

ECO-SYSTEMS MAPPING OF CONTINENTAL'S STRATEGIC DOMAINS



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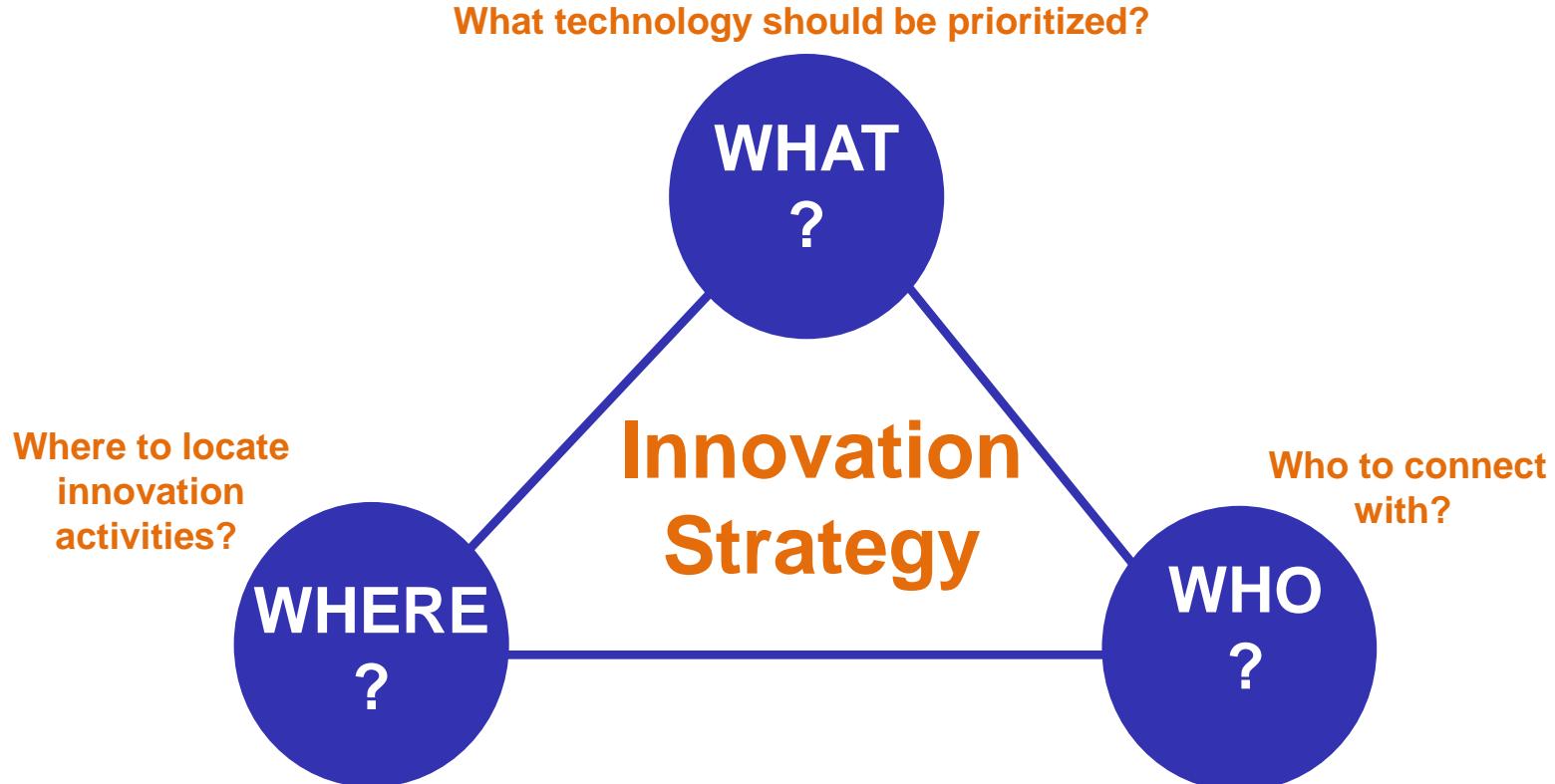
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Context & key objectives



The three pillars of corporate innovation strategy



From strategic challenges to data solutions

	WHAT?	WHERE?	WHO?
Strategic challenge	What technology should be prioritized?	Where to locate innovation activities?	Who to connect with?
Level of analysis	Technological ecosystems	Urban ecosystems	Actor ecosystems
Key metrics	Classification Velocity Relatedness	Patent counts Relatedness density Comp. Advantages	Patent counts Patent shares
Business decisions	R&D investments Tech diversification New use cases	Spatial scouting Set-up incubators Locate R&D labs	Collaborations M&As Talent acquisitions



Key objective

The key objective is to **support Continental's innovation efforts** by **mapping worldwide eco-systems in 8 strategic domains**: head-up displays, computer-aided design, optical systems (general), holography, screen displays (vehicles), optical components, arrangement for software engineering & Automotive ECUs.

- 1 Define the technological profiles of these domains
- 2 Map worldwide knowledge eco-systems in these domains
- 3 Identify the key actors in these domains



Methodological note



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Academic framework of economic complexity

Economic complexity principles are used to define the technological profiles of the different domains and identify knowledge hubs.

The literature on **economic complexity** applies network science, big data, and machine learning to understand economic development. One of the key finding of this literature is that corporate and regional diversification happens through the **principle of relatedness**.

Inventors, companies and regions develop new products and technologies by recombining pre-existing available capabilities. Mapping existing capabilities allows to estimate the distance with any new domain – measured by the concept of relatedness. (see figure 3A). The higher the degree of relatedness between an entity and a new economic activity, the higher the probability of diversification (see figure 3B;3C;3D).

To draw the maps presented in this report, we produce 3 indicators: number of **patents**, **relatedness density** and **relative comparative advantages**. All formulas can be found in Hidalgo, Balland et al. (2020). The location index that we present combines rankings in terms of patent quantity in a given domain + relative specialization & relatedness density (urban profile).

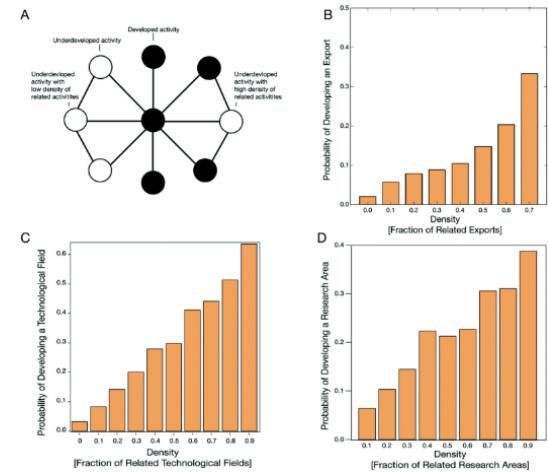


Figure 3. The principle of relatedness

Hidalgo, Balland et al. (2020)
Unifying Themes in Complex Systems



Analysis of large patent datasets

Precise geolocation of the place of knowledge production based on inventors home addresses

Application date

Specific classification in one of the 250,000 different technological category

(12) **United States Patent**
Cros et al.

(10) **Patent No.:** US 8,474,749 B2
(45) **Date of Patent:** Jul. 2, 2013

Publication date

(54) **AIRCRAFT INCLUDING AN UNDERCARRIAGE MOTOR**

(75) Inventors: Christophe Cros, L'Union (FR); Pierre Henri Brousse, Ramonville Saint Agne (FR); Jeremy Bedarides, Toulouse (FR)

(73) Assignees: Airbus (S.A.S.), Blagnac (FR); Airbus Operations SAS, Toulouse (FR); Airbus Operations Ltd., Bristol (GB)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 225 days.

(21) Appl. No.: 13/113,627

(22) Filed: May 23, 2011

(65) **Prior Publication Data**

US 2011/0290933 A1 Dec. 1, 2011

(30) **Foreign Application Priority Data**

May 26, 2010 (FR) 10 02222

(51) **Int. Cl.**
B64C 25/50 (2006.01)

(52) **U.S. Cl.**
USPC 244/50; 244/100 R; 244/111; 244/103 R

(58) **Field of Classification Search**
USPC 244/50
See application file for complete search history.

(56) **References Cited**

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FR 2 930 760 A1 11/2009
WO WO 95/29094 A1 11/1995
WO WO 2009/151622 A1 12/2009

Citations to other patents

OTHER PUBLICATIONS

Preliminary Search Report for priority French Patent Application No. 10 02222, dated Dec. 8, 2010 (w/ English translation).

* cited by examiner

Citation to non-patent literature
(scientific publications, reports)

Primary Examiner — Christopher P Ellis
Assistant Examiner — Medhat Badawi
(74) Attorney, Agent, or Firm — Oliff & Berridge, PLC

(57) **ABSTRACT**

The aircraft includes at least one engine suitable for propelling the aircraft in flight, at least one motor of an undercarriage, and automatic means arranged to cause the aircraft to taxi under drive directly from the engine, while simultaneously using the motor for taxiing, other than during takeoff or landing.

Summary +
complete text

The data source used in this analysis is the OECD REGPAT – 2022 edition



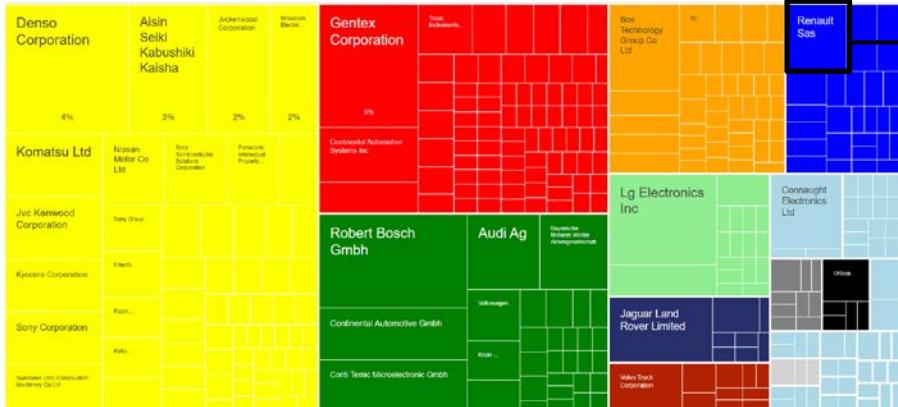
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High-end interactive data visualizations tools

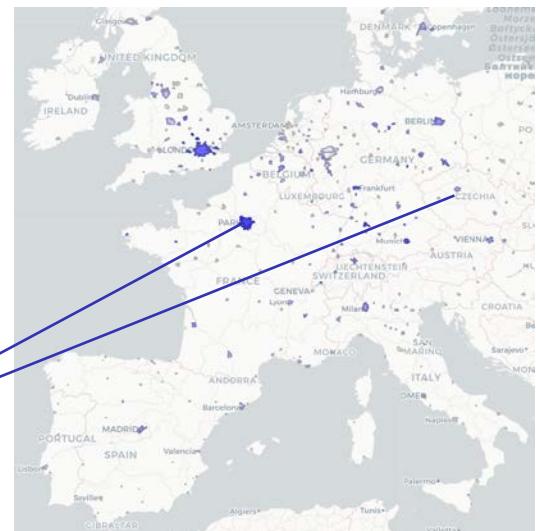
Key information for strategy decision making are made available through high-end interactive data visualizations tools (HTML). Links to the interactive material are launched by



Share of patents produced by a given company/inventor – top candidates for strategic collaborations & hiring



Urban ecosystems with the highest relatedness density, relative comparative advantage and patent counts – top candidates for location choices



Technological profiles of the 8 domains



Classification of patents in strategic domains

We use a text mining algorithm to identify the patents that corresponds to the 8 strategic domains of head-up displays, computer-aided design, optical systems (general), holography, screen displays (vehicules), optical components, arrangement for software engineering & Automotive ECUs.

First, Continental experts & Argos delineate the technological landscape and set up a **list of key words that characterize the different strategic domains**.

Second, a **text mining algorithm** searches these key words and their specific association in the text of **patent documents** as well as in the **Cooperative Patent Classification (CPC) nomenclature**. The CPC nomenclature is developed and maintained by the European Patent Office (EPO) and the US Patent and Trademark Office.

The algorithm returns a list the specific technological classes are most frequently associated with these key words. For 'Screen displays (vehicules)' for instance, the algorithm returns the class B60K2370/152.

In a third step, all the **CPC classes associated by the algorithm with the 8 strategic domains are manually checked** by Continental experts & Argos.

(12) NACH DEM VERTRÄG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG	
(19) Weltorganisation für geistiges Eigentum Internationales Büro	
(43) Internationales Veröffentlichungstermin 24. Juni 2021 (24.06.2021)	(10) Internationale Veröffentlichungsnummer WO 2021/122891 A1
(51) Internationale Patentreklasifikation: B60K 35/00 (2006.01)	HN, HR, HU, ID, IL, IN, IR, IS, IT, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, MG, ME, MG, MK, ML, MN, MO, MT, MU, NL, NO, NZ, PE, PA, PE, PG, PL, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TR, TR, TT, TZ, UA, UG, US, UY, VN, WS, ZA, ZM, ZW.
(21) Internationales Aktenzeichen: PCT/EP2020/086658	
(22) Internationales Anmeldedatum: 17. Dezember 2020 (17.12.2020)	
(25) Einreichungssprache: Deutsch	Deutsch
(26) Veröffentlichungssprache: Deutsch	
(29) Angaben zur Priorität: 2019 22 012.5	18. Dezember 2019 (18.12.2019) DE
(31) Anmelder: CONTINENTAL AUTOMOTIVE GMBH (DE018); Valtemwiler Straße 9, 30165 Hannover (DE)	
(32) Erfinder: KARATEK, Ulrich, c/o Continental Automotiv GmbH, Intellectual Property - Sodenstr. 9, 65824 Schwanbach, DE; (DE018); KARATEK, Ulrich, c/o Continental Automotive GmbH, Intellectual Property - Sodenstr. 9, 65824 Schwanbach a. Ts. (DE)	
(44) Rechtsansprüche: mehrere rechtssichere Ansprüche, für jede vorliegender separate Schutzmaßnahmen. ADPO (DE), GH, GM, KU, LR, LS, MW, MZ, NA, RW, SD, SI, ST, SZ, TZ, UG, ZM, ZW), erweitertes (AM, AZ, BY, KG, KZ, RU, TJ, TM), eurasisches (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, GR, HU, IE, IT, MT, NL, NO, PL, PT, RO, SE, SI, TR, IS, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BJ, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG)	
Veröffentlicht: mit internationalem Rechberichtsvertrag 21. Abstand jj	



Technology space and relatedness measure



The technology space is a representation of the technological links between the different strategic domains (relatedness).

Elements of the TS represent different (sub-) strategic domains and **links between them represents their degree of relatedness**.

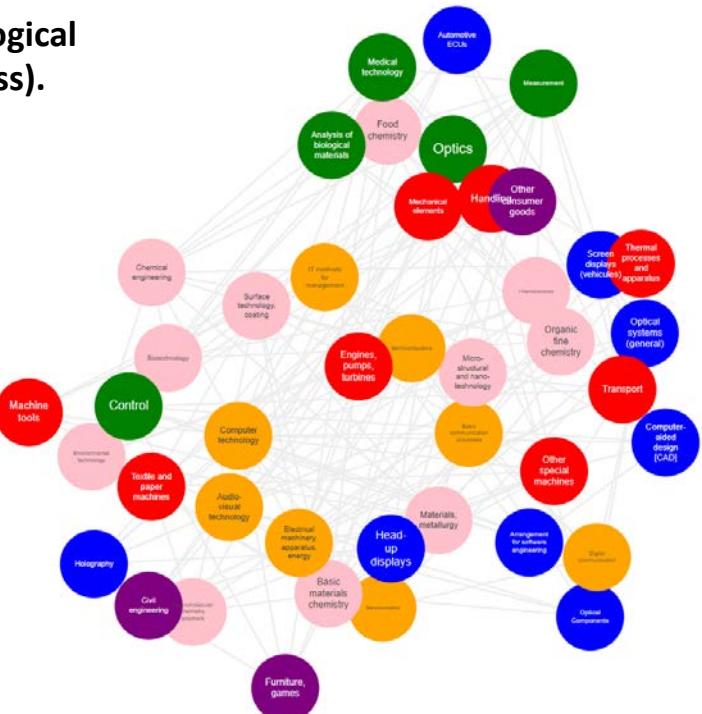
Automotive ECUs, for instance, builds on diverse domains such as transport, computers, and audio-visual technology.

The **degree of relatedness** is measured in 2 steps:

- Count of **co-occurrences** of 2 domains in the same patent
- **Normalization** of these cooccurrences using the cosine index

The exploration of the technology space allows to understand the links between technologies and the way **knowledge recombines into new inventions**.

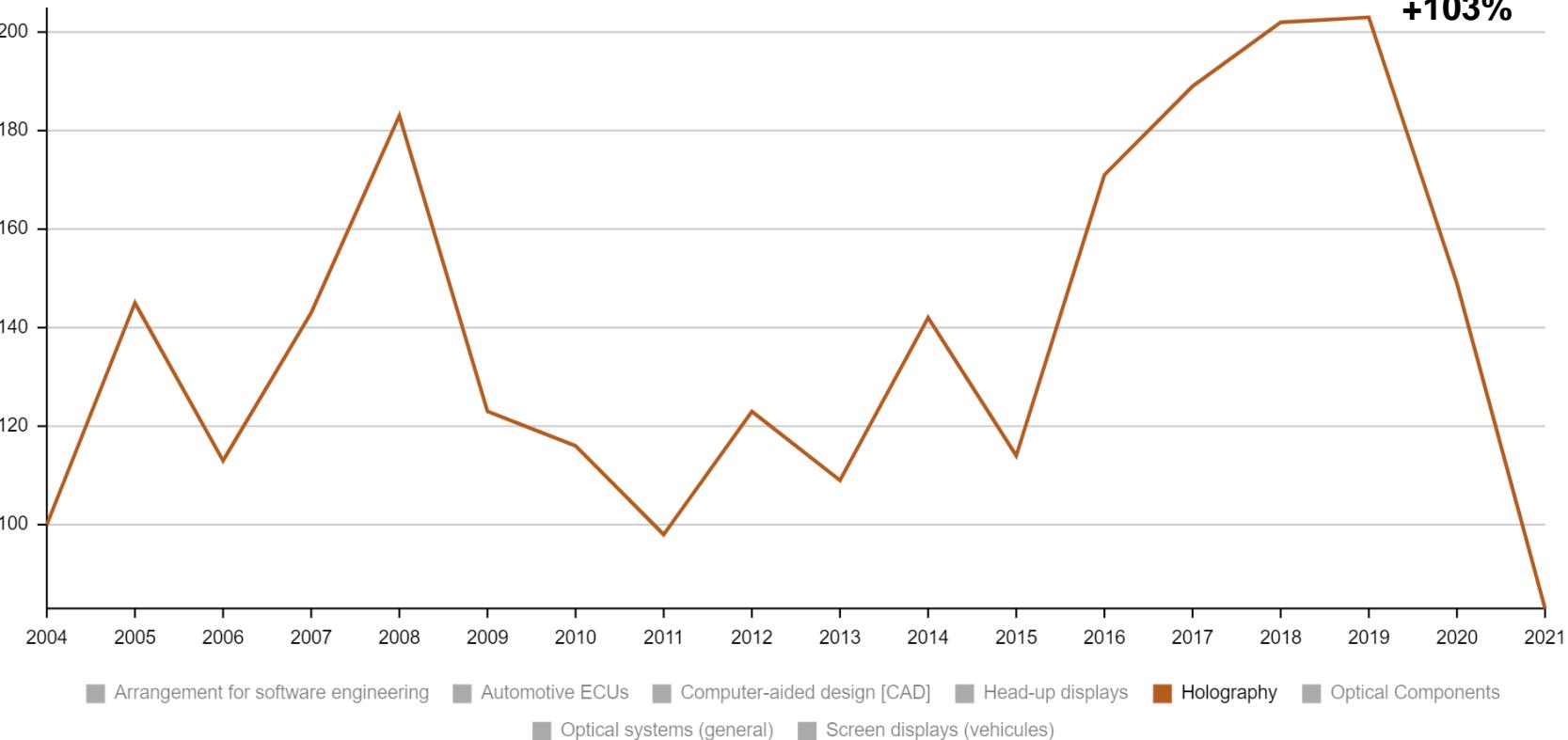
Relatedness metrics are the building blocks of recommendation systems predicting new location hubs or company's diversification potential in different domains. The TS we use for this project is therefore not limited to the 8 domains but includes all technological classes of the CPC nomenclature.



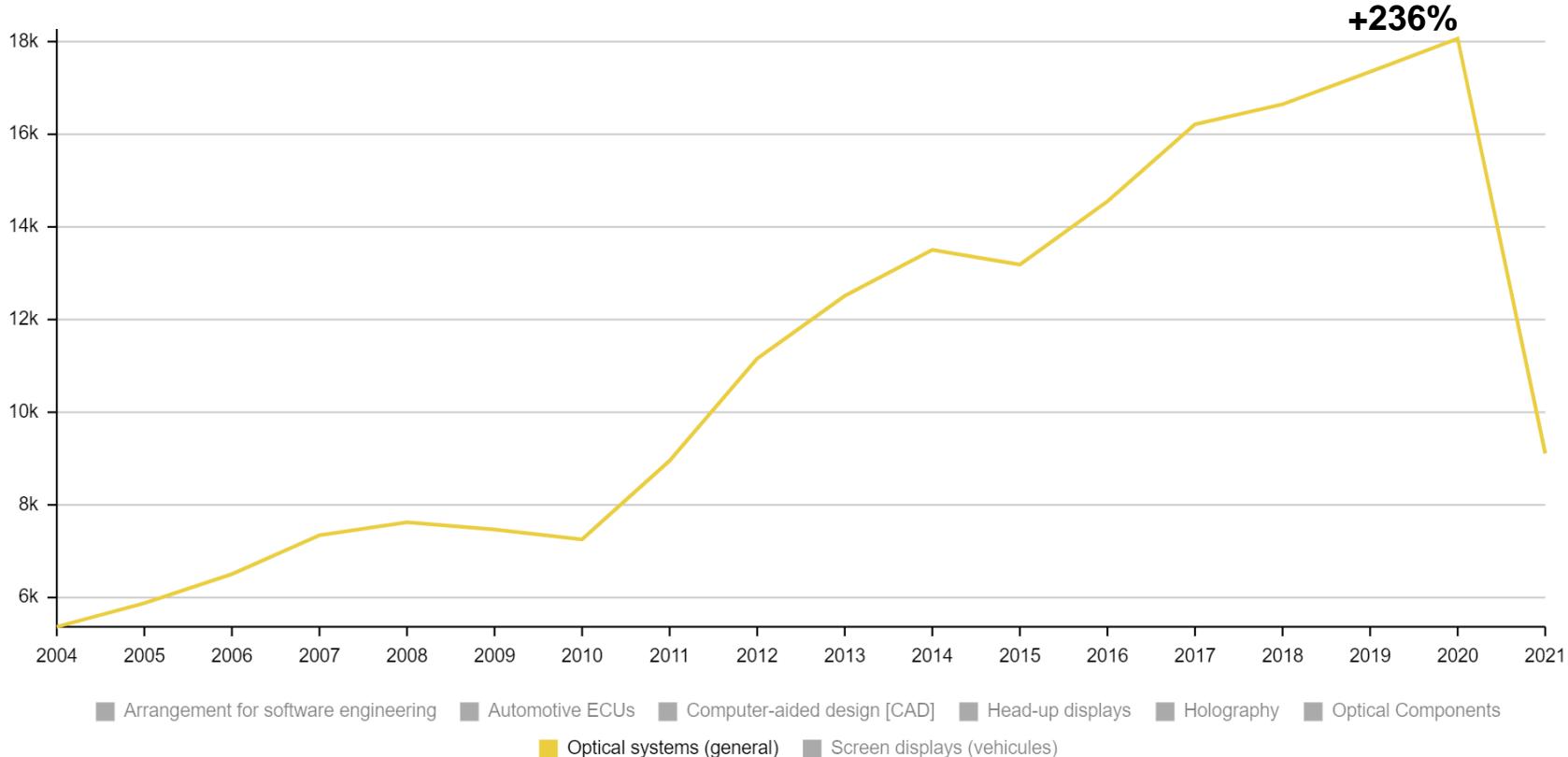
Velocity – Holography



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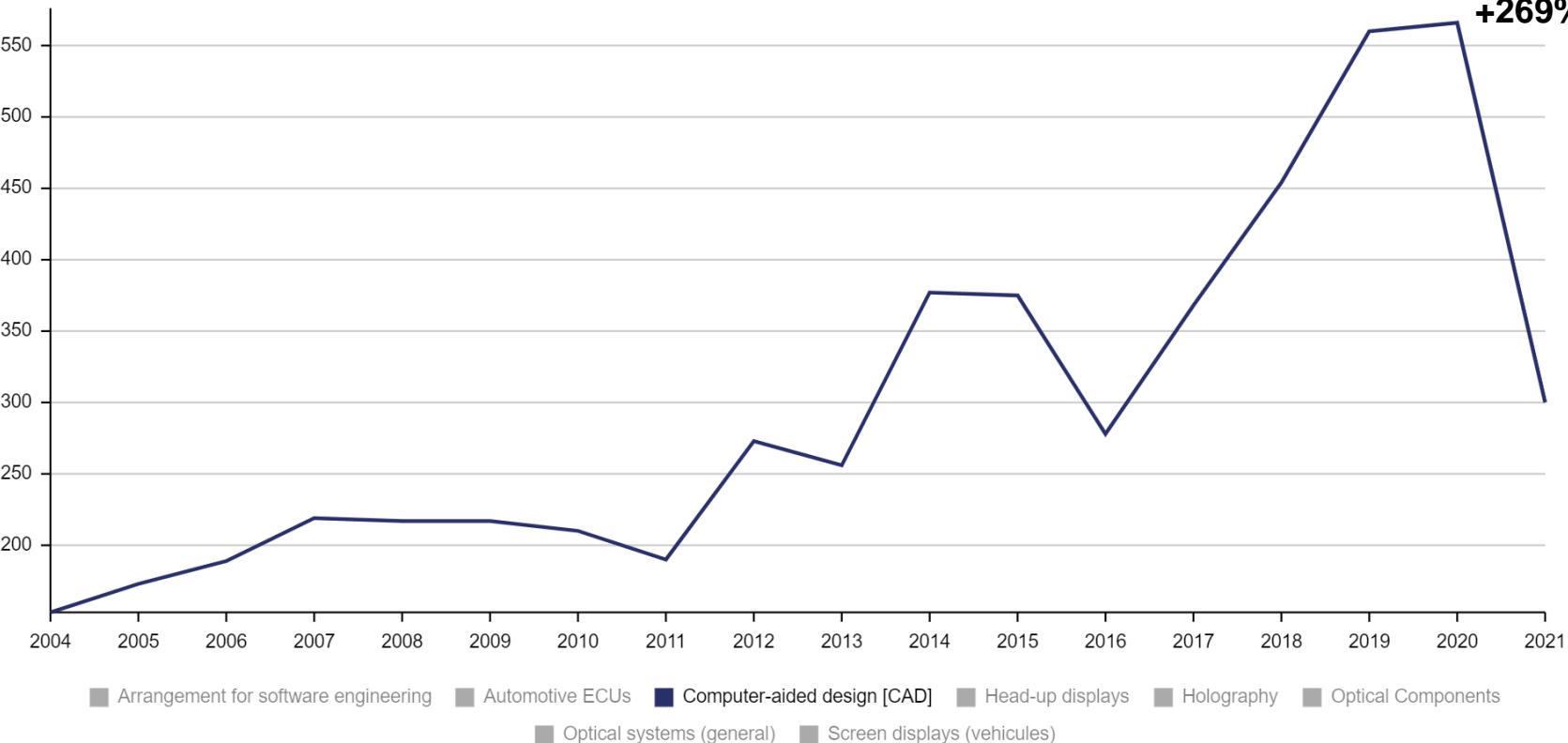
Velocity – Optical systems (general)



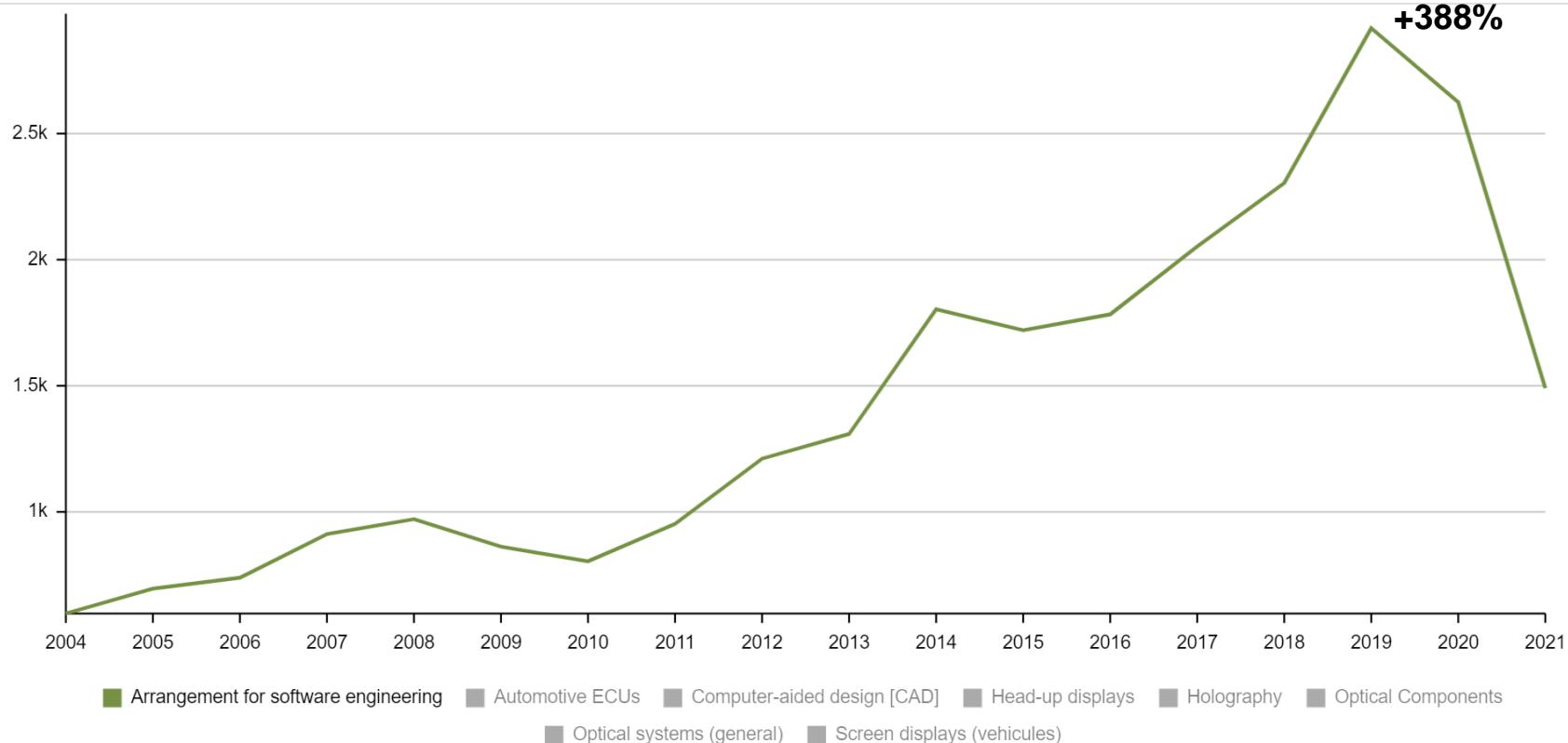
Velocity – Computer-aided design (CAD)



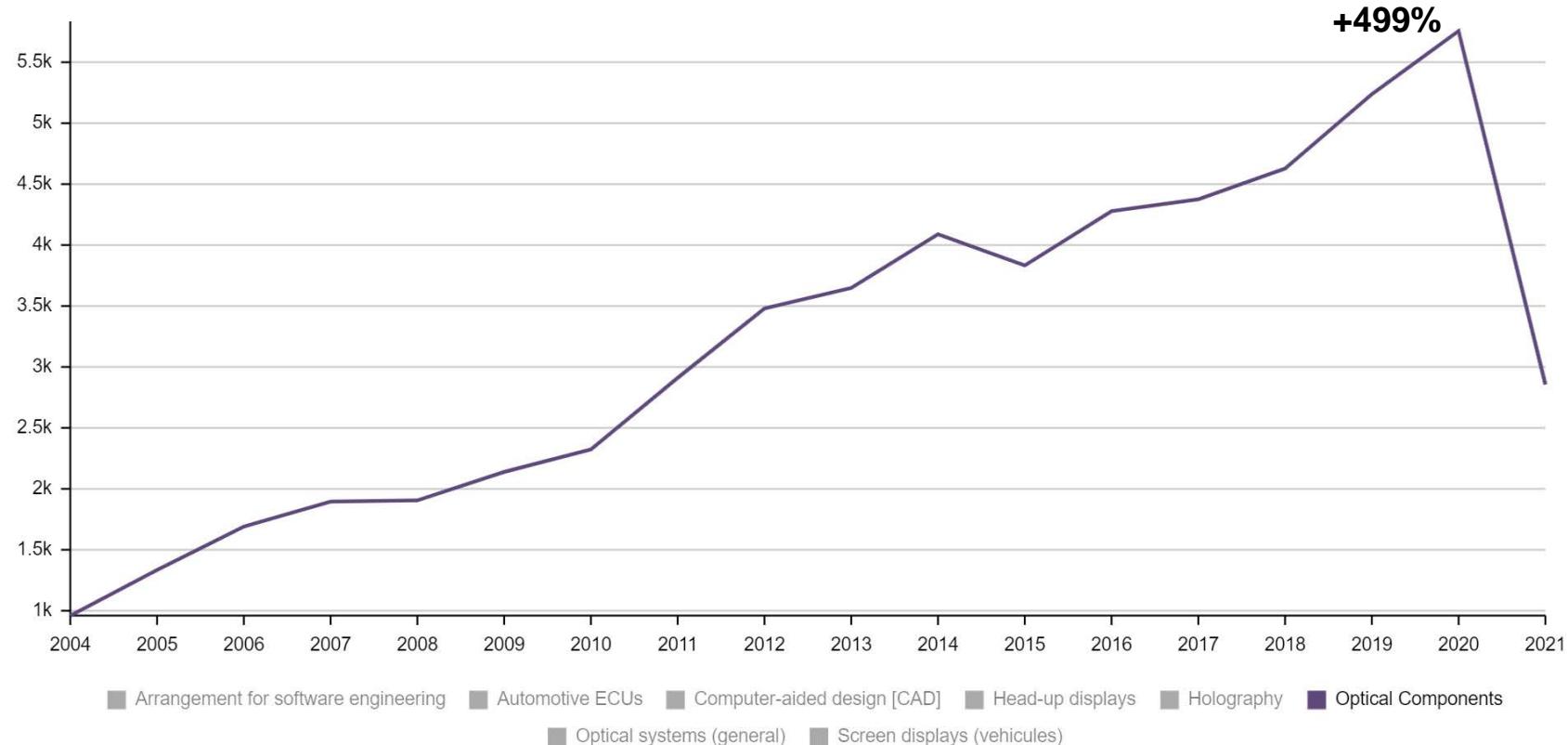
+269%



Velocity – Arrangement for software engineering



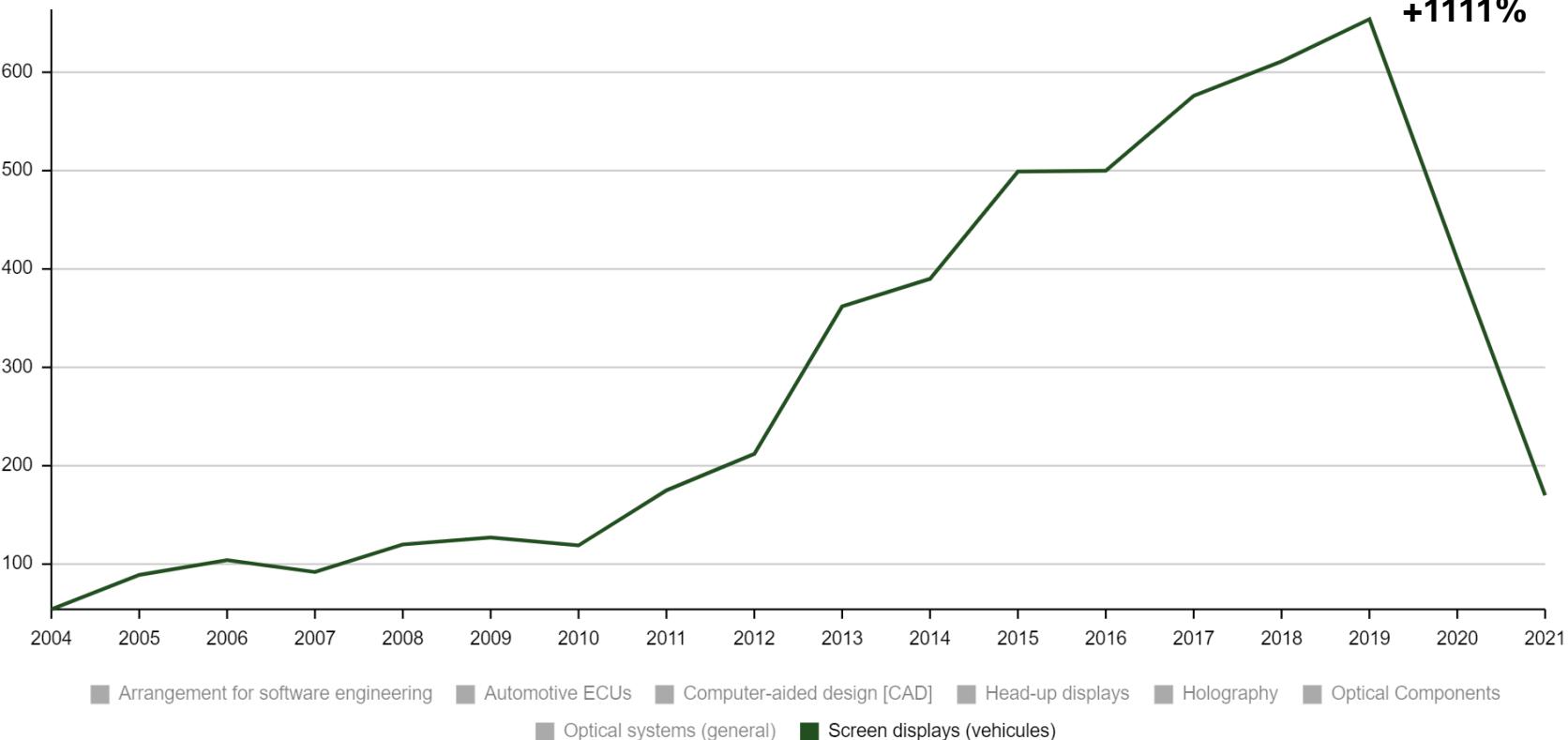
Velocity – Optical components



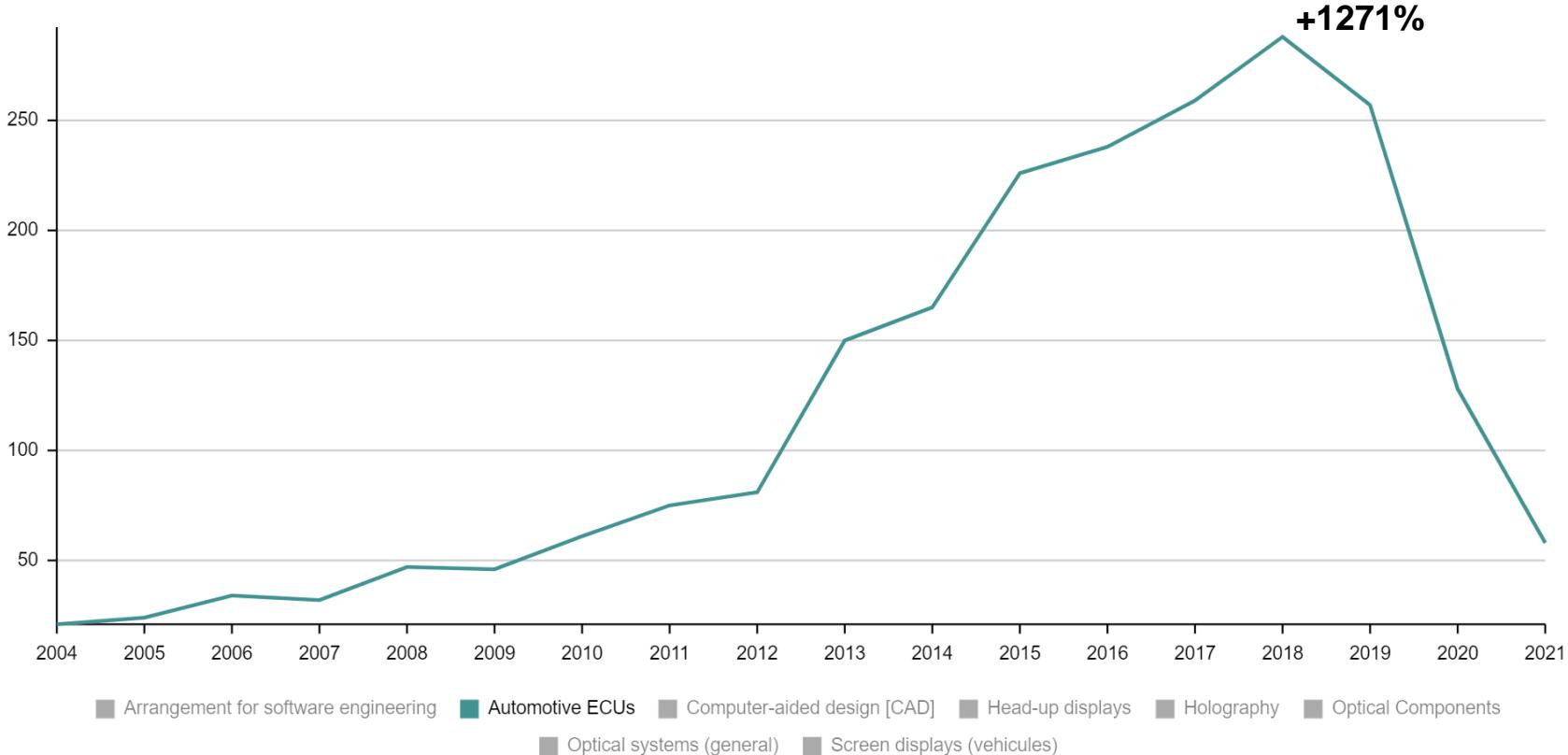
Velocity – Screen displays (vehicles)



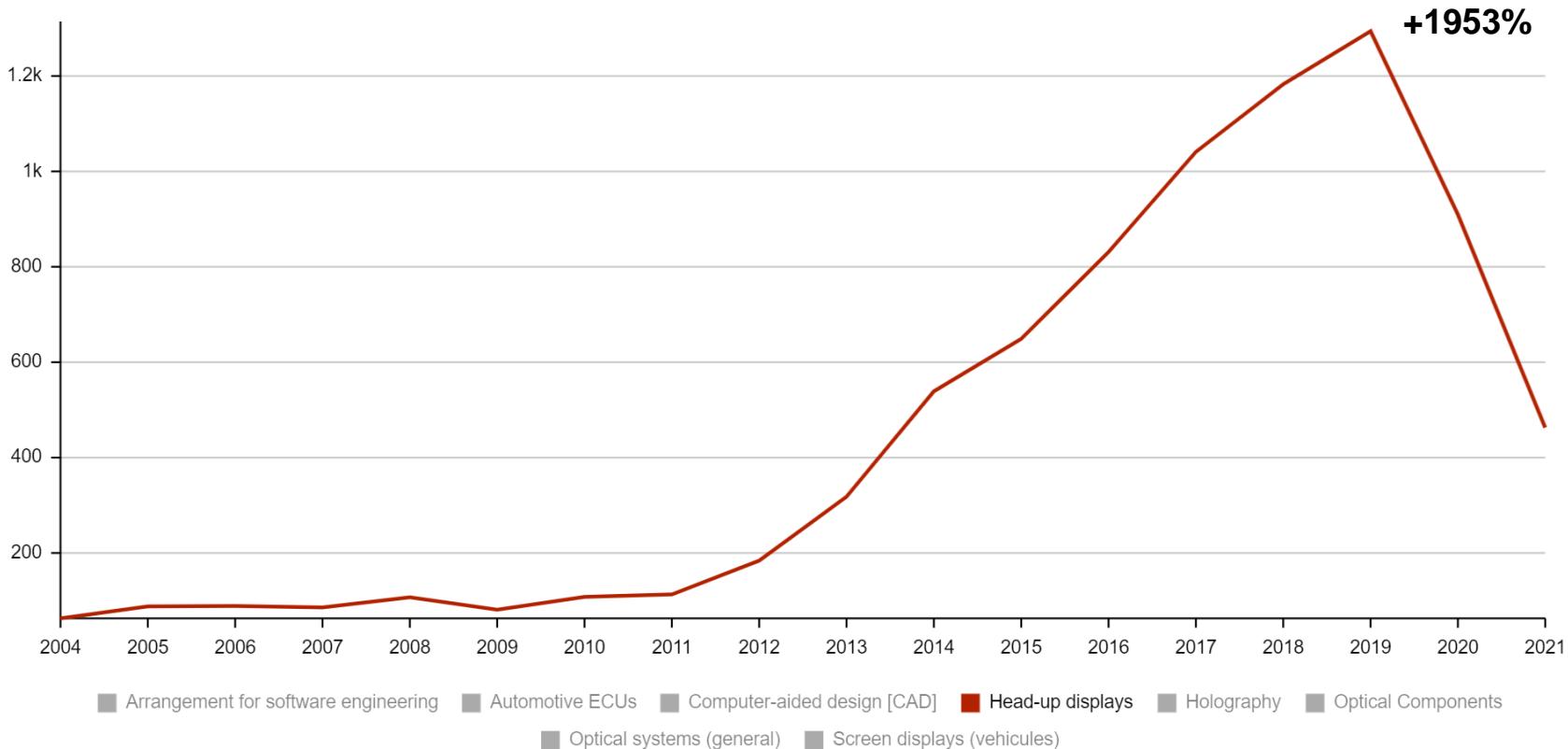
+111%



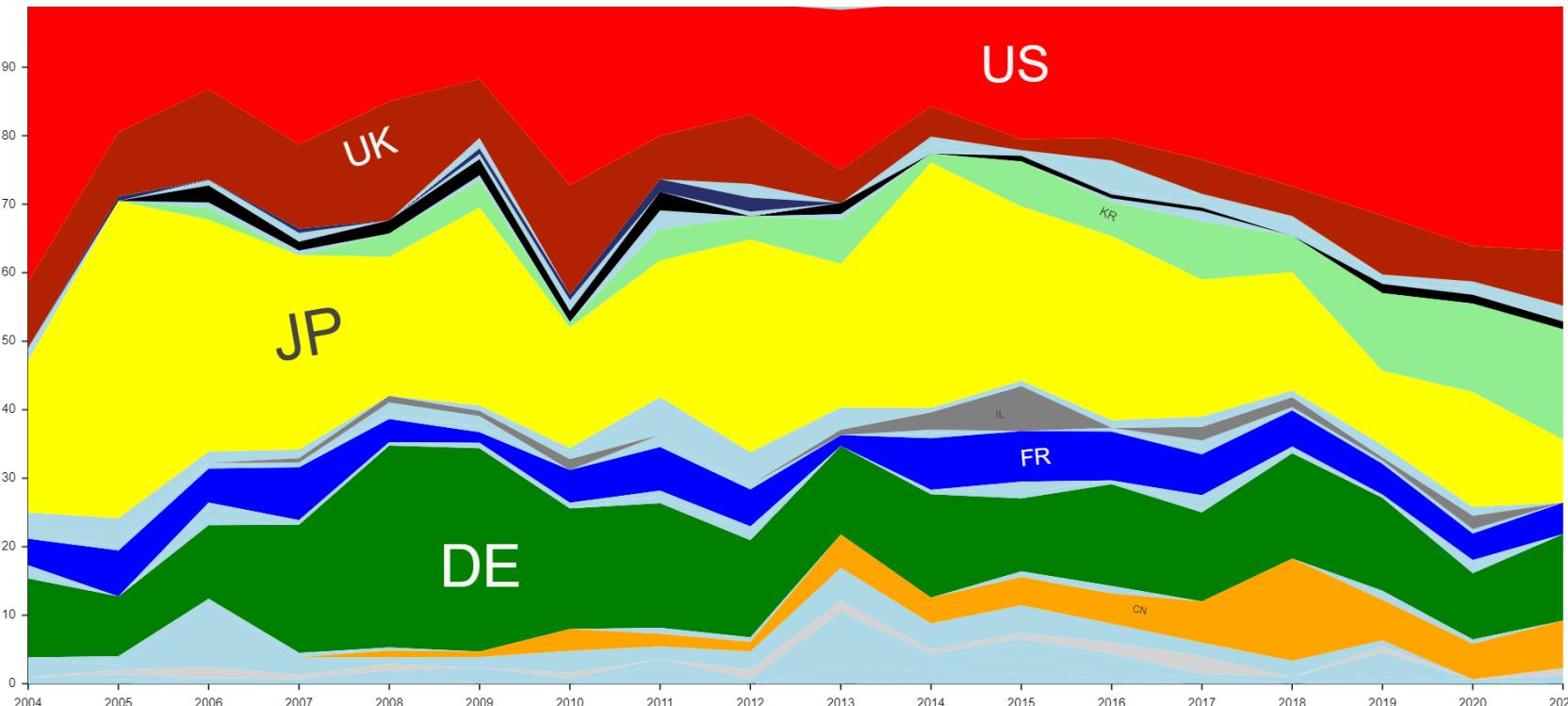
Velocity – Automotive ECUs



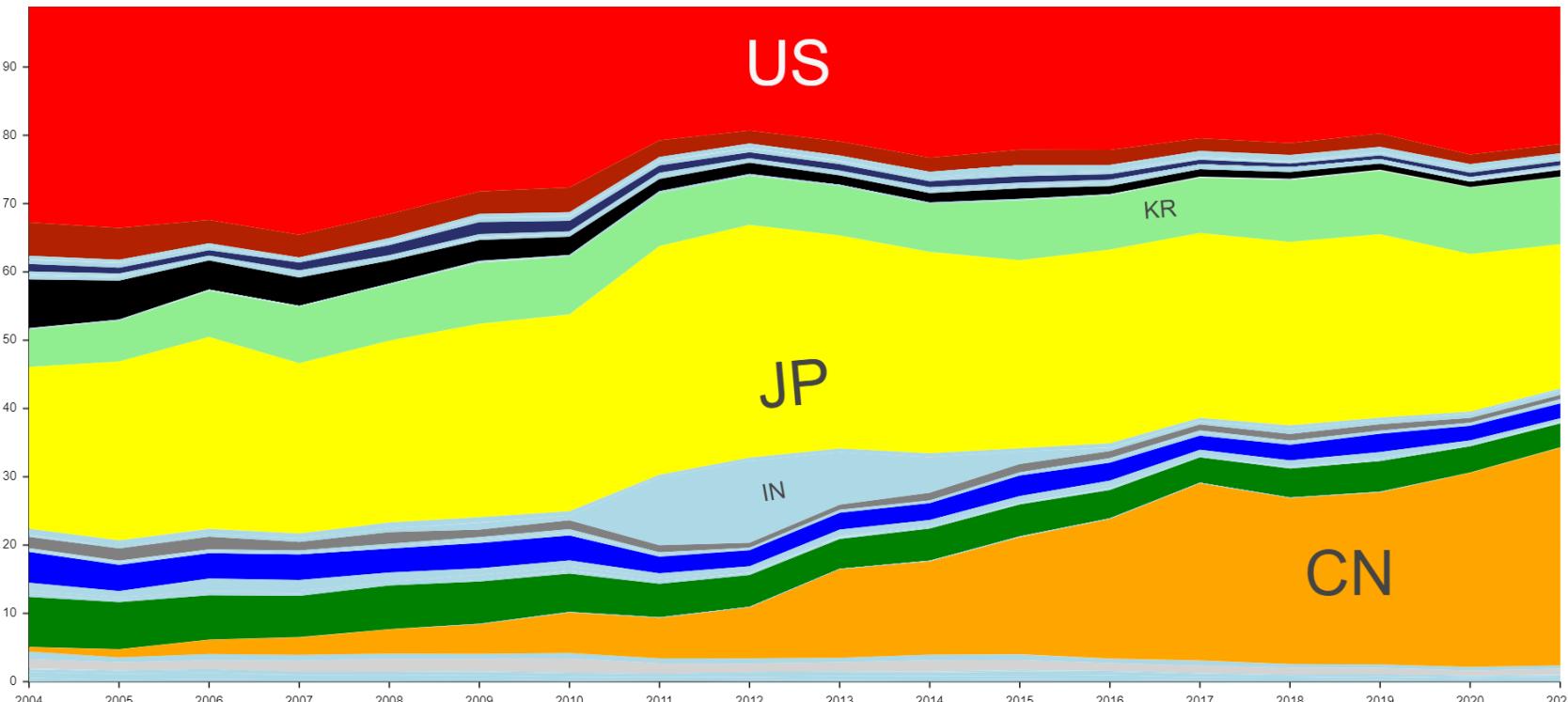
Velocity – HUD



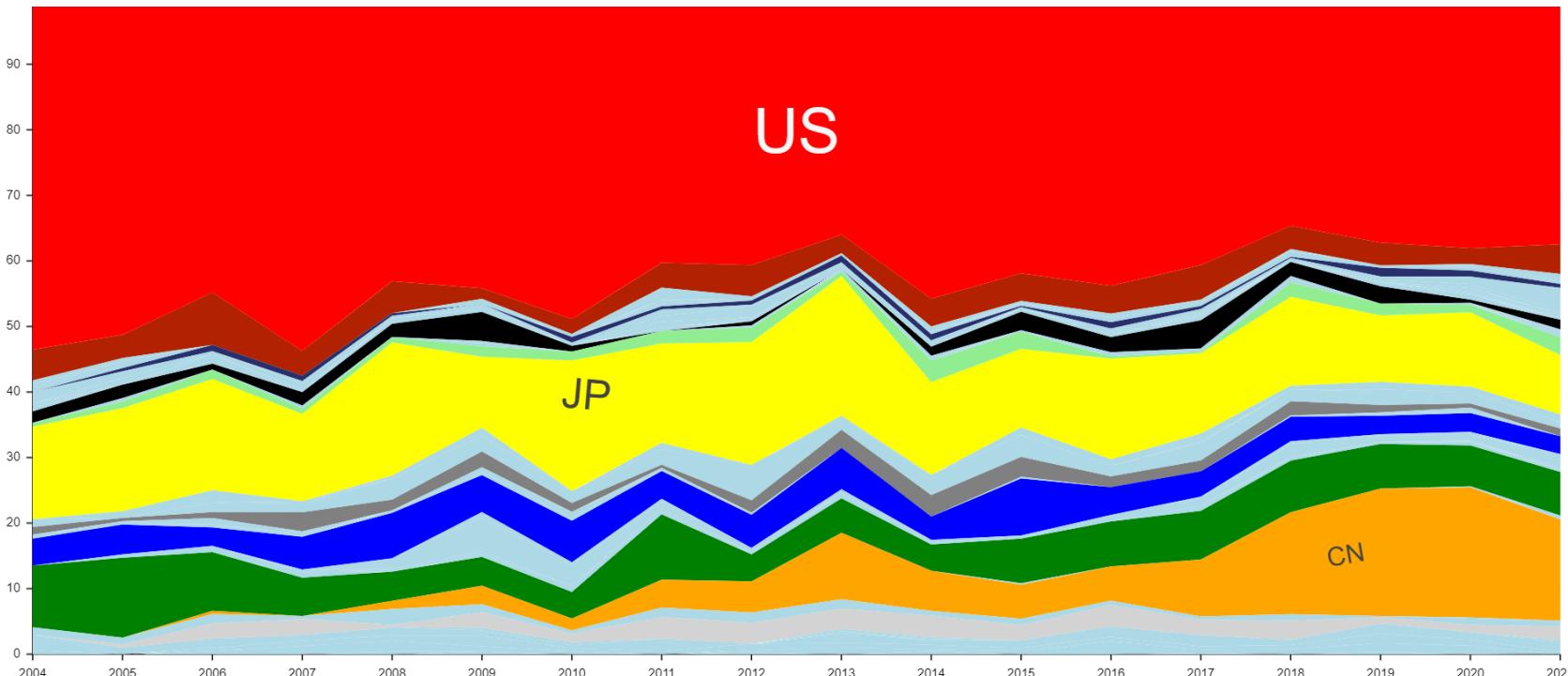
Velocity per country – Holography



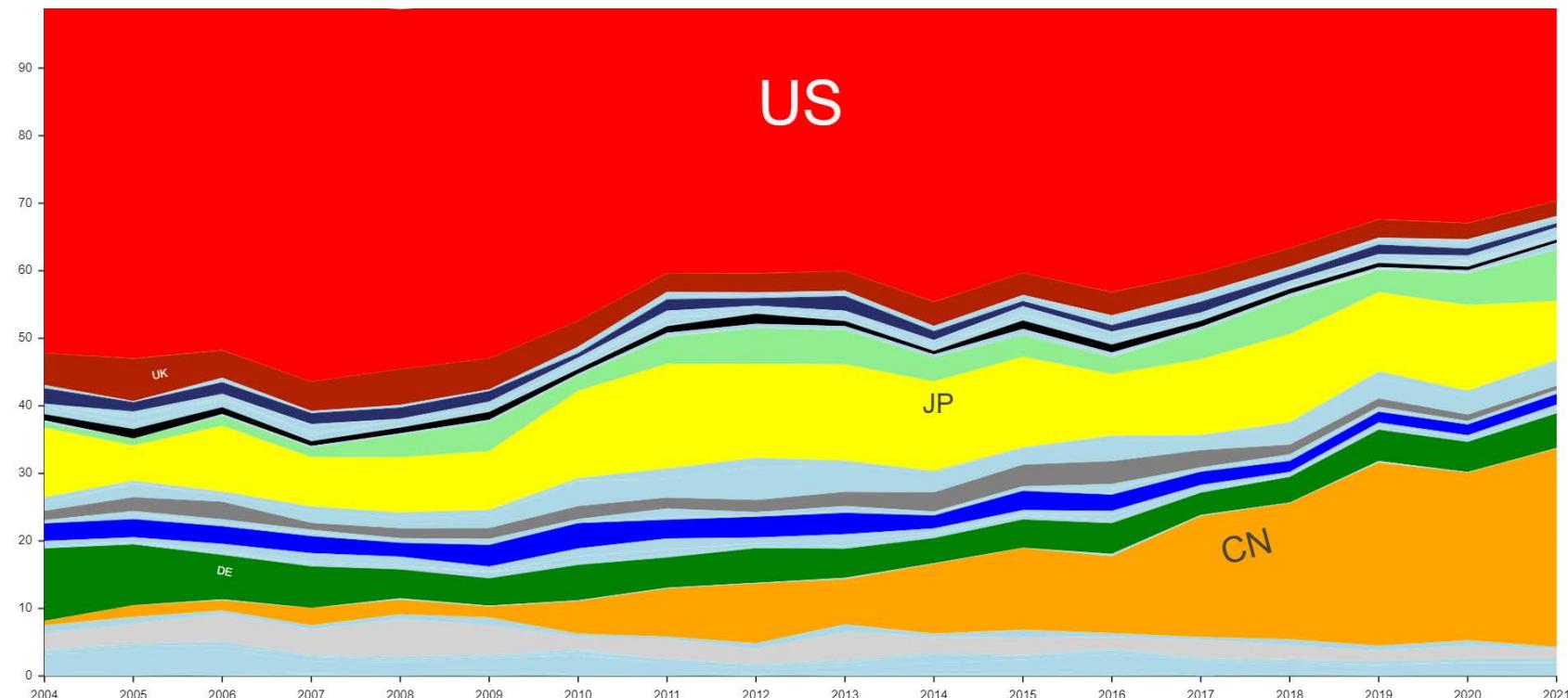
Velocity per country – Optical systems (general)



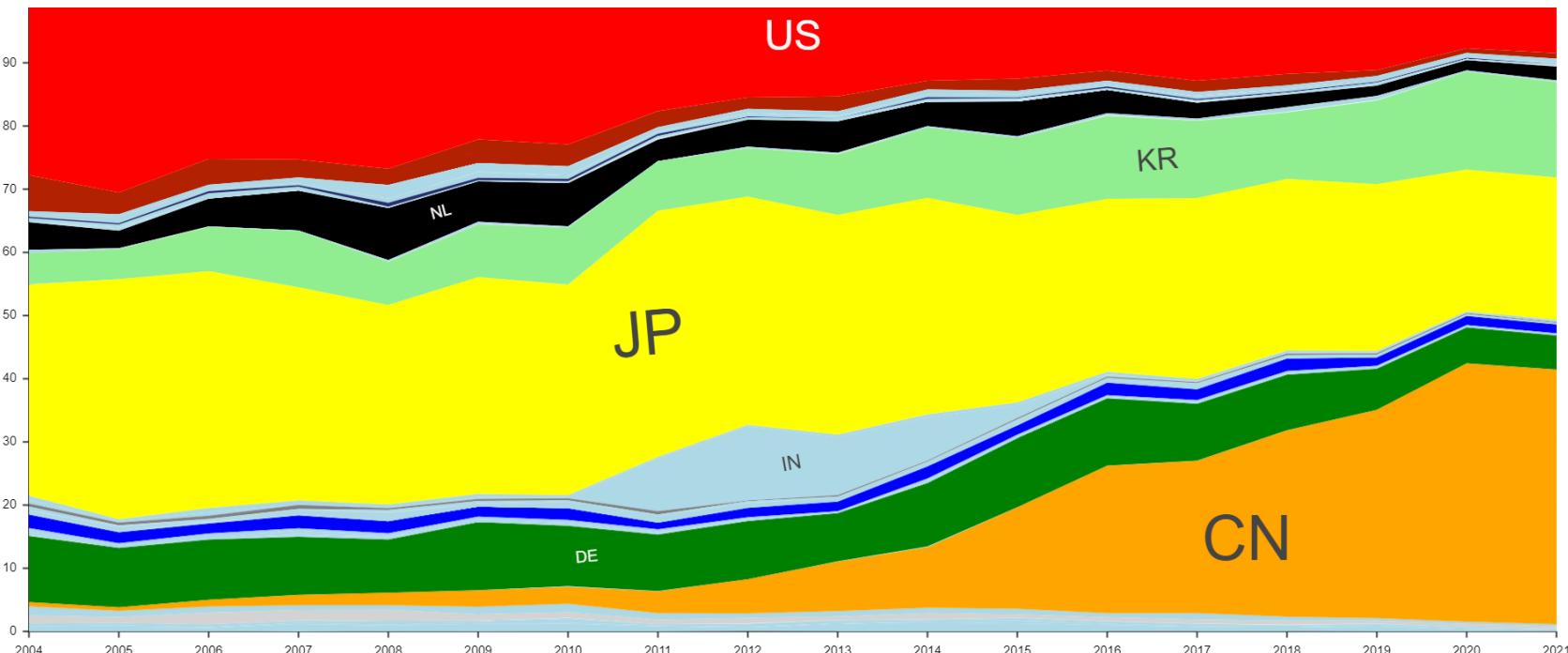
Velocity per country – CAD



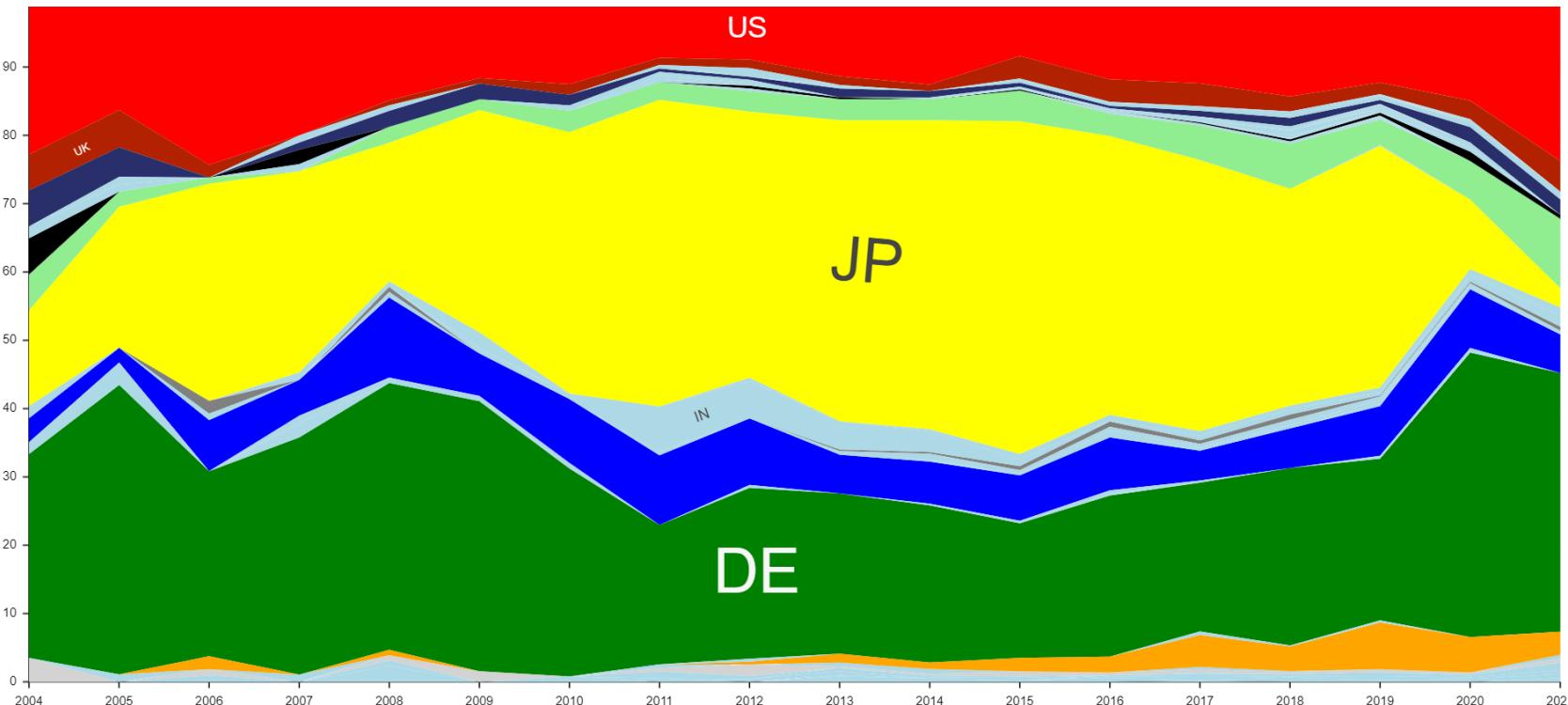
Velocity per country – Arrangements for SE



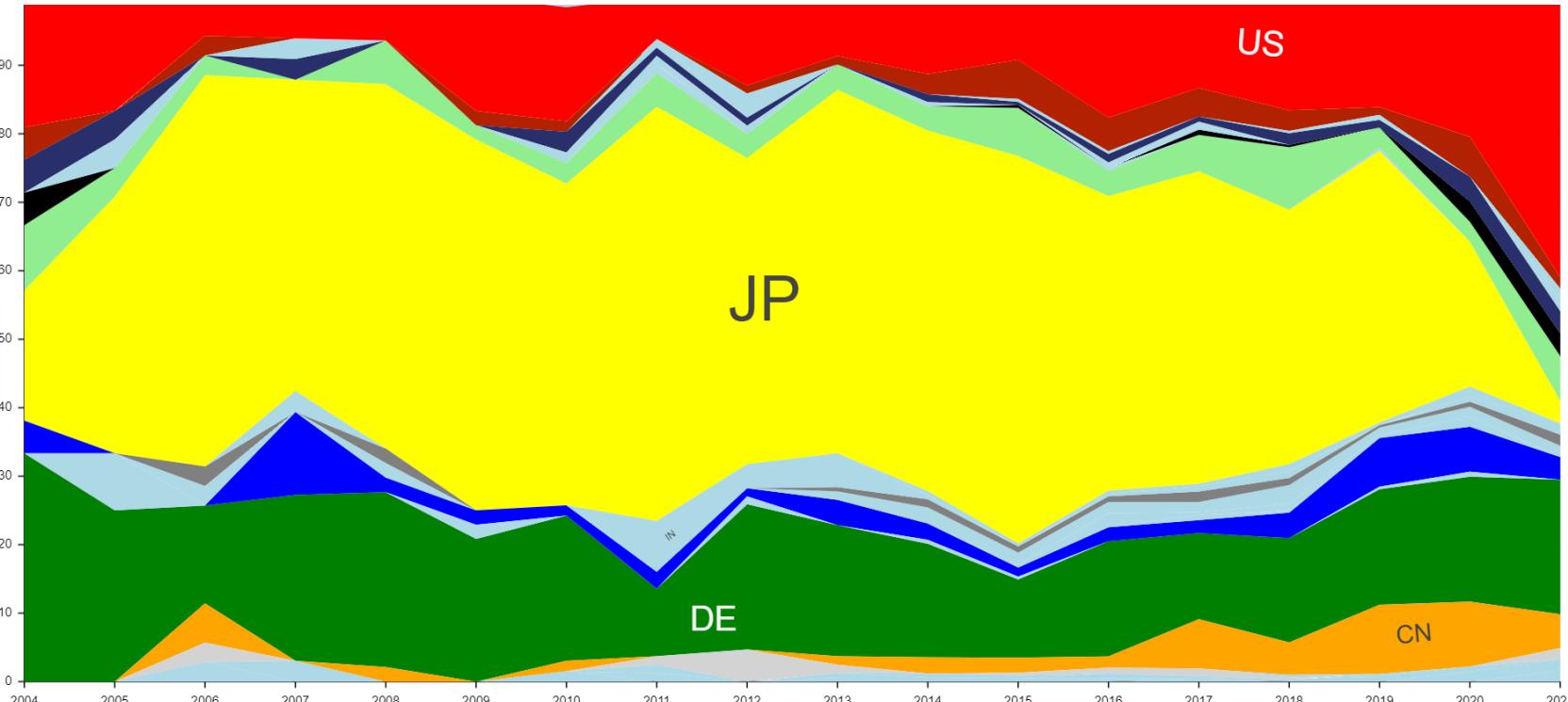
Velocity per country – Optical components



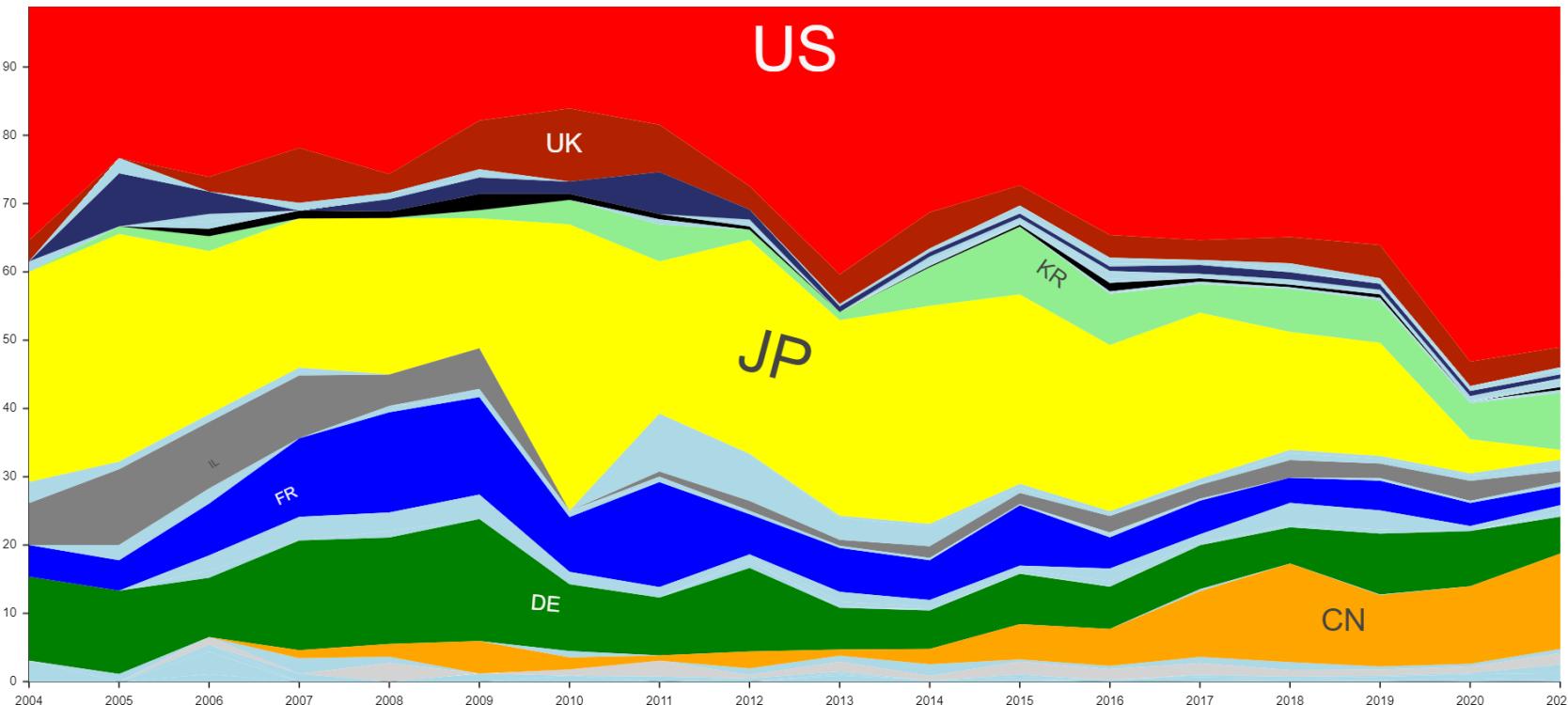
Velocity per country – Screen displays (vehicles)



Velocity per country – Automotive ECUs



Velocity per country – HUD



World urban ecosystems



ARGOS STRATEGY GROUP

East Asia - Holography



Beijing (#13)

Seoul (#12)

Tokyo (#18)

Kyoto (#35)

Daejeon (#40)

CHINA

NORTH KOREA

SOUTH KOREA

TAIWAN

LAOS



ARGOS STRATEGY GROUP

North America - Holography



Seattle (#3)

Denver (#21)

San José - SF (#2)

Los Angeles (#4)

Tucson (#6)



ARGOS STRATEGY GROUP

BELIZE

DOMINICAN
REPUBLIC

32

Europe - Holography



Milton Keynes (#8)

Dresden (#1)

Jena (#5)

Rennes (#10)

Grenoble (#10)

Stuttgart (#10)



East Asia – Optical systems



Beijing (#2)

Seoul (#2)

Tokyo (#1)

CHINA

NORTH KOREA

SOUTH KOREA

Hangzhou (#7)

Shenzhen (#4)

TAIWAN

LAOS



ARGOS STRATEGY GROUP

North America – Optical systems



Seattle (#11)

San José - SF (#5)

Los Angeles (#6)

Rochester NY (#13)

Miami (#18)



ARGOS STRATEGY GROUP

BELIZE

JAMAICA

DOMINICAN
REPUBLIC

35

Europe – Optical systems



Rennes (#10)

Eindhoven (#31)

Aachen (#28)

Jena (#17)

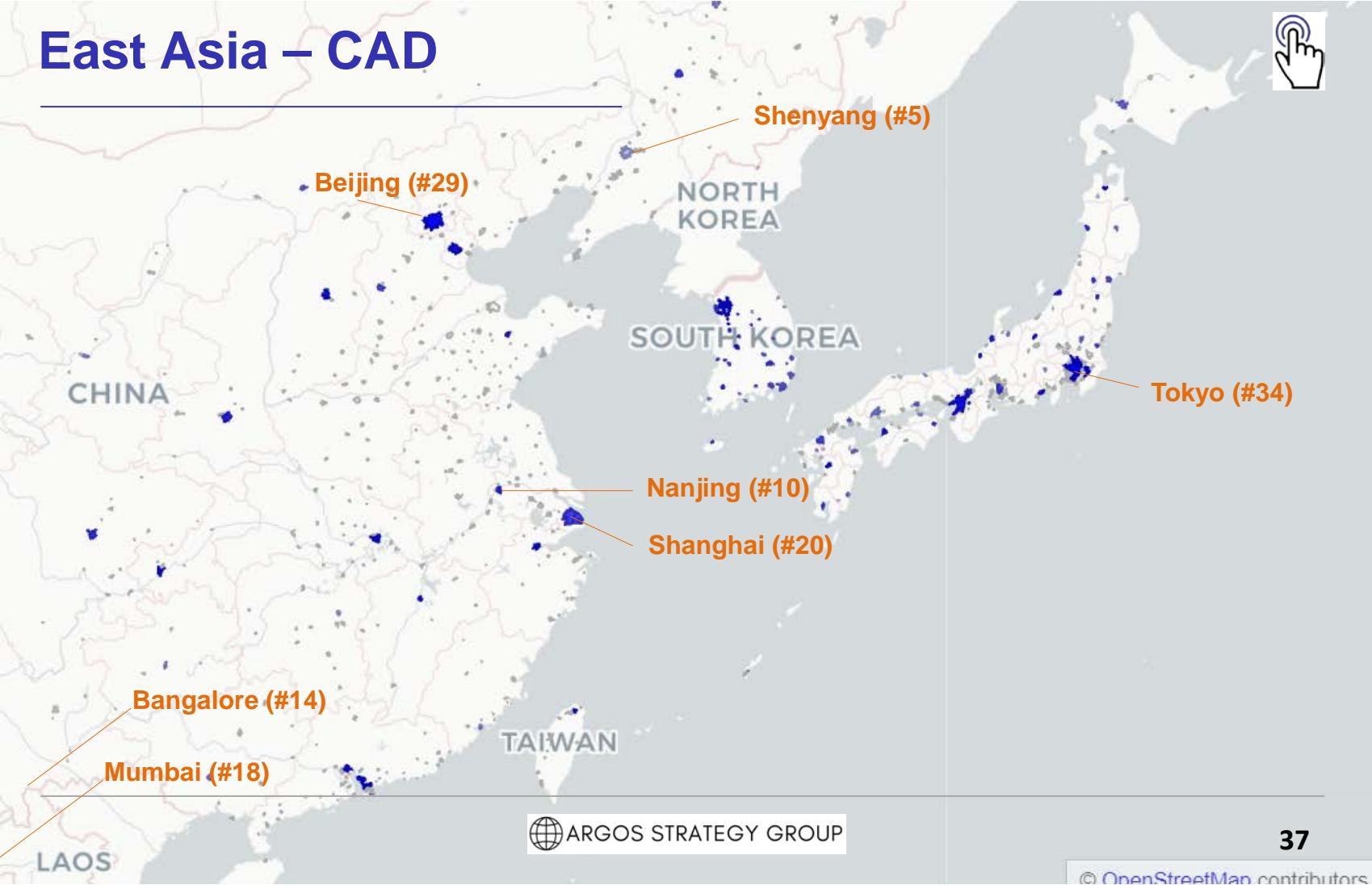
Tel Aviv (#22)

Tempere (#15)



ARGOS STRATEGY GROUP

East Asia – CAD



ARGOS STRATEGY GROUP

North America – CAD



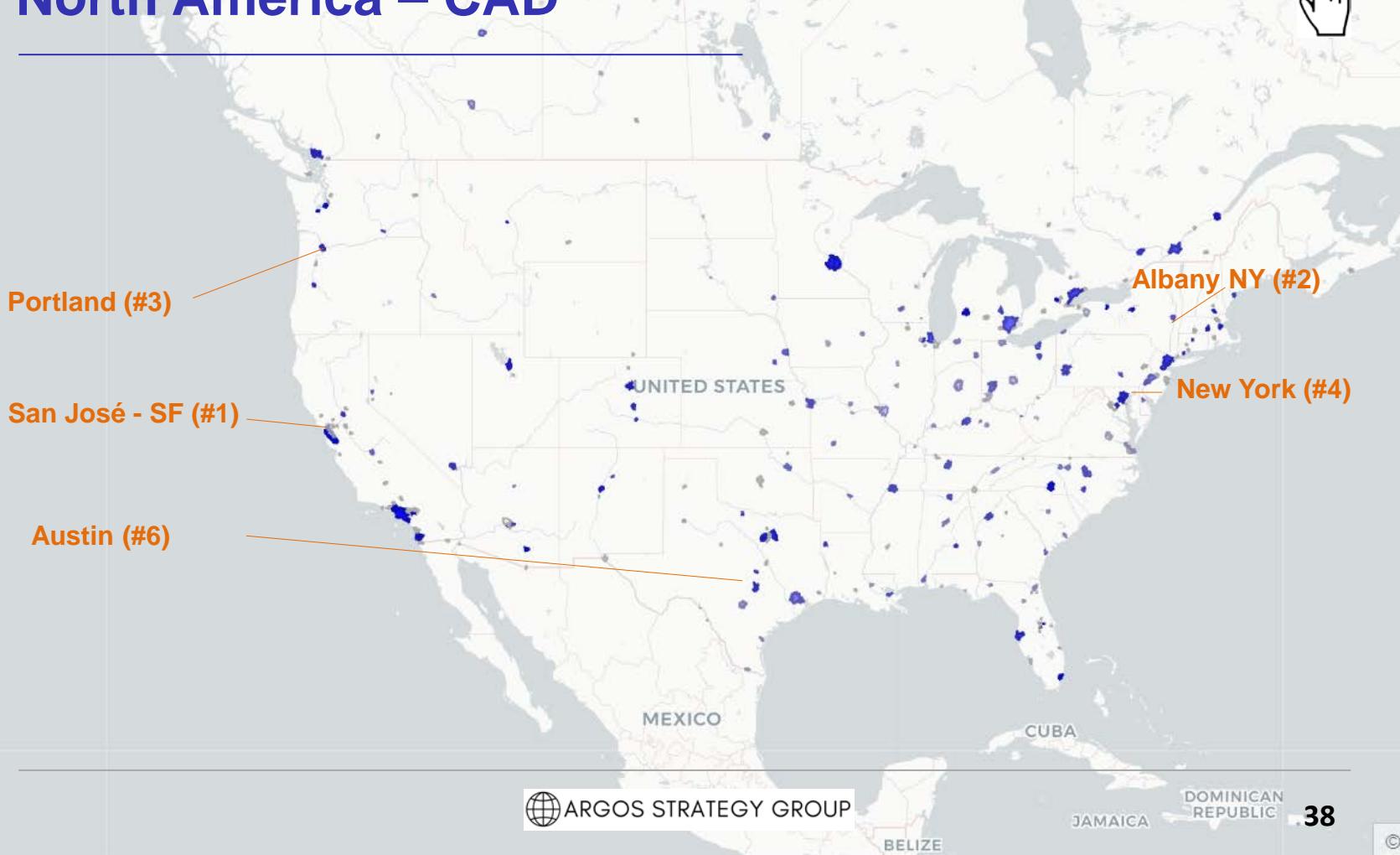
Portland (#3)

San José - SF (#1)

Austin (#6)

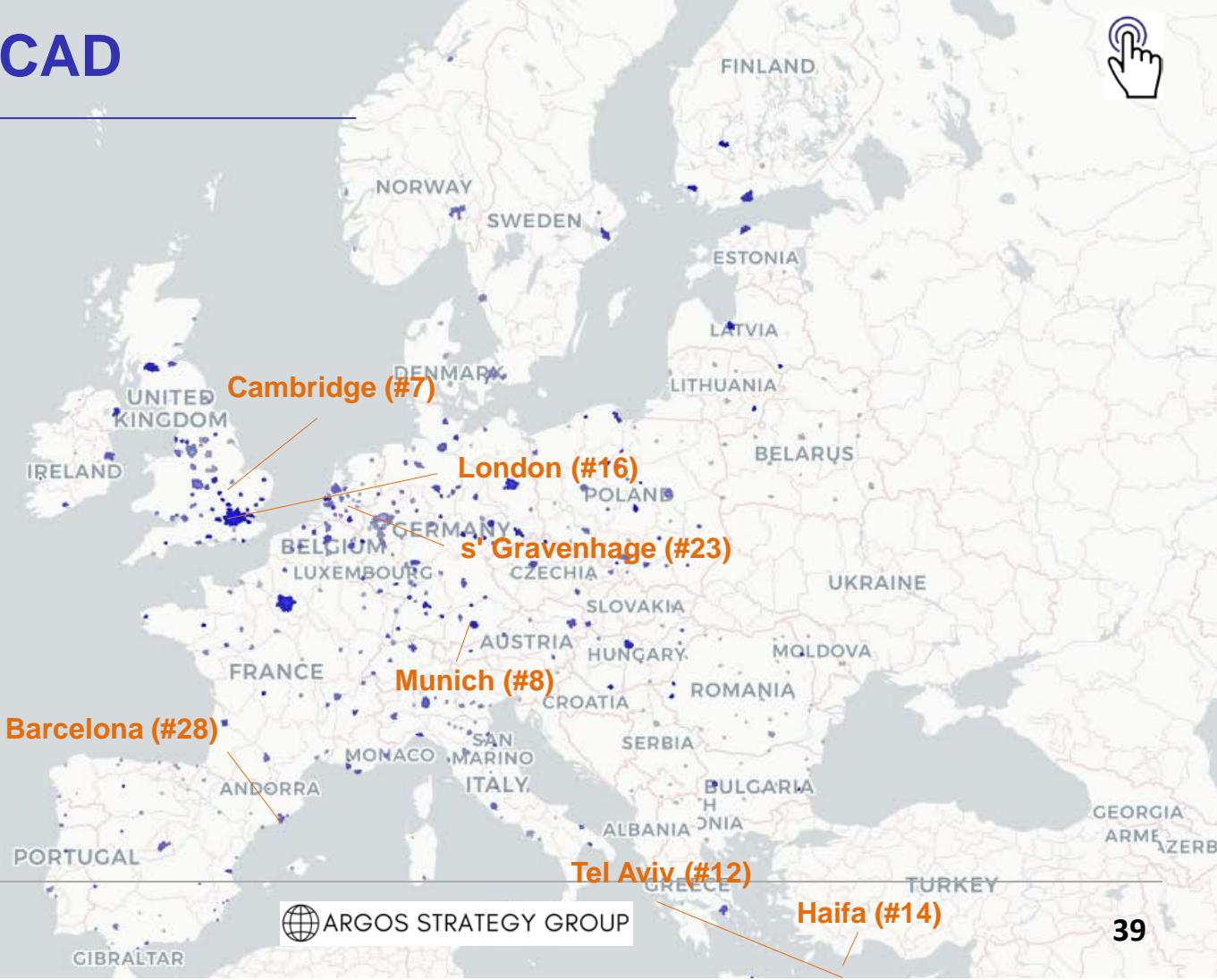
Albany NY (#2)

New York (#4)



ARGOS STRATEGY GROUP

Europe – CAD



ARGOS STRATEGY GROUP

East Asia – Arrangements for SE



Beijing (#10)

Seoul (#26)

CHINA

NORTH KOREA

SOUTH KOREA

Hangzhou (#6)

Shenzhen (#4)

Bangalore (#5)

Mumbai (#12)

Singapore (#19)



ARGOS STRATEGY GROUP

LAOS

North America – Arrangements for SE



Seattle (#1)

San José - SF (#2)

New York (#9)

Washington (#3)

Fayetteville (#7)



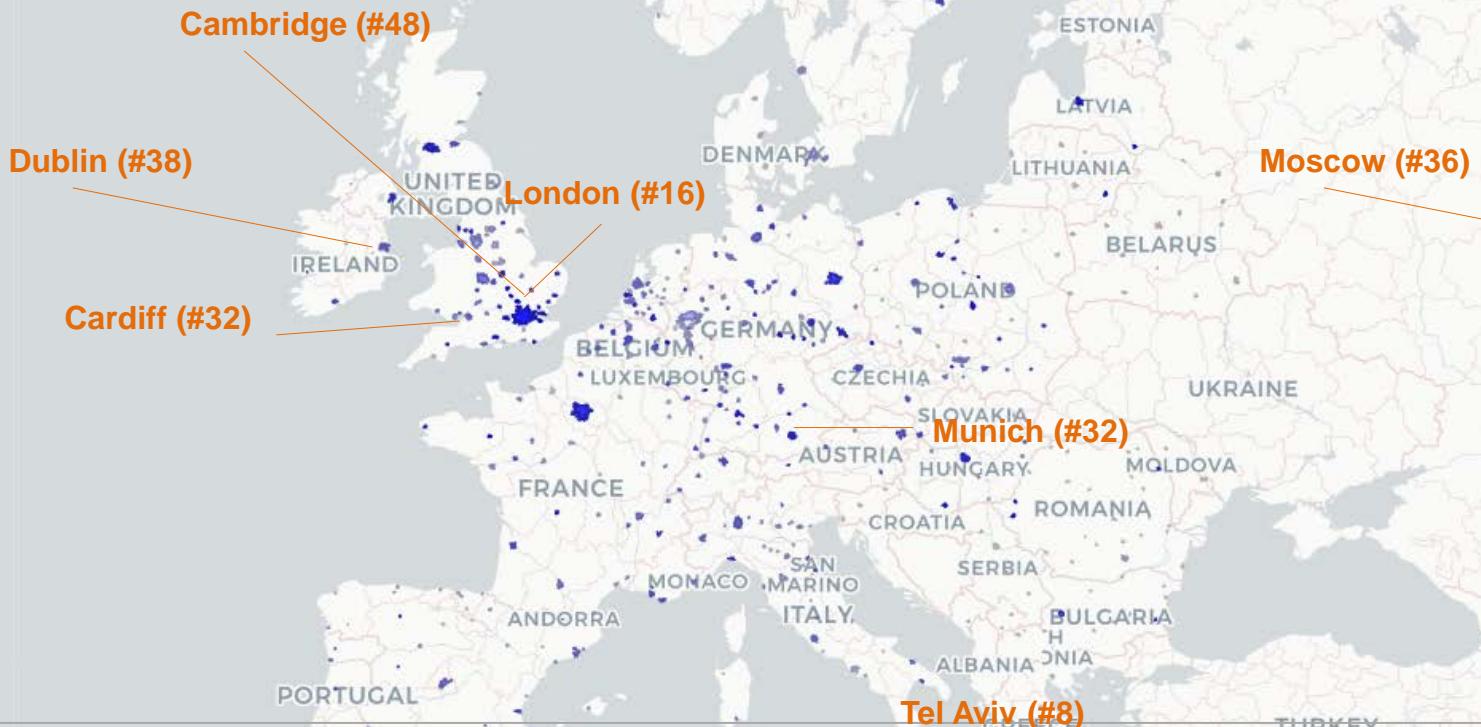
ARGOS STRATEGY GROUP

BELIZE

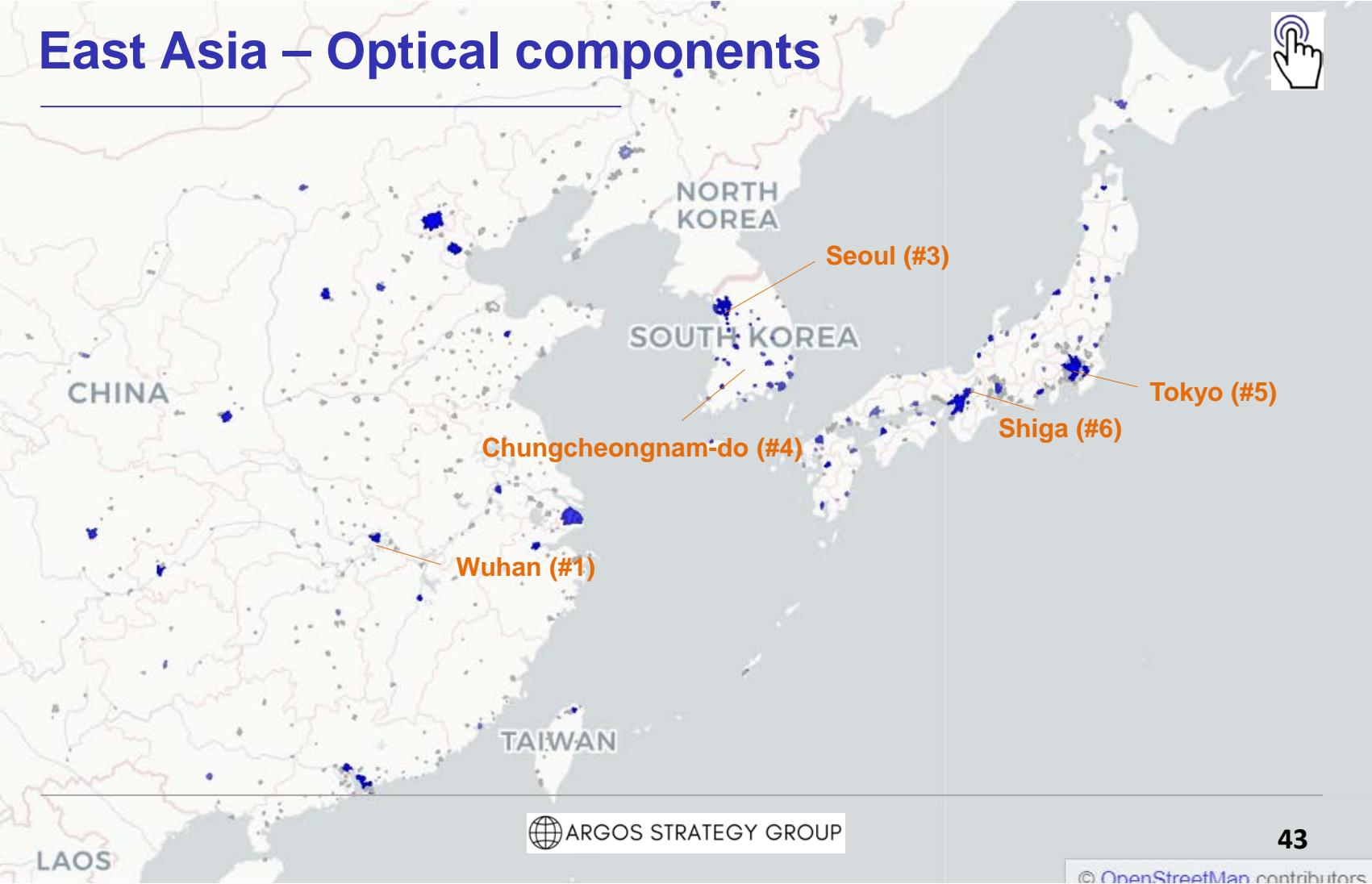
JAMAICA

DOMINICAN
REPUBLIC

Europe – Arrangements for SE



East Asia – Optical components



ARGOS STRATEGY GROUP

North America – Optical components



Portland (#48)

San José - SF (#32)

Albuquerque (#50)

Syracuse NY (#40)

Albany NY (#37)



ARGOS STRATEGY GROUP

BELIZE

JAMAICA

DOMINICAN
REPUBLIC

Europe – Optical components



A map of Europe with several cities highlighted in orange and labeled with their names and numbers in parentheses. The cities are: Frankfurt (#18), Grenoble (#16), Aachen (#13), Darmstadt (#8), and Regensburg (#2). The map also shows the outlines of European countries and major rivers.

Frankfurt (#18)

Grenoble (#16)

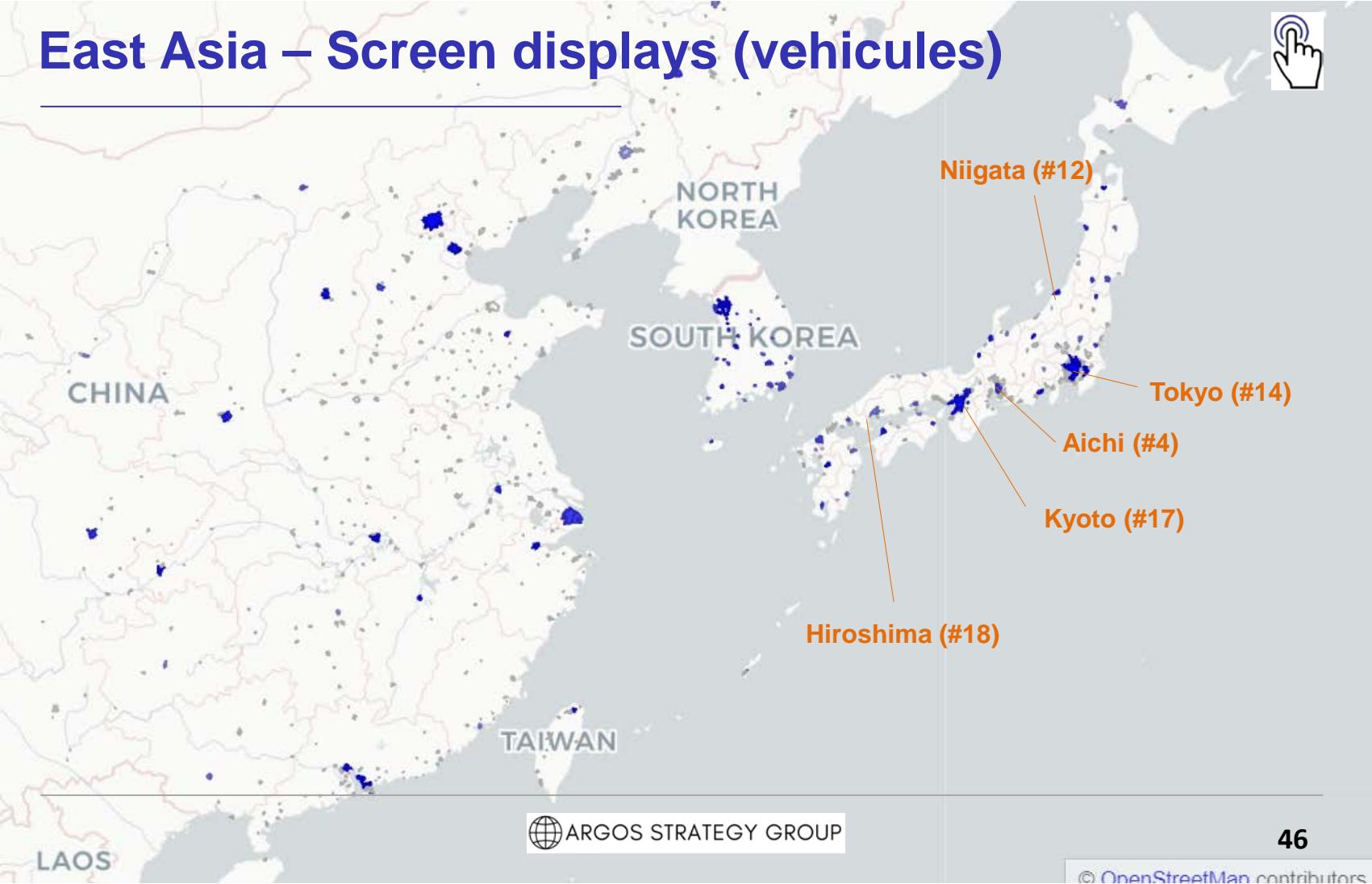
Aachen (#13)

Darmstadt (#8)

Regensburg (#2)

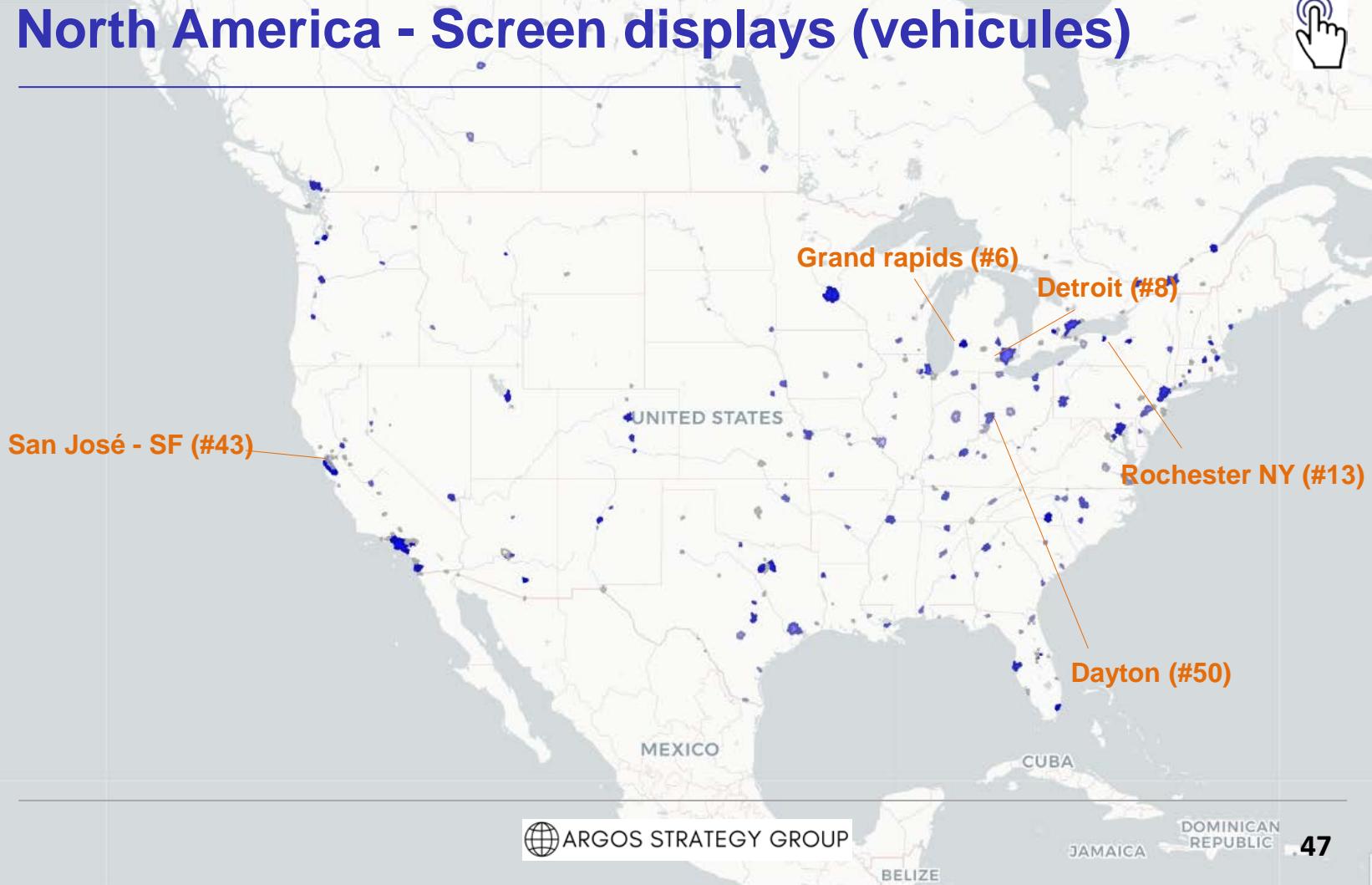


East Asia – Screen displays (vehicles)



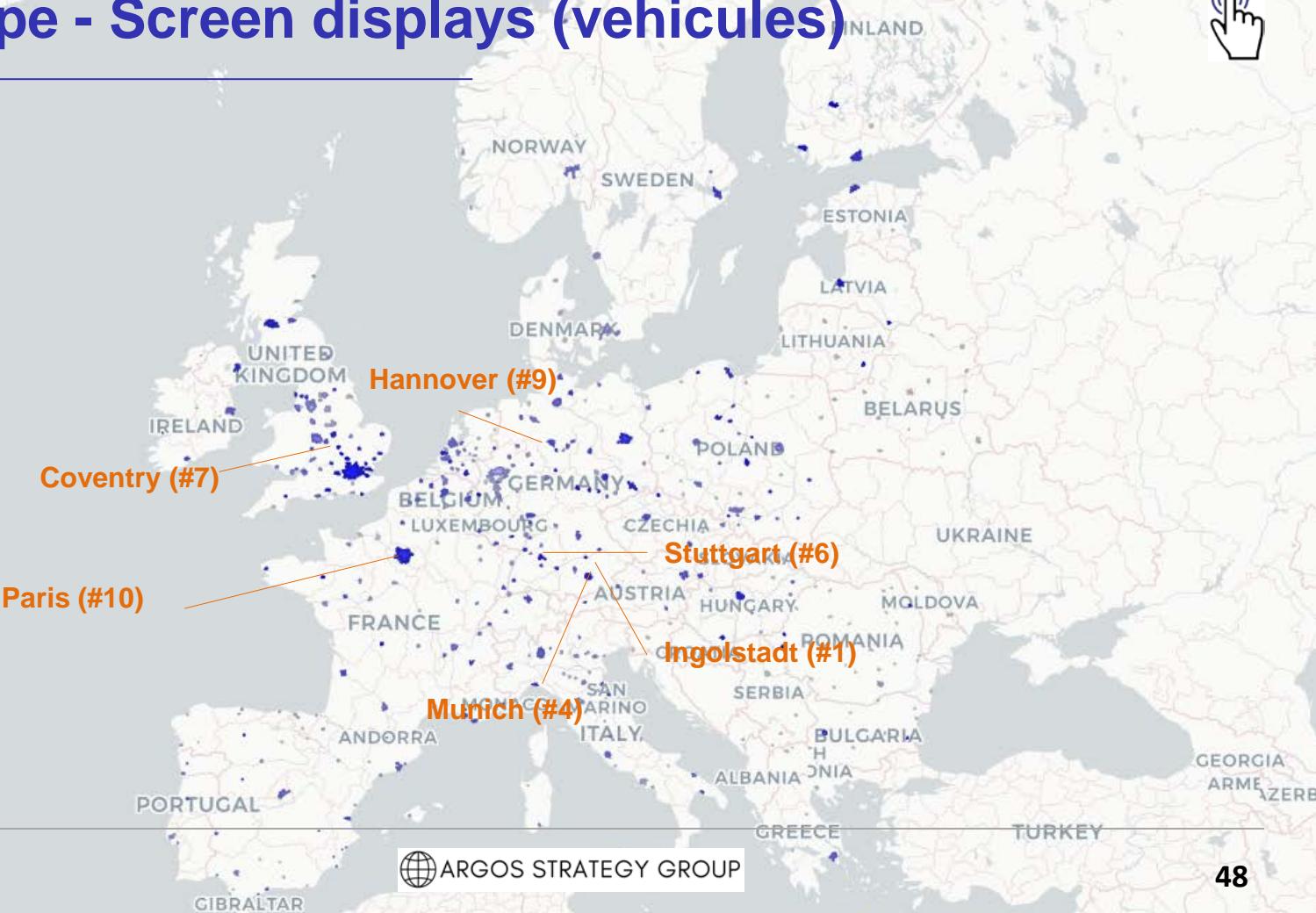
ARGOS STRATEGY GROUP

North America - Screen displays (vehicles)

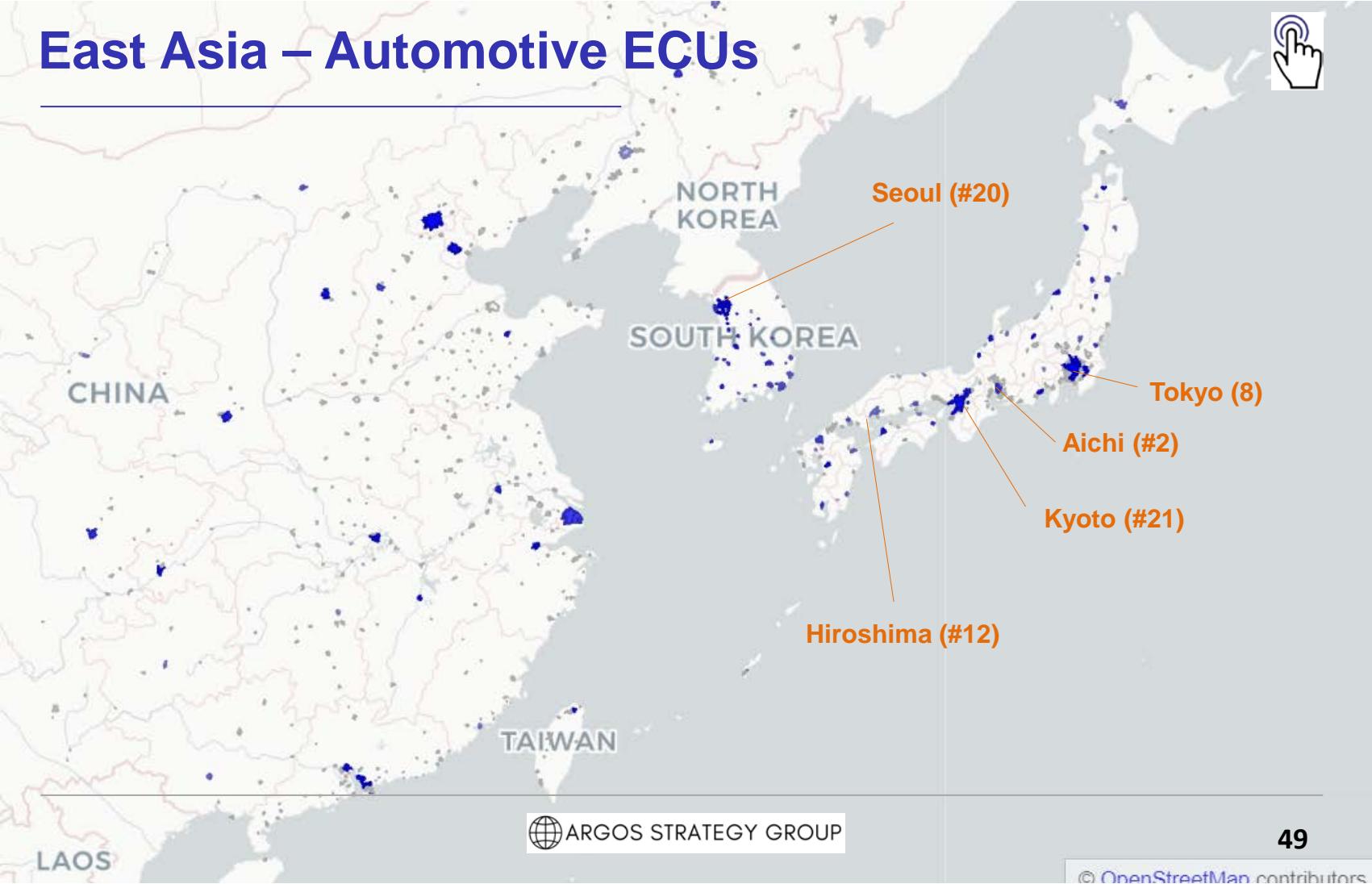


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Europe - Screen displays (vehicles)



East Asia – Automotive ECUs



North America – Automotive ECUs



Seattle (#50)

San José - SF (#28)

Los Angeles (#48)

Grand rapids (#1)

Detroit (#3)

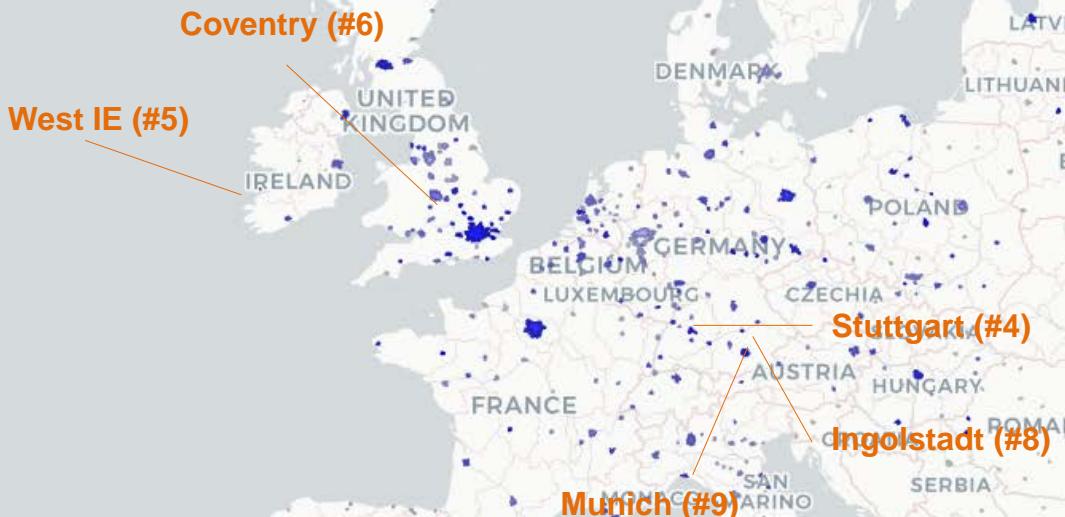


ARGOS STRATEGY GROUP

DOMINICAN
REPUBLIC

50

Europe – Automotive ECUs



East-Asia - Head-up displays



Beijing (#12)

Seoul (#12)

Niigata (#7)

Tokyo (#10)

Kyoto (#18)



ARGOS STRATEGY GROUP

North-America - Head-up displays



Seattle (#2)

San José - SF (#3)

Los Angeles (#13)

Rochester NY (#9)

Miami (#1)



ARGOS STRATEGY GROUP

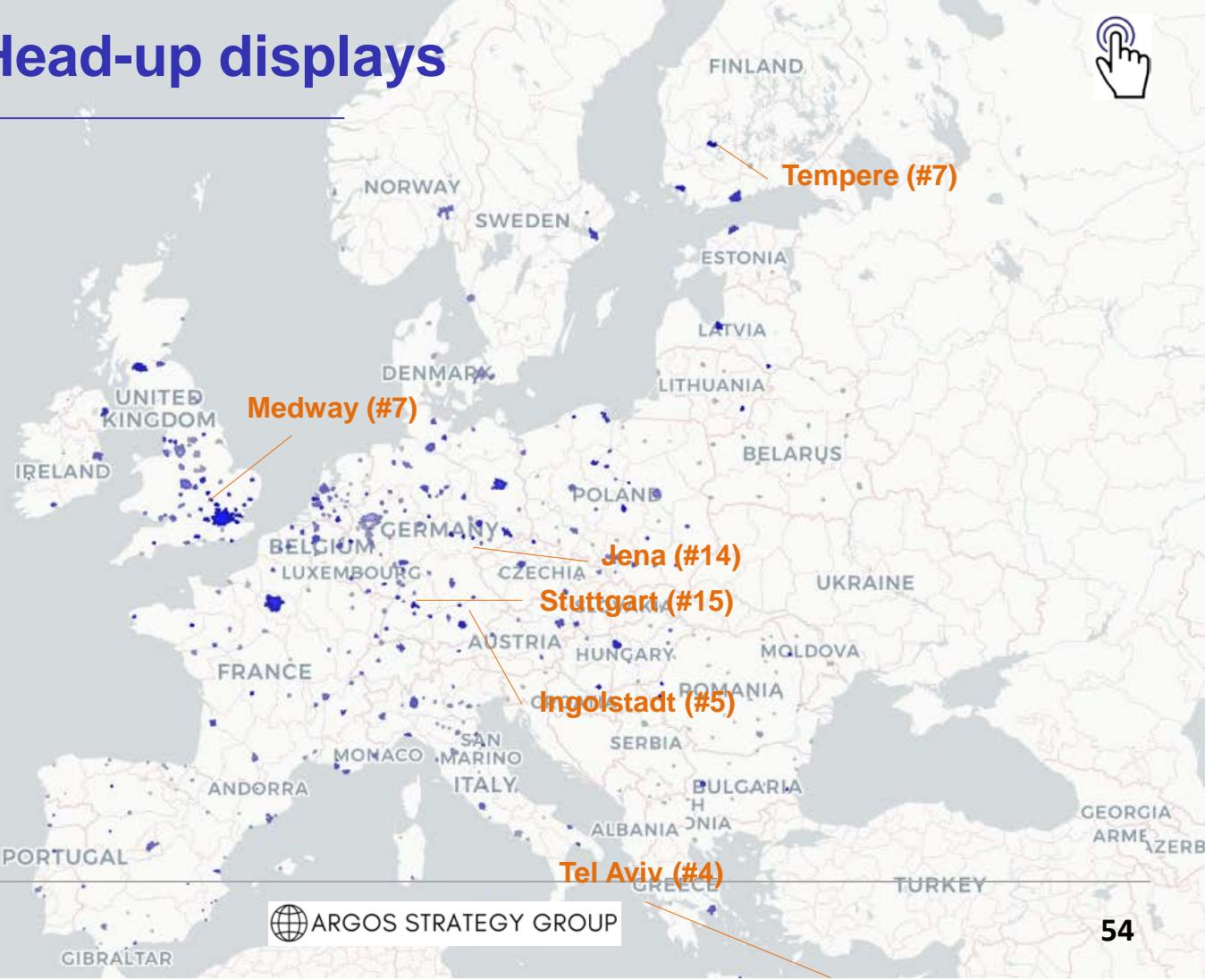
BELIZE

JAMAICA

DOMINICAN
REPUBLIC

53

Europe - Head-up displays

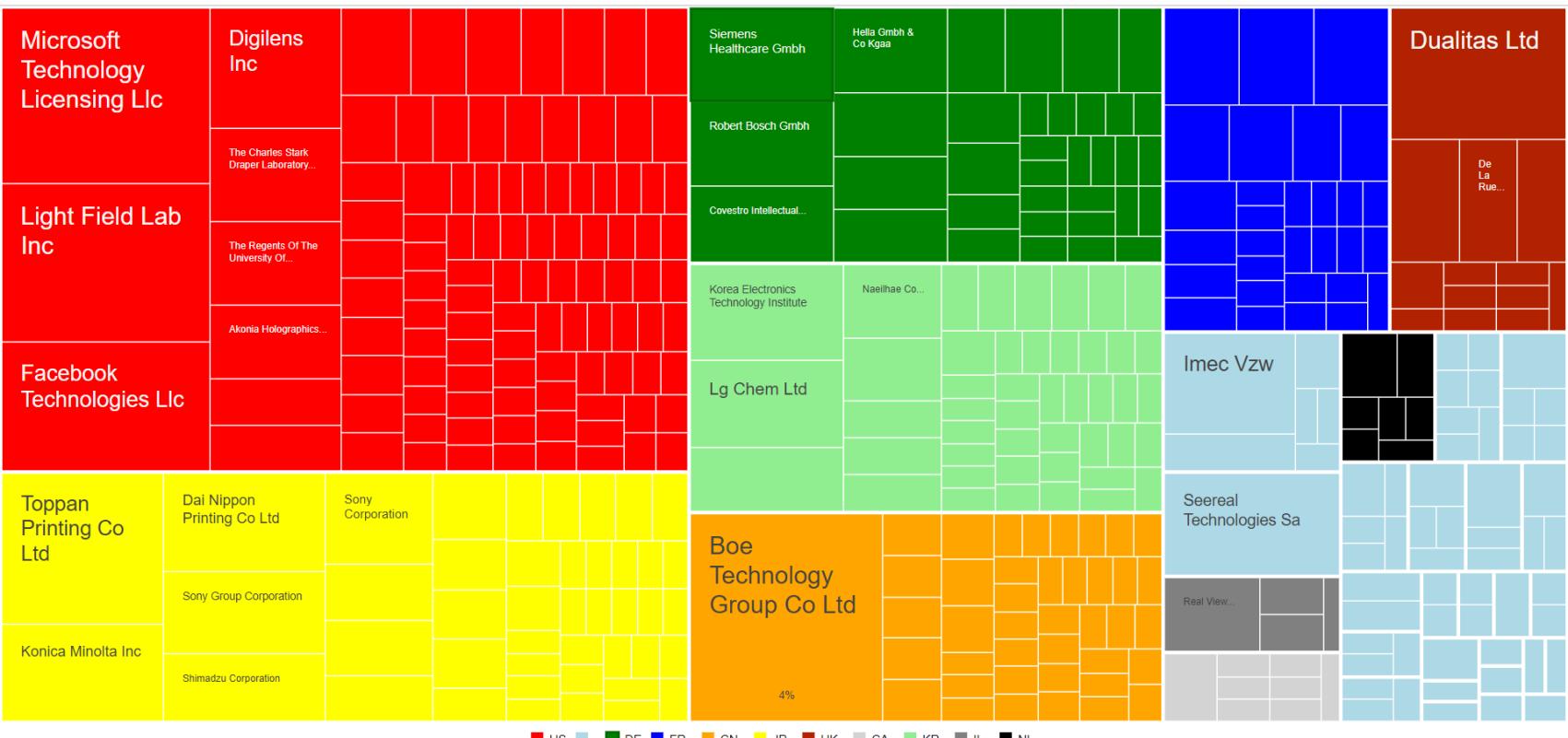


ARGOS STRATEGY GROUP

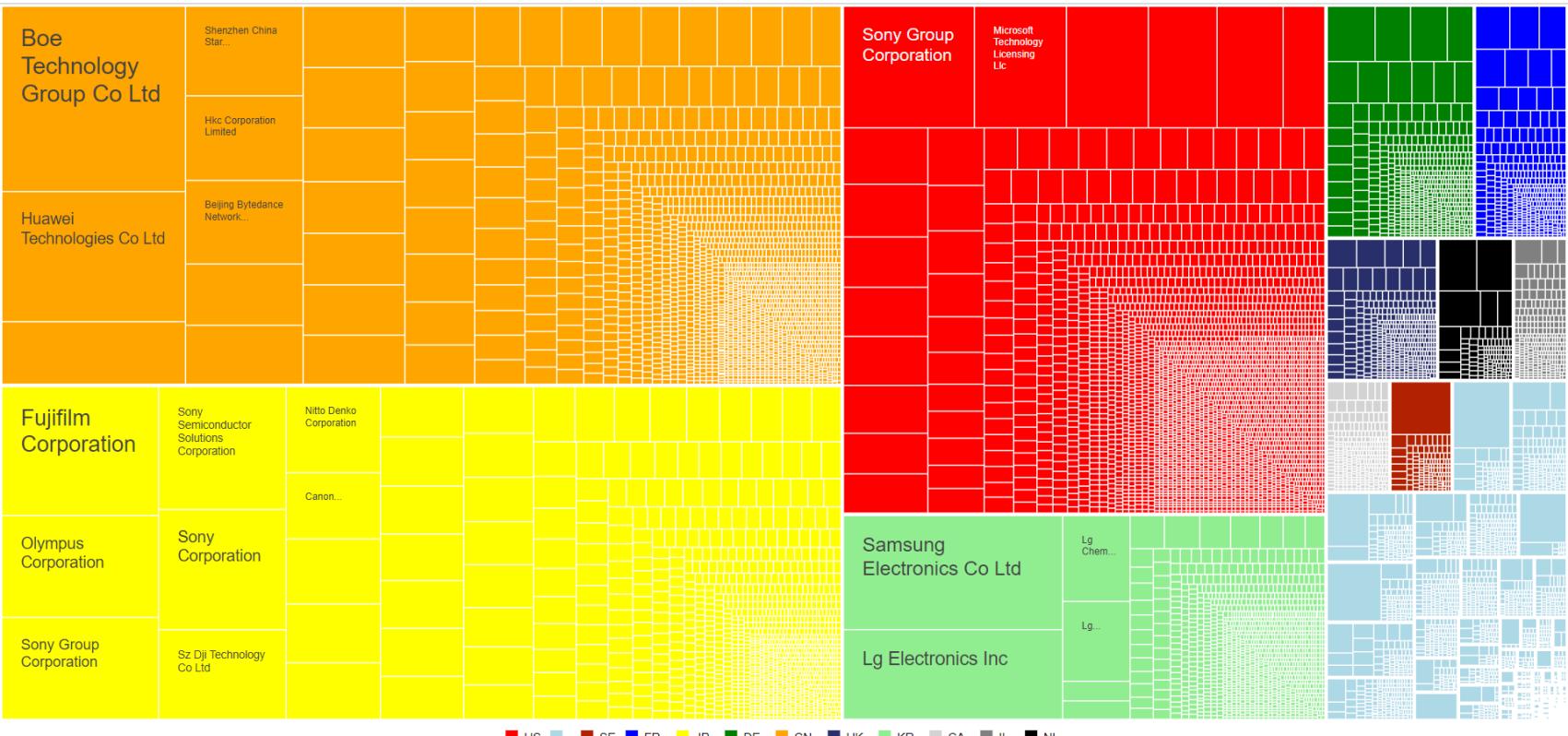
Key organizations & inventors



Applicants – Holography

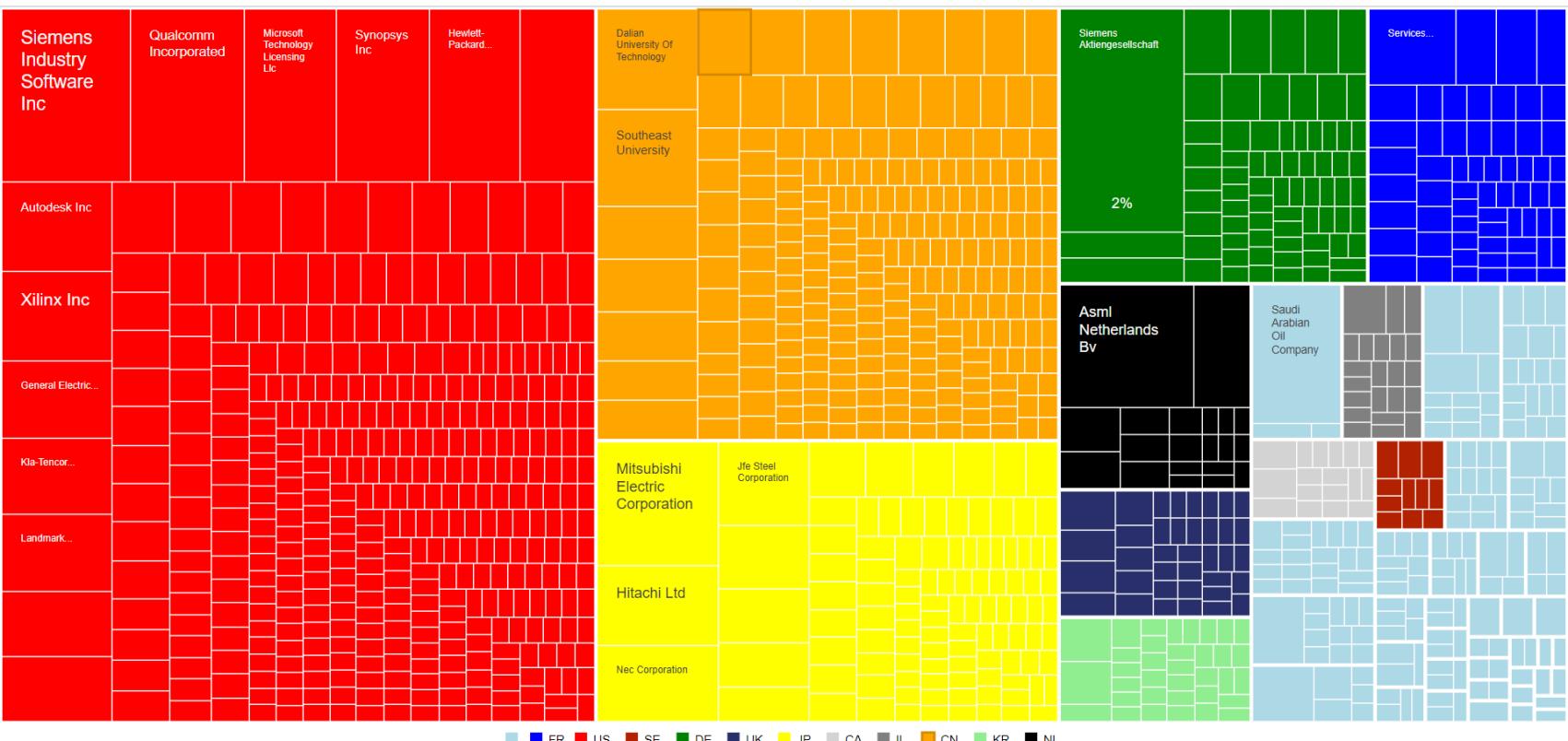


Applicants – Optical systems (general)



ARGOS STRATEGY GROUP

Applicants – CAD

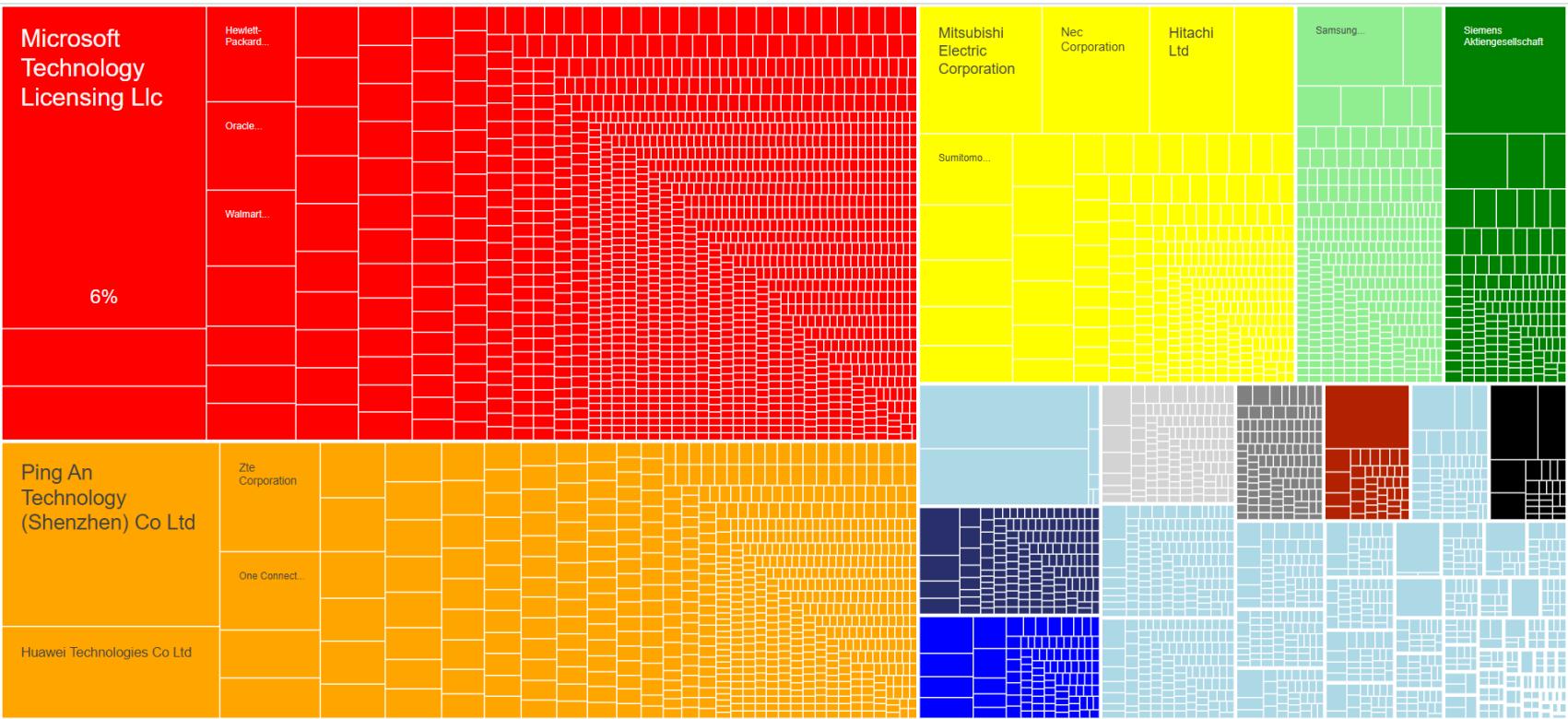


FR US SE DE UK JP CA IL CN KR NL

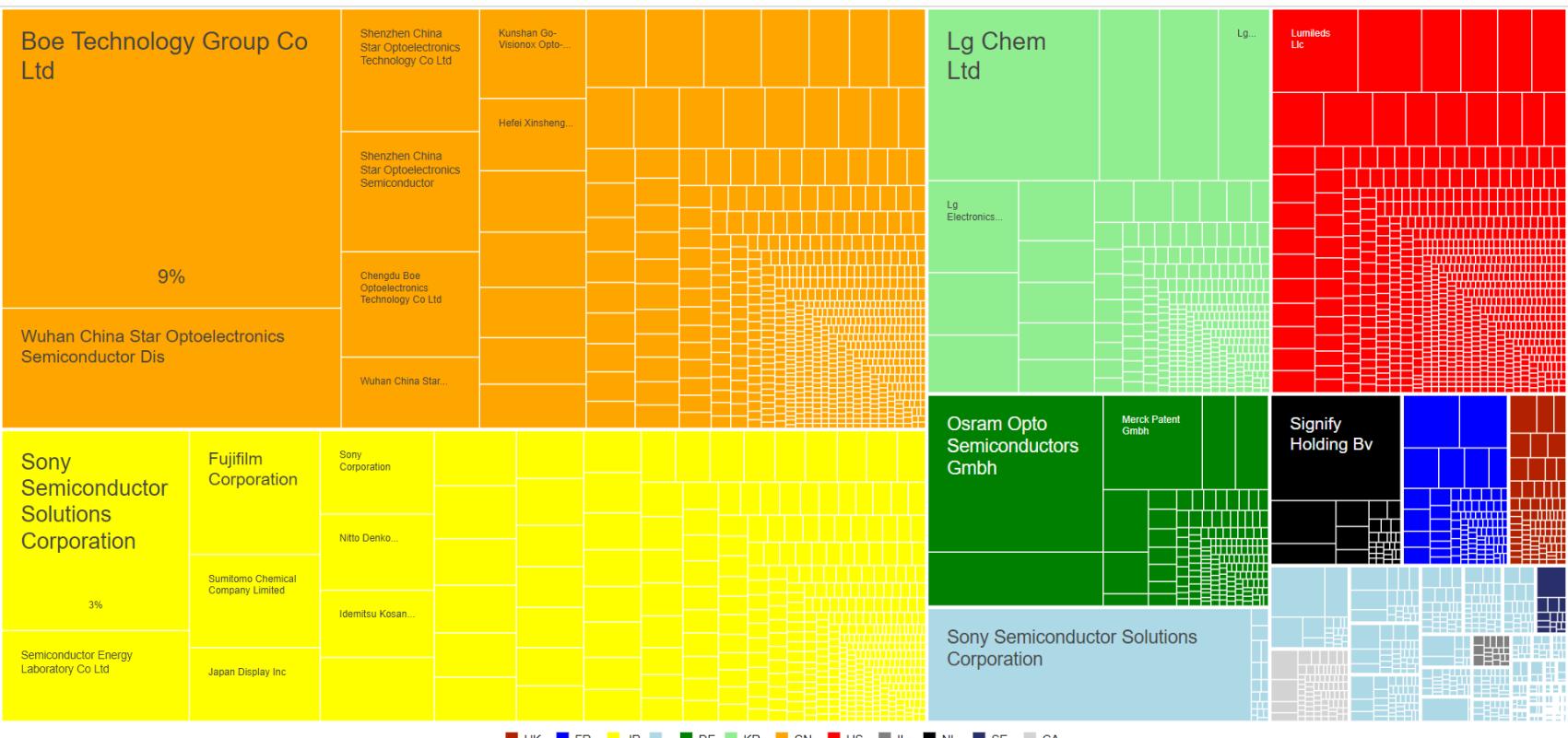


ARGOS STRATEGY GROUP

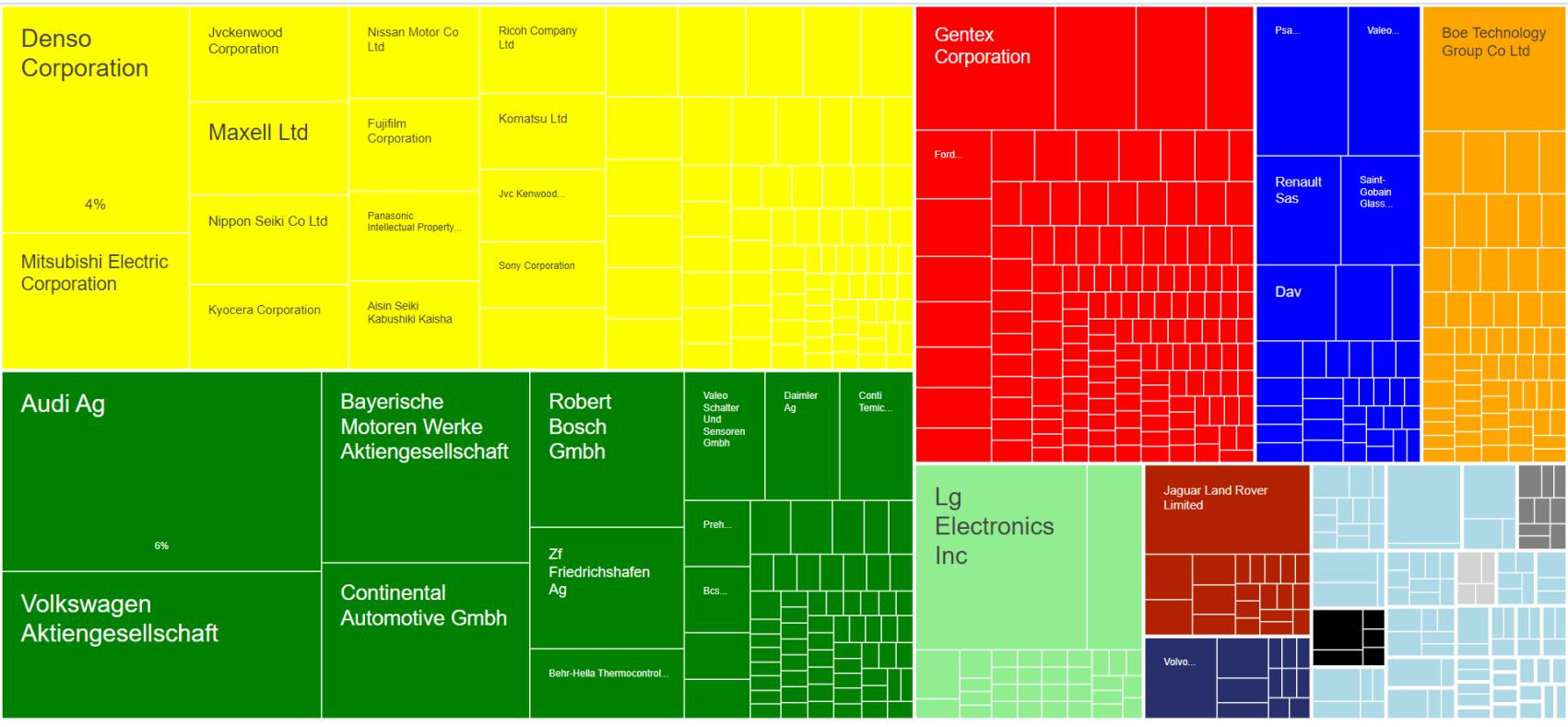
Applicants – Arrangements for SE



Applicants – Optical components



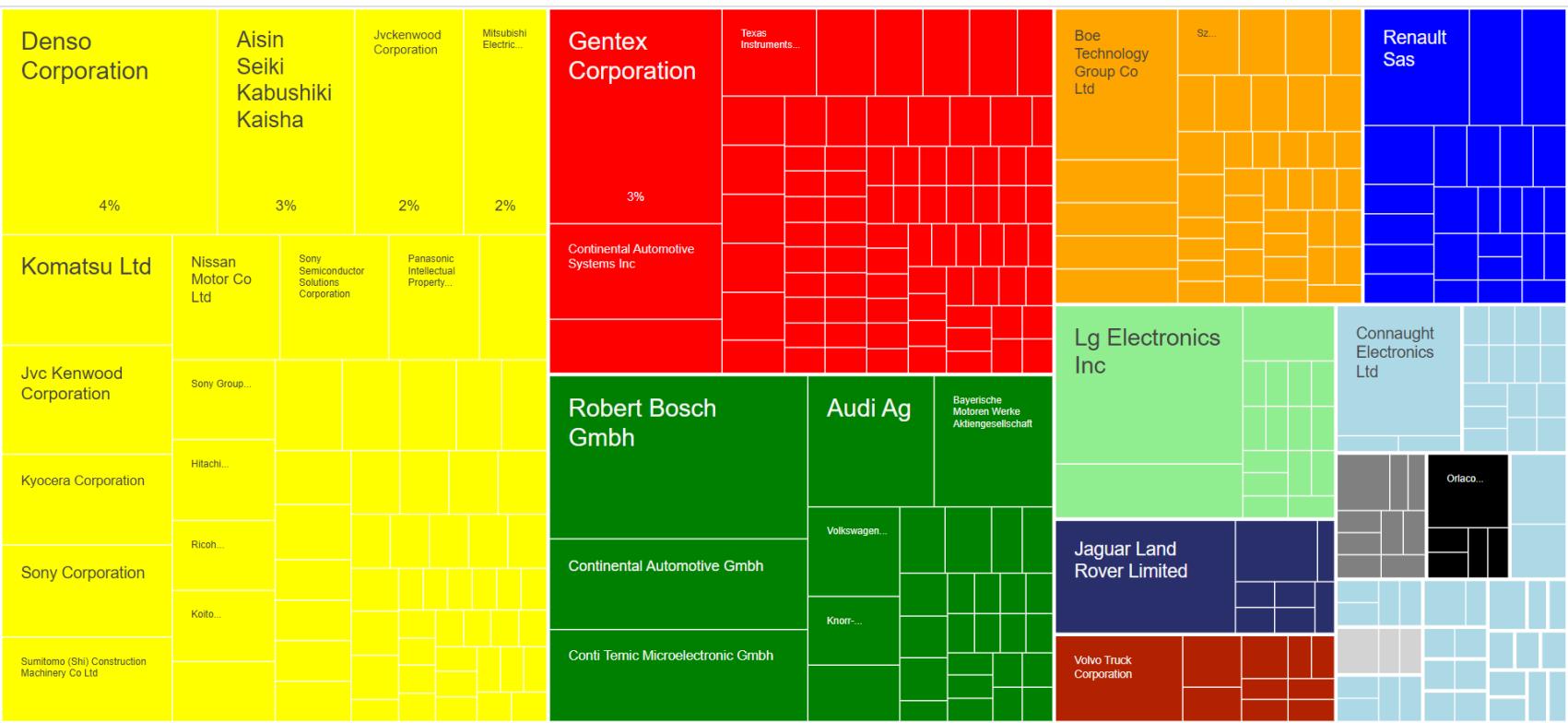
Applicants – Screen displays (vehicles)



■ DE ■ US ■ UK ■ FR ■ JP ■ JP ■ CN ■ KR ■ SE ■ IL ■ CA ■ NL



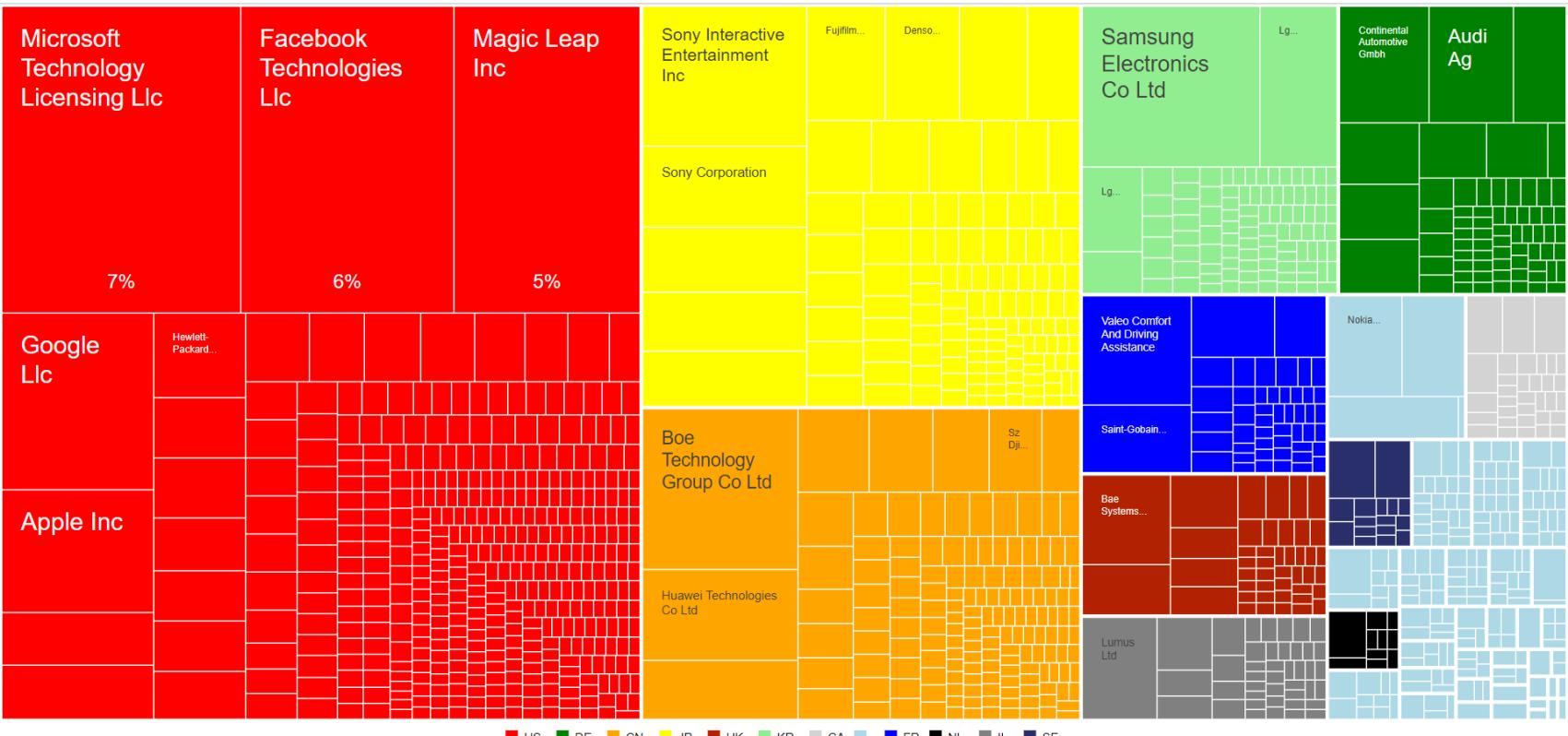
Applicants – Automotive ECUs



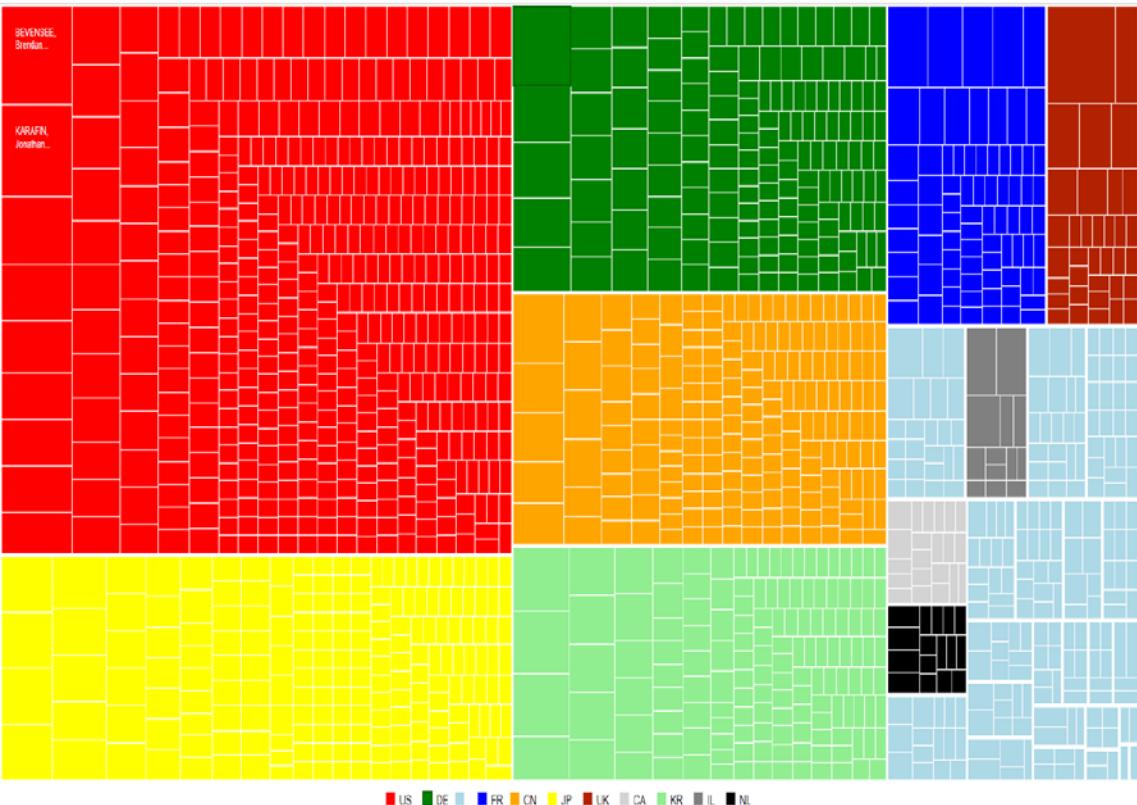
■ JP ■ US ■ CN ■ FR ■ DE ■ SE ■ UK ■ NL ■ KR ■ CA ■ IL



Applicants – HUD



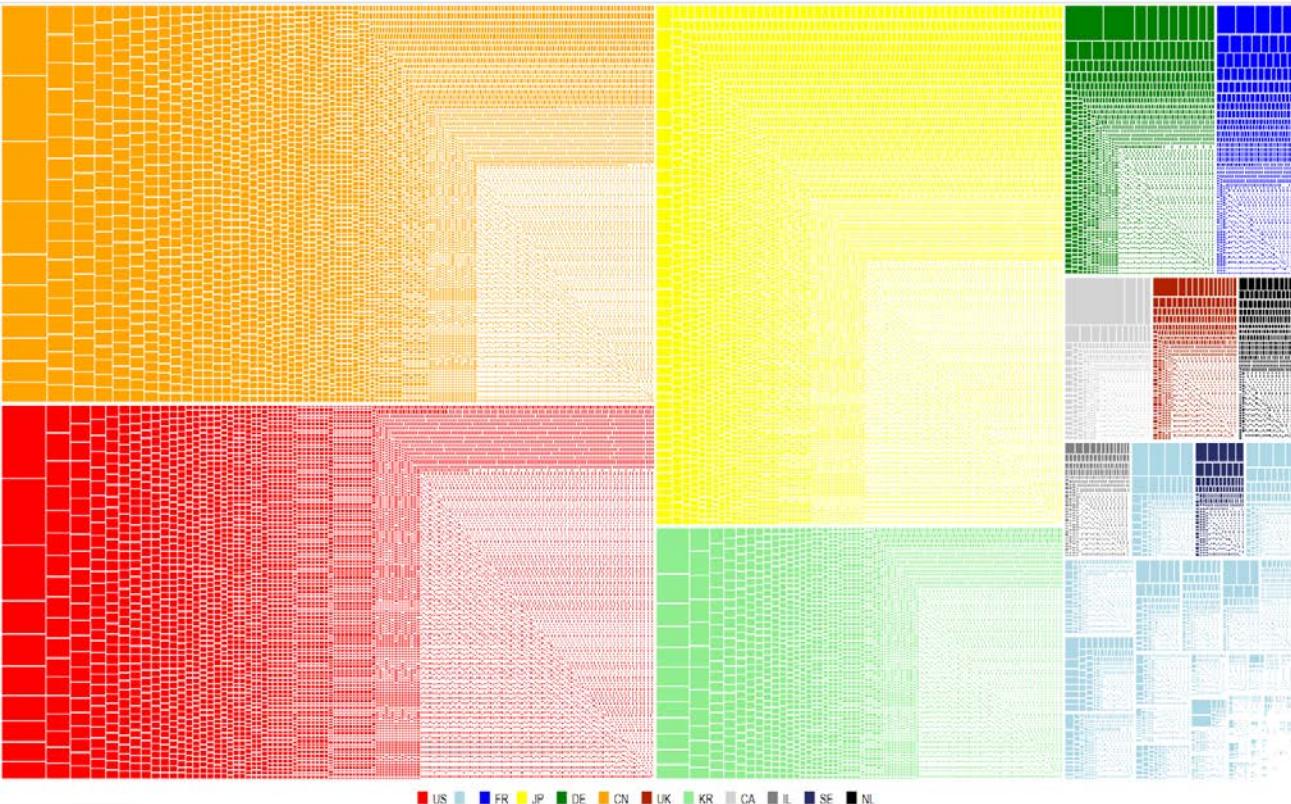
Inventors – Holography



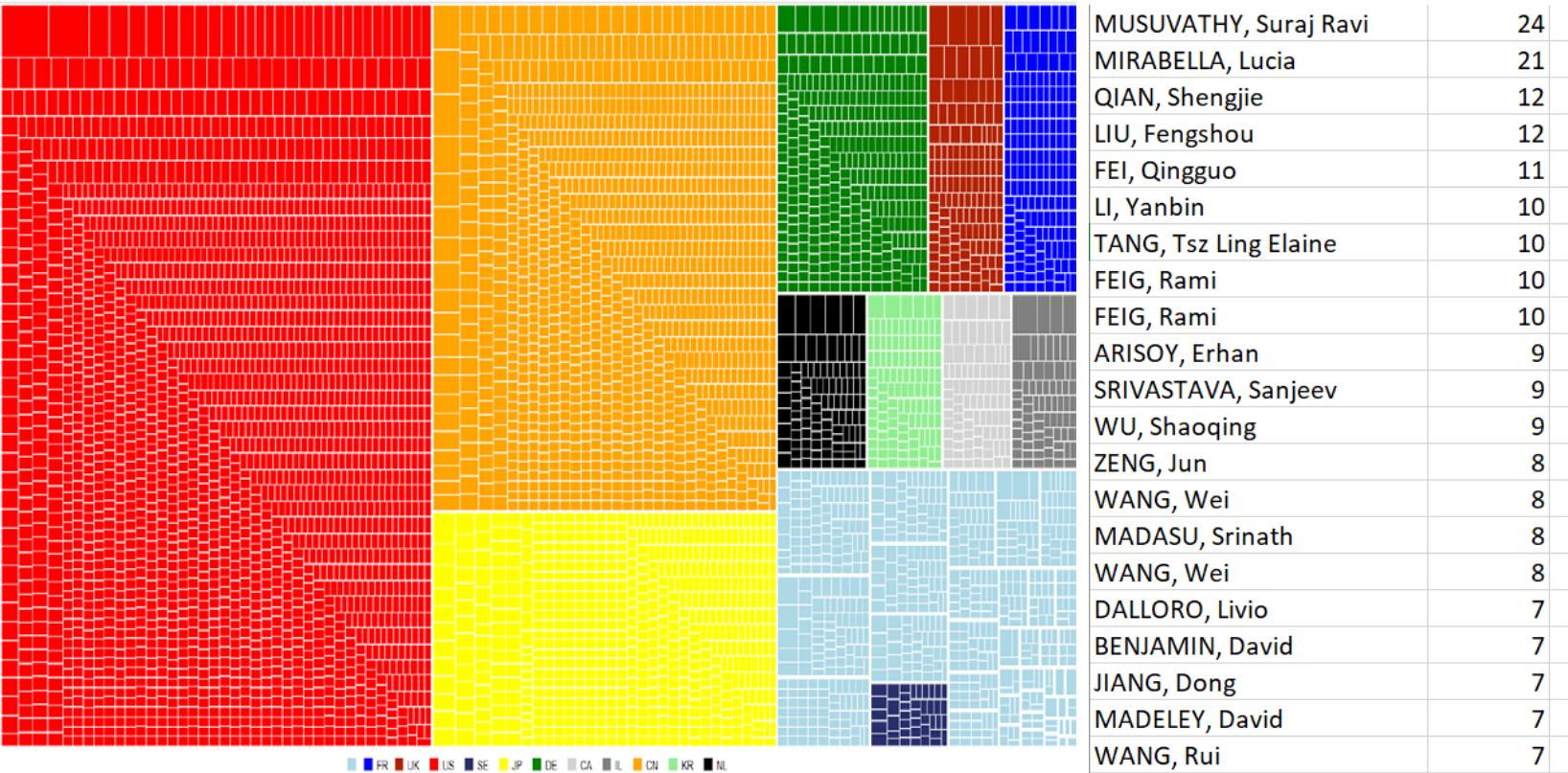
CHRISTMAS, Jamieson	19
BEVENSEE, Brendan, Elwood	19
KARAFIN, Jonathan, Sean	18
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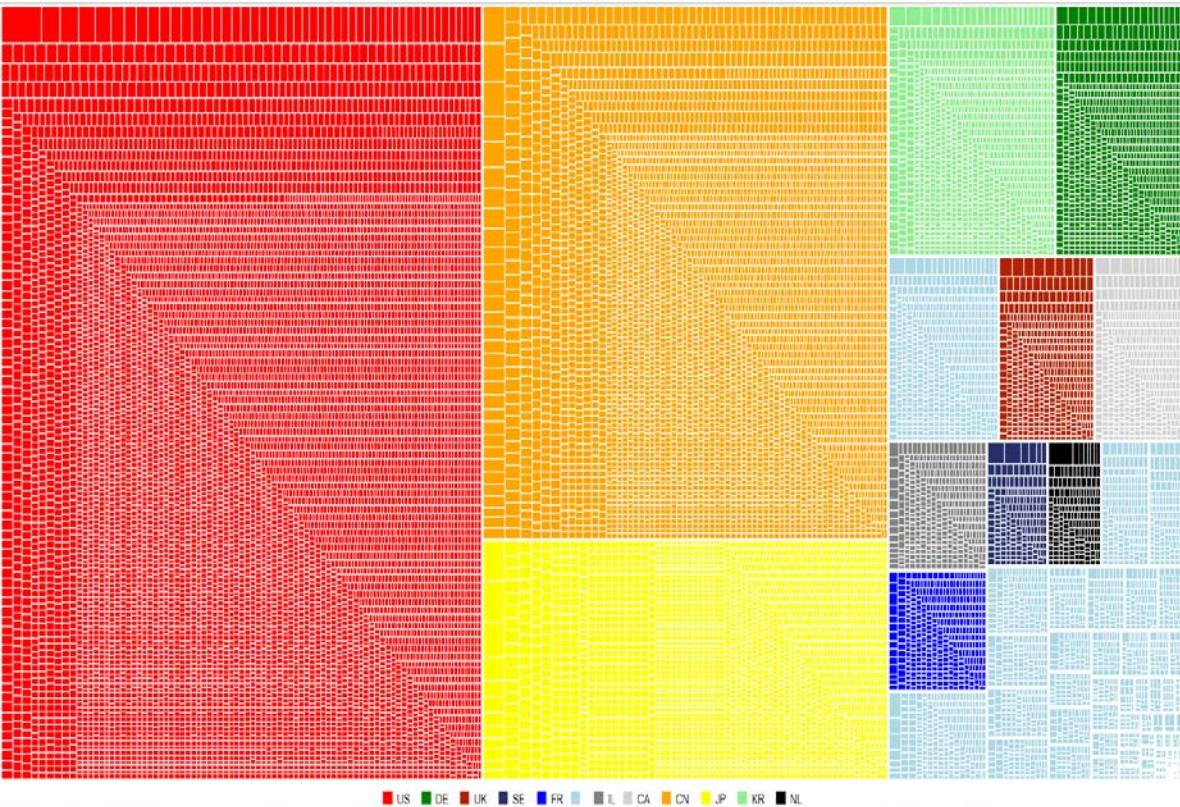
Inventors – Optical systems (general)



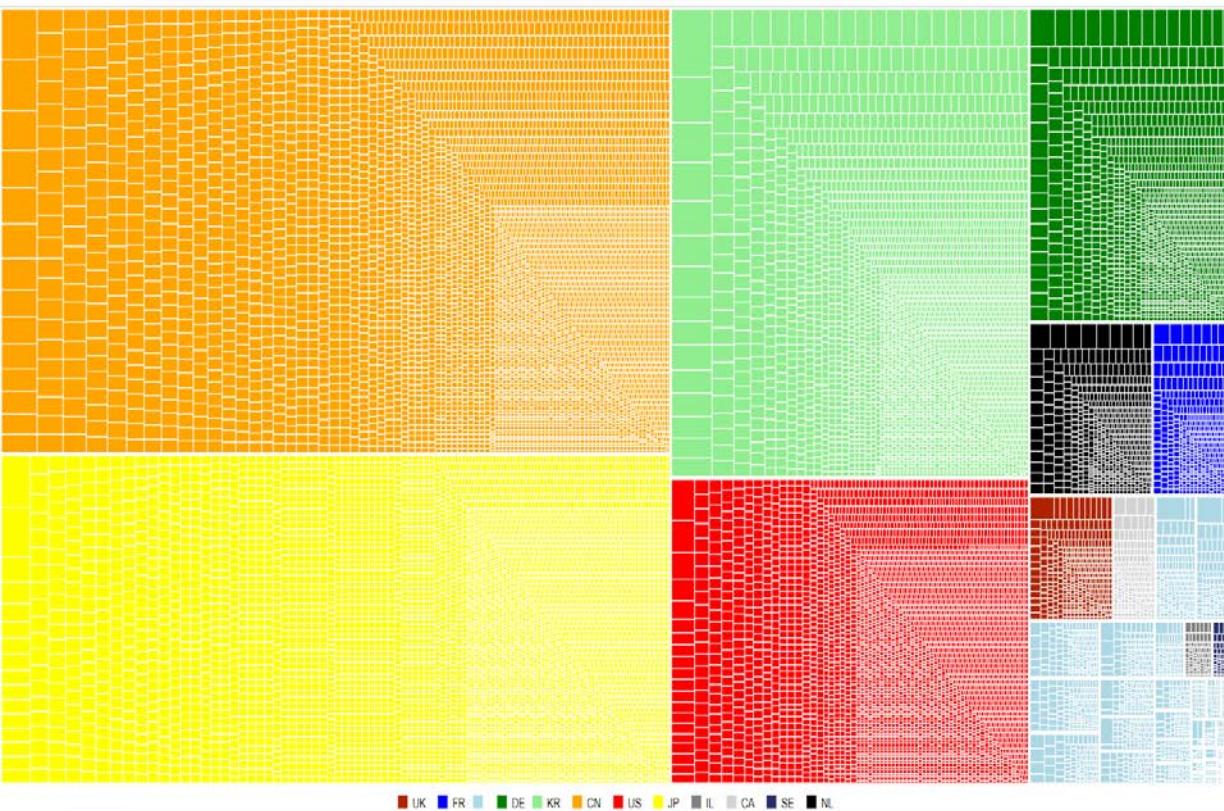
Inventors – CAD



Inventors – Arrangements for SE



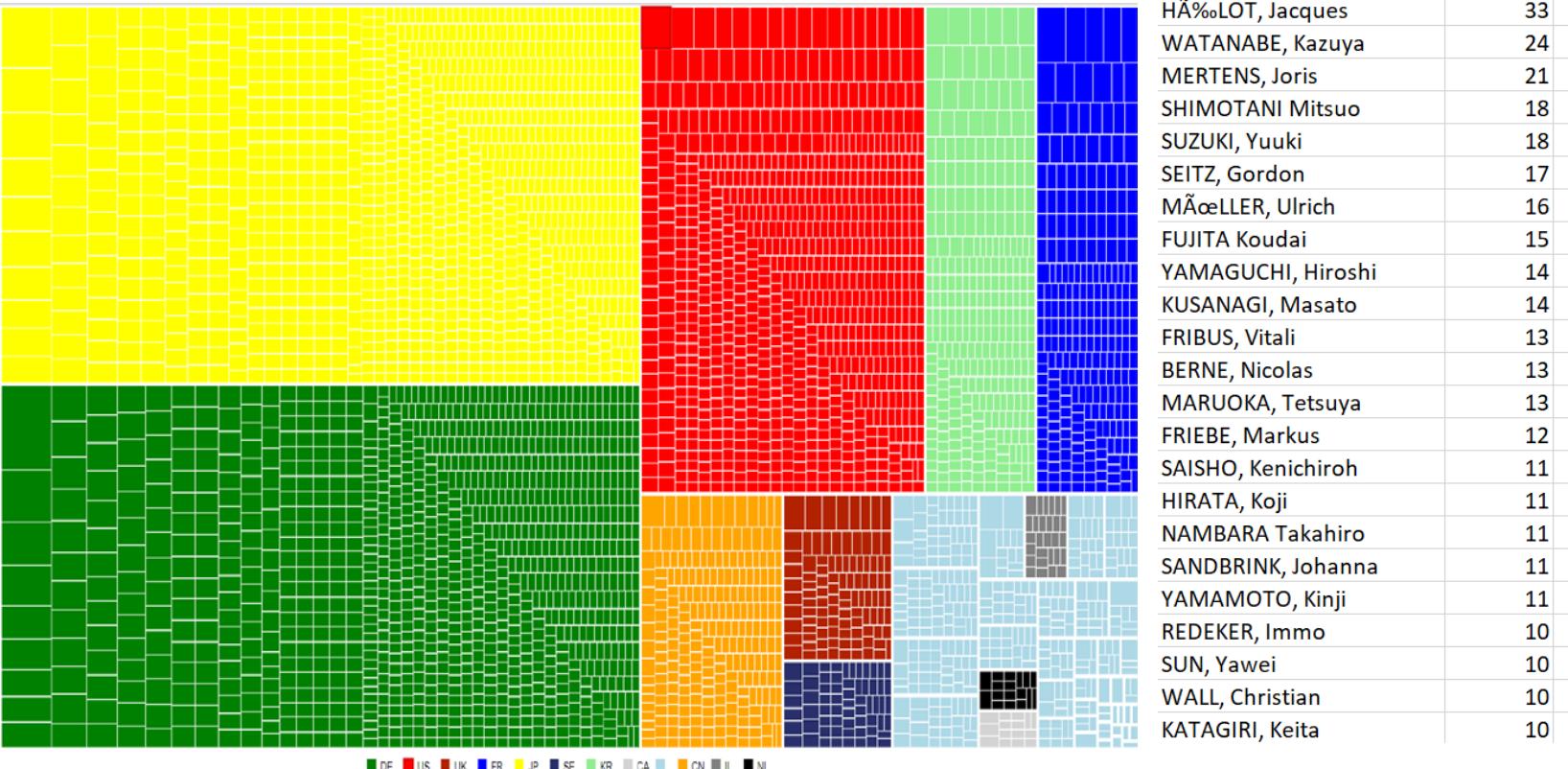
Inventors – Optical components



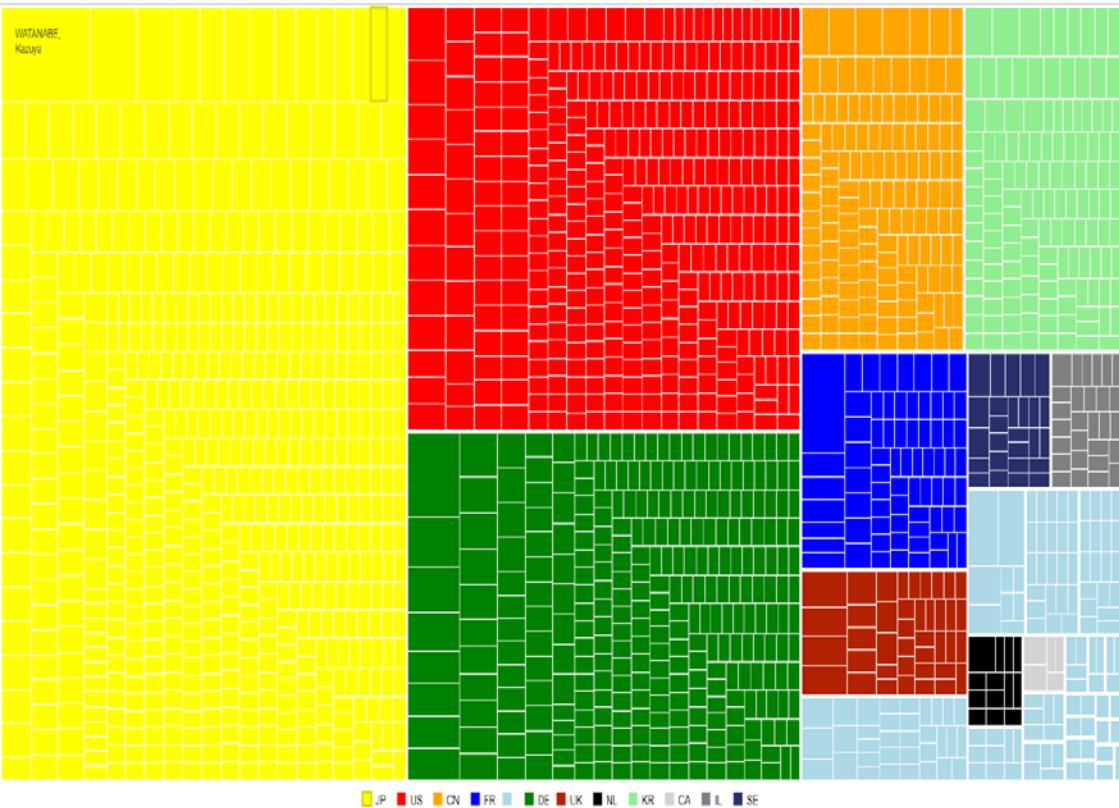
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Inventors – Screen displays (vehicles)



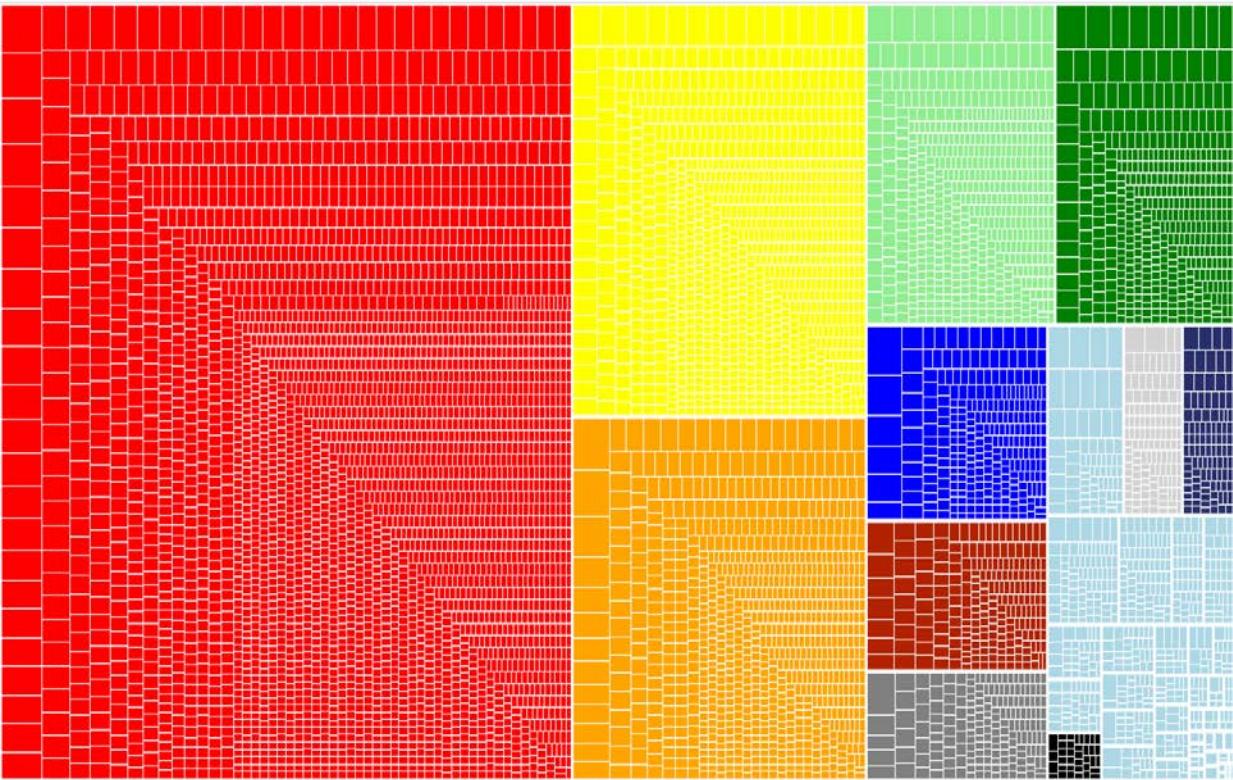
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