

# The Human Context in Requirements Elicitation



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# Agenda

- Introduction
- Publications of a longitudinal Requirements Elicitation studies
- Requirements Elicitation
- Challenges in Requirements Elicitation
- Presentation of three Requirements Elicitation frameworks
  - The **Multicultural** Requirements Elicitation Framework - McRE
  - The Requirements Cultural **Volatility** Framework
  - The Requirements Engineering Framework for **IoT** - REFloT
- Conclusion
- Further work

# Publication of a Longitudinal study regarding Requirements Elicitation

1. Siakas, K., Georgiadou, E., Rahanu, H., Siakas, E., Meggoudis, N., & Siakas, D. (2024). **Overcoming Obstacles in Global Requirements Elicitation: A Multicultural Perspective**. *Journal of Software Engineering Research and Development*, 12(1), 6:1 – 6:27. <https://doi.org/10.5753/jserd.2024.2552>
2. Siakas, E., Lampropoulos, G., Rahanu, H., Georgiadou, E., Siakas, D., Siakas, K. (2024). **REFIoT: A framework to combat requirements engineering in IoT applications and systems**, in M. Yilmaz, P. Clarke, A. Riel, R. Messnarz, C. Greiner, T. Peisl (Eds.) *Systems, Software and Services Process Improvement, EuroSPI, Munich, Germany, 4-6 Sept.*, accepted, proceedings in print.
3. Siakas, E., Rahanu, H., Loveday, J., Georgiadou, E., Siakas, K., Ross, M. (2023). **Managing Ethical Requirements Elicitation**. In: Yilmaz, M., Clarke, P., Riel, A., Messnarz, R. (eds) *Systems, Software and Services Process Improvement. EuroSPI 2023. Communications in Computer and Information Science*, vol 1890. Springer, Cham. [https://doi.org/10.1007/978-3-031-42307-9\\_19](https://doi.org/10.1007/978-3-031-42307-9_19)
4. Siakas, E., Rahanu, H., Georgiadou, E., Siakas, K. (2022). **Requirements Volatility in Multicultural Situational Contexts**. In: Yilmaz, M., Clarke, P., Messnarz, R., Wöran, B. (eds) *Systems, Software and Services Process Improvement. EuroSPI 2022. Communications in Computer and Information Science*, vol 1646, pp. 633-655, Springer, Cham. [https://doi.org/10.1007/978-3-031-15559-8\\_45](https://doi.org/10.1007/978-3-031-15559-8_45)
5. Siakas, E., Rahanu, H., Georgiadou, E., Siakas, K. (2021). **Towards Reducing Communication Gaps in Multicultural and Global Requirements Elicitation**. In: Yilmaz M., Clarke P., Messnarz R., Reiner M. (eds) *Systems, Software and Services Process Improvement. EuroSPI 2021. Communications in Computer and Information Science*, vol 1442. Springer, Cham. pp. 257-277, [https://doi.org/10.1007/978-3-030-85521-5\\_17](https://doi.org/10.1007/978-3-030-85521-5_17)

# Requirements Elicitation

1. The **first activity in the Requirements Engineering (RE) process**
2. Involves critical activities required to **accurately capture the requirements / needs of diverse stakeholders** who have a business interest in the system under development
3. A **communication intensive process**
4. One of the **most critical phases in software and systems development** that has **direct influence on quality and cost**

# Classification of requirements challenges (1)

## People Challenges

- Inadequate stakeholder identification;
- **Communication gaps** between requirements engineer(s) and stakeholder(s) - impact of **human, social, and cultural factors**;
- Limited understanding of project domain knowledge;
- Inadequate negotiation and prioritization of requirements;
- Stakeholders with unreasonable timelines and limited knowledge of what they want.

# Classification of requirements challenges (2)

## Process Challenges

- No defined requirements engineering processes;
- Processes not followed;
- No process measure implemented;
- No Process Improvement in place.

# Classification of requirements challenges (3)

## Business Environment Challenges

- Changes in government regulations;
- Competitors;
- Policy;
- Technology;
- Legal changes.

# Classification of requirements challenges (4)

## Principles of Conduct Challenges

- Values and principles are not established / not followed;
- Methodology not established/not followed;
- Requirements Volatility;
- Ethical and Professional principles not established / not followed.



# Types of requirements

## Functional requirements

- Aim to capture the **intended behavior of the system to be developed**;
- **Related to specific business functions, tasks, or behaviors** that a system under development is expected to support;
- **Use cases** have become a widespread practice for capturing functional requirements.

## Non-functional requirements

- Not directly related to specific functions of the system, but relate to **quality characteristics**, such as **reliability, availability, and security**.

## Domain requirements

- **Domain concepts** or specialized domain terminology. Linguistic ambiguity due to **terminological discrepancies** may occur between stakeholders that belong to different technical domains.

# Actors of Requirements Elicitation

All actors involved in requirements elicitation have **different roles, objectives, backgrounds, domain knowledge, preferences, and priorities**

Examples of **distributed actors**:

- Customers coming from different countries and organizations;
- End-users out of organizational reach;
- Software developers at different levels of global software development working together as virtual teams.
- Developers and customers belong to different professional cultures / backgrounds (developers put emphasis on system / technology – customers on business context).

# Virtual teams in Global Software Development (GDS)

## Virtual Teams



Within a project lifetime virtual teams are connected together with time and money constraints for a specific period of time to accomplish certain distinct objectives

# Culture

**Cultural diversity** can be a competitive advantage for a company if dealt with in a proper manner.

**Cultural constraints** determine which strategies are feasible and which are not.



## **Different expectations as to**

- Expectations of how employers and employees should act
- Expressions of agreement and disagreement
- Styles of management
- Decision making
- Attitudes toward hierarchy
- Approaches to teamwork

## **Influence employee behaviour:**

- Degree of centralisation / formalisation
- Shared values and expectations
- Level of specialisation
- Need for coordination
- Knowledge sharing
- Process maturity

## **Minimum 2 professional cultures**

- Requirements engineer
  - a systems viewpoint (functional / technological)
- End-user stakeholders
  - business point of view
- Different language and jargon are used depending on background of the two sides

# Identified Communication Gaps

Incompatibility in the five factors below were found to create problems in communication

**1**

**National  
Culture**

**2**

**Organisational  
Culture**

**3**

**Professional  
Culture**

**4**

**Processes**

**5**

**Infrastructure**

# Three frameworks were developed by the research team

for

- gaining a deeper understanding of the underlying concepts and empirical inquiry;
- providing a structure of conceptual thinking and theoretical development;
- communicating the basic ideas of theory.

- The **Multicultural** Requirements Elicitation Framework - **McRE**

- The Requirements Cultural **Volatility** Framework

- The Requirements Engineering Framework for **IoT** - **REFIoT**

# The Multicultural Requirements Elicitation(McRE) framework

# Multicultural Requirements Elicitation(McRE) framework

- The meaning and the role of culture in **Global Software Engineering (GSE)** and the **influence of culture on the requirements elicitation process**;
  - The need for **adequate requirements is one of the biggest challenges** facing modern software product development;
  - Bad requirements elicitation results in a futile outcome;
  - Adequate requirements influence the whole systems **development process** as well as the **resulting products and services**;
- The Multicultural Requirements Elicitation [McRE) framework **helps prevent or at least minimize prejudice, conflicts, misunderstandings and misinterpretations arising from cultural differences.**



# Multicultural Requirements Elicitation

## (McRE) framework



# The Requirements Cultural Volatility Framework

# Requirements Volatility

*The emergence of new requirements or modification or removal of existing requirements*

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***Scope creep:*** changes and uncontrolled growth in a project's scope at any point;

***Ambiguous system and project requirements:*** unclear or unspecified requirements;

***Continually changing system and project requirements:*** requirements that are not stable but are likely to change during the development process.

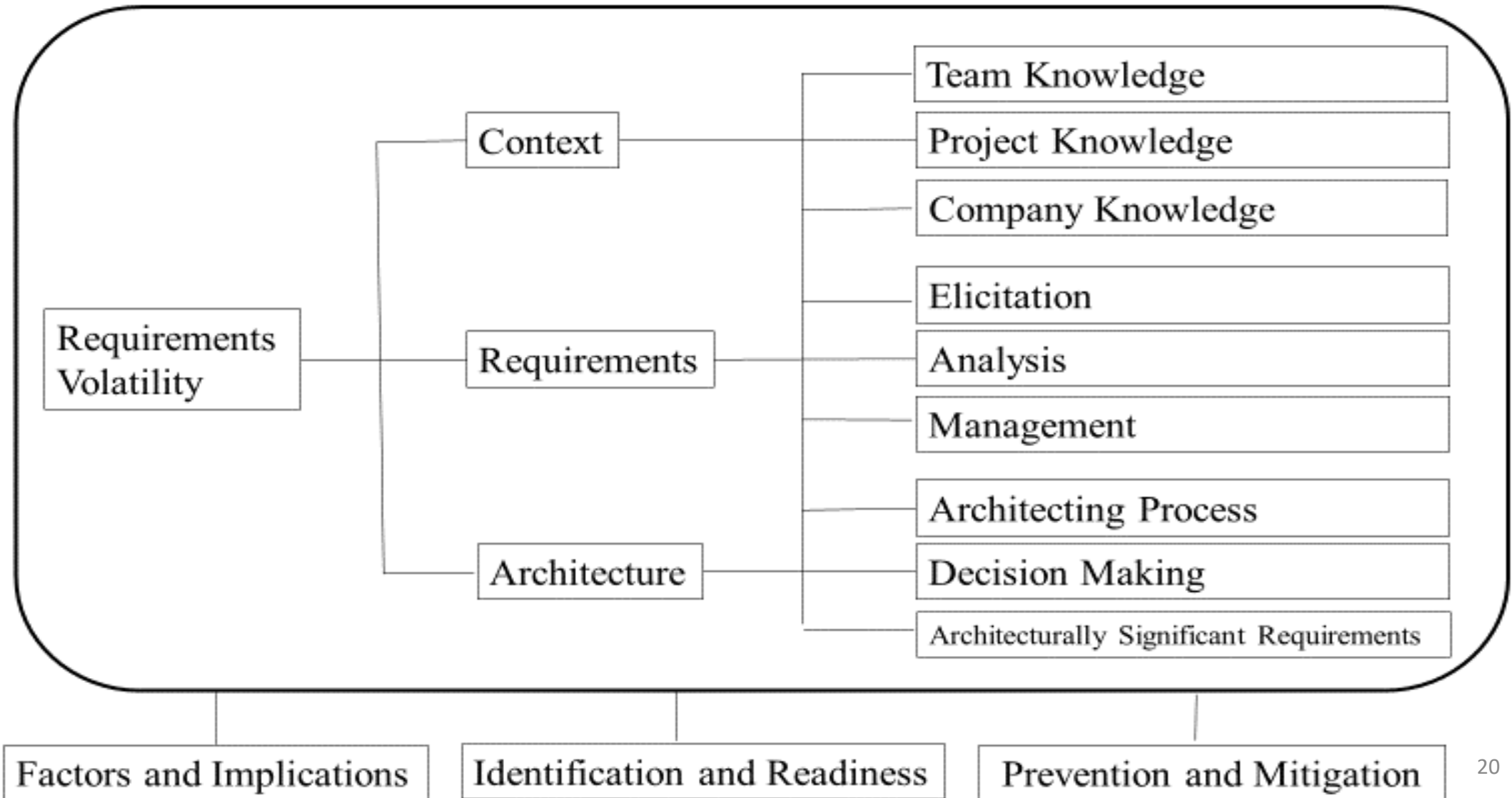
***Ill-defined project goals:*** too many features or neglected critical functionality;

***Abundance of features:*** a large quantity of software and system features. System/software engineers tend to develop more features than needed in pursuit of customer/user satisfaction

***Assumptions and Ambiguities:***

- *Assumptions can arise from ambiguous descriptions (whether intentionally or unintentionally) which are a feature of natural language.*
- *Ambiguity can result from misunderstandings and misinterpretations of terms between developers and between the various stakeholders.*

# Requirements Volatility Depicted



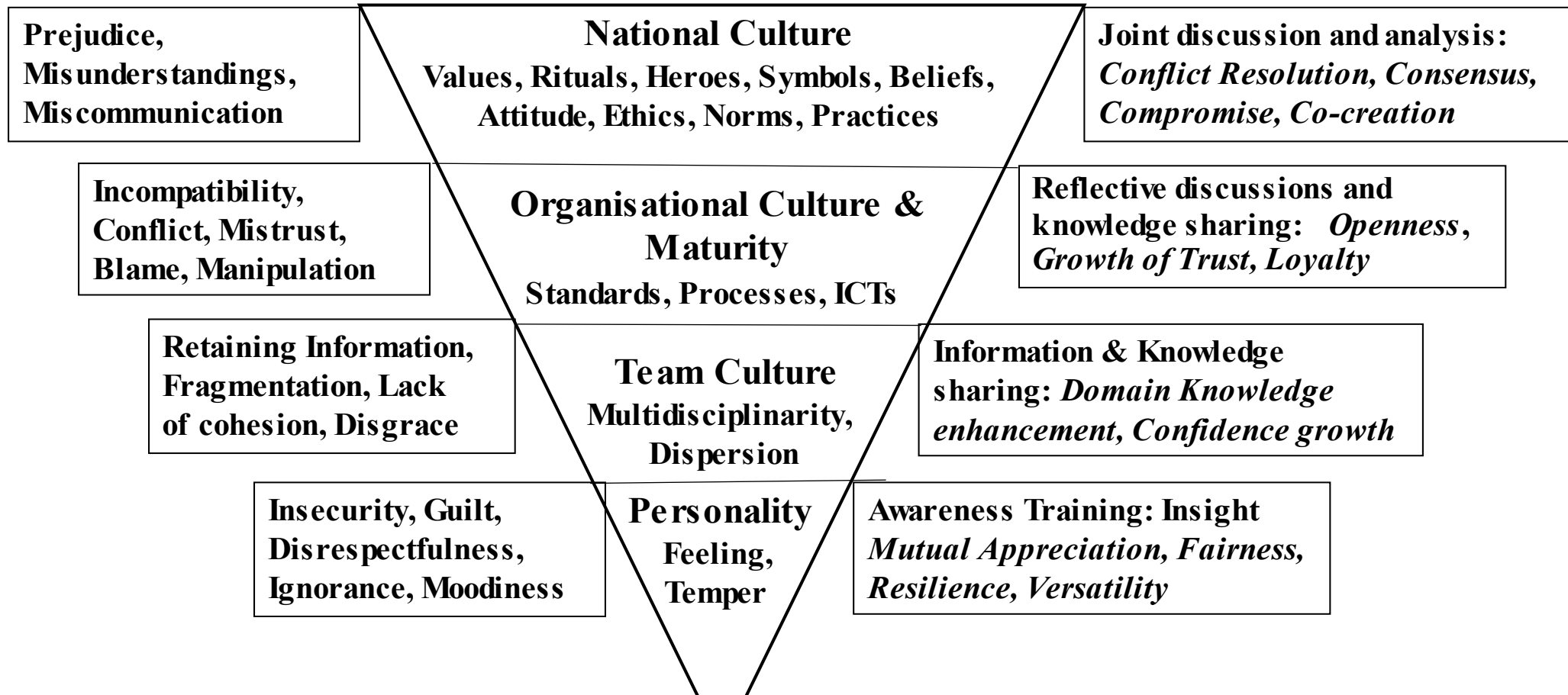
# Grouping of context characteristics influencing volatility

Team Characteristics	Organisation Characteristics	Project characteristics
<ul style="list-style-type: none"><li>• Level of dispersion</li><li>• Cohesion</li><li>• Domain knowledge</li><li>• Language (native/foreign)</li><li>• National culture</li><li>• Organisational culture</li><li>• Team Culture</li><li>• Professional culture (multidisciplinarity)</li></ul>	<ul style="list-style-type: none"><li>• National culture</li><li>• Organisational culture<ul style="list-style-type: none"><li>◦ Clan</li><li>◦ Hierarchical</li><li>◦ Democratic</li><li>◦ Disciplined</li></ul></li><li>• Learning orientation</li><li>• Process orientation</li></ul>	<ul style="list-style-type: none"><li>• Size/Scope/Complexity</li><li>• Effort</li><li>• Predefined processes</li><li>• Process improvement approaches</li><li>• Level of Stakeholder involvement</li><li>◦ Motivation &amp; Constraint</li><li>• Lifecycle models<ul style="list-style-type: none"><li>◦ Waterfall, Spiral, V-Model, Agile, DevOps</li></ul></li></ul>

# The Requirements Cultural Volatility Framework

**Cultural Context: Multiplicity of Dimensions, Interactions, Actions and Expected Benefits**

**Potential Conflicts .....Dimensions and Factors.....Actions & Benefits**

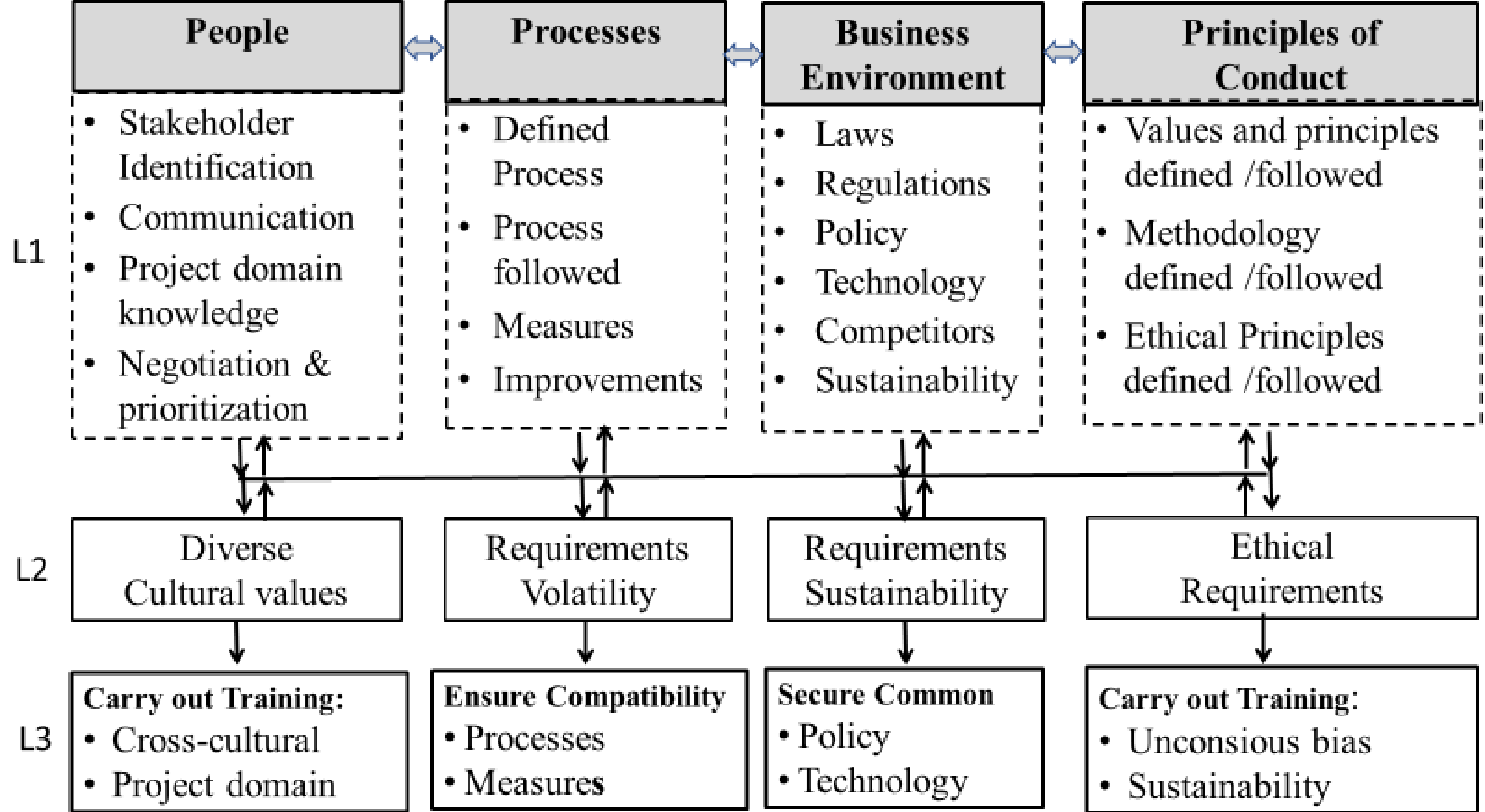


# **The Requirements Engineering Framework for IoT (REFIoT)**

# Internet of Things (IoT)

- An innovative and continuously growing technology comprising of a **network of physical devices embedded with software and sensors** that **collect and share data** over the Internet without human intervention;
- Is an innovation enabler and facilitator of new initiatives;
- There are challenges that need to be addressed for IoT to be fully exploited by various industries.





# Conclusion

Requirements elicitation is a **concerted human activity** regarding requirements determination through **intensive and extensive communication** between the requirements elicitation engineers and the various stakeholders, such as customers, end-users, domain experts, product owners and so on.

The **identification** and the **complex interaction between all the challenges in requirements elicitation** were addressed.

The following **requirements elicitation frameworks** were presented:

Cultural diversity: **The Multicultural Requirements Elicitation Framework - McRE**

Requirements Volatility: **The Requirements Cultural Volatility Framework**

IoT Requirements: **The Requirements Engineering Framework for IoT - REFIoT**

# Potential Further Work Directions

- AI Techniques in Requirements Elicitation
- Explainable AI systems (XAI) for Requirements Elicitation
- ChatGPT's Potential to Assist in Requirements Elicitation Processes
- We are open for collaboration: Please, contact [ksiakas@gmail.com](mailto:ksiakas@gmail.com) if you are interested

Any Questions?

