human beings to setup, coordinate and make decision regarding critical activities.

Of particular importance in this context, is the fact that the current technological setting, more and more technical work is being done suppliers, contractors or even own employees which are working remotely, this is the so called “human cloud.”

This trend is a key factor in the I4.0 labour environment, where programmers, data scientist, IT professionals, statisticians, etc. provide specialized services to hundreds projects scattered across a virtual cloud. These workers can perform their task from anywhere in the world, all that is necessary is internet access (O’CONNOR, 2015).

Furthermore, the available literature (AURIGA, 2015) points out that IT employment has the highest turnover rate than any other industry, reaching 20–30% annually and only lasting from one to four years of tenure. Painting an even more aggravating picture, a report by SYMANTEC (2013), presents evidence from a survey showing that nearly 60 percent of software developers based in the United States believe to have the right to reuse code that they have written in previous assignments for the purposes of their next employment and over 40 percent believe that they should have the IP in their inventions.

This challenge was illustrated by the legal case between Formula One teams and a service provider namely, *Force India v. Malaysia Racing* (2012) EWHC 616 (Ch) and *Force India v. Aerolab* (2013) EWCA Civ 780.

A key issue raised on paragraph 61 of *Force India v Arolab* was the need to distinguish between the personal skill and knowledge of the employees of the service provider and the corporate trade secrets of its clients. The concern was expressed that the development contract should not ‘unduly restrict the ability of Aerolab’s employees from making use of their skill and knowledge, even if that skill and knowledge had been enhanced by information that they had acquired in the course of working on the Force India project’. This dispute shows the difficulties in defining the scope of protection of trade secrets in an era characterized by employee mobility and by open innovation models.

In conclusion, the confluence of digitalised business and high labour mobility, in combination with the above MBD files and the vertically integrated businesses carrying a vast





amount of aggregated know-how and technical information, gives rise to one of the biggest risk to business's IP due to unclear ownership of rights and knowledge spill over as a result of a subsequent competitor employment.

#### **4.4 HORIZONTALLY INTEGRATED BUSINESSES AND THE VALUE OF DATA**

In the typical, pre-I4.0 environment, IP strategies have focused on protecting hardware and software which processes and stores data. However, the data itself, especially in the newly interconnected environment, is of high value and worthy of protection. This value emanates from the ability to perform analytics on data from integrated smart objects, generating new knowledge, which can be the source on competitive advantage and innovation. As such, the rights to these data sets, as well as the bigger aggregated data sets, as well as, the knowledge and insights emanating from it are of critical importance to businesses.

Data, in its more simplistic form, is typically protected by trade secrets and copyright law. Save in the case of databases under EU jurisdiction via the "sui generis" protection scheme provided by the EU Directive 96/9/EC (Directive 96/9/EC, European Parliament and of the Council (March 11, 1996)).

Although the above methods of data protection can be useful in many circumstances, these very often fall short in scope and are considered by many not adequate (DLA Piper, Rights in Data Handbook (Jan. 2013) pg46.). In this case, it is very likely that businesses and IP practitioners will have to resort to contractual agreements in order to govern the operation and the inter-company relations in the I4.0 environment.

Therefore, IP strategies will have to take account of the required contractual agreements surrounding data exchange, particularly addressing the types of, rights to, and licensing constructs related to I4.0 interconnected data.

After discussing some of the challenges in relation to Intellectual Property in this new industrial paradigm, attention now turns to the need to adapt the current IP strategies.

### **5 THE NEED TO ADAPT IP STRATEGIES**

With the current rate of technological and industrial change, and the unpredictable nature of technologies involved in the I4.0 environment, a variety of techniques should be utilised in order to effectively identify and protect IP. While there are a number of common strategies to be deployed in the arena, it is important to emphasize that a one-size-fits-all solution does not exist as each individual business performs to achieve its own strategic objectives and will be setup to according to a particular business model. As such, it is



recommended that the various legal mechanisms be considered alternatively or concurrently, with the non-legal mechanisms as part of a comprehensive IP strategy.

This section will be split into two sub-sections covering first, the non-legal recommendations about Organisational Strategies. The second subsection will then explore a set of recommendations related to the three IP challenges raised above.

## 5.1 BUSINESS STRATEGY RECOMMENDATIONS

IP management involves a lot more than just law and legal knowledge. Even so, IP management is very commonly left to a particular technical or legal department within the business. Such department will typically only focus on the protection of the business from potential infringement of other businesses IP and the protection from the infringement of its IP by competitors. It is argued that this approach to IP management, albeit marginally relevant to business, is nevertheless, unable to deliver tangible benefits and income to businesses as there is too much emphasis in protection and in the legal issues, but not sufficient emphasis on the commercial aspects and the role of IP in the wider business's strategy.

In order to bridge the IP and Business strategy the team responsible for IP management must be not only competent in legal matters related to IP but, also competent and directly involved in the business strategy and long-term objectives. The Handbook of European Intellectual Property Management uses an example of a technology company to illustrate this point.

In the example the technology company identifies that a given market is shifting to a position where another technology company has a strong patent portfolio. In this case, typically a specialist team member from the legal department should flag the potential issue and provide the evidence and offer advice to the business regarding a particular strategy to enter this market. At the same time, a senior IP specialist may devise and propose a strategy for the company to achieve particular agreements with competitors, in order to utilise their patents and reduce the risks and development costs in exchange for some of the company's own IP.

A significant problem occurs when businesses neglect IP management and fail to allocate the relevant resources to monitor the potential markets in which the business plans to enter, as well as the IP landscape. Furthermore, businesses often also fail by delegating the IP management to inappropriate areas of the business. For example, strategic decisions regarding IP management are delegated to operational level IP experts, such decisions are likely to be unsuccessful as the employee is often unable to reach appropriate conclusions due to insufficient knowledge of the business and the business strategies.



In addition, the typical approach in most businesses is that the IP experts are only called upon when it is too late and the problem has already occurred when the business has already infringed the IP rights of another business or if another business has infringed their IP rights.

On the other hand, it is argued that by integrating IP strategies with the Business strategies, a business can make effective decisions as the part of the managerial responsibility, thus transforming IP into a real asset and an important resource adding value to the business.

Nevertheless, it is a challenge to change the current practices, which arguably are driven by the senior management perception of IP as a very complex and time-consuming area which should be entrusted to subject area experts within the in-house legal departments or external third parties. Furthermore, it is argued that this is also the main reason for the tendency to neglect the importance of IP and to link it to the wider business strategy.

Another challenge to businesses, as argued in the European Handbook of Intellectual Property Management, is the fact that it is very difficult to recruit people with the right capabilities in this area and able to effectively assume the role of an IP manager or executive. Furthermore, even if someone should succeed; they become a significant drain on the wage budget. The employee must be competent in legal, technical and business aspects. Most IPR managers today have technical education combined with a degree in patent law, but they lack training and practical experience in business. A good example of how difficult it is to find an employee who has all the necessary skills is one of the largest Danish companies which had the position of IPR executive vacant for 18 months.

There are several solutions available. The management can either engage potential talents who are already employed in the company, invite them to strategy seminars, challenge them on the issue of IPR and its significance in various fields, and send them on courses, or pay external consultants to spar with the management.

### **5.1.1 Look at Competitors' Patents**

An appropriate IP strategy focuses not only on balancing the business own IP rights, but also at dealing with the competitors'. These represent an important but highly underestimated information channel, which provides valuable insight into which products the competitors can be expected to develop during the next five years.

An ineffective approach to solving the task is to completely refrain from patenting and worrying about competitors' patents. The promising approach, on the other hand, is to make efforts to translate competitors' patent applications into something that is of relevance to one's own business. The competitors' applications may in fact influence your decision about the next



product you introduce to the market. Again, it is crucial for a company's competitive edge to have an IPR executive who not only has insight into technical and legal areas, but is also a skilled businessman.

This is also highly relevant in cases where mergers and acquisitions are on the agenda. Here, a traditional legal approach would consist of focusing solely on assessing whether the company that is being acquired has any potential or ongoing legal proceedings due to patent infringements. However, the IPR executive should play a much more central role in these cases, and already at an early stage evaluate whether the intellectual property rights of the other company have commercial relevance for their own business. Patents and other intellectual property rights can be worthless if competitors have something better, and assessment of this sort requires more than just legal expertise. It requires that the person responsible for IPR is part of the management team.

### **5.1.2 The Growing Importance of IPR**

Working with IPR poses significant challenges for a company, first in finding the right person for the job and second in effectively managing its IPR. We often see companies facing these challenges by burying their heads in the sand. However, this can turn out to be a costly affair because globalization means that the focus on patents and other intellectual property rights is continuously increasing in importance.

Globalisation means that it is highly unlikely that you will identify a local need that does not exist elsewhere in the world. Presumably, somewhere in the world, someone else will be in the process of developing something in order to meet that same need. Therefore, it is important to have an IP strategy ready as soon as you have a new product or production process.

## **5.2 INTELLECTUAL PROPERTY RECOMMENDATIONS: LIFE CYCLE RECOMMENDATIONS**

In order to mitigate the potential risks of utilising MBDs in inter-organisational collaborations businesses should be particularly careful when sharing files. The next three recommendations form a non-exhaustive list, which is generic and applicable in most cases where a MBD model is shared. Nevertheless, each individual business should ensure that the information shared contributes to the business goals and objectives.



### **5.2.1 Always Use NDA'S (Non-Disclosure Agreements)**

MBD files should only be shared after the parties have signed a suitable and effective NDA. Such agreement must clearly define the term 'Confidential Information' as including electronic information such as, but not limited to MBD models and associated files.

### **5.2.2 Always Share Only the Necessary Layers Information**

Businesses should pay particular attention to how much detail is shared within the interconnected value networks. Each file should be configured specifically for the purpose for which it is going to be shared. For example, a particular supplier may need the details regarding a component within a product, but not the model for the whole product. Thus the files should be suited for the different uses so that the unnecessary parts of the product design are masked (UKIPO 2014).

### **5.2.3 Always Use Confidentiality Notices**

Business should include confidentiality notices in all documents before sharing. Such notices should at least include the business's name and the word confidential "[Company] Confidential" in the MBD file name. It is also best practice to embed a proprietary notice in the file to be shared, for example:

The information contained herein is the confidential and proprietary property of [Company]. It is to be used only for the benefit of [Company] and shall not be disclosed, transferred, reproduced, altered, or used for any purpose without the express prior written consent of [Company]. (MILLIEN, 2016, pg. 21)

As mentioned above, these three recommendations are not exhaustive and attention should be given to the particular relationship between the parties sharing and receiving the files, as well as any other protection that may be available in case of misappropriation of intellectual property.

## **5.3 HUMAN CLOUD RECOMMENDATIONS**

In order to address the risks 107onsidera knowledge spillover in relation to high labour mobility and the vertically integrated businesses carrying a vast amount of aggregated know-



how and technical information, business should be 108onsidera t least the following two actions:

### **5.3.1 Use Non-Disclosure Clauses in Employment and Contractor Contracts**

Businesses should ensure that contractual agreements for both, employees and contractors contain non-disclosure clauses. Furthermore, these contracts should also include an IP assignment clause specifying the ownership of IP at the first point of engagement.

### **5.3.2 Implement It and Physical Security Measures**

Businesses should ensure that adequate security controls are in place, preventing not only the physical risks (document management, disabling USBs, etc.), but also IT risks (network monitoring, data loss software). These security controls should prevent the access to source code files, MBD files, design specifications and other IP-rich documents.

It is also important to remember that these security measures must be implemented in accordance with the particular jurisdiction, particularly the national and regional laws governing employee privacy, inventor remuneration and limitations on employee invention ownership.

## **5.4 DATA SHARING RECOMMENDATIONS**

Data sharing is one of the most critical aspects of the fourth industrial revolution. The vast amounts of data to be shared and aggregated across the entire value chain is particularly important as the rights to the individual data sets, as well as the bigger aggregated data sets and the knowledge emanating from it are of critical importance to businesses. As such, we lay out a non-exhaustive set of recommendations with the three basic actions which will improve the business' IP protection.

### **5.4.1 Categorize the Different Data Types**

Businesses should be aware of the main data types to be shared in the inter-organisational relationships emanating from Industry 4.0. Furthermore, contractual terms between businesses exchanging data should address at least the following data types:

- a) Raw data, machine data and unprocessed data:



This is simply the big data sets that are collected from the relevant smart objects at issue in the IoT-related contract;

b) Processed data:

This is the set of data resulting from the analysis of the raw data by any actor (Suppliers, manufacturers, customers, end users) in the Industry 4.0 environment; and

c) Input data:

This is any data that is entered by the end-users who interact with the relevant smart objects at issue (and/or their respective customers).

#### **5.4.2 Data Ownership Rights**

Businesses should also be aware of the different data ownership rights in relation to inter-organisational data exchange. Once more, contractual agreements in this area should address at least the following points:

a) The smart-object manufacturers may simply own the data regardless of whether the smart object itself is sold or leased to a customer;

b) The smart object manufacturers may own the data, but the customer will receive a license to some or all of the data;

c) The smart-object manufacturer may own the data, but the customer and some third parties will receive a license to some or all of the data; or

d) The customer may own the data, but the smart-object manufacturer will receive a license to some or all of the data and for all or some specific purposes.

#### **5.5 IP OWNERSHIP CLAUSES**

Finally, businesses should also consider the fact that similar to joint IP ownership clauses, data rights provisions in Industry 4.0 related contracts will be the subject of a much negotiation, which often times will likely be contentious negotiations as the powers of the various parties in a value chain will influence how much each party will give away. Nevertheless, such contracts should at least consider the following licensing constructs surrounding IP: What data? What rights? What IP? Who owns the IP? Who are the licensor and the licensee? What is the particular business model? What products or services or areas of use? In what territory? What is the term (time) of such right? Are the rights exclusive or non-exclusive? Is there a right to sublicense?



These constructs should be incorporated into the particular contractual agreements. The following is an example of an ownership clause where a “smart-object manufacturer owns the raw and processed data, but the customer receives a license to some of the data.

The Customer acknowledges and agrees that the Manufacturer owns all rights, titles and interest in the Equipment Data. The Customer will upon request deliver such data to the Manufacturer. The Manufacturer hereby grants the Customer a perpetual, non-exclusive, non-transferable, royalty-free license to use, reproduce and store the Equipment Data solely to the extent required to operate Customer’s equipment. (MILLIEN, 2016, pg. 22)

Furthermore, in this case it is critical to provide a clear definition of equipment data as in the following example:

*Equipment Data* means any data, metadata, logs or other information generated by the operation of the Software or the Device, but does not include any personally identifiable information, nor any information entered into the Software or the Device by the Customer’s employees, agents or end-users, except to the extent portions of such information appears in anonymized or aggregated form or in automated logs or similar records through the normal operation of the Software. (MILLIEN, 2016 pg. 22)

Finally, in the Industry 4.0 inter-organisation relations, data from suppliers and customers will often be aggregated other device data generated by a particular business. It is important to also define the expectations, responsibilities and liabilities regarding data security and privacy, as both suppliers and customers may be vulnerable to breaches of data security and privacy.

Therefore, contracts in this area must be made as clearly and carefully as possible. It should include the details regarding the gathering, anonymizing, notifying and using customer and supplier data.

## 6 CONCLUSION

The phenomenon of I4.0 will reach businesses of all sizes and across all industries which will generate rich data which, when coupled with analytics will enable more efficient monitoring and controlling of operations leading to increased levels of flexibility and efficiency.

While these new technology offerings and business models have no effect on IP rights themselves, it does affect how IP strategies should be formulated. That is, the basic requirements for their registration and enforcement of IP obviously remain unchanged. But, the practices and strategies for securing and commercialising IP in such environment are completely different.





The interconnected supply chain allows devices in different businesses to work together to provide new functionality and/or data analytics to businesses throughout the supply chain as well as, the customers. Flexibility imparted to products through their increased data processing and communication capabilities creates uncertainty when it comes to IP protection. A flexible and multi-faceted IP strategy informed by the business strategy and business model must be implemented to ensure control over the business value offering as well as, the brand, technology ownership, reputation and joint technological innovation, while preserving options for fast route to market, configuration and customisation in light of the involvement of multiple businesses within the Industry 4.0 value chain.

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