Towards A Framework of Internet of Things (IoT) In Smart Buildings: A Bibliometric Approach

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University of **READING** MALAYSIA

PAQS CONGRESS

SINGAPORE 2022

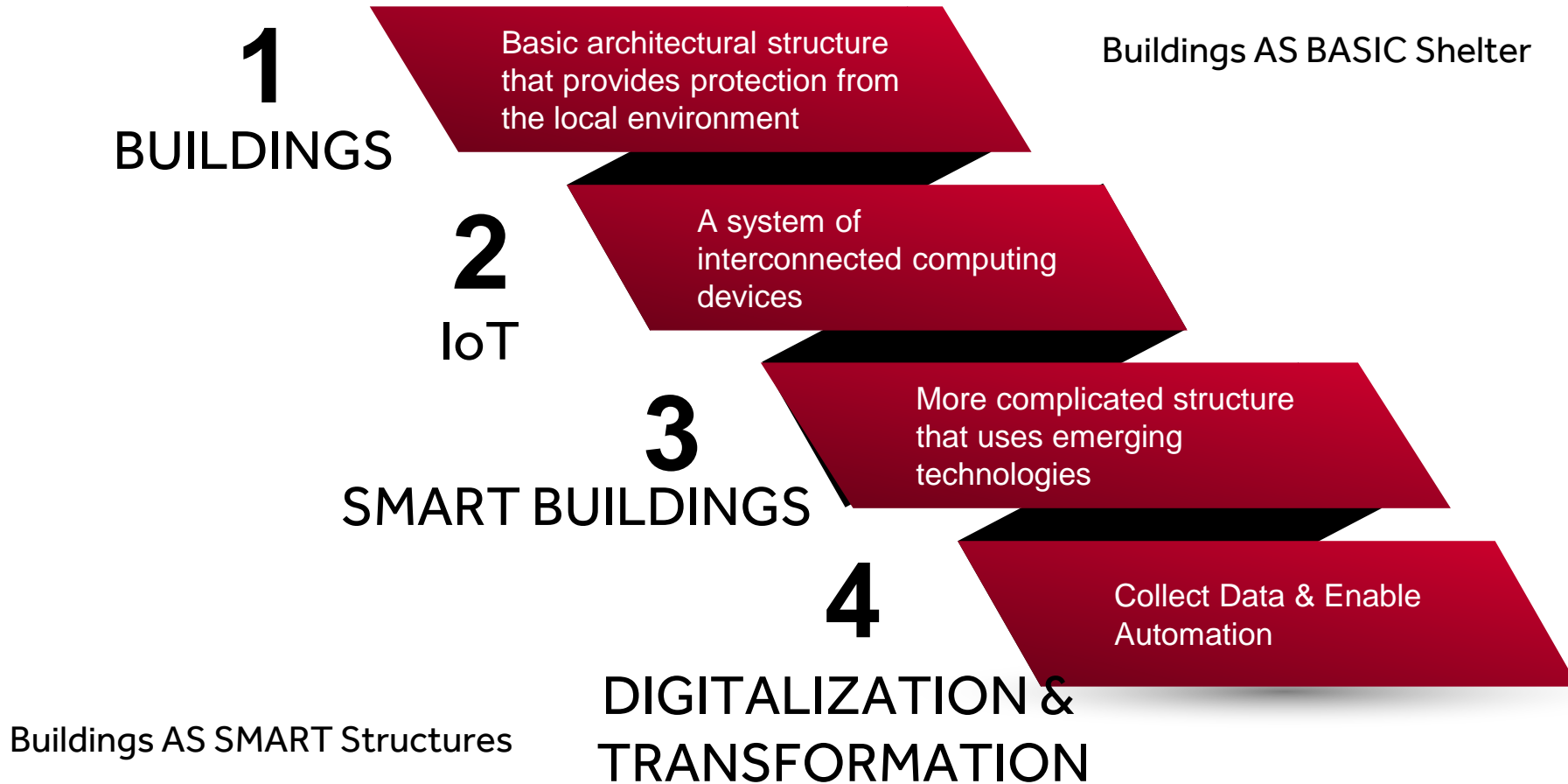9 TO 13 SEPTEMBER 2022

MARINA BAY SANDS SINGAPORE

PRESENTATION OUTLINE

- Background of the Study
- Smart Buildings & IoT
- Methodology
- Findings
- IoT Framework for Smart Buildings
- Conclusion

BACKGROUND OF THE STUDY

1 BUILDINGS

Basic architectural structure that provides protection from the local environment

Buildings AS BASIC Shelter

2 IoT

A system of interconnected computing devices

3 SMART BUILDINGS

More complicated structure that uses emerging technologies

4 DIGITALIZATION & TRANSFORMATION

Collect Data & Enable Automation

Buildings AS SMART Structures

SMART BUILDINGS & IOT

- This investigation may potentially reveal additional prospective domains and lines of inquiry for technological advancement.
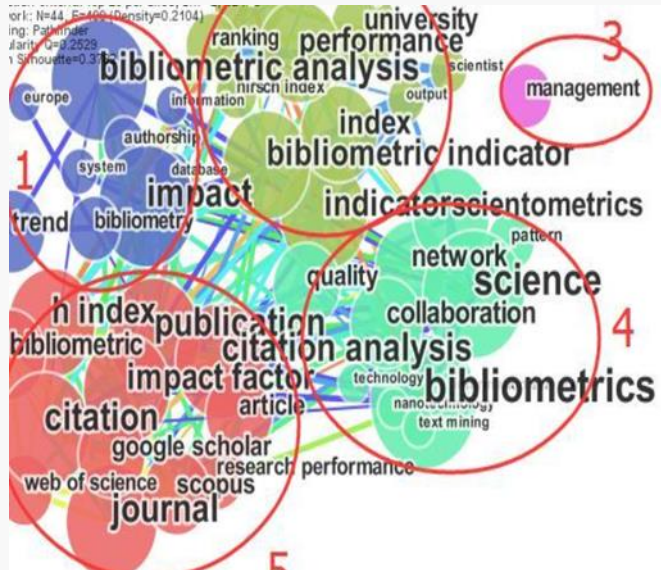
- Research Questions?

SMART BUILDINGS & IOT

1. Which **stages** of IoT development in smart buildings are currently underway, according to the publication year?

2. Which IoT application **clusters** are there in smart buildings?

3. What is the Internet of Things **Framework** for Smart Buildings?

METHODOLOGY

- **BIBLIOMETRIC ANALYSIS**

- Bibliometric analysis is a method that includes statistical analysis of published articles and citations to measure their impact.

- Unveils pivotal articles & objectively illustrates linkages between and among articles about a certain research area.

METHODOLOGY

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Components of SRL paper

ABSTRACT
- Background
- Statement of problem
- Aim / Objective of the study
- Methodology/Results
- Conclusion/future research

INTRODUCTION
- Existing knowledge on the Problem
- Limitations on the existing knowledge (Extension)
- Your research question (why the research?)
- 500 words for each aspect.

METHODOLOGY
- Search Strategy
- Selection Criteria
- Quality Assessment
- Data Extraction

RESULTS & INTERPRETATIONS

Descriptive Analysis
- Records distribution over the years
- Country distribution
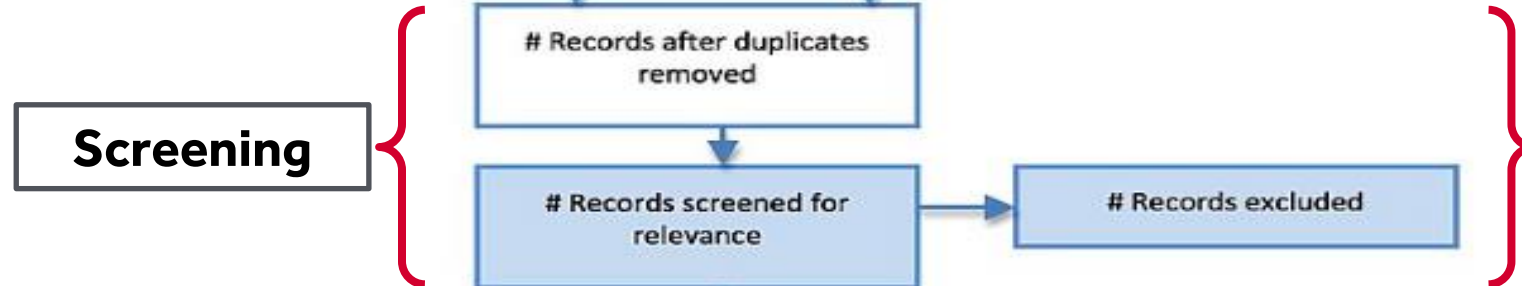- Most cited records
- Most cited journals

DISCUSSION & CONCLUSION
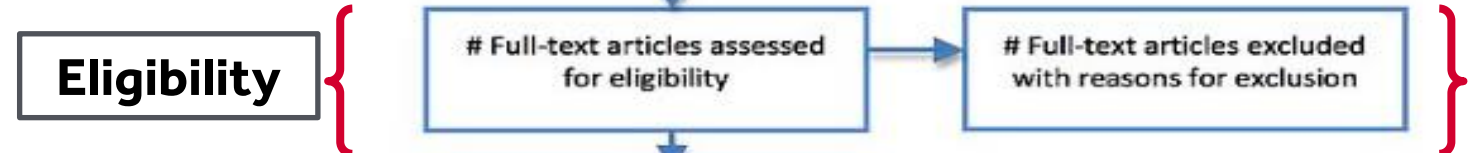- Mapping Existing Literature
- Highlight Limitations
- Identify gaps

FUTURE AGENDA
- Fill the existing gaps through future research

METHODOLOGY

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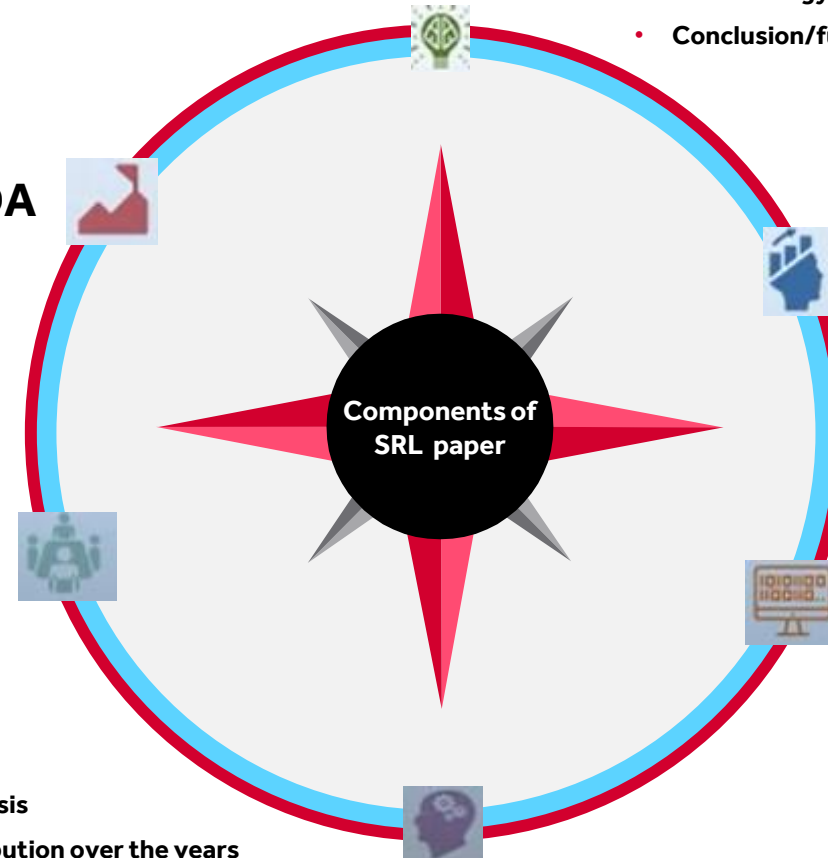
- Keywords
- Search Criteria & Database
- Records Extracted

Identification

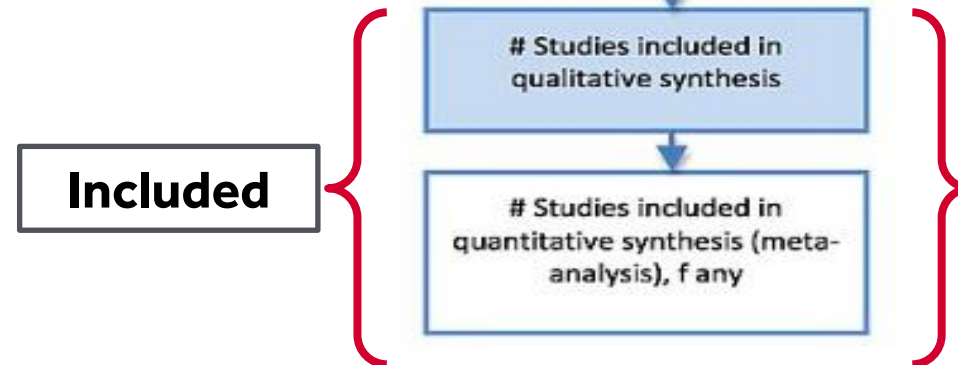| # Records identified through database searching | # Records identified through other sources |
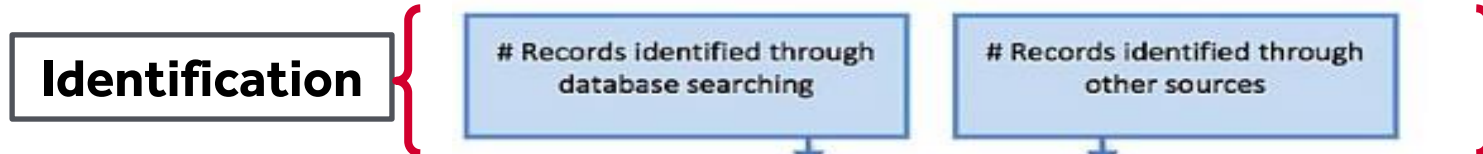
- Inclusion & Exclusion Criteria; article, years under consideration, countries, subject area, country, journal etc.

Screening

Records after duplicates removed

| # Records screened for relevance | # Records excluded |

- Quality Assessment
- Scope irrelevant studies should be excluded; duplicates removed

Eligibility

| # Full-text articles assessed for eligibility | # Full-text articles excluded with reasons for exclusion |

- Final number of articles to be included

Included

Studies included in qualitative synthesis

Studies included in quantitative synthesis (meta-analysis), f any

Note: PRISMA – *Preferred Reporting Items for Systematic Reviews and Meta Analysis*

Identification

Identification of Appropriate Database
(SCOPUS, Web of Science Core Collection, etc.)

Largest Records Identified through SCOPUS
Database - 1167 Documents

Identification of Appropriate Search Keyword
("IoT-enabled Smart Buildings", "IoT-intergrated Smart Buildings",
"IoT in Smart Buildings", "IoT and Smart Buildings", "IoT" and "Smart
Buildings", "Internet of Things" and "Smart Buildings", "IoT-based
Smart Buildings"

Selection of "Internet of Things" and "Smart
Buildings" as the appropriate keyword using
Article Titles, Abstracts and Keywords

Screening & Inclusion

(1167 Documents from 2010-2022)
(1077 Documents from 2010-2021 - with articles in press)
(1062 Documents from 2010-2021 - without articles in press)

Upload of SCOPUS csv file (1062) to VOSviewer Software

Science Mapping & Network Analysis

(Keywords Co-occurrence, Co-authorship, Co-citations between
countries, sponsors & research institutions)

Research Clusters

IoT Framework for Smart Buildings

BIBLIOMETRIC PROCEDURE

FINDINGS

Documents by year — Scopus

Initiation Phase 2010 - 2012

Development Phase 2012 - 2021
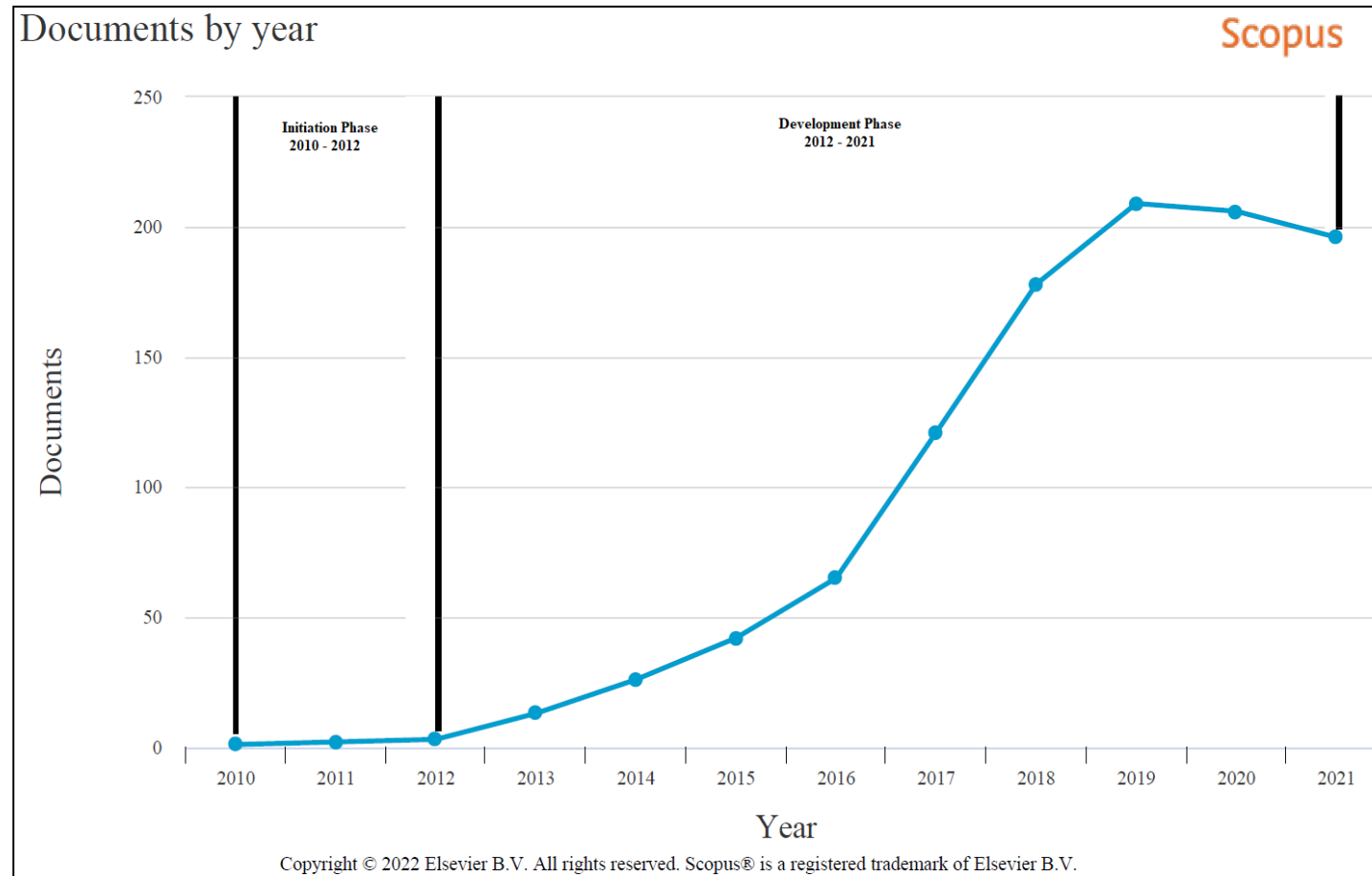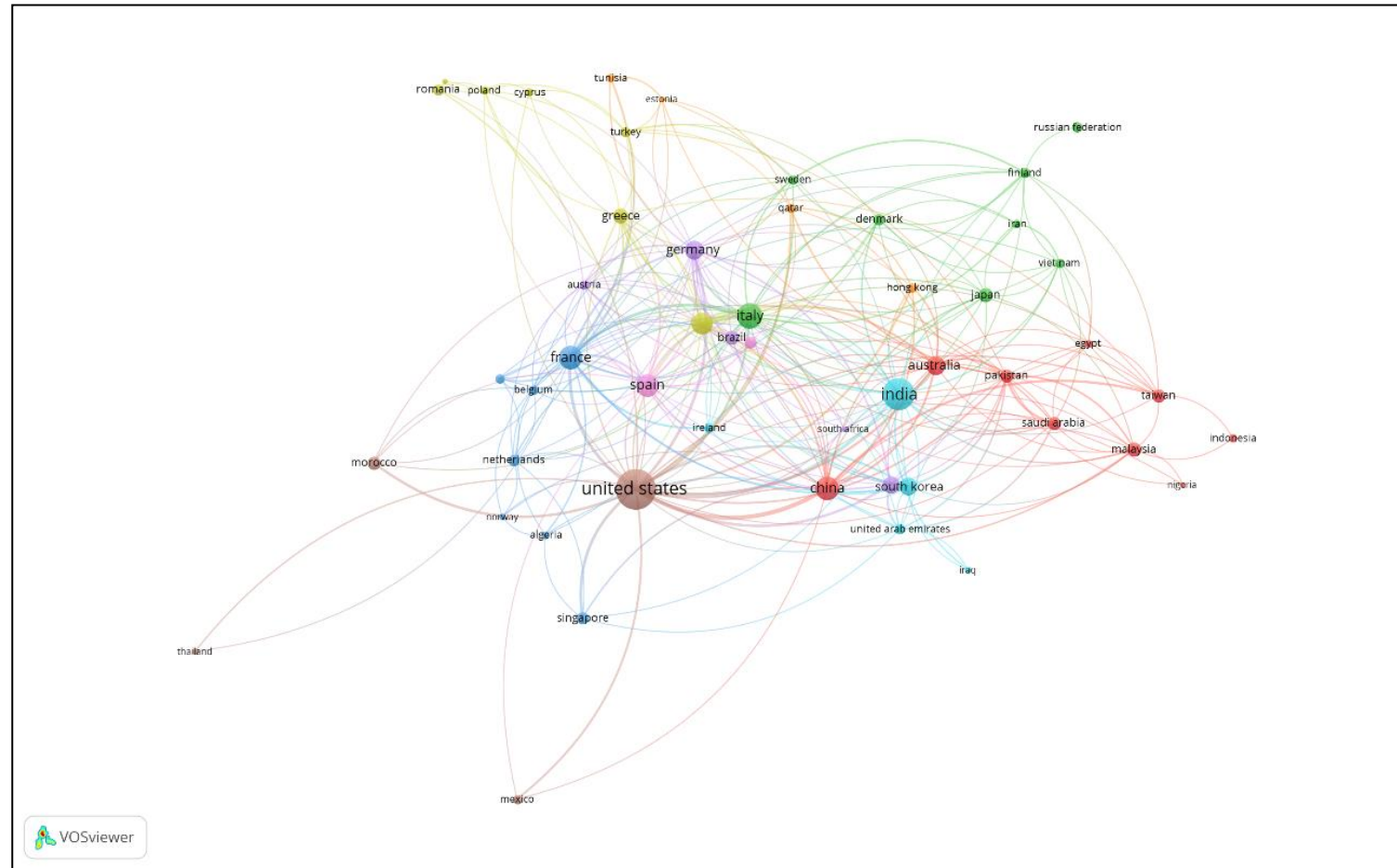
Literature sample and year of publication of IoT and smart buildings research

10

FINDINGS

Relationships Between Countries

FINDINGS

Major Keywords detected in IoT and Smart Buildings research

| Cluster		Major Keyword	Theme	Phase
1	Yellow	Internet of things	Internet of things & network security	Data Collection
2	Purple	Network Architecture	Network Architecture & Cloud Computing	Data Transfer
3	Red	Intelligent buildings	Intelligent buildings & Smart Environment	Data Analysis
4	Green	Smart Building	Smart Buildings & Energy Efficiency	Data Visualization
5	Blue	Automation	Automation & Embedded Systems	Automation & Control

FINDINGS
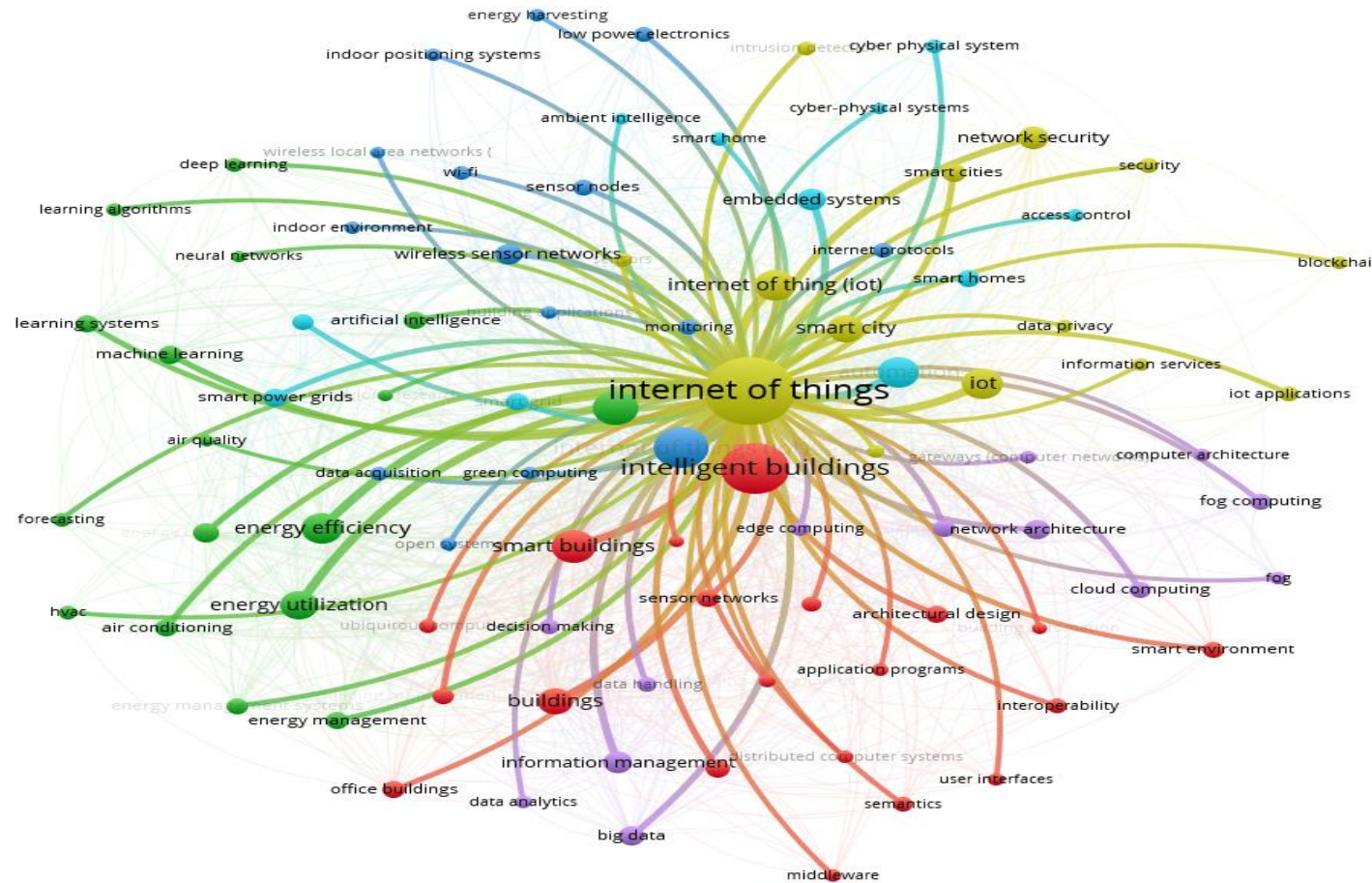
Custer 1 - Internet of things & network security

FINDINGS
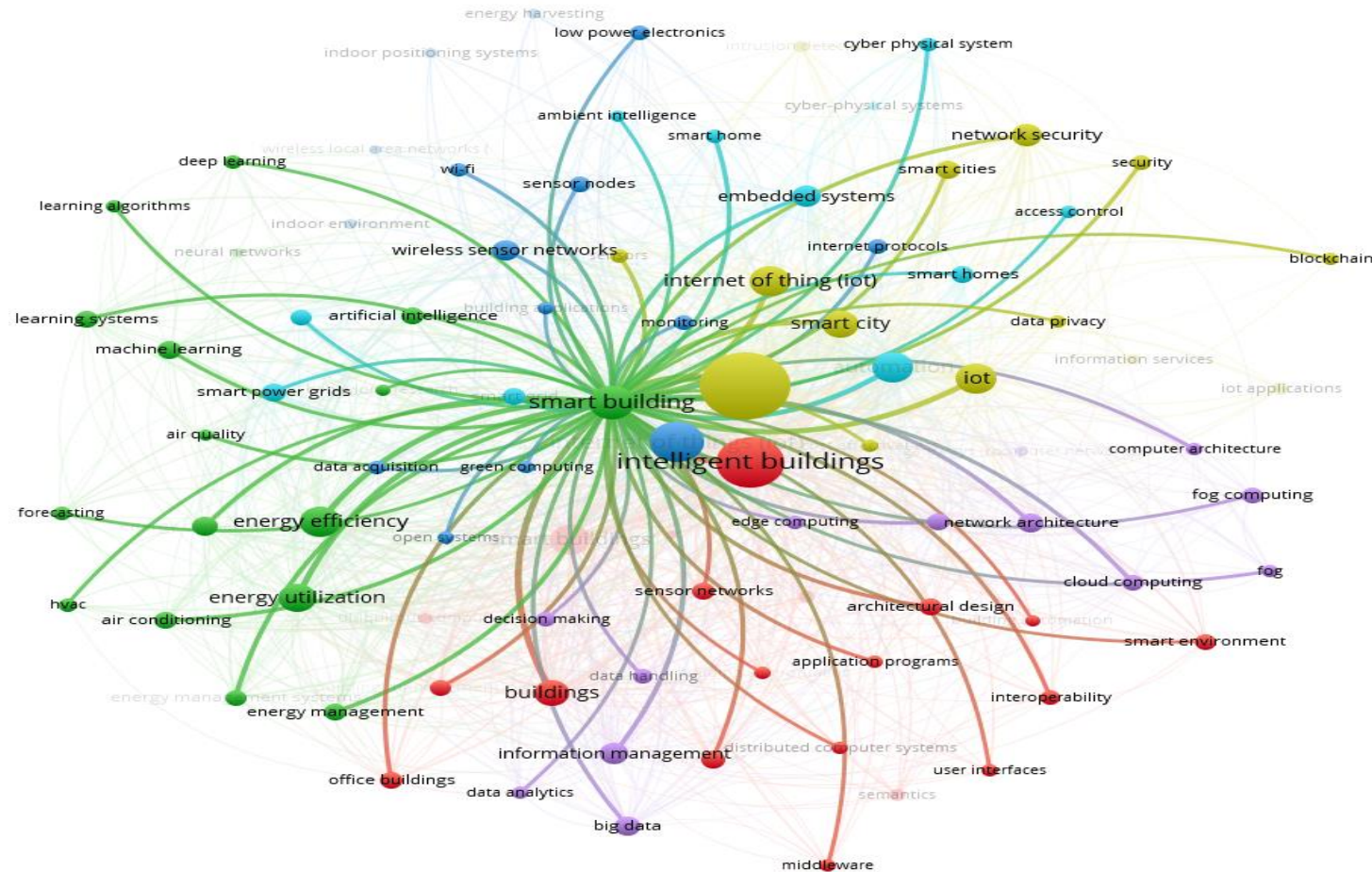
Custer 2 - Network Architecture & Cloud Computing
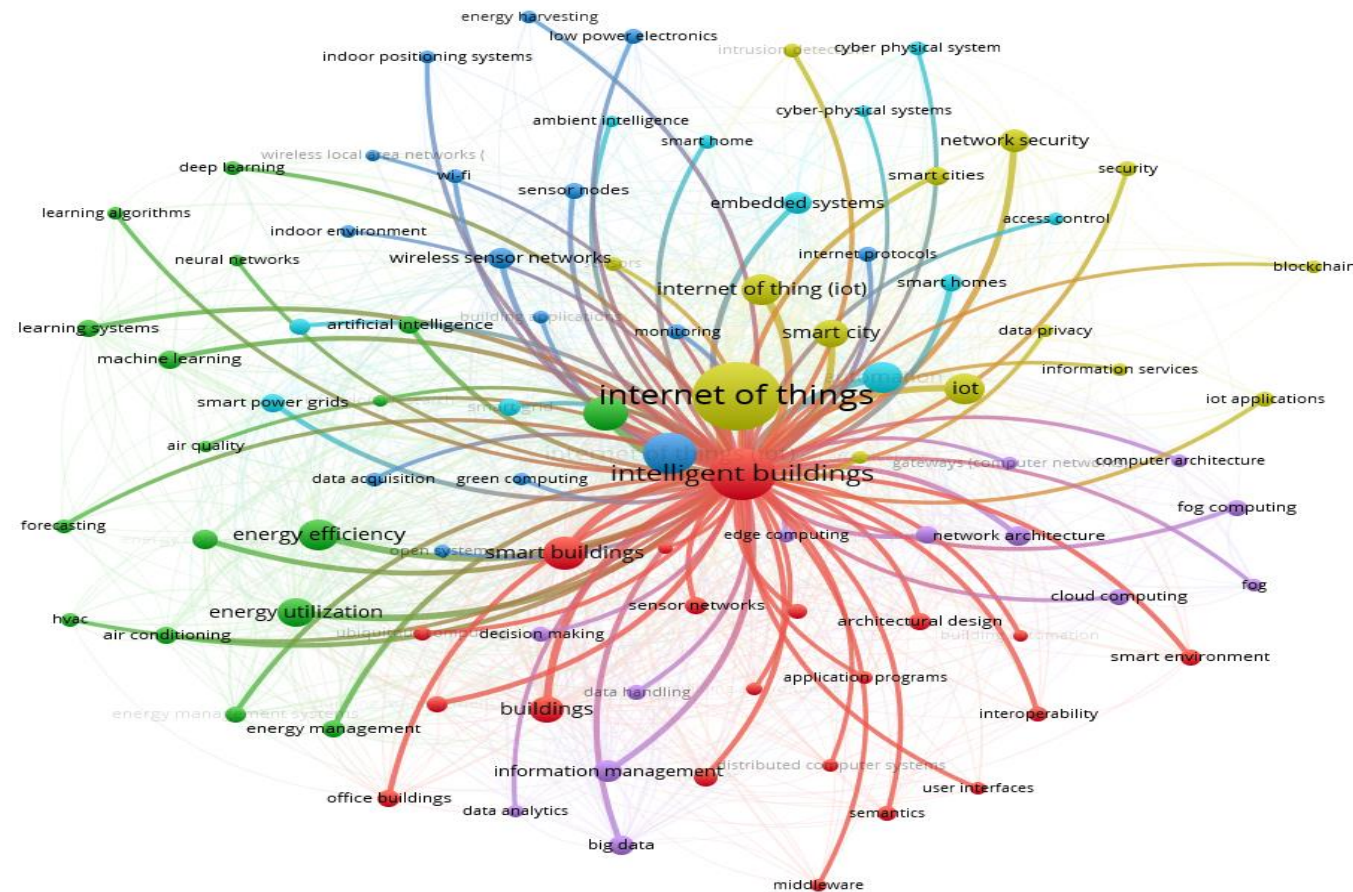
FINDINGS

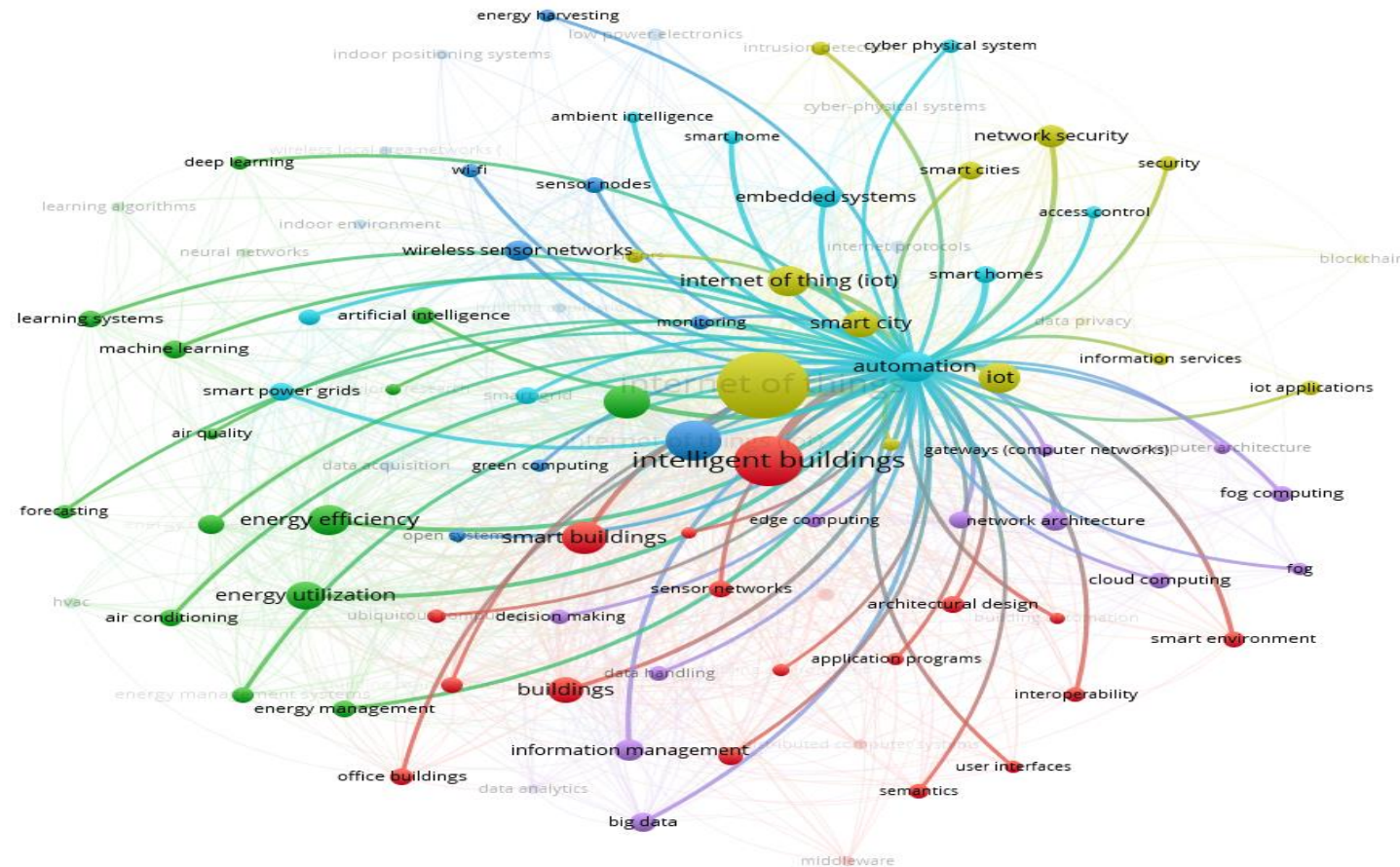Custer 3 - Intelligent buildings & Smart Environment

FINDINGS
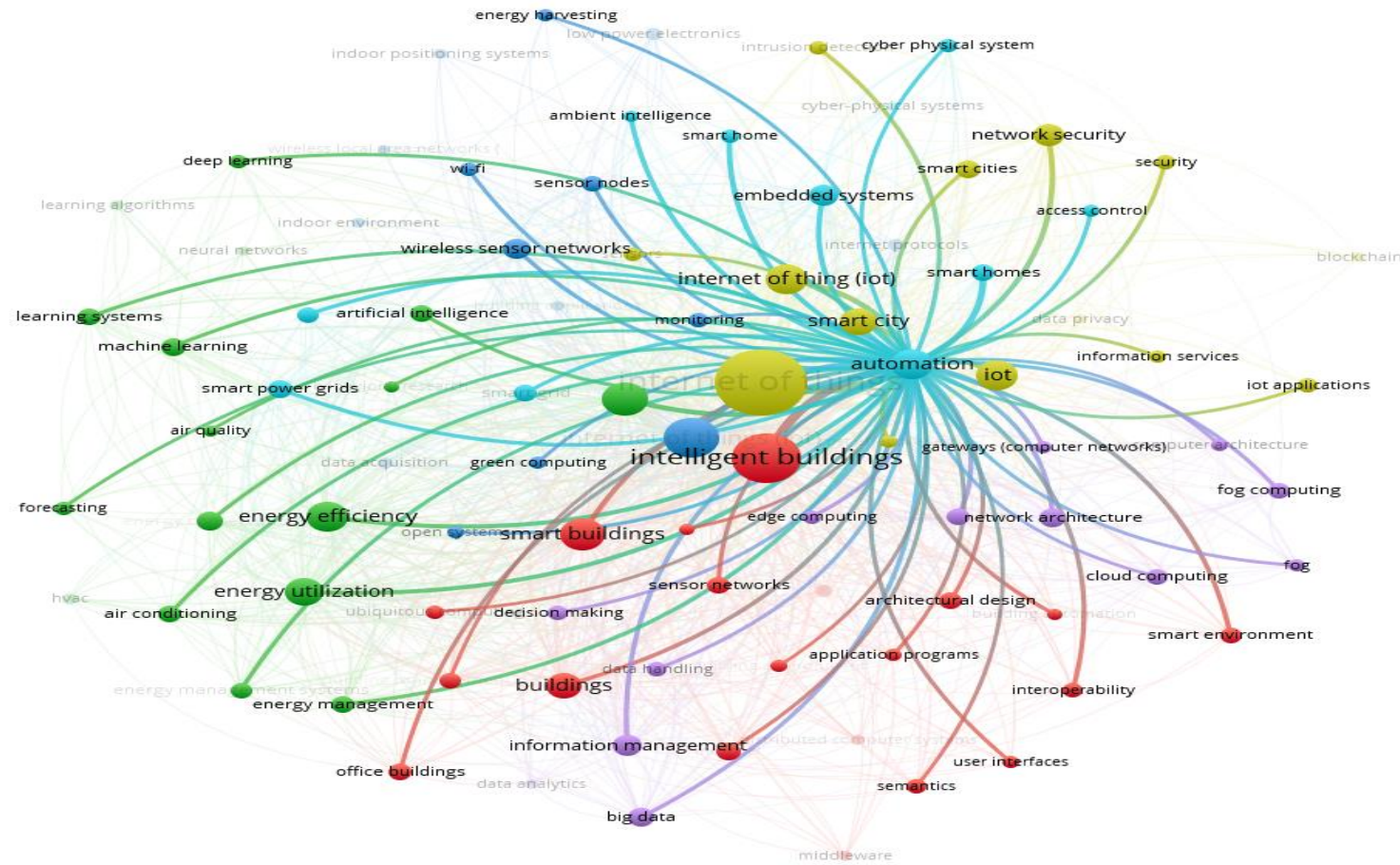

Custer 4 - Smart Buildings & Energy Efficiency

FINDINGS

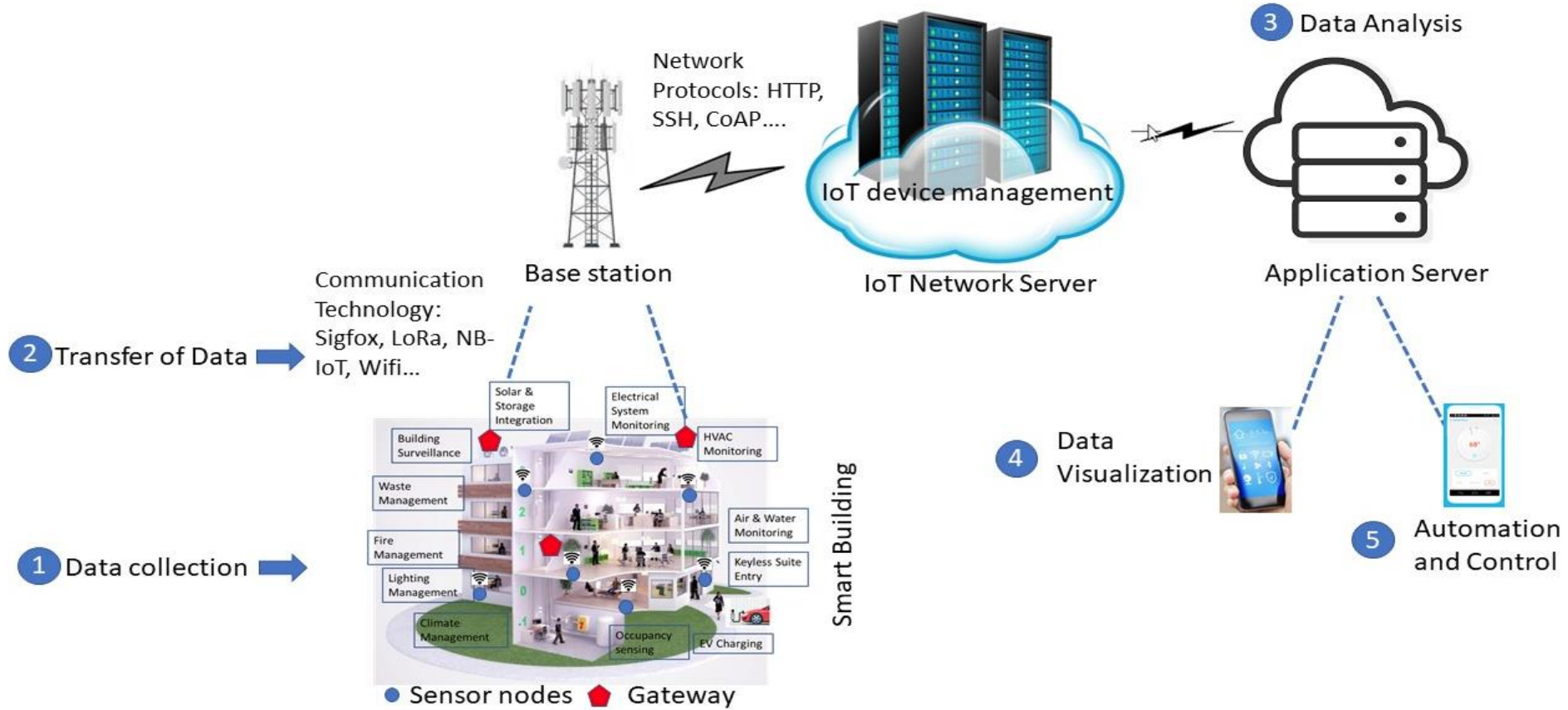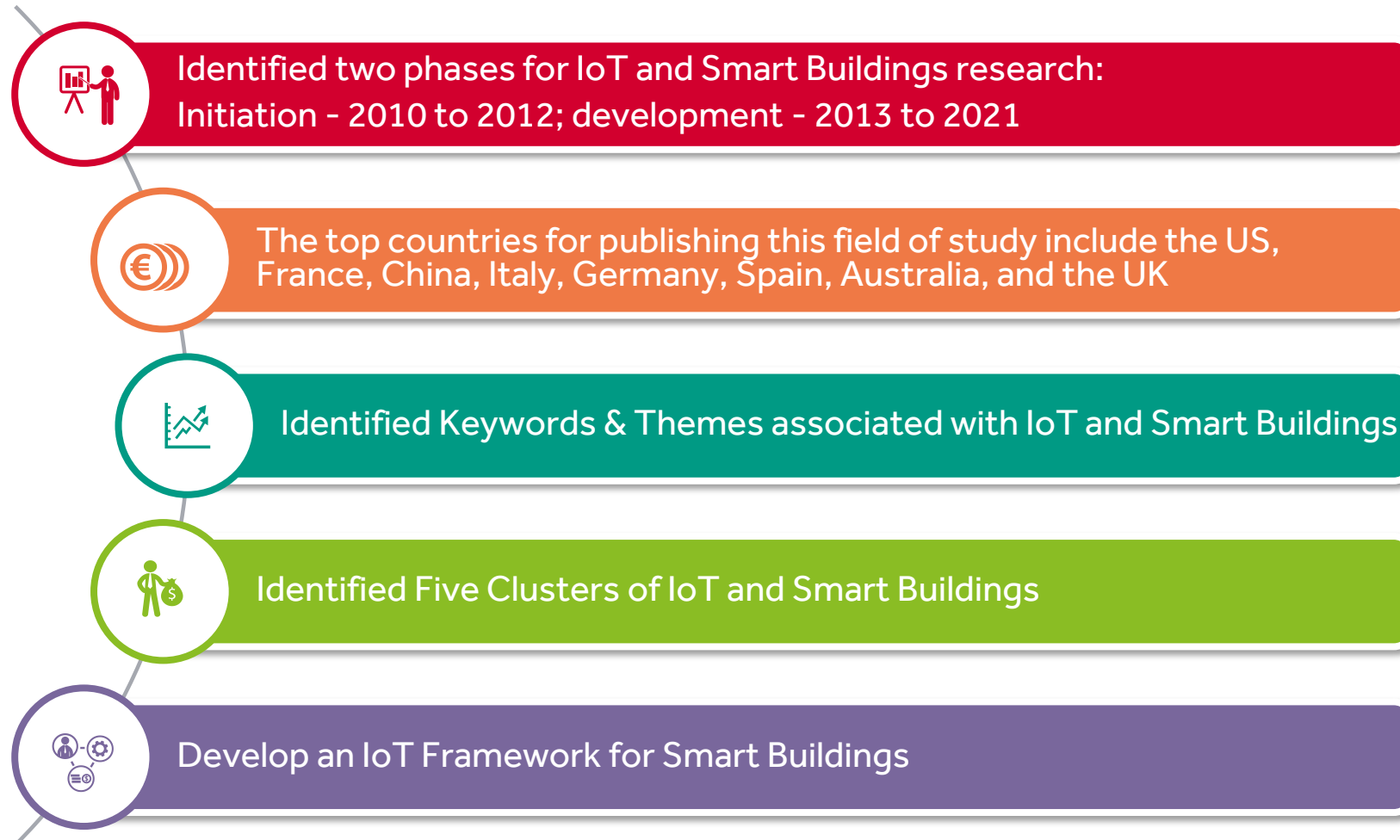
Custer 5 - Automation & Embedded Systems

FINDINGS

Custer 5 - Automation & Embedded Systems

FINDINGS

IoT Framework for Smart Buildings

CONESLUSION

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Identified two phases for IoT and Smart Buildings research:
Initiation - 2010 to 2012; development - 2013 to 2021

The top countries for publishing this field of study include the US, France, China, Italy, Germany, Spain, Australia, and the UK

Identified Keywords & Themes associated with IoT and Smart Buildings

Identified Five Clusters of IoT and Smart Buildings

Develop an IoT Framework for Smart Buildings

THANK YOU !