

Submission to:

## National Security and Investment: Sectors in Scope of the Mandatory Regime

Consultation by: Department for Business , Energy and Industry Strategy

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Permission: Is granted to publish this submission

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Responses are provided from the Photonics Leadership Group, based on discussions at past PLG meetings and surveys of the industry as representative of the consensus views of the £13.5bn UK photonics industry. Whilst providing a overall input, the views of individual organisations may differ and should be consulted for detailed responses that maybe more specific than the overview represented here.

The UK photonics industry directly employees 69,000 people generating an output of £13.5bn based on 2018 company figures. Many UK photonics manufacturers are strongly export focused, in some cases exporting almost their entire output. With high growth, at least double that of the broader economy, and a strong international focus, many UK photonics companies have leveraged foreign investment to support and accelerate their growth. In only almost all cases this investment has been used to significantly expand UK facilities and capability in manufacturing, research and development.

### Questions applying to all sectors

- 1. Are the sector definitions sufficiently clear to enable investors and businesses to self-assess whether they must notify and receive approval for relevant transactions? If not, how can the definitions be improved?**

The sector definitions vary considerably in their detail and clarity. Some such as Quantum Technology are well defined, others are, at best, inconsistent. The advanced materials section in particular is very wide ranging in its scope, and is noticeable less clear in its definitions, with many inconsistencies within the detailed sub-sectors. For example, there is a major imbalance between the definitions in the Artificial Intelligence section being confined to 1/3 page whilst advance materials stretches to over 11 pages. The burden of notification and number of notifications is therefore heavily skewed toward advanced materials. Our comments are therefore predominantly confined to the advanced materials definitions.

Within the advanced materials section self-assessment is made particularly difficult by the inclusion of many poorly quantified or relative terms without a defined bench mark. Terms such as 'improve', 'exceeding', 'excellent', 'reduce', 'enable' especially in reference to an ill defined generic performance parameter such as 'robustness' 'stability' and 'quality' are too vague for any company to make a simple assessment. An improvement in one application could be seen as a degradation to another. What is robust in one application may be unstable in another. These terms do not define a material composition or format but imply an application specific performance, but without the clarity on quantifying that performance or the application of concern.

Further clarity is also required in what constitutes a component- a term used over 30 times in the draft definition. This term very much depends where an organisation is operating in the supply chain. For example, a semiconductor, machine tool or aerospace company supplying a £1million+ product could well consider a £100,000 laser, robot or even an engine a component. At the other extreme a company supplying a printed circuit board, or consumer webcam may consider a £0.10 transistor or lens a component- the interpretation of the term 'component' depends heavily on where one operates in the supply chain and lacks a universal definition. To simplify interpretation of what is meant by 'component', the term should always be defined in the context in which it is used.

#### Advanced materials, Entities covered.

1a..'research into' will university research contracts with foreign parties covering the defined sub-sectors require mandatory notification? If included when should such notification take place? - on signature of the contract – at which point the research is in the future and thus no trigger event in the form of transfer of knowledge can have occurred because the knowledge has yet to be generated, or when substantial research progress / results are reported and delivered to the partners. Note any requirement to notify on generation of research output, rather than on signature, would capture many on-going and existing projects, putting potentially a significant source of international research income at risk.

How should collaborative arrangements with foreign research institutes be covered where the objective is joint and collaborative knowledge generation?

Note other mandatory notification sectors e.g. Advanced Robotics, Artificial Intelligence, Civil Nuclear and, Communications do not include research organisations, whilst Engineering Biology and Quantum Tech do. The inclusion of research needs to be consistent across all sectors, otherwise there is a risk of confusion, or the potential to use descriptive changes to avoid inclusion thus causing a major skewing of areas appearing to attract international collaboration

Clarification is urgently required so the UK's globally leading research sector can take necessary action and put in place process to ensure conformity.

1b & 1e..'developing or producing'... 'providing products for use in' These clauses can be interpreted as covering the sales of any product falling within this sector definition. Is it the intention that all international sales of all products e.g. in the advanced materials sub-sectors and/or enabling their manufacture should be subject to notification?. The UK photonics industry produce £13.5bn worth of output with 75% of its 1000 companies exporting >75% of their output and >25% exporting 90% of their output. Almost all of these products incorporate "Photonic and optoelectronic materials". If mandatory notifications are required on all such sales the number of notices from this industry alone

could be many thousands per year. Additional clarity is needed on whether products containing the defined material, or only the materials themselves are covered and what the precise position is regarding product sales which by definition involve transfer of control of an asset.

When considering whether sales are covered the interrelation to export control regulation needs to be clearly defined, in particular which regulation takes precedence. Export control regulations are extremely detailed and provide detailed specification on what is covered in terms of supply. Whilst the rationale notes the objective has been to cover 'materials, technologies and capabilities' not covered by export control, the net impact if all asset transfers including sales are included is essential to significantly expand the scope of export control. Does the possession of an export license remove the need to file a mandatory notification for the transfer of the covered asset?

No clear rationale is currently provided on why something should be in the mandatory notification list and not on the export control list or visa-versa. One rational simplification, reducing a large number of notices, would be to constraint notification to only asset transfer covering organisation ownership and control rather than other forms of asset transfer such as sales for advance materials. It should certainly be clarified whether transfers covered by an export license require notification.

1c and 1d... 'enabler for use in', 'designed to be used to make' This clause implies all test and measurement / inspection equipment used in advanced materials manufacturing is included in scope. If this is the intention it should be explicitly stated especially as 'test and inspection' equipment is used extensively within the sub-sector definition but not in the definition of organisations to be covered. As the UK supplies many key sub-systems e.g. lasers to OEMs for integration into manufacturing equipment internationally, is the intention to cover such components as well as the equipment they are built into?.

If to be included what types of end use are included, e.g. only the manufacture of advanced materials defined in section 3 or all advanced materials? How should test, measurement and production equipment related to other mandatory sectors e.g. communications be treated? It is not covered in the specific definitions for communications, but has as much if not more relevance than many areas related to advance materials.

1g... 'know-how or services of enablers' When a higher performance sub-system or test and measurement system or similar is sold part of the sales process frequently includes end user training and standard or development of bespoke processes so the end user get best use of the equipment. It is not normally possible to decouple high performance equipment sales from the provision of know-how in the use of such equipment. Thus clarity on whether sales of equipment require notification requires parallel clarity in what constitutes a sale. e.g. does it include the transfer of the associated know-how to use the machine or components.

Comments on the technical definitions of the sub-sectors are included in response to Question 2

## **2. To what extent are technical and scientific terms correct and sufficiently clear and commonly understood for the purposes of determining relevant activities?**

There is significant inconsistency in the technical definitions in the advance materials sub-sectors and elsewhere detailed as follows. Ambiguity in the definition of components and undefined generic

terms such as 'robustness' 'stability' and 'quality' and none quantified relative benchmarks such as 'exceeding', 'excellent', 'reduce', 'enable' has been noted previously.

### Advanced Materials

3e Metamaterials. Overall a detailed technical definition is incorporated setting the standard that should be used elsewhere. However, as noted in the rationale, the definition extends beyond just materials to include 'test, inspection and production equipment'. Whilst clear in this sub-section the terminology is different to section 1, which as noted above requires clarity on the type of organisation considered in scope.

3e iii, Uses the term feedstock, this requires further clear definition, e.g. are component materials covered? If so only for the fabrication method stipulated or for all metamaterials?

3e v1 makes an explicit inclusions of technologies rather than materials. This may be confusion within a sector described as advanced materials. It would be better to state materials capable of altering their function and behaviour once installed or produced.

3f semiconductors, lack clarity of some key definitions including:-

3fi1 key components. Is the intention to cover all components incorporating compound semiconductors? If so is the definition of compound semiconductors only the materials defined in 3fiii1 or any compound semiconductor? The term 'enabled by' is used without definition- as the entire economy depends on, and is thus enabled by, compound semiconductors through their widespread use in the internet hardware, this could be misinterpreted as meaning anything made in the UK, thus implying notification is required for all asset transfers of any type!

3fii 1-3 test and inspection and production equipment. Despite the title none of the three areas detailed mentions test and inspection equipment, rather they are all capabilities e.g. capability to process, fabricate or package. This presents two levels of ambiguity, firstly such capability is not an advanced materials, second, to which advanced materials does such capability apply – only those cited in 3fiii1 or more generally?

3fiii Materials. On one side 3fiii1 is a very limited set of materials, but is unclear if notification is limited to these materials or would include similar ones and or whether there are any compositional limits or definitions, that would help reduce unnecessary notifications. In contrast 3fiii2 does not define a material but anything which exceeds performance of existing technology. How should a company assess if they exceed performance, especially when overall performance is often a compromise between different parameters with an improvement in one offset with a degradation in another, according to the requirements of the application. This is a particular challenge for detection and imaging, where e.g. resolution, sensitivity and speed must often be offset against each other. At very minimum these terms need a proper technical definition and the performance that constitutes an improvement defined. Without such clarity any, and every, product variant is likely to result in a notification.

In general this is an example of an area which is well covered in export control regulations and where cross-reference to export control would be beneficial. In most cases the precise performance that drives national security concern is defined in export control lists and should be

kept there. The mandatory notification list should be confined to e.g simple definition of material families without reference to relative performance.

3g Photonics and Optoelectronic materials. Unlike the metamaterials sub-section 3e, this area lacks a detailed 'where' definition section that defines photonics and optoelectronics in terms of waveband, interaction with light etc and lacks any quantification of terminology.

Whilst included under materials, consideration should be given to whether this area is better matched or indeed already covered by the Dual Use area of the Bill. Whilst optical materials have many defence and security applications (e.g in situationally awareness imaging) they are also widely used in other domains e.g. life science imaging, manufacturing and consumer devices. A number of the applications implied under 3g are related to defence and security applications that would be covered by the 'Military and Dual Use' section. Materials should only be included here if the intention is to cover non-defence and security applications and the definitions should reflect what is important in those other applications.

3gi1 is very ambiguous as to what increase amplification, quality or robustness means. One might assume amplification means optical amplification, but this is unclear. More unclear is what increase or improved is relative to and how would a organisation make such an assessment. Does one mean improved relative to ones other products, or UK or international competitors. Is that improvement in performance specification, or best results achieved in the laboratory in the UK or worldwide? Reduced size or volume of what? Quality and robustness are even more important to define. Robustness against what? – there is no standard definition. One persons improvement can be another's degradation, as noted below under 3gi3.

3gi2 as written this implies a coating can change the loss 'in' i.e. inside the material of a lens – this is not meaningful- it is not possible to change what happens inside a material by adding something to the outside. Much greater clarity is required, for example is it meant to cover t reduced absorption in the coating material? Or change in performance at a particular wavelength. If one means reduction of loss in use, it is essential to consider that in coatings improved performance at one wavelength / colour is almost always accompanied by increased loss at other wavelengths. Hundreds of thousands of lens are produced in the UK annually (e.g. for consumer ophthalmic eyewear – most with coatings) all with different loss / reflection profiles. As written any new coating design on a set of consumer glasses could potentially require mandatory notification!.

3gi3 the detailed terms requires much better definition. e.g. does improved physical stability mean against mechanical perturbation or chemical or environmental ingress, or all of the above. What constitutes an improvement (as above) relative to what? How would an organisation make such an assessment? Given the huge variety of applications where lenses and mirrors are utilised, from healthcare to industrial manufacturing, robustness can cover an almost infinite range of properties that are applicable in these different domains. Without defining either the application space, what constitutes an improvement, against what benchmark and what property the number of potential notifications could run to many thousand per year under this category alone.

Over 3gi2 and 3gi3 the number of notifications would be significantly reduced if size of optic above which notification was required was defined. In most cases it is only larger diameter optics

that are of national security concern, but these should already be covered under the 'Military and Dual Use' section. As above, review of whether there is national security benefit of coverage beyond Military and Dual use should be carefully considered.

3gi5 what constitutes a wide 'field of view'? One persons wide is another narrow how should an organisation make such assessment without any quantification of the 'field of view' of interest and clear technical definition of the terminology? Furthermore 'field of view' is a property of an imaging system not of an isolated material, sensor or focal plain array, it can be dynamic (e.g. telephoto lens), is heavily dependent on wavelength (colour) and can be wide in one dimension and narrow in another. Similar components / materials can be arranged in different systems and fabricated with different shapes to give different 'fields of view. Thus for one application a material may improve performance without altering the 'field of view' but in another the same material could be reconfigured to impact the 'field of view'. If the material is designed and supplied for the former application, but at a some latter point in time a customer chooses without the suppliers knowledge to apply to a wider 'field of view' configuration, how is the supplier meant to know when/ if they should notify. If any potential future impact on 'field of view' is intended to be covered at any wavelength, this could trigger high volumes of notifications on all existing optical materials any one of which could be used in a design with impact on the 'field of view' at some wavelength.

A more precise definition would be to focus on the material properties that enable wider 'field of view' e.g. materials with refractive index above X over a wavelength range Y. Alternatively focus on the system properties, as are covered in the existing export control list and better suited to the detailed technical coverage provided therein. Consideration should also be given to coverage of materials with non-uniform refractive index, which potentially have much greater impact on imaging system performance without necessarily changing the field of view.

3giii1 as in 3ev1 this clause refers to technologies not materials. It improves on others by defining quality, but should use the full technical definition e.g. having a beam divergence relative to ideal Gaussian beam measured as an M squared of less than 1.2. Technical abbreviations such as M2 are never clear. High power should probably refer to average optical power greater than 3KW. It should certainly clearly define whether is this is intended to be pulsed, peak continuous or average power and any relevant pulse parameters- a very low average power laser can have a peak power much greater than 3KW.

3giii2 What is a significant distance?, in manufacturing applications 2metres is a significant distance between light source and processed material but this distance may have no national security implications. Given defence applications are assumed covered under the 'Military and Dual Use' section focus should be on a definition of distance that triggers a national security concern in other applications.

In both 3giii1 and2 'enable' and 'approaches' needs clear definition. Does it mean new materials alone, if new techniques are intended to be covered careful consideration should be given to their inclusion with an advanced materials section. It may not be clear to an organisation developing such techniques without novel materials that they need to read into the advanced materials to discover they should make a notification.

3h 2d materials. There is inconsistency here between graphene where coverage is defined by application and other 2D materials where it is only defined very vaguely through 'excellent properties'. Given graphene is just one type of 2D material, careful consideration should be given to whether it should be treated separately, or just as one example of a 2D material. There are 100's of different types of 2D materials. To have some notification requirements just confined to one type e.g. graphene, risks missing development in other 2D materials and will require more frequent updates to the notification list as those other materials inevitable develop.

3hiii5 How should an organisation assess if they have a material with excellent thermal, photonic or electronics properties. What is excellent?

Give the breadth of application and vagueness on properties of concern ( and potential of both to change over time), it would be more transparent to simply state all 2D materials and methods of fabricating with a very clear definition of what is a 2D material. The latter definition being lacking at present.

3i Nanotechnology. The term nano-technology needs a clear definition. It is notable that this section appears to be restricted to only test, inspection, production equipment and methods for specific applications not the actual materials. Is this intentional?

3i2fii photonics and optoelectronics and semiconductors materials are covered (3f and 3g) and covered relevant to nanotechnology fabrication methods should be included in those sections and not repeated here for clarity.

3i2fv metamaterials are mentioned again here but are covered in a separate higher level section. They should be in one or the other not both.

3i2fv "additive manufacturing of moving parts..." is not a material, but a process/ method.

Given the considerable overlap to other sections it is unclear if the nanotechnology section adds any value. Clarity would be improved if items contained within 3i were captured alongside the materials to which they refer this would enable an organisation to assess, 1) do I work with this material?, 2) do I work with it in this format?, 3) do I supply or enable any of these processes?

### **3. To what extent do these definitions include the areas of the economy where foreign investment has the greatest potential to cause national security risks?**

Within the context of advanced material sub-sectors it is not always transparent what is meant by an advanced material. For example under 3gi1 one assumes that optical glass fibre as well as the glass itself is intended to be included, but this is not explicit.

An upfront definition of materials would be beneficial that clarifies that whenever the term is used it should be taken to mean both chemical composition and reconfiguration into different formats. Where ever possible both the composition and the physical format requiring notification should be defined. National security risks can come as much from importing raw materials and recombining and reconfiguring them into a value added format as they can in the material itself.

#### **4. How else, aside from mandatory notification under the NSI regime, can the Government ensure relevant transactions receive appropriate screening while minimising the impact on business?**

Organisations need to be able to apply for guidance in advance of a transaction or potential trigger events. Organisations should also be able to apply for an exemption covering a range of transfers not related to investment or sale of a company. Whilst the legislation puts the emphasis on the acquirer to notify, as these will be foreign entities they will look to the UK organisation providing the asset to provide first guidance. Thus the burden of compliance will fall heavily on UK industry.

The 30 day timeline for providing a response to a notification must be delivered upon in over 95% of cases. Companies should have recourse for compensation if this time limit is missed, proportionate to the value of asset transfers impacted.

Given the penalties associated with not complying and the impact on reducing the 5 year call-in if a notification is made, many companies will initially take a cautionary approach and notify. Government needs to be prepared for a high initial notification surge.

Early and clear guidance on where organisations are expected to notify, but more importantly where they are not, is urgently required. The process for modifying and updating the mandatory notification list also requires clarity, just as there is a process for reviewing and updating the Export control list and obtaining international input via the Wassenaar arrangement. Given that the full impact of the NSI legislation and number of notifications is impossible to assess accurately in advance, the update and revision process will be particularly important in the first 2-3 years of operation and with the mandatory notification list requiring more frequent review and revision during this initial implementation phase.

The process for notification needs to be made publicly available immediately so that those with a transaction in the pipeline from 11 November 2020 can prepare the required information in advance of the legislation becoming law and make correct compliance notification immediately on completion. Clear guidance is required for such transactions that risk being caught in limbo between 11 November and the Bill becoming law and the notification process being up and running.

Clarification on the interaction with export control is required.

Clarification on the position regarding standard product sales especially those of high value products that are associated with process knowledge transfer / training as part of the sales is urgently required.

Clarification on the situation regarding enabling components and systems that e.g. support advanced materials or communications equipment but are not otherwise noted needs to be clarified.

Clarification on the intended situation with respect to industrial research contracts between universities or RTO's and foreign organisations, not least on when a trigger event would be deemed to have occurred. The handling of research between different mandatory notification sectors needs to be consistent.



**5. Do these definitions strike the right balance between safeguarding national security and minimising the burdens placed on businesses and investors? Is it possible to narrow the scope of the definitions without compromising national security?**

As noted above many of the definitions are very poorly quantified and open to potentially very broad interpretation especially if a naturally cautionary approach is taken from organisations. This would open the pathway to a huge number of notifications especially around transfer of assets outside company investment / sale. Whilst the inclusion of such transfers is understandable, full consideration of the full number of notifications that may result and how to focus only on the ones of most importance to national security is lacking.

Given it appears a definition of national security will not be included in the Bill, organisations will be unable to make a definitive assessment if a transfer has national security implications. Indeed this will be especially true for foreign organisations looking who are less likely to be familiar with detailed UK concerns. Therefore most prudent organisations will naturally defer to the UK government to make the national security assessment and notify purely based on the sector definitions. This will potentially lead to a very large number of potentially irrelevant notifications swamping capacity and obscuring those of genuine concern. At the very minimum foreign investors and purchasers will need clear tools to help understand when a notification is not required.

**Communications**

**10. Is the definition sufficient to capture all our interests to enable us to respond to potential and exceptional national security concerns in particular equipment and services suppliers and digital infrastructure?**

The proposed definition is overly brief. The critical clarification included in the rationale that defines associated facilities should be brought into the main definition for namely:-

1. inclusion of sub-sea fibre optic cables and services,
2. The associated telecoms supply chain....
3. Digital infrastructure companies....

These are all essential components of the definition and should be included with it and be better defined. All definitions should stand alone without any requirement to cross-reference the rationale.

As written, in the current rationale, it is indicated that the entire telecom supply chain is included from the most basic components to services supplied. This needs much tighter definition. For example does it extend to the semiconductor wafers from which lasers and detectors are made which go into the transceivers that, many layers higher, in the supply chain form a key part of a communications network? What about the test and measurement equipment that is used to made in the UK and exported globally for use in the manufacture of communications equipment systems and components?

Some but not all of these cases these are covered in the advanced materials section, thus this section may benefit from the simple clarification of 'materials and components.... not covered elsewhere that are used in communications networks'.

**11. Is the definition clear that the Communications sector definition includes entities that provide public and private electronics communications networks, and their associated facilities?**

On the inclusion of digital infrastructure there is significant overlap with the Data infrastructure section that includes a much more comprehensive definition of who is covered and included. The separation between communication and data infrastructure is increasingly artificial and outdated. In the modern digital economy a significant portion of communications traffic goes through a datacentre and therefore interacts with data infrastructure. Data infrastructure operators also run and manage the interconnection between their datacentres sometime on private networks, but often using at least some of the wider communications infrastructure.

Therefore an organisation may consider itself a data infrastructure provider, but be impacted by mandatory requirements in the communications section and many if not all communication operators host data infrastructure. Serious consideration should be given to combining the communications and data infrastructure sections into one, which would give clarification and improve definitions. In particular, it would resolve the outstanding questions of whether an organisation supplying equipment or components to datacentres but not wider area communication networks is covered

**12. How can the definition be narrowed to exclude private communications networks that do not pose a risk to national security?**

**Data Infrastructure**

**19. Does the data infrastructure definition capture all entities whose operations give it potential access to relevant data or relevant data infrastructure, and exclude those without such access? In your response, we are particularly interested in whether we have accurately covered the various operating and ownership models within the data infrastructure sector; the provision of technical services to relevant data infrastructure; and the provision of virtualised services to relevant data infrastructure.**

As noted above, the separate between communication and data infrastructure is potential artificial and outdated. In the modern digital economy a significant portion of communications traffic goes through a datacentre and therefore interacts with data infrastructure. Data infrastructure operators also run and manage the interconnection between their datacentres sometime on private networks but often using at least some of the wider communications infrastructure.

Therefore an organisation may consider itself a data infrastructure provider but be impacted by mandatory requirements in the communications section and many if not all communication operators host data infrastructure. Serious consideration should be given to combining the communications and data infrastructure sections into one.

For example if an organisation provides the equipment within a datacentre for communicating outside that datacentre which section takes precedence?

