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CENTER FOR INTELLECTUAL PROPERTY

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**INTELLECTUAL ASSET ASSESSMENT**
**A case delivered to WIPO - work in progress**

# SOMATOM.X CITE including myExam Companion

The purpose of the work is to provide a brief overview of the IAM framework and how, through a pedagogical approach, an increased understanding of the core components of the framework can be achieved.

The material in this presentation is still work in progress and continuously developed and adjusted to suit specific educational training. Thus, this material does not in any way represent a final report or stand alone educational material, and therefore shall be viewed as a base for building relevant educational training in intellectual property and technology based innovation strategies.

CHALMERS UNIVERSITY OF TECHNOLOGY | UNIVERSITY OF GOTHENBURG

# The case

- This case is an intellectual assessment on a product solution for CT-scanner enabling AI-based support systems for image analyzing in diagnostics of patients
- In the analysis, we exemplify by using parts of the Siemens Healthineers* product offering “SOMATOM.X CITE including myExam Companion”
- The focus of the analysis is on technology development and the convergence of technology areas relevant for AI-based medical devices
- We have applied an academically developed framework for assessment and management of intellectual assets (CIP IA Framework)
- The main ambition in the case is to illustrate how the identification, assessment and management of intellectual assets are fundamental means to promote technology driven innovation and business development
- The case is chosen to illustrate the importance of intellectual assets in industrial business settings that are digitalized and even transformed through artificial intelligence
- In the assessment we have only had access to public external sources.
- **<u>This is work in progress</u>**

* **Siemens Healthineers AG** (formerly **Siemens Healthcare**, **Siemens Medical Solutions**, **Siemens Medical Systems**) is the mother company for several medical technology companies and is headquartered in Germany. In this case we refer to the company as both Siemens Healthineers and Siemens Healthcare due to title registration in patent documentation. The company is part of the Siemens AG group.

# 0

# About the IAM-framework

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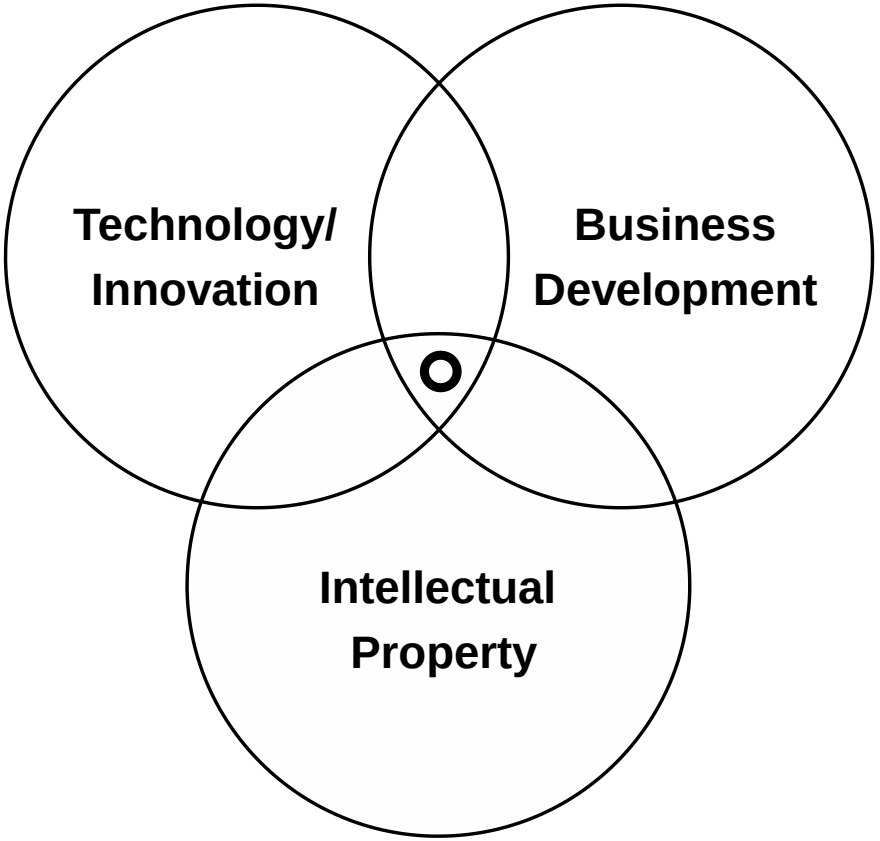
# A CIP-approach to Intellectual Asset Management



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The CIP IAM framework is based on four main framework questions, that together have the ambition to ***unveil*** as well as ***operationalize*** how intellectual assets create value in business

| | |
|---|---|
| **CAPTURE**<br><br>Which knowledge and IPR assets have been, can be and should be claimed by the firm? | **LEVERAGE**<br><br>How does, can and should the firm leverage/manage and create value from it's IA? |
| **POSITION**<br><br>How is, can and should the firm be positioned on the market and in the value chain? | **ORGANISE**<br><br>How has the firm developed and how can and should the firm develop its capability for innovation etc.? |

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The **theoretical foundation** of the CIP IAM framework is that an intellectual asset approach will help us to understand and manage innovation and business development. Theoretically intellectual assets, both knowledge assets and IPR assets, can as substantial phenomena be understood as captured objects/resources, positions on markets/landscapes, individual and organizational capability, and value propositions. The framework is based on the insight that when we assess and manage intellectual assets, from these perspectives, it will help us to manage and promote innovation based on new technology etc.

| | |
|---|---|
| **CAPTURE**<br><br>Intellectual assets are captured and objectified resources | **LEVERAGE**<br><br>Intellectual assets are value propositions |
| **POSITION**<br><br>Intellectual assets are positions on fields and landscapes | **ORGANISE**<br><br>Intellectual assets are individual and organisational capability |

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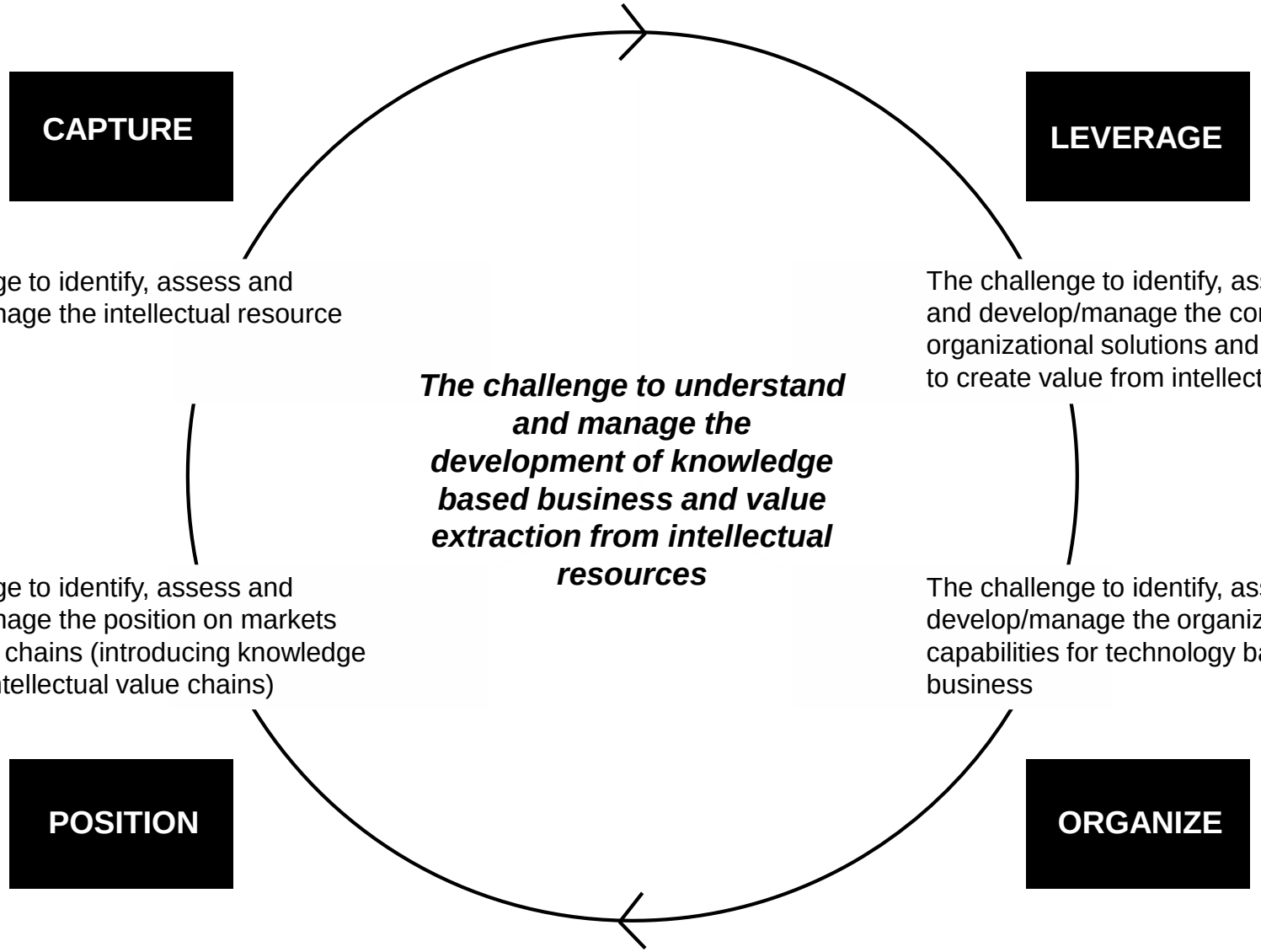
Four main challenges underlying the framework questions, i.e. four challenges to address if to understand how intellectual assets creates value in technology based business!



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An explicit ambition with the CIP IAM framework is to help us understand and manage industrial transformation.

- Most of IAM capability is developed with in an industrial business paradigm. We therefore need to understand how intellectual assets create value in industrial business to be able to understand what is different in business in a a context of digitalization

***Industrial development***  ***Digitalization***

# 1

# Introduction to the product and the industrial setting

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# About the case: SOMATOM.X CITE including myExam Companion

- Focus area
  - Industrial radiology based product with capacity to interact with and manage digital interfaces (digital disruption)
  - Computed tomography (CT) scanning technology procedure for cardiac scanning and imaging procedure based on computer processing
  - Mainly looking at the AI-based image processing and analytics function as the software based decision supportsystem
  - Capacity to include AI-based software solutions as support system for image recognition and analyzing
  - Capacity to partake in IoT-solutions (IoMT)

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# Product Segment and Product Description; CT scanning and medical imaging in general

## Product Segment of CT scanners

> CT-scanners are typically categorized into the following segments; type, device architecture, technology, application and end-user.
> The CT scan technology is measured in the amount of slices, where the three main measurement methods are high-slice, mid-slice and low-slice.
> A high slice indicates a reduced scan time and higher resolution in images.

## Product Description of CT scanners

> The scanner includes hardware components that are integrated with software features which enlarges the value-offering.
> Portable scanners currently enables significant growth, which results in the relevancy of future stationary CT scanners.
> Software innovations is a strong driving force and value-creation asset in the CT-scanner.

## Product Segment of Medical Imaging

> Key segments that use AI based medical imaging are within breast-, cardiovascular-, lung- and neurological fields.
> X-rays, CT-scanners, MRI and Ultrasounds are examples of machines that apply connectivity functions aligned with IoMT and AI.
> The CT scan segment is expected to experience the fastest growth, due to the high extent of AI integration.

## Product Description of Medical Imaging

> A medical apparatus that have connectivity functions integrated in the product and are aligned with IoMT and AI.
> The apparatus utilizes and implements AI in the technology, which in the industry is increasing in importance.
> Incorporating AI-solution into the products enables a larger value-offerings for medical imaging actors, who utilize the platform approach.

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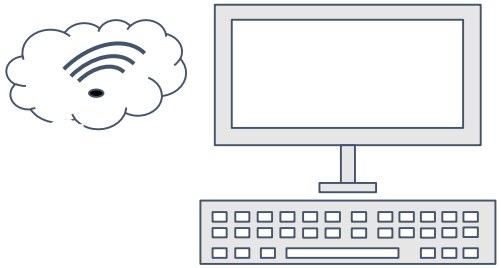
# Product Description and Product Segments; product and service components



## SOMATOM X.Cite

**Product Components**
> X-ray Tube
> Stellar Detector
> X-ray beam shaping filters
> Collimators
> Control System
> Mobile Control panel

**Characteristics**
> Intelligent navigation for enhanced consistency
> Patient-friendly design with an 82 cm bore
> Personalized imaging for comprehensive results
> Consistent standards across your institution.

## myExam Companion

**Service Components**
> AI Intelligent assistant of workflow
> AI-Rad Companion - Diagnosis assistant
> Remote Service and management
> Data accessibility - hospital network
> Other digital Service integration
> Condensed into decision trees

**Characteristics**
> Built-in expertise
> Intuitive interfaces
> Intelligent Guidance

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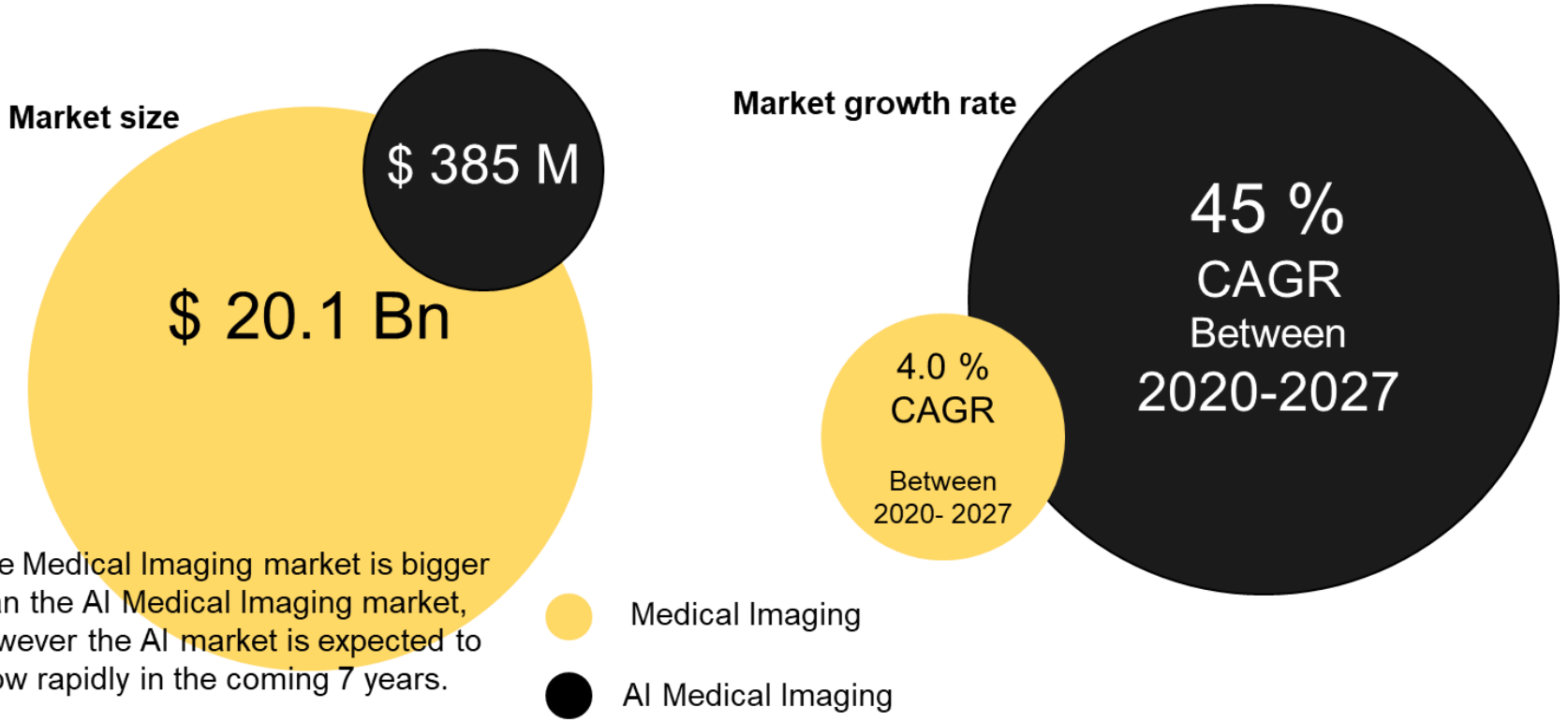
# Industry description; the AI Medical Imaging market is still small but has a rapid growth rate




The Medical Imaging market is bigger than the AI Medical Imaging market, however the AI market is expected to grow rapidly in the coming 7 years.

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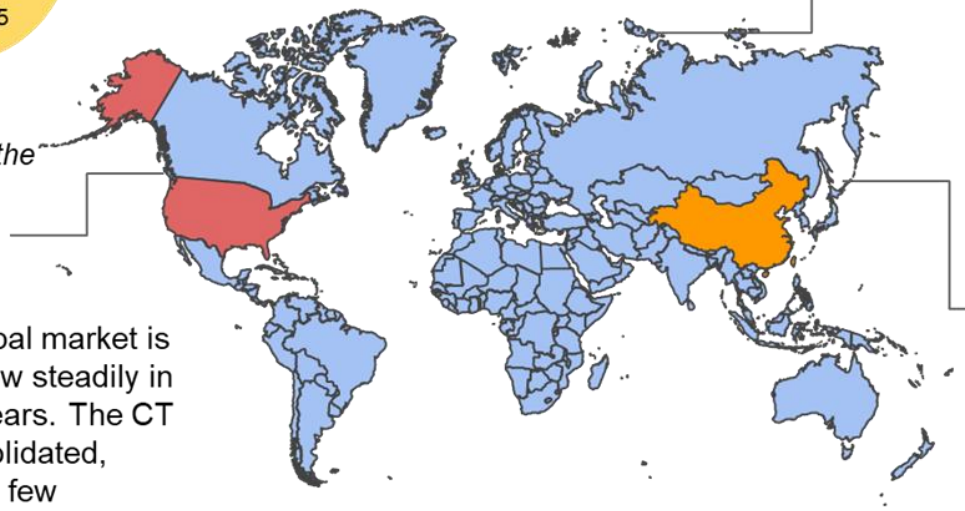
# Industry description; large actors are prominent in the CT scan segment and focus is shifted towards Pacific Asia

*CT Scan Market*

5.4-8.4 %
CAGR
Between
2019- 2025

*Total global value CT scan market*

$ 5.2-6.6 Bn



*North America is the largest market*

*Pacific Asia is the fastest growing market*

The overall global market is expected to grow steadily in the coming 7 years. The CT market is consolidated, dominated by a few prominent actors.

*Largest Actors on the Global CT-market*

GE PHILIPS Canon SIEMENS Healthineers HITACHI

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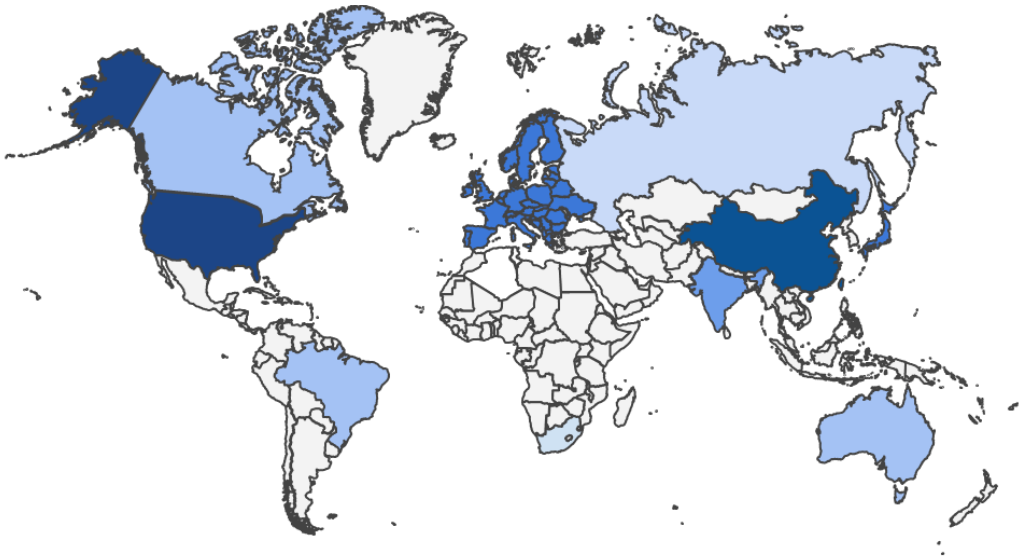
# Industry description; CT market is patent intense but not many CT and AI patents are registered yet.

| | CT patents | / | CT+AI patents |
|---|---|---|---|
| Canon | 2663 | | 15 |
| GE | 1756 | | 19 |
| HITACHI | 1407 | | 5 |
| SIEMENS Healthineers | 1058 | | 25 |
| PHILIPS | 445 | | 11 |

Source: Orbit




Medical CT patent families portfolio size for the top 5 players in the market and their main market presence. Patent portfolio size for AI patent are small among all actors, but growing.

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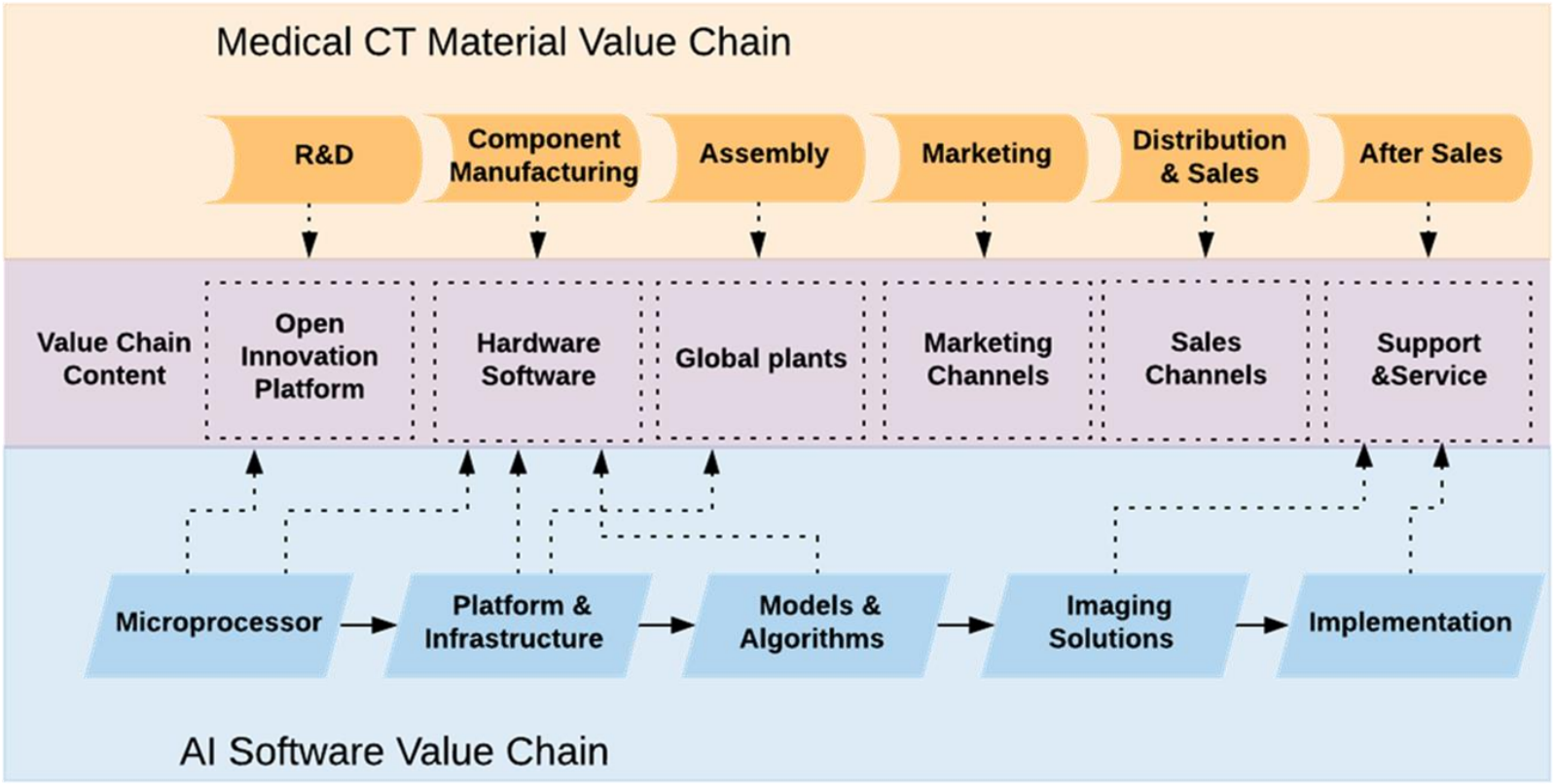
# Business Strategy and Industry Value Chain; there is convergence between material and digital value chains in AI-based CT-scanning product solutions



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# 2

## Capture

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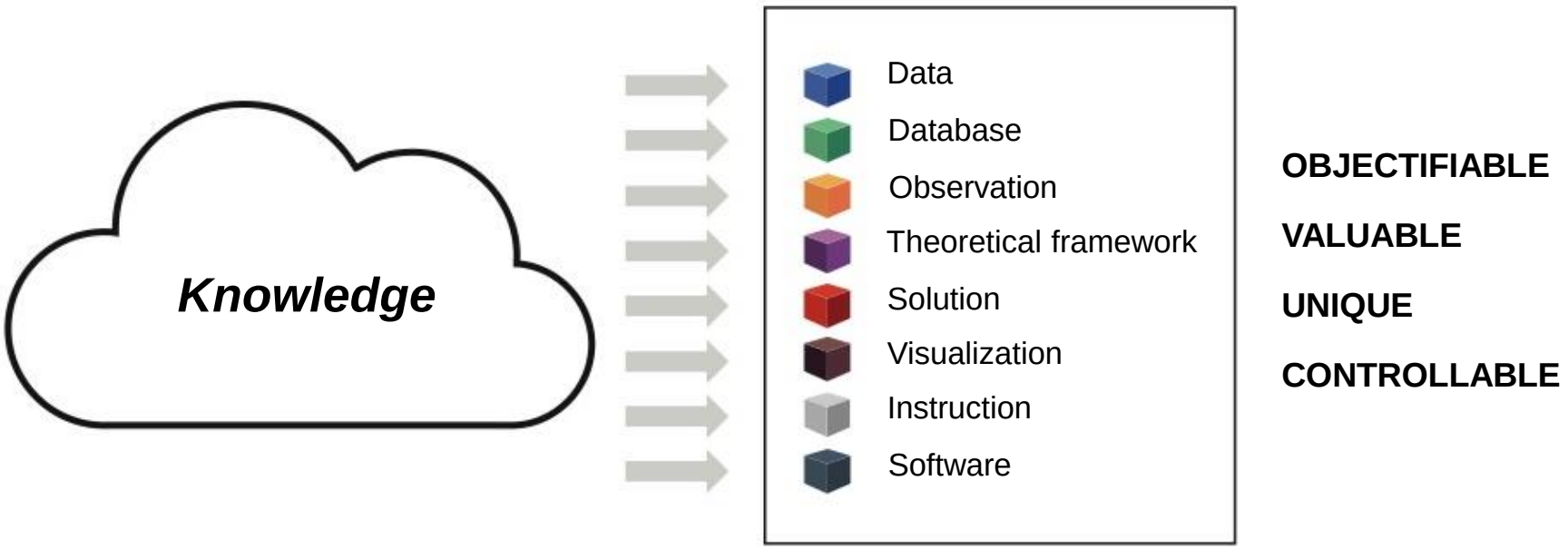
# Assessment of the intellectual assets as the firm resources

- We do an internal analysis of the firm's intellectual assets and their relationship to each other and the value propositions of the firm.

- These intellectual assets would not only include easy to find registered IPRs such as patents, trademark rights, and design rights, but also all valuable know-how in the form of data, databases, observations, theoretical frameworks, solutions, instructions, and software that may be or may not be managed explicitly as trade secrets or copyrightable works but may exist only in the heads of the employees of the firm.

# Intellectual assets: What we are looking for




**OBJECTIFIABLE**

**VALUABLE**

**UNIQUE**

**CONTROLLABLE**

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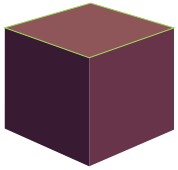
# Intellectual assets are assessed and ’tagged’ with relevant metadata to further increase manageability



TA-01

**Assessments (examples)**

| | |
|---|---|
| **Value** | Value for commercial offering |
| **Value** | Value for collaboration output |
| **Control** | Secrecy-based control |
| **Control** | IPR-based control |
| **Control** | Contractual control |

**Tags** (examples)

| | |
|---|---|
| **Creator** | Who created the intellectual asset? |
| **Owner** | Who controls the intellectual asset? |
| **IPRs** | What IPRs are associated with it? |
| **Tech area** | Which techn<ical area does it relate to? |
| **Contracts** | What agreements apply, if any? |

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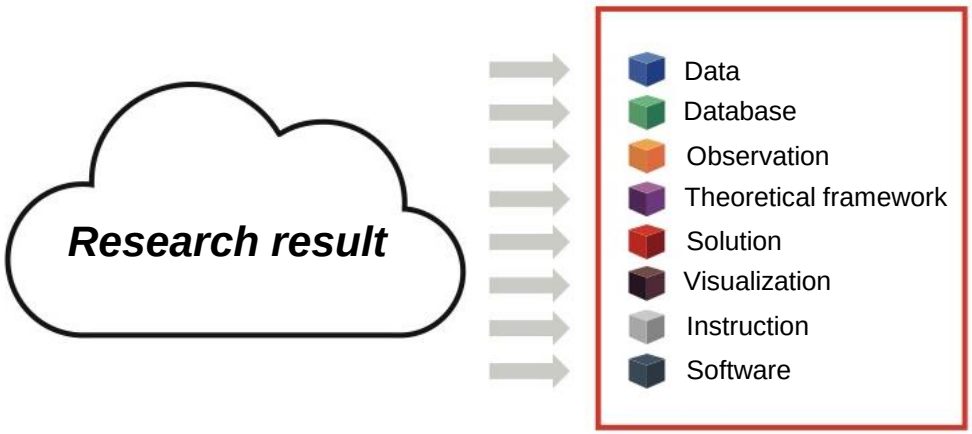
# How we use captured and tagged intellectual assets

*Research results*

*Technology Assets*




The methodology will, for example, be used to:

- Continuously capture research results as intellectual assets
- Increase knowledge sharing within and between research groups
- Analyze utilization potential and different ways to utilize each asset
- Define background, side ground and foreground in R&D projects
- Govern openness
- Tag to individuals who created and are knowledgeable about each asset

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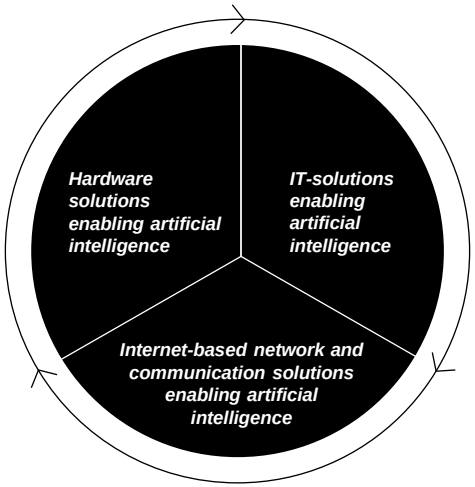
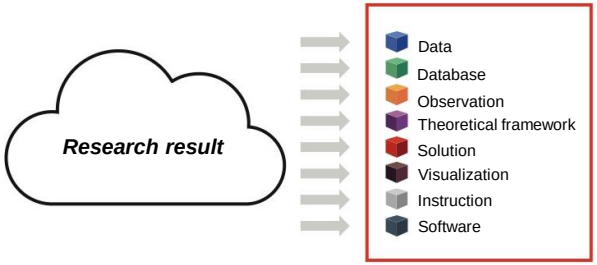
# Deconstructing the product solution into technology asset categories

- Starting point in relevant patent documentation controlled by Siemens Healthcare, for full list see Appendix
- Analyzing patent documentation and classifications in order determine the nature of technology
- The AI-based technology classification scheme is based on the three spheres of AI-innovation activities
  - Hardware solutions
  - IT-solutions
  - (Internet-based) network and communication solutions
- The classification scheme is further based on previous understanding of technology asset classification schemes



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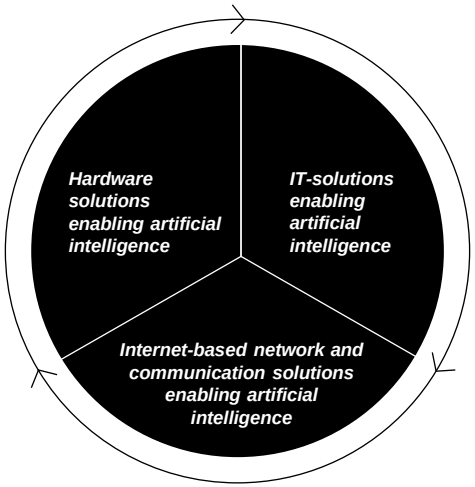
# Deconstructing the product solution into technology asset categories

- Identifying technology assets within the three spheres of AI-innovation activities
- The technology categories consist of mainly
  - Hardware-related solutions
  - IT-related solutions
  - Network and communication-related solutions
  - Software-based instructions
    - including artificial neural networks and algorithm solutions
  - Database
  - Data
    - raw data
    - processed data

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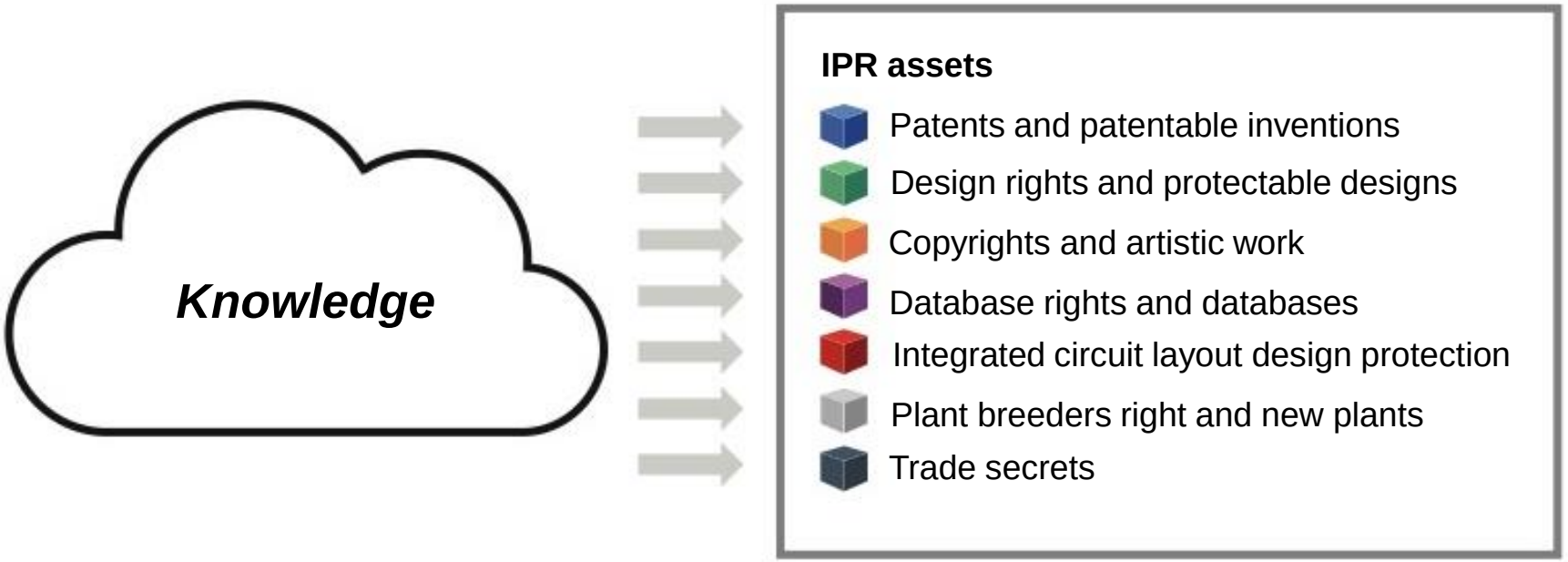
# When we have a firm understanding of the technology assets, we can identify and assess the possibility of claiming IPRs



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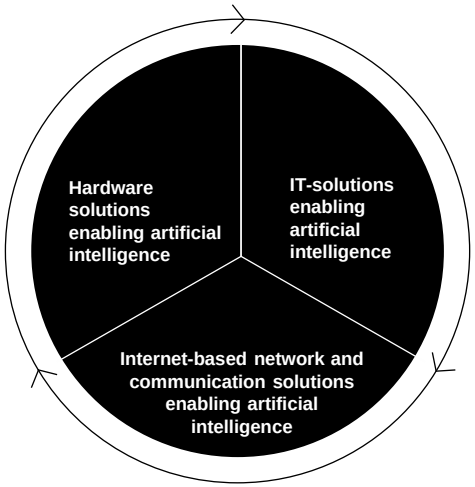
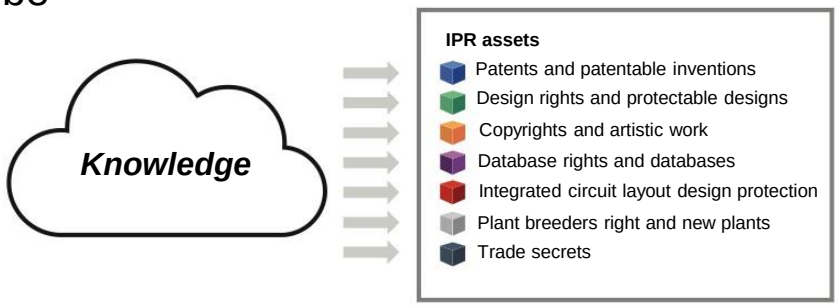
# Managing the product solution as IPR assets

- Managing the technology assets as IPR assets on the basis of strong and/or weak property rights claims
- Strong rights claims are based on intellectual property rights
- Weak rights claims are based on trade secret legislation and claiming TA through contracts
- In the interface between hardware and software based technology assets, complementary property rights claim may be needed



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# The product as portfolio of technology assets

- Claiming the technology assets by using a technology asset-list (TA-list) with specific characteristics to identify and objectify the nature and status of the technology assets enables creation and management of an asset portfolio
- The TA-list couple the assets to the technical functionality to the utility of the product solution
- The TA-list include information for claiming and categorizing, ”tagging” legal status and nature of the technology, and evaluate potential claims to the technology assets

1A) Claiming technology asset (examples)

| ID | Category | Description | Function | Utility |
|---|---|---|---|---|
| IA01 | | | | |
| IA02 | | | | |
| IA… | | | | |

1B) ”Tagging” the technology asset (examples)

| ID | IPR-tagging | Technology-tagging | Techdomain-tagging | …… |
|---|---|---|---|---|
| IA01 | | | | |
| IA02 | | | | |
| IA… | | | | |

1C) Evaluating claims to the technology asset (examples)

| ID | Creative claim | Title claim | Disposition claim | …… |
|---|---|---|---|---|
| IA01 | | | | |
| IA02 | | | | |
| IA… | | | | |

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# The Siemens product solution as a portfolio of technology and IPR assets (and IPR-”tagging”) – an excerpt

| ID | Category | Description | IPR-tagging |
|---|---|---|---|
| TA01 | Hardware-related solution | An x-ray tube for processing detection data of x-ray radiation detector in dual-source computed tomography system to generate image data. | US9673592 |
| TA02 | Hardware-related solution | An x-ray tube unit housing in which a vacuum housing is disposed including a high voltage component | US9842720 |
| TA03 | Hardware-related solution | A method for manufacturing a collimator module and/or a collimator bridge including a collimator module, a collimator bridge, a collimator and a tomography device. | US9966158 |
| TA06 | Hardware-related solution | A method of X-ray CT scanning of an examination object using two emitter-detector systems arranged at different angles on a shared gantry of a CT system. | US10251613 |
| TA10 | Hardware-related solution | A method for operating an imaging X-ray device for acquisition of a projection image. | US10740900 |
| TA18 | Network and communication-related solution | A computer-implemented network system for accessing a dose image database. | US10146907 |
| TA19 | IT-related solution | Method for producing a noise-reduced CT image data record, computer system, and CT system. | US9186114 |
| TA20 | IT-related solution | An adaptive method for generating CT image data. | US20180322664 |
| TA26 | IT-related solution | A method for supporting a reporting physician in evaluation of an image data set of a patient recorded with an image recording system, | US20170323442 |
| TA27 | IT-related solution | A method and system for medical image pre-processing for medical image scanner. | US20200104994 |
| TA28 | IT-related solution | A method for training a learning-based medical scanner obtaining training data from demonstrations of scanning sequences. | US10748034 |
| TA29 | IT-related solution | Smart imaging using artificial intelligence. | US20190073765 |
| TA30 | IT-related solution | A computer-based diagnostic system, comprising an image generation unit configured to generate tomographic images of an organ of a patient. | US20190164642 |
| TA31 | Software-based instruction | Software code enabling transfer of image data between image database and software based components. | (US10146907) |
| TA32 | Processed data | AI-training data for usage in artificial intelligence solutions | (US10748034) |
| TA33 | Database | Database of AI-training data | (US10748034) |
| TA34 | Software-based instruction | Software instruction enabling artificial intelligence models for imaging | (US20190073765) |
| TA35 | Software-based instruction | Computer program for AI-based diagnostic system. | (US20190164642) |

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# The TA-list with some additional ”taggings”

| ID | Inventor | Technology-tagging | Techdomain-tagging |
|---|---|---|---|
| TA01 | DITTRICH RONALD; FERGER THOMAS; HOFFMANN CHRISTIAN | Electric discharge tubes; Spark gaps technology; Emergency protective circuit arrangements; X-ray technique | Electrical machinery, apparatus, energy; Medical technology |
| TA02 | BERK JAN; FREUDENBERGER JÖRG; NEUMEIER ERNST; NOACK JANA; SCHWARZ RAIMUND; WERNER LOTHAR | Electric discharge tubes; X-ray technique | Electrical machinery, apparatus, energy;Medical technology |
| TA03 | REITZ BODO; WREGE JAN | Techniqus for handling particles or ionizing for X-ray microscopes | Engines; pumps; turbines |
| TA06 | ALLMENDINGER THOMAS; SUNNEGARDH JOHAN | Medical diagnosis (examination, detecting, measuring, radiation); Evaluation and analyzing material using X-ray; Measurment of X-radiation; X-ray technique | Electrical machinery, apparatus, energy; Medical technology |
| TA10 | RITTER ANDRE | Medical diagnosis (examination, detecting, measuring, radiation); Image data processing | Computer technology; Medical technology |
| TA18 | SEIFERT SASCHA | Medical diagnosis (examiniation, detecting, measuring, radiation); Electric digital data processing; Information and communication technology (ICT) specially adapted for the handling or processing of medical or healthcare data | Computer technology; Medical technology |
| TA19 | FLOHR THOMAS; RAUPACH RAINER; SCHMIDT BERNHARD | Medical diagnosis (examination, detecting, measuring, radiation); Data recognition and handling record carriers | Computer technology; Medical technology |
| TA20 | FEUERLEIN UTE; HOFMANN CHRISTIAN; MAYER ROBERT; RAUPACH RAINER; SOZA GRZEGORZ | Medical diagnosis (examination, detecting, measuring, radiation); Image data processing | Computer technology; Medical technology |
| TA26 | SUEHLING MICHAEL | Medical diagnosis (examination, detecting, measuring, radiation); Electric digital data processing; Data recognition and handling record carriers; Computer systems based on computational models (biological models-simulating life); Image data processing | Computer technology; Medical technology |
| TA27 | SHARMA PUNEET | Medical diagnosis (examination, detecting, measuring, radiation); Image data processing; Information and communication technology (ICT) specially adapted for the handling or processing of medical or healthcare data | Computer technology; Medical technology |
| TA28 | SINGH VIVEK KUMAR; KIRCHBERG KLAUS J; MA KAI; CHANG YAO-JEN; CHEN TERRENCE | Medical diagnosis (examination, detecting, measuring, radiation); Data recognition and handling record carriers; Image data processing; Information and communication technology (ICT) specially adapted for the handling or processing of medical or healthcare data; Computer systems based on computational models (biological models-simulating life) | Computer technology; Medical technology |
| TA29 | LIAO RUI; GIRARD ERIN; MIAO SHUN; ZHENG XIANJUN S | Medical diagnosis (examination, detecting, measuring, radiation); Data recognition and handling record carriers; Image data processing; Information and communication technology (ICT) specially adapted for the handling or processing of medical or healthcare data; Computer systems based on computational models (biological models-simulating life) | Computer technology |
| TA30 | HARTUNG ANDRE; IONASEC RAZVAN | Medical diagnosis (examination, detecting, measuring, radiation); Data recognition and handling record carriers; Computer systems based on computational models (biological models-simulating life); Image data processing; Information and communication technology (ICT) specially adapted for the handling or processing of medical or healthcare data | Computer technology; Medical technology |
| TA31 | SEIFERT SASCHA | Medical diagnosis (examiniation, detecting, measuring, radiation); Electric digital data processing; Information and communication technology (ICT) specially adapted for the handling or processing of medical or healthcare data | Computer technology; Medical technology |
| TA32 | (SINGH VIVEK KUMAR; KIRCHBERG KLAUS J; MA KAI; CHANG YAO-JEN; CHEN TERRENCE) | Medical diagnosis (examination, detecting, measuring, radiation); Data recognition and handling record carriers; Image data processing; Information and communication technology (ICT) specially adapted for the handling or processing of medical or healthcare data; Computer systems based on computational models (biological models-simulating life) | Computer technology; Medical technology |
| TA33 | (SINGH VIVEK KUMAR; KIRCHBERG KLAUS J; MA KAI; CHANG YAO-JEN; CHEN TERRENCE) | Medical diagnosis (examination, detecting, measuring, radiation); Data recognition and handling record carriers; Image data processing; Information and communication technology (ICT) specially adapted for the handling or processing of medical or healthcare data; Computer systems based on computational models (biological models-simulating life) | Computer technology; Medical technology |
| TA34 | (LIAO RUI; GIRARD ERIN; MIAO SHUN; ZHENG XIANJUN S) | Medical diagnosis (examination, detecting, measuring, radiation); Data recognition and handling record carriers; Image data processing; Information and communication technology (ICT) specially adapted for the handling or processing of medical or healthcare data; Computer systems based on computational models (biological models-simulating life) | Computer technology; Medical technology |
| TA35 | (HARTUNG ANDRE; IONASEC RAZVAN) | Medical diagnosis (examination, detecting, measuring, radiation); Data recognition and handling record carriers; Computer systems based on computational models (biological models-simulating life); Image data processing; Information and communication technology (ICT) specially adapted for the handling or processing of medical or healthcare data | Computer technology; Medical technology |

# Capture – general take-outs

- The capture process and TA-list
  - enables a structured breakdown of the technology assets as building blocks in order capture the portfolio of assets for the AI-based project solution,
  - unveil convergence between technology domains, mainly between medical and computer technology, sets new expectations on the development and management of technology asset portfolios for medical devices,
  - enables title and dependency clearance regarding processed data where one must identify additional layers of rights to data and contributors to enable the right to use data,
  - enables the identification and ”tagging” of key creators (inventors etc.) with the capacity to drive the development processes forward within the converging technology fields for the product solution,
  - highlights critical information for evaluating opportunities and risks in relation to the technology building blocks for the product solution,
  - unveil necessary considerations in relation to the technology resource base, and
  - making strategic business considerations going forward.

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# 3

# Position

# Assessment of the intellectual assets as positions on technology markets

- An external analysis of the technology positions of potential collaborating/competing firms in the technology market and the commercial positions of potential collaborating/competing firms in the product market. This is required to understand the competitive position of the firm's assets in relation to its value network. Depending on the competitive environment, this of course could include the evaluation of tens to hundreds of patents and tens of actors in relation to technology development and strength of IPR positions in addition to the evaluation of other key factors such as market power, collective dependence through standards and other collaborative platforms, public regulation, and so on.

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# Positioning: A process for characterizing positions in the external research, IP and market/industry landscape

**Create overview of knowledge area**

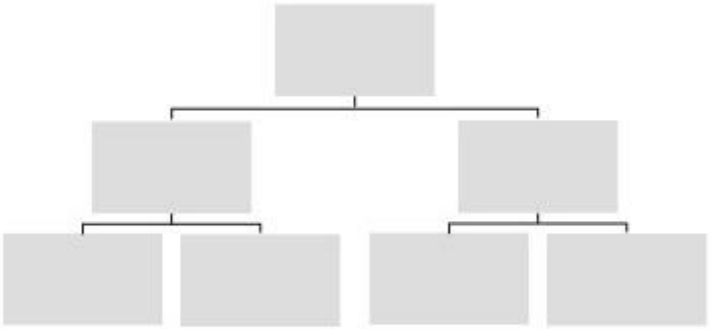
**Characterize the fields and trends**

**Characterize actors positions and interactions**

**Define opportunities/ objectives**

- Data
- Database
- Observation
- Solution
- Theoretical framework
- Visualization
- Instruction
- Software

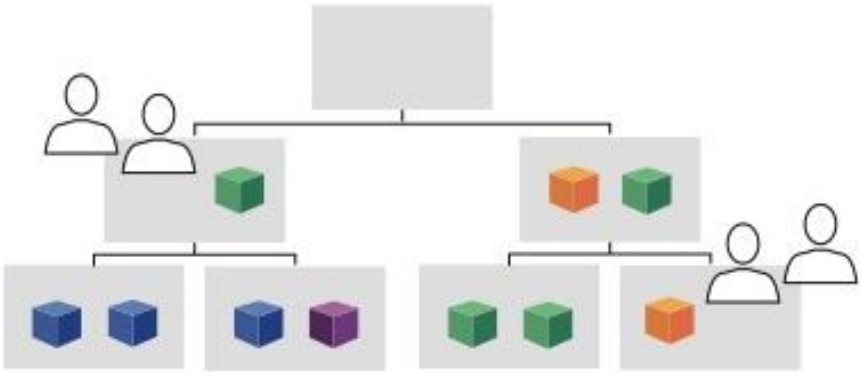
# Control maps: Key questions and types of analyses



**Key questions [Examples]**

- What is the patenting density in the area?
- What areas are currently considered to be hot and/or emerging areas? Where is there still unclaimed technology space?
- What are the characteristics of the IPR landscape of the field?
  - How are IPRs used to block competitors?
  - How are IPRs used to build, collaborate and exploit?
- Where are different actor filing patents?
- Who are leading or emerging players in the area?
- What is our relative position - How strong is our portfolio? Are we keeping up with competition?
- What are different geographies relative position in the area?

# Combined, the Knowledge Domain Tree and IAM methodology offer a foundation for technology and IP strategy decision-making



**Example questions**

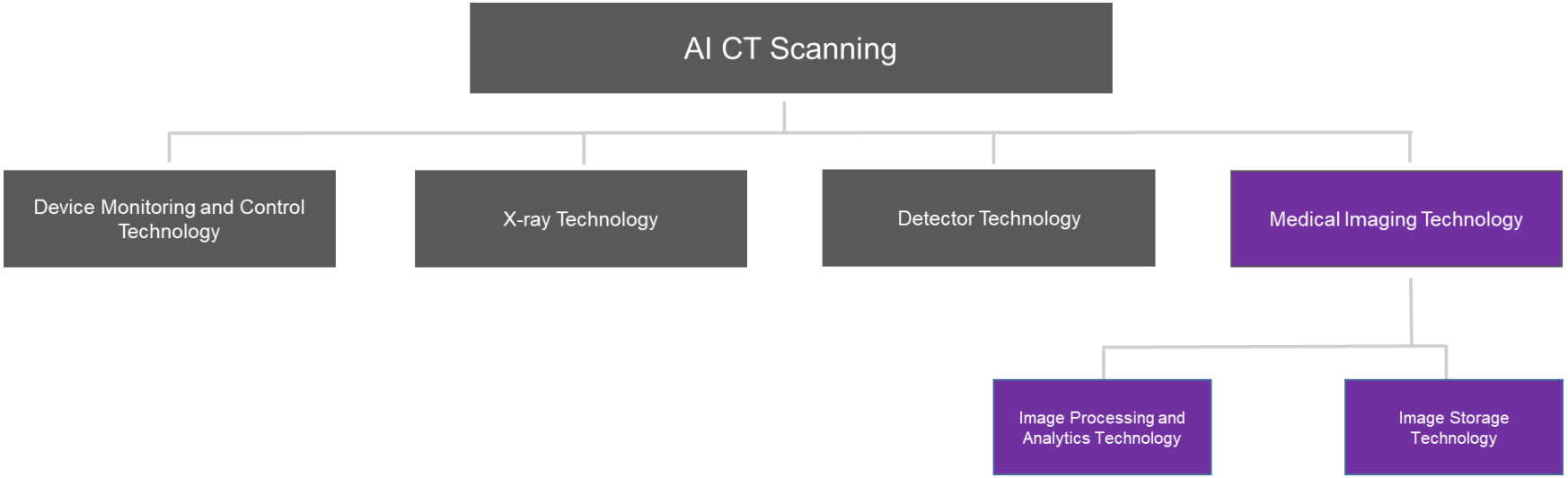
- Where do business opportunities exist?
- What are the external environments in important technology domains?
- Where should we have our value propositions?
- Where do we have and where do we need unique and valuable assets?
- Where should we collaborate?
- What IP strategy should we have for the different technology domains?

# Some patenting areas of the product solution

An analysis of relevant keywords regarding AI-based CT-based scanning apparatus (and medical scanning in general for AI solutions) shows examples of relevant patent IPC classifications to consider when identifying the nature of technology, technology fields etc.

- Section A – HUMAN NECESSITIES
  - A61 - MEDICAL OR VETERINARY SCIENCE; HYGIENE
    - A61B 6/00 - Apparatus for radiation diagnosis, e.g. combined with radiation therapy equipment
- Section H – ELECTRICITY
  - H01 – BASIC ELECTRIC ELEMENTS
    - H01J – ELECTRIC DISCHARGE TUBES OR DISCHARGE LAMPS
  - H05 - ELECTRIC TECHNIQUES NOT OTHERWISE PROVIDED FOR
    - H05G – X-ray technique
- Section G – PHYSICS
  - G06 – COMPUTING; CALCULATION;COUNTING
    - G06K – RECOGNITION OF DATA; PRESENTATION OF DATA; RECORD CARRIERS; HANDLING RECORD CARRIERS
    - G06N – COMPUTER SYSTEMS BASED ON SPECIFIC COMPUTATIONAL MODELS
      - G06N 3/00 - Computer systems based on biological models
      - G06N 20/00 – Machine learning
    - G06T – IMAGE DATA PROCESSING OR GENERATION, IN GENERAL
  - G16 – INFORMATION AND COMMUNICATION TECHNOLOGY [ICT] SPECIALLY ADAPTED FOR SPECIFIC APPLICATION FIELDS
    - G16H – HEALTHCARE INFORMATICS, i.e. INFORMATION AND COMMUNICATION TECHNOLOGY [ICT] SPECIALLY ADAPTED FOR THE HANDLING OR PROCESSING OF MEDICAL OR HEALTHCARE DATA

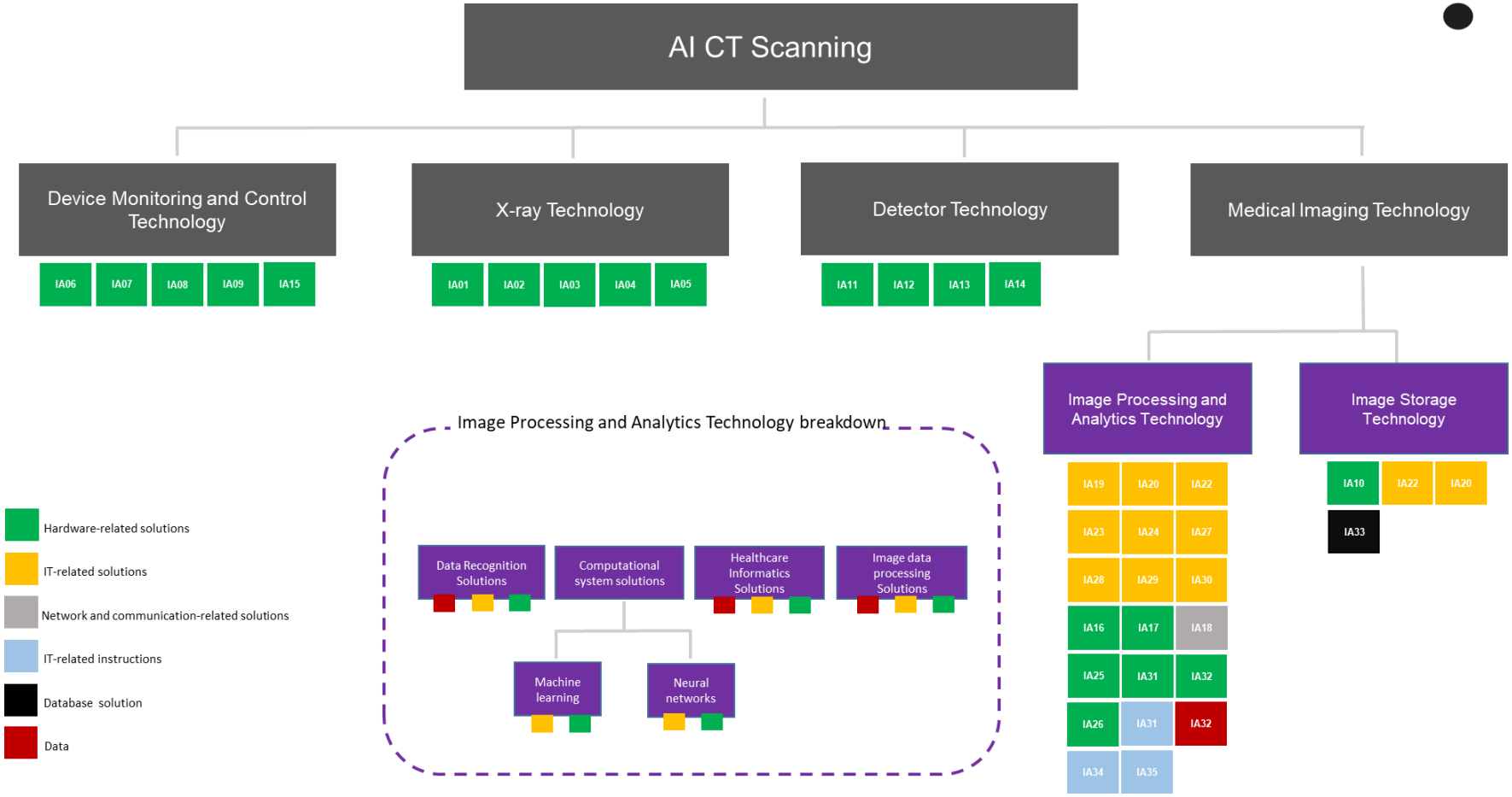
# The product solution as a technology tree and technology fields*




*The technology tree and technology fields are based on patent information and IPC/CPC classifications

*Work in progress

# Siemens position in the technology fields*




*The position is based on an analysis of the assets in the TA-list in relation to the technology fields

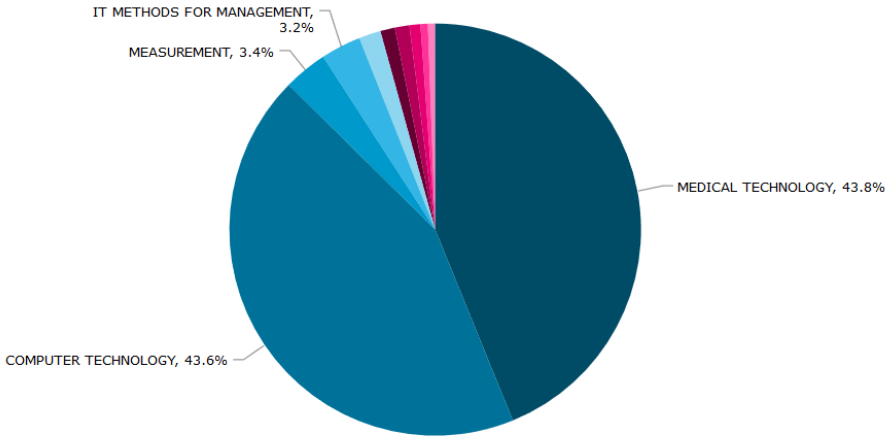
*Work in progress

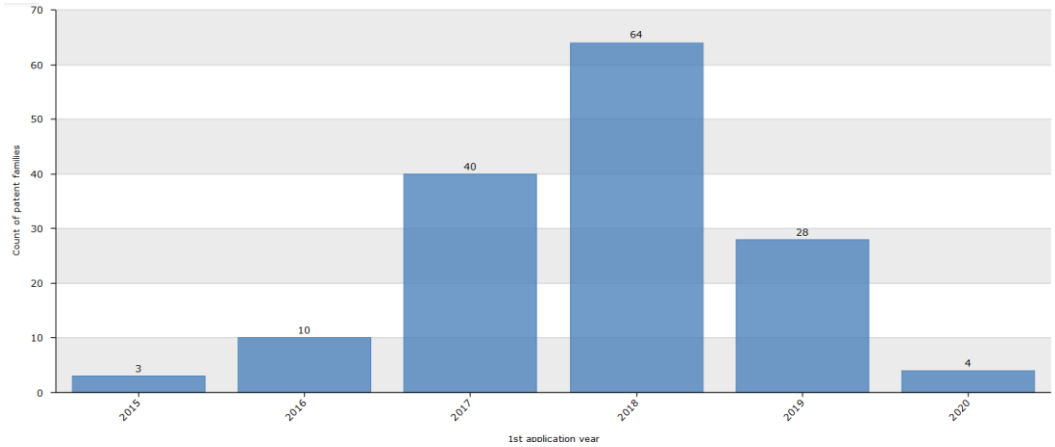
# Patenting activity within the technology area

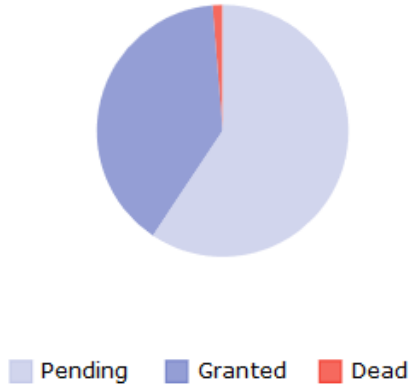
## Key take-aways

Digitalization and the entrance of AI-solutions creates a new convergent technology base for medical technology solutions

- ❑ The technology development activities are mainly at the interface of medical and computer technologies
- ❑ Not yet a crowded area but there is an increasing patenting trend in the last five years
- ❑ A vast majority of the patent documents are alive
- ❑ A majority of the patent documents are pending



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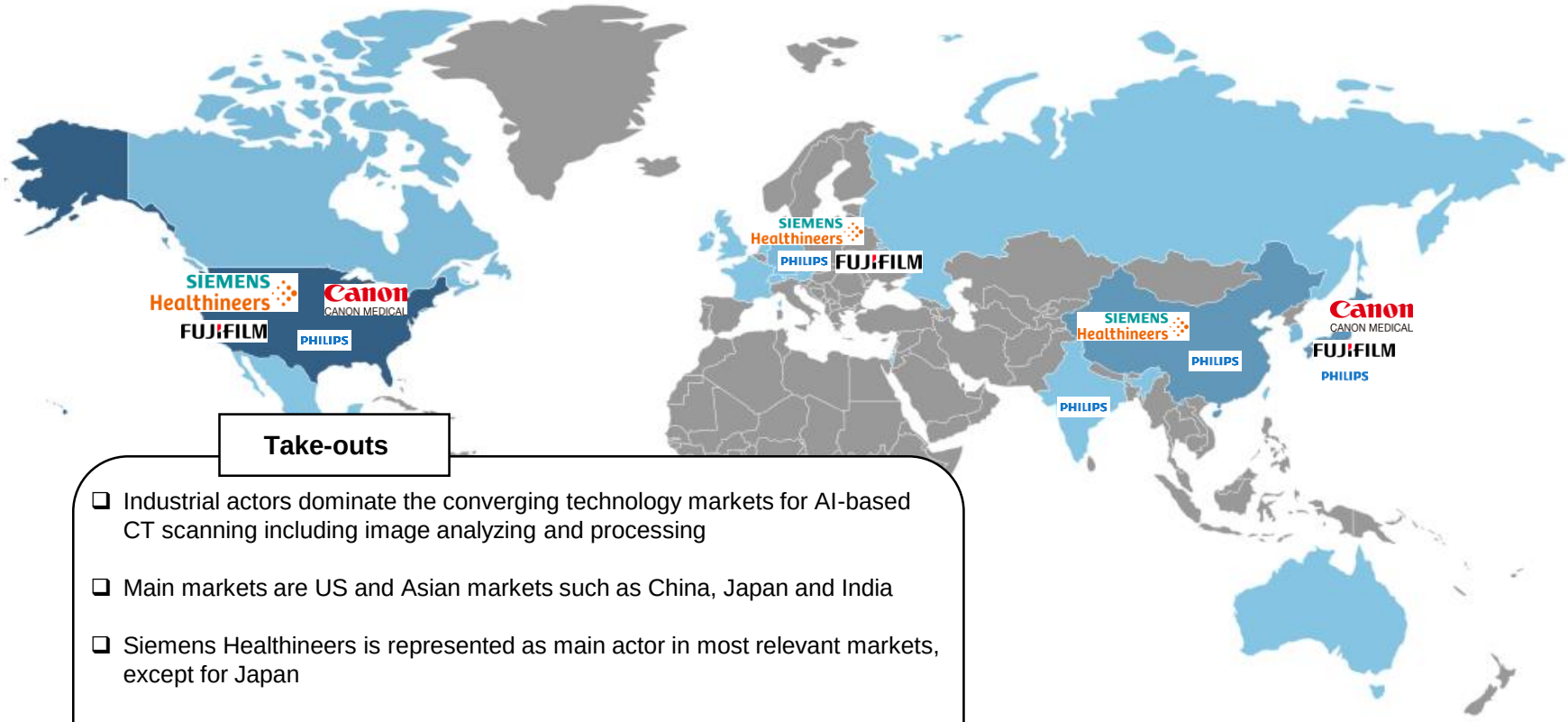
# Market actors and technology positions




**Take-outs**

- ❑ Industrial actors dominate the converging technology markets for AI-based CT scanning including image analyzing and processing
- ❑ Main markets are US and Asian markets such as China, Japan and India
- ❑ Siemens Healthineers is represented as main actor in most relevant markets, except for Japan
- ❑ For the current product segment Siemens patentportfolio encompass patents from US, Europe and Asia

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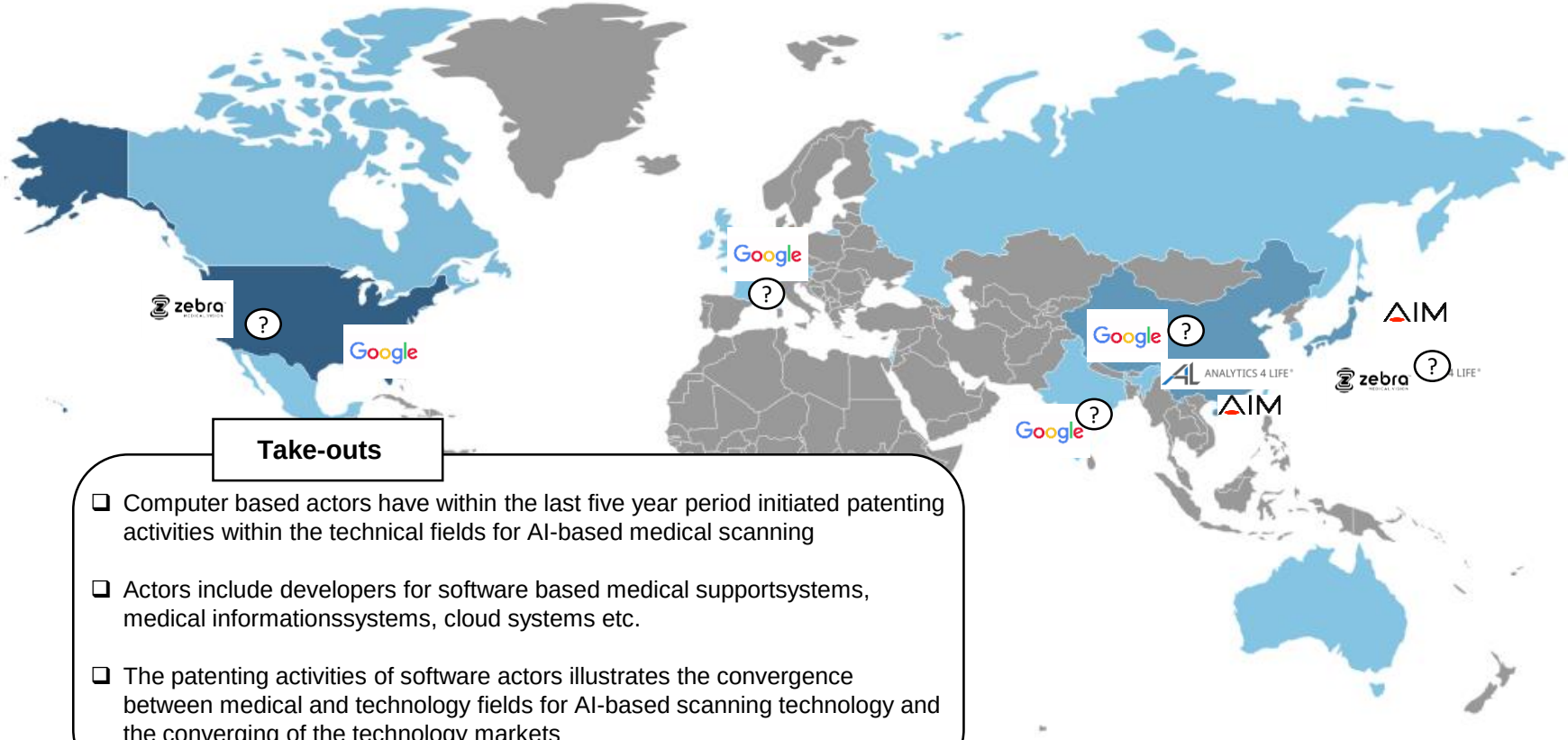
# Computer based technology actors entering the medical device field – some examples




**Take-outs**

- Computer based actors have within the last five year period initiated patenting activities within the technical fields for AI-based medical scanning
- Actors include developers for software based medical supportsystems, medical informationssystems, cloud systems etc.
- The patenting activities of software actors illustrates the convergence between medical and technology fields for AI-based scanning technology and the converging of the technology markets

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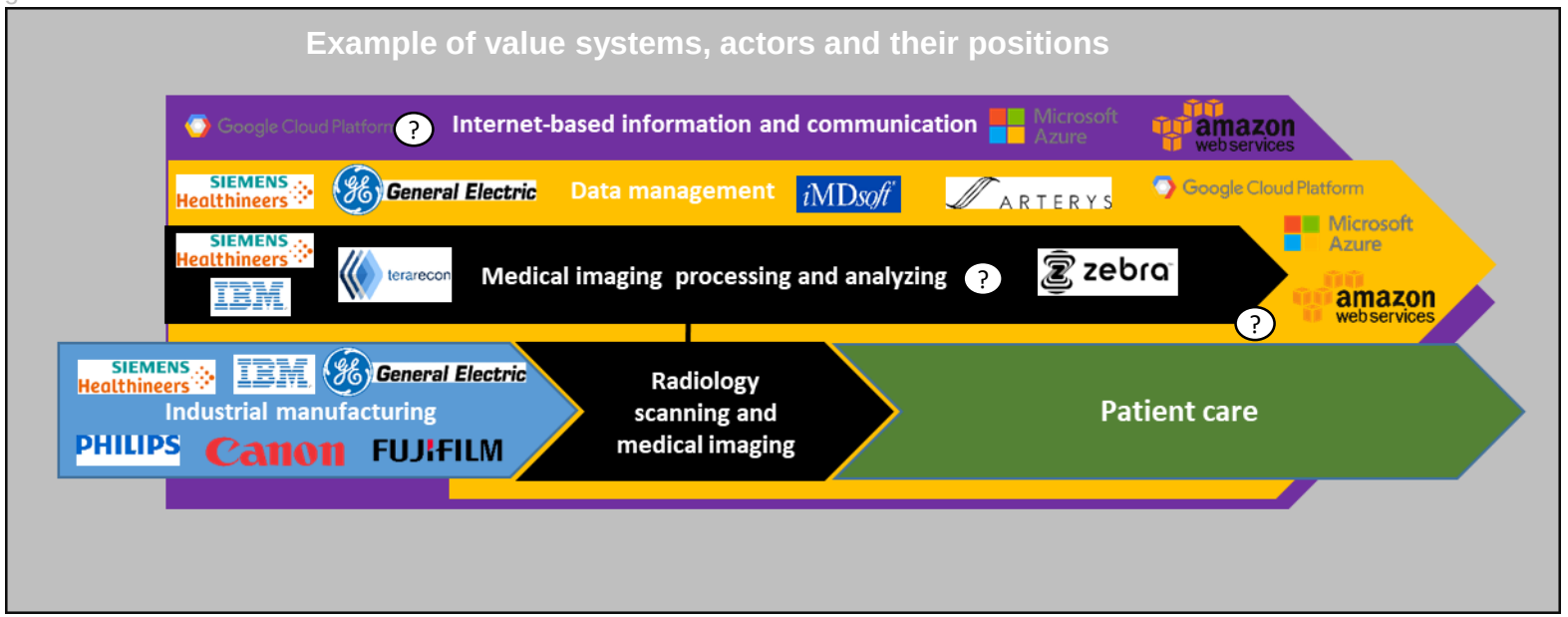


# Utilization for AI-based CT scanning solutions

Digitalization of technology and the entrance of AI-solutions creates a new utilization paths for medical technology solutions.

- ❑ The convergence of medical and computer technology creates new utlization paths for established actors wtihin the medical device field. On the same note, actors from the computer technology field establish themselves as actors for medical device solutions
- ❑ Established actors develop their technology market positions in new utilization areas
- ❑ Siemens (and other established medical device actors) starts to position themselves closer to the computer technology field and the utilization schemes for computer based solutions
- ❑ The interplay of value systems illustrates the convergence between medical and computer-based value creation within the field of AI-based medical scanning

# Positioning – general take-outs

- The positioning process
  - unveils new patenting areas for medical devices
  - unveils the status of patenting activities within computer based technologies connected to medical devices
  - enables identification of converging technology fields unveils how traditional technology such as electricity, physics and medicine relate to computer technology and mathematics are positioned for AI-based medical (CT) scanning solutions
  - show that the convergence of technology fields for AI-based medical (CT) scanning solutions contribute to converging value system based on material and digital value creation
  - show how industrial medical device companies position themselves in relation to software providers and ICT based software companies in converging value systems
  - show there is an increasing interest for industrial medical device companies to position themselves in the data management segment

*Work in progress

# 4

# Leverage

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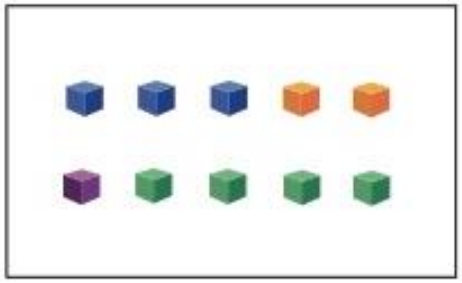
# Assessment of the intellectual assets as value propositions in intellectual value networks

- The challenge to identify, assess and develop/manage the business models, contracts, organizational solutions and other means to utilize/create value from intellectual assets

*Work in progress

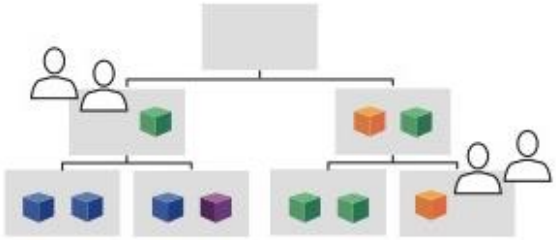
# Typical set-up of IAM-based analysis for developing a IA-based utilization strategy



### Intellectual asset portfolio analysis

What are our most valuable intellectual assets?

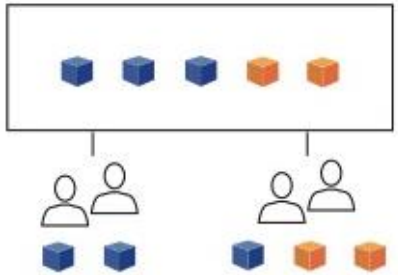
What control do we have over our intellectual assets?



### External landscape characterization

What characterizes the research, control and utilization landscape?

What positions do others have and what is our relative position?



### Utilization recommendations: Portfolio creation and usage

What utilization options exists given our IAs and the state of the external landscape?

What are important considerations for pursuing different utilization options?

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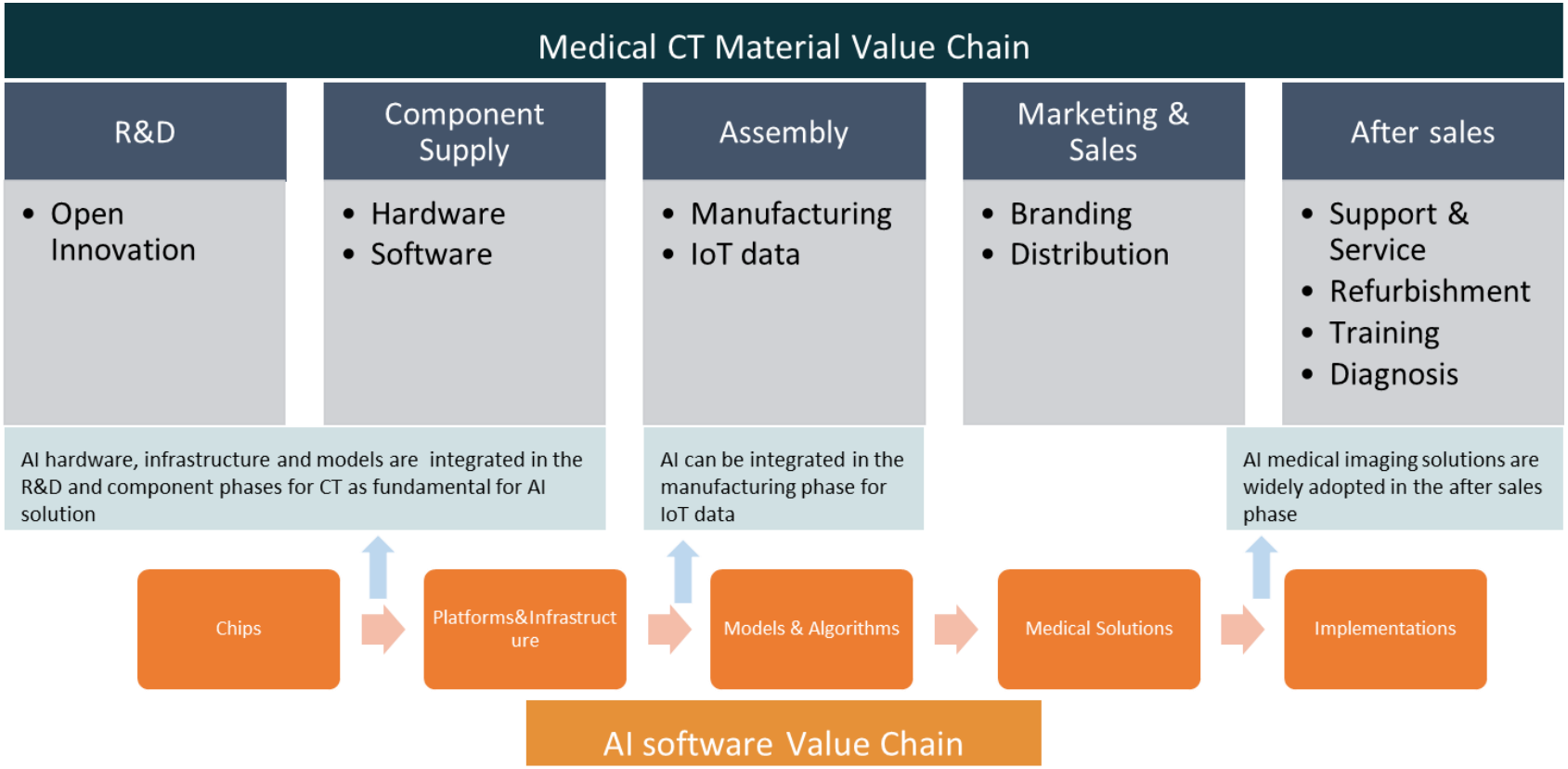
# Convergence in value creation for CT scanning devices



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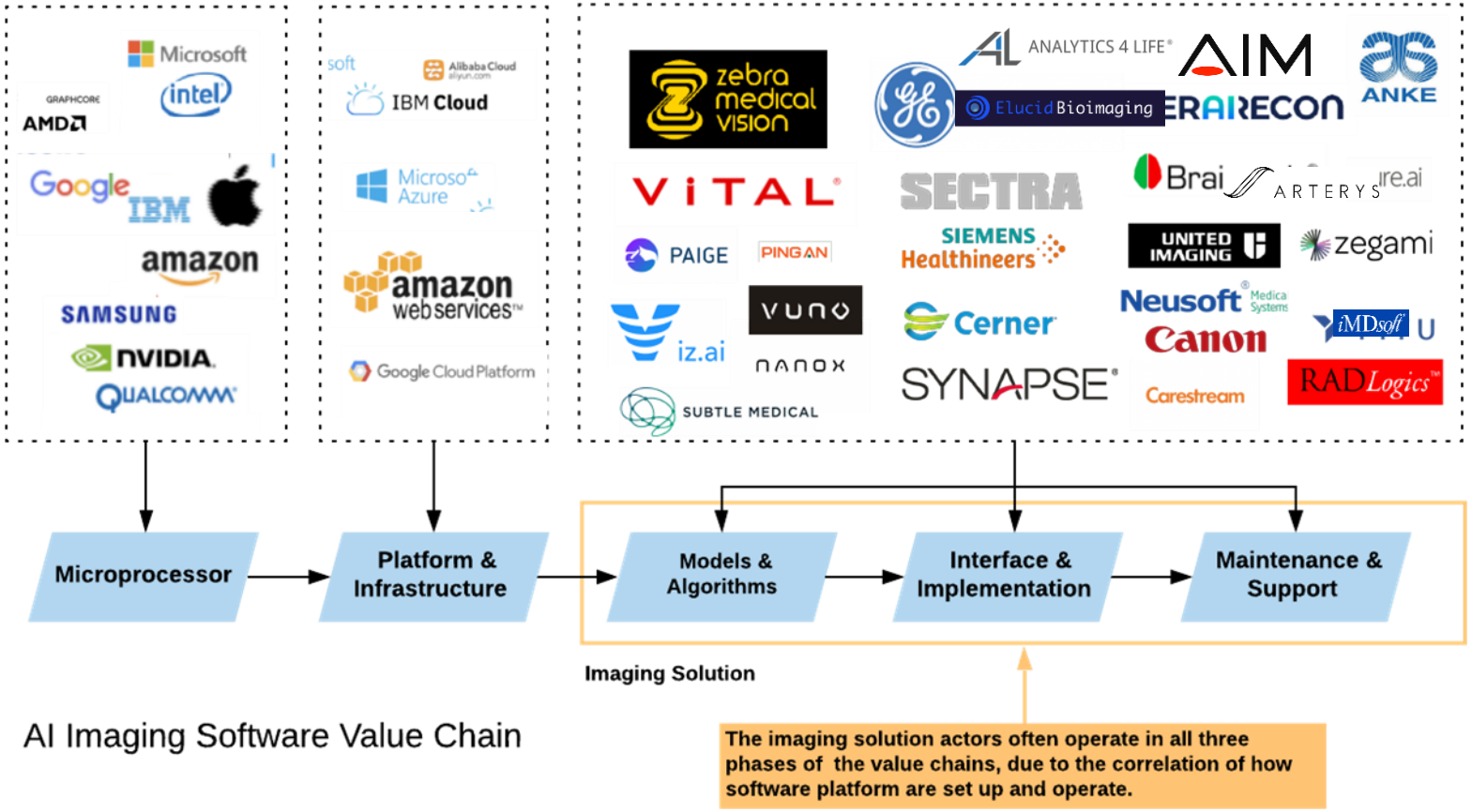
# New actors enters through the AI medical imaging value chain



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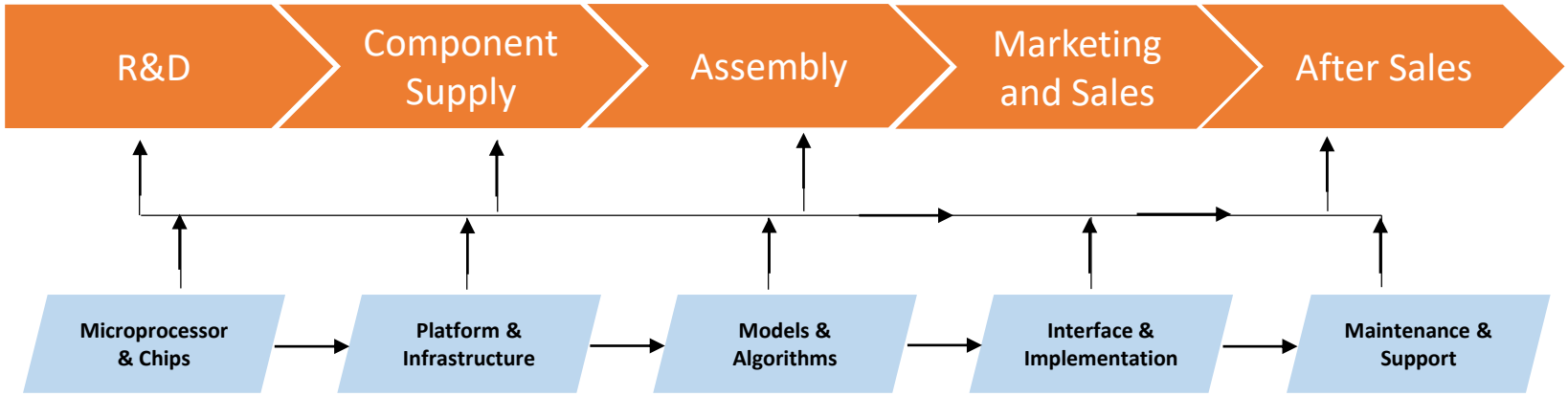
# The interplay of contractual objects between the material and digital value chain




## Contractual interplay of technology assets and IPR in value chains

- The technology assets in the TA-list constitute the subject matter of transactions within and between the value chains and the actors, i.e. the contractual objects including hardware-related solutions, IT-related solutions, network and communication-related solutions, software-based instructions, database, raw data and processed data
- The contractual transactions facilitate value creation within the material and digital value chain as such, but also enables value creation between the said value creation schemes (as a converging value creation scheme)
- Examples of agreements include R&D agreements, production agreements, licensing agreements, software development agreement, cloud service agreements, distribution agreements, service agreements etc.to facilitate and govern the transaction and sharing of the subject matter.

# Leverage - general take-outs

- The leverages process
  - discloses how AI-based CT scanning solutions involve multiple business models
    - product manufacturing-driven model
    - data-driven model
    - service-driven model
    - etc.
  - highlights the importance of managing competing norms between different IP-strategies, i.e. excluding vs. including IP strategies in example
    - technology-driven IP-strategy
    - product-driven IP-strategy
    - data-driven IP-strategy
  - highlights the  importance to consider intervening legislation in relation to the utlilization fields, such as medical device regulations, data protection (including cyber security) and privacy regulations, product safety regulations, anti-competition and public procurement regulations etc.
  - discloses how computer and software based actors affect the leverage and contract models for medical devices due to the implementation of software in the product solutions

*Work in progress

# 5

## Organize

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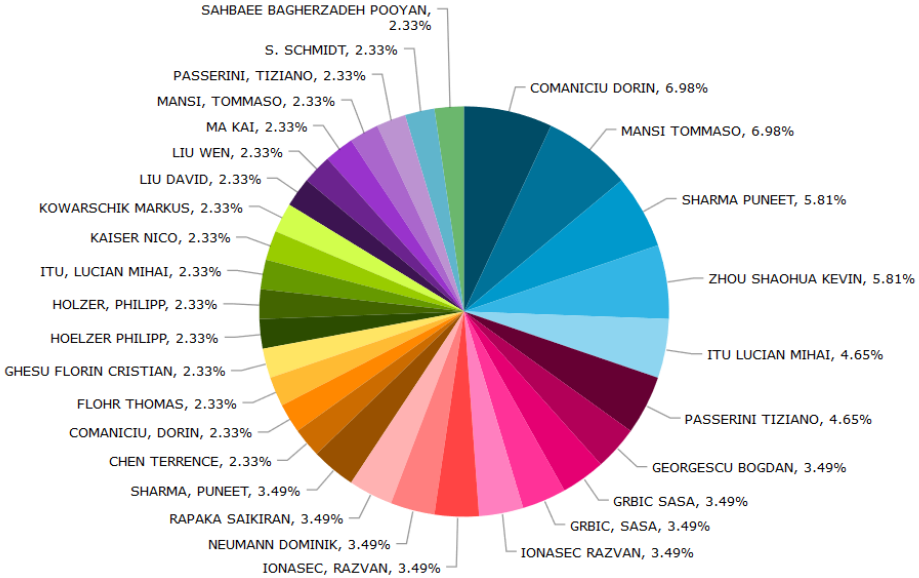
# Assessment of the intellectual assets as human and organizational capabilities

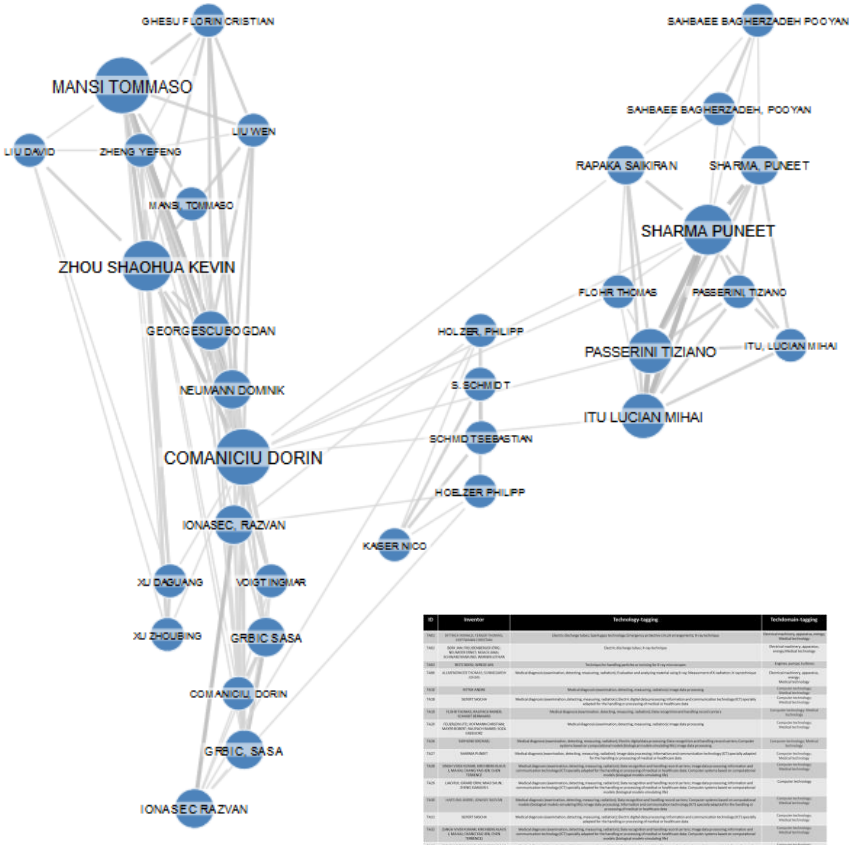
- The challenge to identify, assess and develop/manage the individual and organizational capabilities for technology based innovation.

# Organizing individual capability

**Take-outs**

- Development activities is linked to the individual capability of the inventors and their work to collaborate on individual levels
- Many of the inventors work together in some kind of structured process, see co-inventorship
- In relation to the info of TA-list, and the inventor - technology-"tagging", one can also identify how the organizing of the co-inventors in many cases follow the logic between medical and computer technology





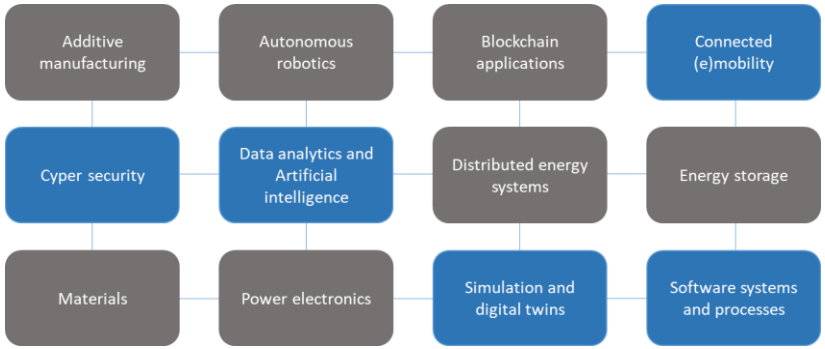

*The analysis is based on the TA-list and patentinformation including information on inventors and the relation between co-inventorship within the company*

# The organization of Siemens AG and technology focus

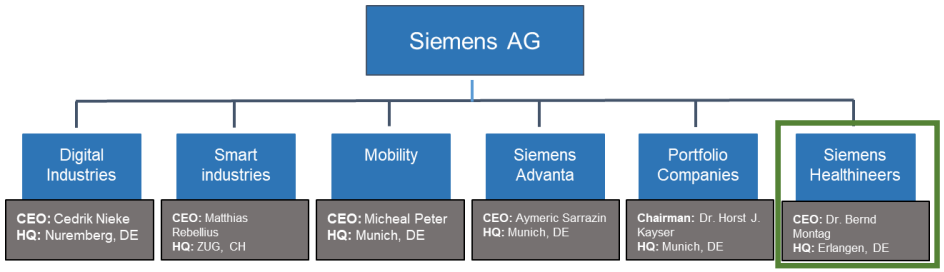
## Take-outs

- Siemens AG group is working within many advanced technology fields and business areas. The business and operations still emanates from industrial manufacturing and material value chain controlling positions on product markets and product manufacturing processes
- The organizing of general working areas the reinforces the notion that Siemens is an actor with the capability of driving the development of industrial digitalization and convergence between computer technology and technologies such as medical, energy, mechanical technology etc.
- Siemens drive organizational change in order to meeting the new demands for industrial actors within digital products and infrastructure

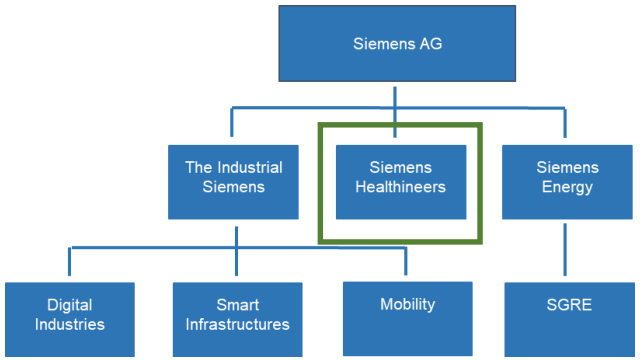
**General working areas for the Siemens Corporation group***




**Siemens Organization Chart***




**Siemens Future Organization Chart (Vision 2020+)***




*Source: Siemens Annual Report 2019*

*Work in progress

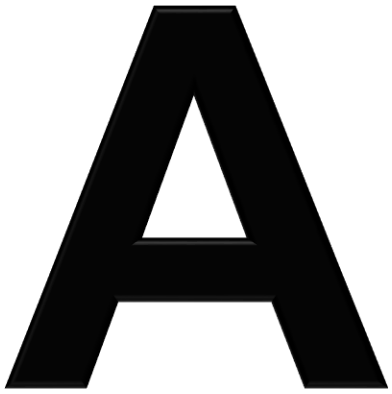
# Siemens Healthineers – a multinational organization*

- Siemnes Healthineers is an multinational organization in many parts of the world
- As an actor within medicial devices, Siemens Healthineers must meet legal requirements for being a producer and supplier of medical devices
- The sales process of medical devices often include public procurement procedures due to public actors as consumers
- Product liability and insurance solutions are also to a great extent connected to national jurisdiction


*Source: Siemens homepage*

# Organize – general take outs

- The organizing process
  - discloses how technology development derive from individual capability which is organized as departments of the company to create organizational capability
  - highlights how industrial actors working with AI-based solutions re-organize their hierarchical company structure to meet new demands in relation to the implementation of computer technology, connectivity and smart solutions
  - highlights how industrial actors working with AI-based solutions re-organize in order to manage relationships with computer-based technology actors in relation to development and utilization of product solutions



# Appendix

*By deconstructing the product solution and search for relevant technologies and patent documents stating Siemens as assignee, it was possible to identify possible technology assets and an example for a patent portfolio in relation to the the product solution. However, by no means shall this be considered to reflect the actual technology assets and patent portfolio(s) for the product solution. The compilation is made by only using public available information and is work in progress.*

# Patent documents for the product solution

**US10251613** - X-ray CT scanning and dual-source CT system

**US10736599** - CT system and method for determining the position and range of a mobile control element for control of the CT system

**US9799480** - CT system

**DE102016213929** - CT system and method for displaying image and / or text information

**US10740900** - Method for operating an imaging X-ray device, in particular a computed tomography system, an X-ray device and a computer program product

**WO2013167373** - X-ray detector for use in a ct system

**US9646731** - X-ray radiation detector, CT system and related method

**US7180075** - X-ray detector including a scintillator with a photosensor coating, and a production process

**US7358501** - Detector module, detector and computer tomograph

**DE102009031546** - Method for processing detector data of a radiation detector, compression device and imaging device

**US9943283** - CT system having a modular x-ray detector and data transmission system for transmitting detector data

**CN111326249** - Processing device, user equipment and system for controlling medical equipment

**US20190272475** - Method of performing fault management in an electronic apparatus

**US10146907** - Network system and method for controlling a computer tomograph

**US9186114** - Network system and method for controlling a computer tomograph

**US20180322664** - Adaptive method for generating artifact-reduced ct image data

**US20200113534** - Evaluating a reliability of a ct volume image

**US7116808** - Method for producing an image sequence from volume datasets

**US20200234449** - Medical imaging device, method for supporting medical personnel, computer program product, and computer-readable storage medium

**US10373313** - Spatially consistent multi-scale anatomical landmark detection in incomplete 3D-CT data

**US20200265177** - Method for checking a characteristic variable of an application procedure of an x-ray based medical imaging application

**US20170323442** - Method for supporting a reporting physician in the evaluation of an image data set, image recording system, computer program and electronically readable data carrier

**US20200104994** - Medical Image Pre-Processing at the Scanner for Facilitating Joint Interpretation by Radiologists and Artificial Intelligence Algorithms

**US10748034** - Method and system for learning to obtain medical scans of patients

**US20190073765** - Smart imaging using artificial intelligence

**US20190164642** - Computer-based diagnostic system