

# LMFP for Li-ion Batteries

Patent Landscape Analysis - January 2026

*Who are the key players and newcomers in the global IP race for LMFP batteries?*



## LMFP for Li-ion Batteries

- Type: Patent Landscape Analysis
- Publication: January 2026
- Reference: KM26002

### Deliverables

- Database (>7,800 patent families)
- Report (>400 slides)
- Interactive dashboard (optional)

### Pricing

- €4,990 - Report+Database
- €7,990 - Report+Database+Dashboard

### KEY FEATURES

- **Global patenting trends**, including time evolution of patent publications, countries of patent filings, etc.
- **Main patent assignees and IP newcomers** grouped by geographical area.
- Key players' **IP position** and the relative **strength** of their patent portfolio.
- Focus on key players' IP portfolios.
- Patents categorized by **supply chain segments** (precursors, cathode active materials, cathode, battery cells).
- For each segment: **IP dynamics**, ranking of **main patent assignees**, **IP newcomers**, **key IP players**, **key patents**, and **recent developments**.
- **Excel database** containing all patents analyzed in the report, including **patent segmentations** and hyperlinks to an **updated online database**.
- **Interactive dashboard** enabling free and dynamic exploration of the patent landscape, allowing users to instantly drill down into key insights and tailor the analysis to their specific needs.

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- [Silicon Anode for Li-ion Batteries](#)
- [Halide Solid Electrolytes for Li-ion Batteries](#)

## LMFP: A promising cathode material for next-generation Li-ion batteries witnessing a fast-growing and shifting patenting activity

The burgeoning global demand for highly efficient and environmentally friendly energy storage solutions, driven primarily by the widespread adoption of electric vehicles (EVs) and large-scale energy storage systems (ESS), has made the development of advanced lithium-ion battery (LIB) cathode materials a critical focus. While the olivine-structured lithium iron phosphate (LFP) is widely valued for its high safety, stability, low cost, and environmental friendliness, its relatively low operating voltage, typically around 3.4 V (vs. Li/Li+), limits its energy density and falls short of the increasing requirements for high-performance applications. Lithium manganese iron phosphate (LMFP), developed by partially substituting iron with manganese in the olivine structure, has emerged as a promising alternative. This composition incorporates the high thermal stability and cost-effectiveness of LFP while leveraging the higher redox potential of manganese, resulting in a 10% to 20% higher energy density than LFP. Despite these advantages, LMFP faces intrinsic challenges notably poor electronic and ionic conductivity, sluggish lithium-ion diffusion kinetics, manganese dissolution issues, and capacity degradation related to the Jahn–Teller effect induced by Mn<sup>3+</sup>. Consequently, extensive research, supported by robust patent activity, has been performed for the last ten years.

In this context, the present report aims to provide a **comprehensive analysis of the patent landscape** related to the **lithium manganese iron phosphate, from materials to battery cells**. Knowmade's analysts have selected and analyzed more than 7,800+ patent families (inventions) related to LMFP.

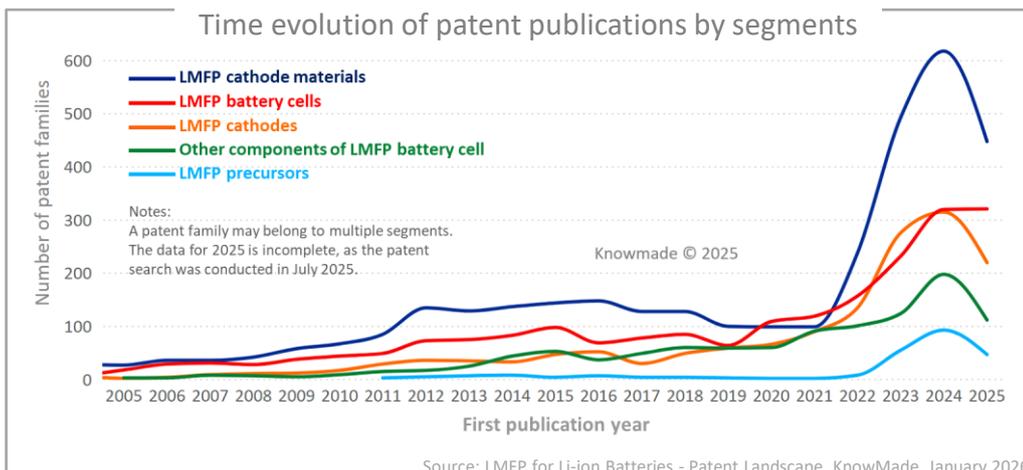
The general objectives of the present report are:

- to identify and map the key IP players in each chosen technological segment (precursors, cathode active materials, cathodes, battery cells).
- to assess the geographical distribution of patent families, current legal status of patents, helping stakeholders understand strategic positioning and navigate their competitive environment.
- to get an overview of key and recent patents across the value chain.

These strategic insights will support R&D, investment, and policy decisions in the evolving field of Li-ion battery.

### LMFP for Li-ion Batteries

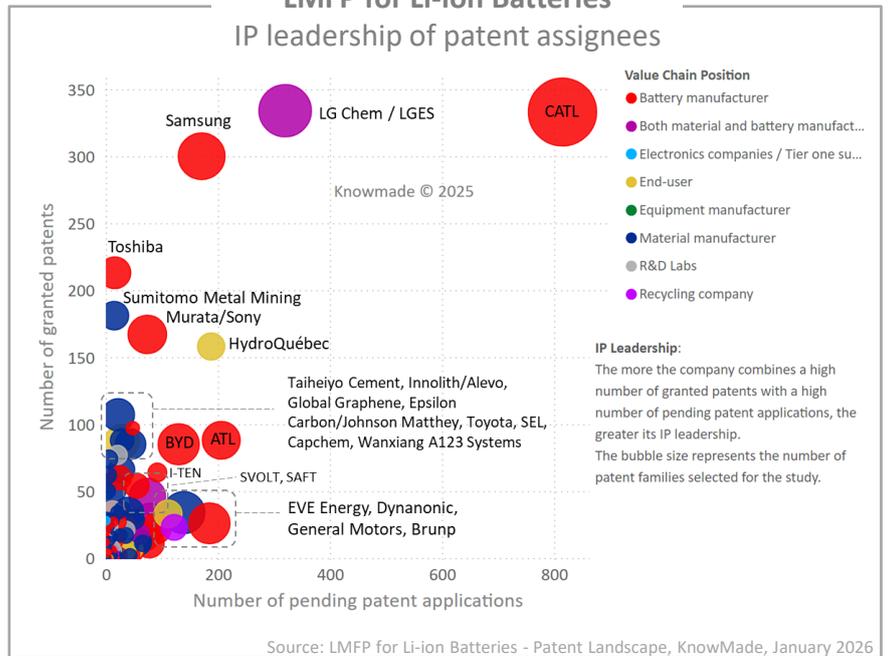
Time evolution of patent publications by segments



### Understanding the main trends, the key players' IP position and IP strategy

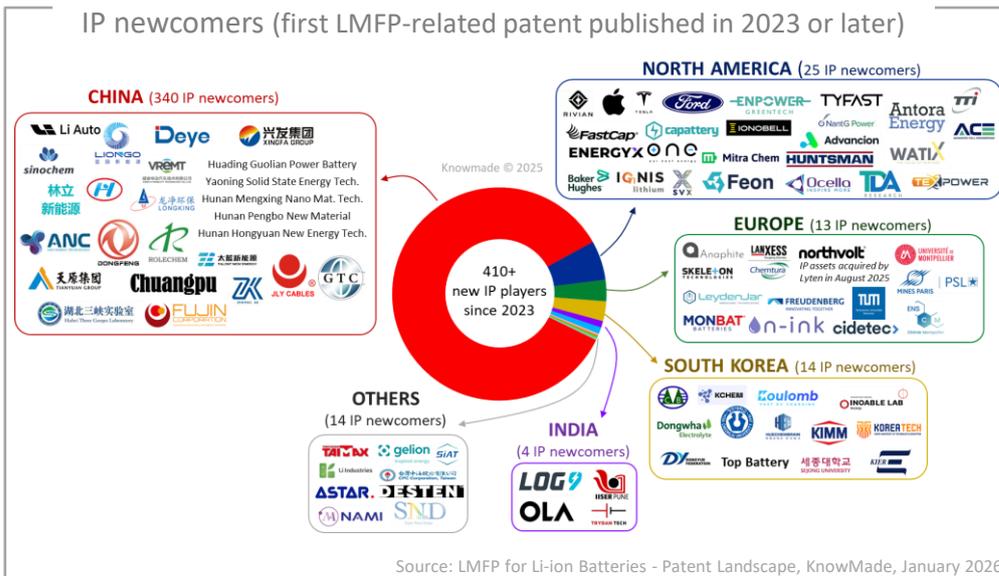
IP competition analysis should reflect the vision of players with a strategy to enter and develop their business in the LMFP Li-ion battery market. In this report, Knowmade's analysts provide a comprehensive overview of the competitive IP landscape and latest technological developments in this field. The report identifies the IP leaders, most active patent applicants, and new entrants in the IP landscape. It also sheds light on under-the-radar companies and new players in this field. The report covers IP dynamics and key trends in terms of patents applications, patent assignees, filing countries, and technological segment of interest (precursors, cathode active materials, cathode, battery cells, etc.). Dedicated sections of the report focus on the patent portfolios of key players from various countries.

### LMFP for Li-ion Batteries IP leadership of patent assignees



### LMFP for Li-ion Batteries

#### IP newcomers (first LMFP-related patent published in 2023 or later)



### Identify the IP newcomers

Since 2023, Chinese entities have established themselves as dominant newcomers in the LMFP patent landscape. Over 410 new IP players have entered the LMFP patent landscape since 2023, with around 80% coming from China. More than 20 newcomers are non-Chinese start-ups. The main Chinese entrants are material and battery manufacturers, while other Asian newcomers are primarily R&D institutes and material producers. American newcomers include both start-ups and established companies, whereas other non-Asian entrants consist mainly of R&D organizations, battery manufacturers, and material suppliers. Dedicated sections of the report focus on the patent portfolios of IP new entrants from various countries.

### Deep dive into key and recent patents across LMFP value chain

All patents selected for this study have been categorized by supply chain segment (precursor, cathode material, cathode, battery cells). For each supply chain segment, this report includes a time-evolution of patent applications, main and key patent assignees, and a description of key and recently patented technologies. An understanding of the current technical challenges addressed in the patents is also presented.

### LMFP for Li-ion Batteries Precursor-related key patents

Patent number & assignee	Legal status	Material Type / Key Features	Advantage Provided
KNOWLITECH (EP4)	Pending (CN, EP, WO, KR)	Mn1-xFexPO4 or Mn1-xFexMnPO4 precursors with a nanoporous structure and an extremely small particle size (at most 50 nm), often doped with one or more elements (M) such as Co, Mg, B, V, Ti	Improves the specific capacity, rate performance, and cycle performance of the resulting battery cathode material. The preparation method simplifies the process by not requiring a reducing agent or soluble ferrous salt.
YANG ZHIKUAN (CN1)	Lapsed (CN)	Battery-grade MnxFe1-xPO4 precursor synthesized via hydrothermal oxidation-coprecipitation, where both Mn and Fe are in the trivalent state (Mn3+, Fe3+)	The method is simple and practicable, easy for large-scale production, and the prepared precursor exhibits high purity and uniform distribution of iron and manganese elements at the atomic level, making it an optimal LiFeMnPO4 precursor
LB GROUP	Pending (CN)	Spherical-like Manganese-Titanium Co-doped Iron Phosphate precursor	Solves the problem of low purity and uneven doping. Achieves high purity, uniform element doping distribution, high tap density, low specific surface area, and easy compaction, leading to good electrochemical performance and improved compacted density/energy density of the cathode material
PULEAD TECH. IND. (CN1)	Granted (CN)	FexMn1-x-yMyPO4·2H2O intermediate. Preparation uses an ethanol-water mixed system.	Provides a preparation method that is simple in process, low in cost (solvent can be recycled), high in yield, and low in reaction temperature. It ensures uniform mixing of Fe and Mn at the atomic level.
SUMITOMO METAL MINING (WO2)	Granted (JP)	Manganese Iron Ammonium Phosphate precursor (NH4MnFe1-xPO4·2H2O).	Allows for the production of a positive electrode active material with fine particle diameters (crystallite diameters 50 nm) and a carbon content of 1%-5%, resulting in high initial discharge capacity (≥150 mAh/g) and high energy efficiency (≥85% efficiency).
CHEMISCHE FABRIK BUDENHEIM (US2)	Granted (US)	Mn-bearing monometal or mixed-metal phosphate precursors (MnxMety3[PO4]2·3H2O) with an orthorhombic cell, often featuring a platelet-shaped morphology (thickness 20 nm to 70 nm).	The process is comparatively energy-efficient and simple and yields high purity material suitable for producing cathode materials with high energy storage density levels. The platelet morphology is particularly advantageous for the final lithiated cathode material.
PINNACLE MAT. TECH./ JANSOHN NEW ENERGY MAT. (EP4)	Granted (CN), Pending (WO)	Phosphate precursor (LMMy[PO4]x+y/zAr·wH2O) containing lithium, transition metals (including Fe and Mn), and crystal water.	The precursor has good uniformity and excellent structural stability. It enables the preparation of olivine cathode material through low-temperature sintering (260°C-600°C). The final material exhibits good electrochemical properties.
ROUTE JJ (US2)	Lapsed (CN, EP, KR, JP, US)	Composite cathode material precursor and active material featuring Hollow Nanofibrous Carbon integrated with an olivine-type lithium phosphate cathode material (LiMPO4).	Improves electric conductivity and ensures high capacity density suitable for high-capacity batteries because the active material is loaded both outside and inside the hollow nanofibrous carbon, preventing wasted space. The resulting battery shows improved electroconductivity, energy density, stability, safety, and cycle life characteristics.

Source: LMFP for Li-ion Batteries - Patent Landscape, KnowMade, January 2026



### Useful patent database

This report includes an extensive **Excel database** with all patents analyzed in this study, including **patent information** (numbers, dates, assignees, title, abstract, etc.), **hyperlinks to an updated online database** (original documents, legal status, etc.), and **segments** (precursors, cathode active materials, cathodes, battery cells).

Family number (Serial number family ID from FamPat database)	Patent number (publication number)	Title	Abstract	Current legal status (Pending, Granted, Revoked, Expired, Lapsed)	Current patent assignees (as mentioned in the parent database)	Patent assignee name used in the report	Earliest application date of the family (yyyy-mm-dd)	Earliest publication date of the family (yyyy-mm-dd)	Earliest grant date of the family (yyyy-mm-dd)	Expected expiry dates (yyyy-mm-dd)	Biblio Summary (link to full patent description original document)	Supply chain segmentation				
												Precursors	Cathode active materials	Cathodes	Battery cells	Other components of battery cell
110068480	CN102007372	[KR10-2025-0102371]	[KR10-2025-0102371]	PENDING	LG ENERGY SOLUTIONS LTD	LG Chem/LG Ener	2024-05-13	2025-01-14	2025-07-18	(KR10-2025-0102371)	<a href="#">Doco</a>		X			
115451701	CN102038932	[CN102038932]	[CN102038932]	PENDING	MINMETALS NEW MCC (China MinM	China MinM	2025-06-30	2025-07-29		(CN102038932)	<a href="#">Doco</a>		X			
11681998	CN102042936	[CN102042936]	[CN102042936]	PENDING	RESEARCH INSTI FIST (Research Ins	Research Ins	2024-03-29	2024-10-03		(CN102042936)	<a href="#">Doco</a>		X			
116368004	CN102035754	[CN102035754]	[CN102035754]	PENDING	CATL - CONTEMF CATL (Contempore	Contempore	2025-06-23	2025-07-22		(CN102035754)	<a href="#">Doco</a>			X		
115352034	CN102048920	[CN102048920]	[CN102048920]	PENDING	HUNAN YUNENG T B YN (Yuneng) Che	Yuneng) Che	2025-06-23	2025-07-22		(CN102048920)	<a href="#">Doco</a>		X			
115348563	CN102035926	[CN102035926]	[CN102035926]	PENDING	SICHUAN FUJIN N Sichuan Fujin New	Sichuan Fujin New	2025-06-23	2025-07-22		(CN102035926)	<a href="#">Doco</a>		X			
115344368	CN102034120	[CN102034120]	[CN102034120]	PENDING	HUNAN HONGYU H Hunan Hongyuan T	Hunan Hongyuan T	2025-06-20	2025-07-18		(CN102034120)	<a href="#">Doco</a>		X			
115334171	CN102034134	[CN102034134]	[CN102034134]	PENDING	CATL - CONTEMF CATL (Contempore	Contempore	2025-06-20	2025-07-18		(CN102034134)	<a href="#">Doco</a>			X		
115331438	CN102034130	[CN102034130]	[CN102034130]	PENDING	CATL - CONTEMF CATL (Contempore	Contempore	2025-06-20	2025-07-18		(CN102034130)	<a href="#">Doco</a>			X		
115316493	CN102034133	[CN102034133]	[CN102034133]	PENDING	CATL - CONTEMF CATL (Contempore	Contempore	2025-06-20	2025-07-18		(CN102034133)	<a href="#">Doco</a>			X		
115316408	CN102034131	[CN102034131]	[CN102034131]	PENDING	CATL - CONTEMF CATL (Contempore	Contempore	2025-06-20	2025-07-18		(CN102034131)	<a href="#">Doco</a>			X		
115318419	CN102028502	[CN102028502]	[CN102028502]	PENDING	SICHUAN FUJIN N Sichuan Fujin New	Sichuan Fujin New	2025-06-19	2025-07-18		(CN102028502)	<a href="#">Doco</a>		X			
115267076	CN102039872	[CN102039872]	[CN102039872]	PENDING	GUANGZHOU TIM Tinci Materials Tec	Tinci Materials Tec	2025-06-19	2025-07-15		(CN102039872)	<a href="#">Doco</a>			X		
115265114	CN102039762	[CN102039762]	[CN102039762]	PENDING	SUZHOU QINGTAI QingTao Energu D	QingTao Energu D	2025-06-17	2025-07-15		(CN102039762)	<a href="#">Doco</a>		X			
11517620	CN102041336	[CN102041336]	[CN102041336]	PENDING	SHENZHEN MAOL Maolue Technology	Maolue Technology	2025-06-16	2025-07-18		(CN102041336)	<a href="#">Doco</a>			X		
					MINMETALS NEW MCC (China MinM	China MinM				(CN102039802)	<a href="#">Doco</a>					



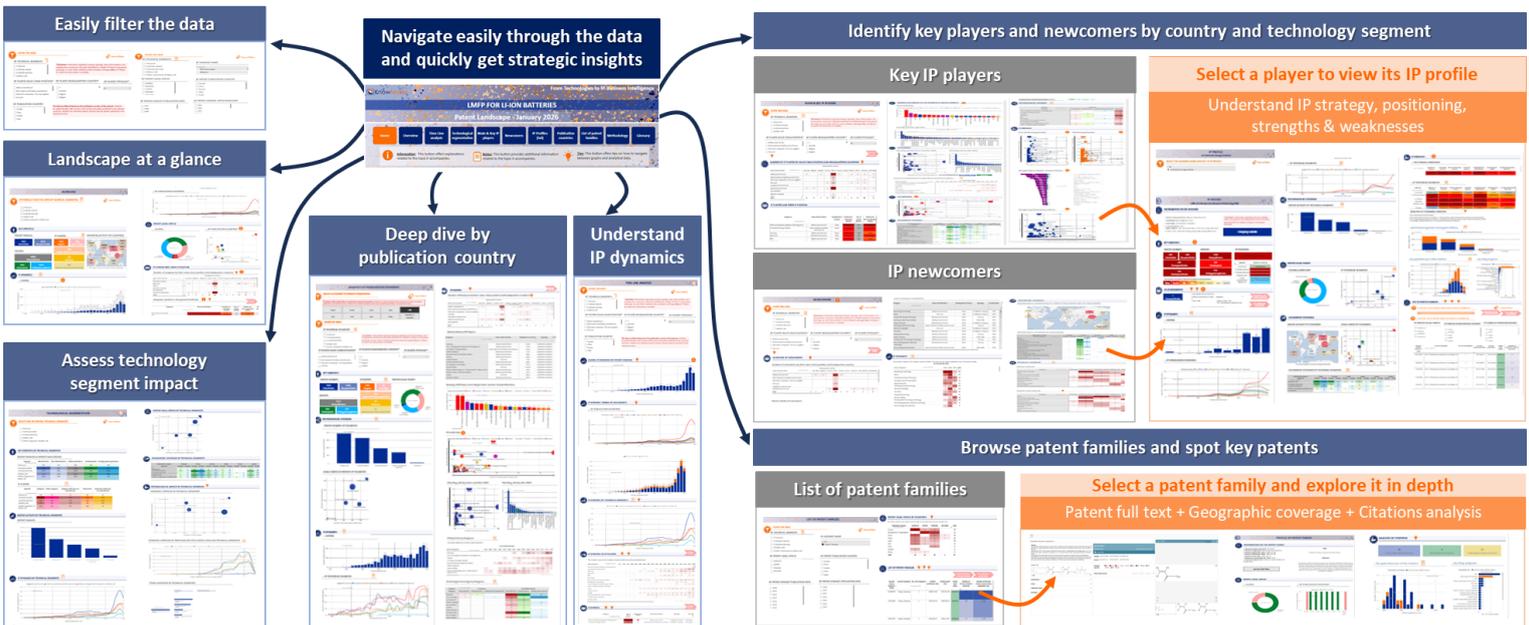
### Interactive dashboard (optional)

**Optional add-on:** One-year access to the interactive dashboard for unlimited authorized users within your organization.

An interactive dashboard can be provided with this report, transforming the analysis into a true decision-support tool that puts you in control. It enables you to explore the patent landscape dynamically by applicant, technology, geography, publication period, or legal status, and to drill down instantly into key insights, from high-level trends to individual players and patents.

Tailored to the specific needs of R&D, IP, strategy, and business development teams, the dashboard delivers immediate visual answers to critical questions, enabling faster and more informed strategic decision-making across your organization.

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## Companies mentioned in the report (non-exhaustive)

**INDUSTRIALS:** CATL, LG Chem/LG Energy Solutions, Samsung, Dynanonic, BYD, EVE Energy, Murata/Sony, ATL, Guoxuan High Tech Power Energy/Gotion, SVOLT, Toyota, Taiheiyo Cement, Toshiba, Sumitomo Chemical/Tanaka Chemical, Tinci Materials Technology, Envision/AESC, Global Graphene, COSMX/COSLIGHT, Sumitomo Metal Mining, Sunwoda, General Motors, Rongbay Technology, HydroQuébec, Reliance New Energy/Lithium Werks, Epsilon Carbon/Johnson Matthey and more.

**R&D LABORATORIES:** SEL, Kyushu University, AIST, Tokyo Metropolitan University, Central South University, Institute of Physics, Tsinghua University, Beijing Institute of Technology, Hanyang University, UNIST, KAIST, RIST, KERI, CEA, CNRS, Fraunhofer, Université de Montréal, University of Chicago, University of Michigan, Lockheed Martin/UT-Battelle and more.

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• Patent activities by technological segments (precursors, cathode		• Time evolution of patent publications		Nanotech, and more
materials, cathode, battery cells, and other components)		• Patent families, pending applications and granted patents by		• <b>Other companies:</b> Epsilon Carbon/Johnson Matthey, Aleees
• Time evolution of patent publications by segments (precursors,		segments (precursors, cathode materials, cathode, battery cells,		(Advanced Lithium Electrochemistry), Reliance New Energy (Incl.
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The Seller shall by no means be responsible for any delay in respect of article 2.2 above, and including in cases where a new event or access to new contradictory information would require for the analyst extra time to compute or compare the data in order to enable the Seller to deliver a high quality Products.

2.3 The mailing of the Product will occur only upon payment by the Buyer, in accordance with the conditions contained in article 3.

2.4 The mailing is operated through electronic means either by email via the sales department. If the Product’s electronic delivery format is defective, the Seller undertakes to replace it at no charge to the Buyer provided that it is informed of the defective formatting within 90 days from the date of the original download or receipt of the Product.

2.5 The person receiving the Products on behalf of the Buyer shall immediately verify the quality of the Products and their conformity to the order. Any claim for apparent defects or for

non-conformity shall be sent in writing to the Seller within 8 days of receipt of the Products. For this purpose, the Buyer agrees to produce sufficient evidence of such defects.

2.6 No return of Products shall be accepted without prior information to the Seller, even in case of delayed delivery. Any Product returned to the Seller without providing prior information to the Seller as required under article 2.5 shall remain at the Buyer’s risk.

## 3. Price, invoicing and payment

3.1 Prices are given in the orders corresponding to each Product sold on a unit basis or corresponding to annual subscriptions. They are expressed to be inclusive of all taxes. The prices may be reevaluated from time to time. The effective price is deemed to be the one applicable at the time of the order.

3.2 Payments due by the Buyer shall be sent by cheque payable to KnowMade, PayPal, or by electronic transfer to the following account:

Banque Populaire Méditerranée, CAP 3000 Quartier du lac, 06700 St Laurent du Var

BIC or SWIFT code: CCBPFRPPMAR

IBAN: : FR76 1460 7003 6360 6214 5695 139

To ensure the payments, the Seller reserves the right to request down payments from the Buyer. In this case, the need of down payments will be mentioned on the order.

3.3 Payment is due by the Buyer to the Seller within 30 days from invoice date, except in the case of a particular written agreement. If the Buyer fails to pay within this time and fails to contact the Seller, the latter shall be entitled to invoice interest in arrears based on the annual rate Refi of the «BCE» + 7 points, in accordance with article L. 441-6 of the French Commercial Code. Our publications (report, database, tool...) are delivered only after reception of the payment.

3.4 In the event of termination of the contract, or of misconduct, during the contract, the Seller will have the right to invoice at the stage in progress, and to take legal action for damages.

## 4. Liabilities

4.1 The Buyer or any other individual or legal person acting on its behalf, being a business user buying the Products for its business activities, shall be solely responsible for choosing the Products and for the use and interpretations he makes of the documents it purchases, of the results he obtains, and of the advice and acts it deduces thereof.

4.2 The Seller shall only be liable for (i) direct and (ii) foreseeable pecuniary loss, caused by the Products or arising from a material breach of this agreement

4.3 In no event shall the Seller be liable for:

a) damages of any kind, including without limitation, incidental or consequential damages (including, but not limited to, damages for loss of profits, business interruption and loss of programs or information) arising out of the use of or inability to use the Seller’s website or the Products, or any information provided on the website, or in the Products;

b) any claim attributable to errors, omissions or other inaccuracies in the Product or interpretations thereof.

4.4 All the information contained in the Products has been obtained from sources believed to be reliable. The Seller does not warrant the accuracy, completeness adequacy or reliability of such information, which cannot be guaranteed to be free from errors.

4.5 All the Products that the Seller sells may, upon prior notice to the Buyer from time to time be modified by or substituted with similar Products meeting the needs of the Buyer. This modification shall not lead to the liability of the Seller, provided that the Seller ensures the substituted Product is similar to the Product initially ordered.

4.6 In the case where, after inspection, it is acknowledged that the Products contain defects, the Seller undertakes to replace the defective products as far as the supplies allow and without indemnities or compensation of any kind for labor costs, delays, loss caused or any other reason. The replacement is guaranteed for a maximum of two months starting from the delivery date. Any replacement is excluded for any event as set out in article 5 below.

4.7 The deadlines that the Seller is asked to state for the mailing of the Products are given for information only and are not guaranteed. If such deadlines are not met, it shall not lead to any damages or cancellation of the orders, except for non-acceptable delays exceeding [4] months from the stated deadline, without information from the Seller. In such case only, the Buyer shall be entitled to ask for a reimbursement of its first down payment to the exclusion of any further damages.

4.8 The Seller does not make any warranties, express or implied, including, without limitation, those of saleability and fitness for a particular purpose, with respect to the Products. Although the Seller shall take reasonable steps to screen Products for infection of viruses, worms, Trojan horses or other codes containing contaminating or destructive properties before making the Products available, the Seller cannot guarantee that any Product will be free from infection.

## 5. Force majeure

The Seller shall not be liable for any delay in performance directly or indirectly caused by or resulting from acts of nature, fire, flood, accident, riot, war, government intervention, embargoes, strikes, labor difficulties, equipment failure, late deliveries by suppliers or other difficulties which are beyond the control, and not the fault of the Seller.

## 6. Protection of the Seller’s IPR

6.1 All the IPR attached to the Products are and remain the property of the Seller and are protected under French and international copyright law and conventions.

6.2 The Buyer agreed not to disclose, copy, reproduce, redistribute, resell or publish the Product, or any part of it to any other party other than employees of its company. The Buyer shall have the right to use the Products solely for its own internal information purposes. In particular, the Buyer shall therefore not use the Product for purposes such as:

- Information storage and retrieval systems;
- Recordings and re-transmittals over any network (including any local area network);
- use in any timesharing, service bureau, bulletin board or similar arrangement or public display;
- Posting any Product to any other online service (including bulletin boards or the Internet);
- Licensing, leasing, selling, offering for sale or assigning the Product.

6.3 The Buyer shall be solely responsible towards the Seller of all infringements of this obligation, whether this infringement comes from its employees or any person to whom the Buyer has sent the Products and shall personally take care of any related proceedings, and the Buyer shall bear related financial consequences in their entirety.

6.4 The Buyer shall define within its company point of contact for the needs of the contract. This person will be the recipient of each new report in PDF format. This person shall also be responsible for respect of the copyrights and will guaranty that the Products are not disseminated out of the company.

## 7. Termination

7.1 If the Buyer cancels the order in whole or in part or postpones the date of mailing, the Buyer shall indemnify the Seller for the entire costs that have been incurred as at the date of notification by the Buyer of such delay or cancellation. This may also apply for any other direct or indirect consequential loss that may be borne by the Seller, following this decision.

7.2 In the event of breach by one Party under these conditions or the order, the non-breaching Party may send a notification to the other by recorded delivery letter upon which, after a period of thirty (30) days without solving the problem, the non-breaching Party shall be entitled to terminate all the pending orders, without being liable for any compensation.

## 8. Miscellaneous

All the provisions of these Terms and Conditions are for the benefit of the Seller itself, but also for its licensors, employees and agents. Each of them is entitled to assert and enforce those provisions against the Buyer.

Any notices under these Terms and Conditions shall be given in writing. They shall be effective upon receipt by the other Party.

The Seller may, from time to time, update these Terms and Conditions and the Buyer, is deemed to have accepted the latest version of these terms and conditions, provided they have been communicated to him in due time.

## 9. Governing law and jurisdiction

9.1 Any dispute arising out or linked to these Terms and Conditions or to any contract (orders) entered into in application of these Terms and Conditions shall be settled by the French Commercial Courts of Grasse, which shall have exclusive jurisdiction upon such issues.

9.2 French law shall govern the relation between the Buyer and the Seller, in accordance with these Terms and Conditions.