How the internet of things technology enhances emergency response operations

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Introduction

- A need for dynamic, instantaneous information
- IoT is one of the ways to enable this.

- Questions asked:
  - Does the use of the IoT technology enhance ER operations?
  - In which way does this enhancement occur?
  - What is the strategic value of the IoT in ER operations

Technical Background

- IoT is multi-disciplinary
  - Hardware, near-field comm., networking, data fusion and decision-making.
- RFID - automated identification technology.
- WSN – Wireless sensor networks.
- Data fusion
  - associating, combining, aggregating, integrating, and blending data from multiple sources.
- IoT has three fundamental characteristics
  - Global and real-time, mainly wireless with ability to provide comprehensive data and remote tracking or monitoring.

Research Methods

- Access to three fire and rescue services(FRSs).
- Data acquisition
  - Interviewing core emergency personnel(front-end and back-end). 20 per FRS, 90 minutes.
  - Questionnaire to focus group. 3 focus groups, 72 questions.
  - Observed three one-hour firefighter training sessions.
- Task-technology fit approach.
  - Mapping the IoT-technology to the information required in ER operations.

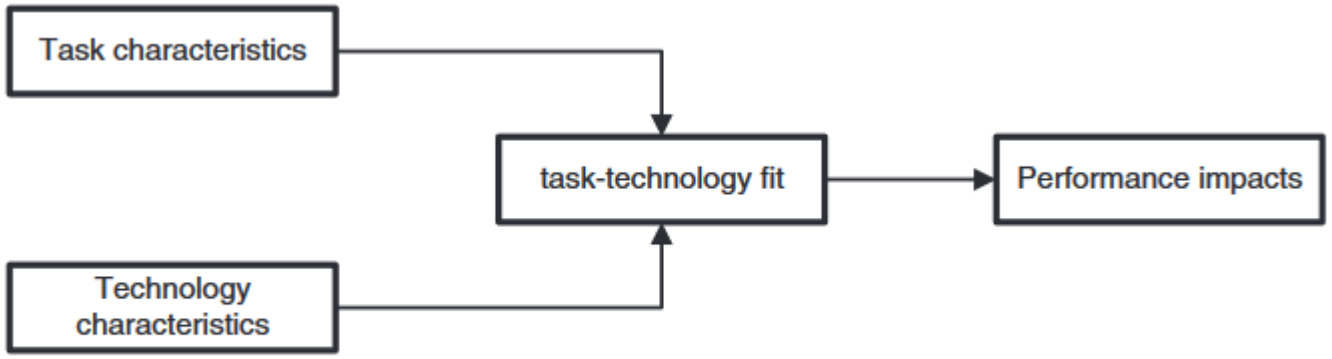

Fig. 1. The basic task-technology fit model.

Emergency Response Operations in the UK

- Strict protocols.
- Triggered by 999 calls to command center.
- X amount of fire engines dispatched to incident site.
- On-site incident commanders make decisions to scene management and if needed call in additional help.
- Three rhytms in ER operations
  - Mobilization rhythm, focus to confirm information received and prepare physically and mentally.
  - Preliminary situation assessment rhythm, decide tactical mode and request additional resources.
  - Intervention rhythm, starts with physical intervention and ends with the end of the ER operation.

Information Required to Support ER ops

Table 1
A tabular model of information requirements for ER operations.

	Front-end			Back-end (command centre)
	Mobilization	Preliminary situation assessment	Intervention	
Priority of the tasks	Prepare first responders and make sense of what will face them upon arrival	Decide the tactical mode and the request of additional resources	Reduce the loss caused by the accident and ensure the safety of the fire crew	Optimize resource allocation and dispatch
Category of information	Environmental conditions	Environmental conditions, available resources	Environnemental conditions, information on response participants, status of casualties, available resources	Environnemental conditions, information on response participants, status of casualties, available resources
Requester of the information	Incident commanders, fire fighters	Incident commanders	Incident commanders, fire fighters	The command centre
Source of information	Command centre, central database, physical sensors installed in the incident scene, Internet	Local people, physical sensors installed in the incident scene	Local people, on-site officers, physical sensors installed in the incident scene	Non emergency personnel, on-site officers, central database, Internet
Richness of information	Low	Medium	Medium	High
Importance in real-time	Important	Very important	Extreme important	Less important

Task-technology fit analysis

Hypothesis 1 (H_1). Adopting the IoT technology to deal with the information requirements will have a positive impact in determining the fit between the information requirements and the IoT technology.

Hypothesis 2 (H_2). The fit between the information requirements and the IoT technology will have an impact in determining the strategic value of the IoT technology in ER operations.

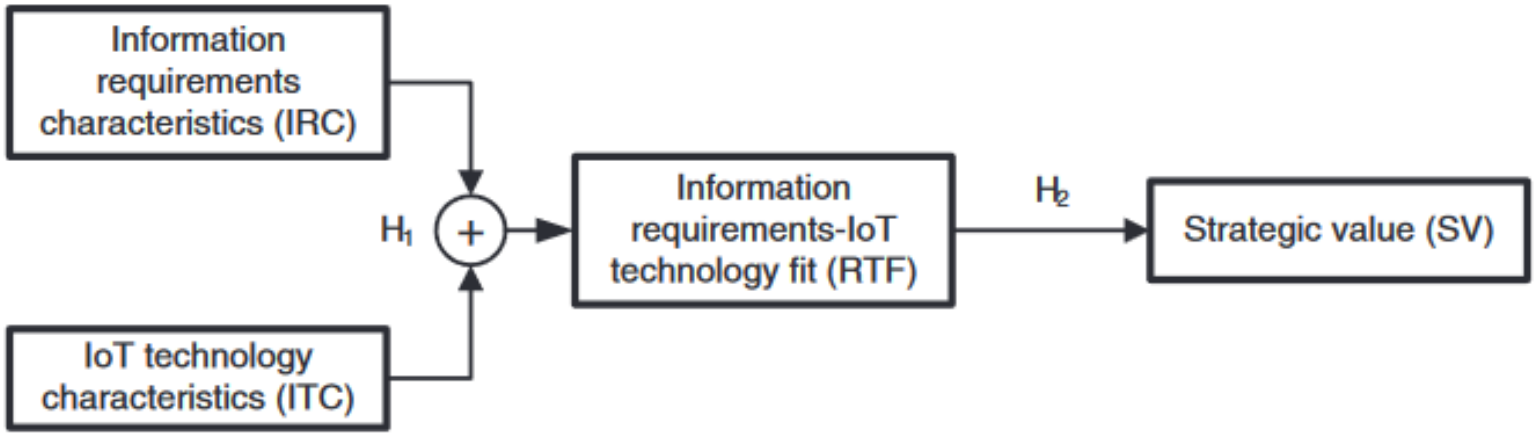

Fig. 2. Proposed research model for the IoT technology.

Research Findings

- Supported Hypothesis 1 -The IoT technology can enhance ER operations from the following four perspectives.
  - (i) Accountability of resources and personnel.
  - (ii) Assessment of the situation
  - (iii) Resource allocation
  - (iv) Multi-organizational coordination.
- Supported Hypothesis 2 -ER operations enhanced by the above four perspectives can achieve the following three aspects of strategic value.
  - (i) Efficient cooperation between various organizations.
  - (ii) Accurate situational awareness.
  - (iii) Complete visibility of response forces and their remaining capabilities.

Limitations

- Paper does not use the technology acceptance model(TAM) with their technology-task model(TFF).
- The questions can be diffuse.
- The strategic value is proposed before any tests.

Conclusion and Future Work

- IoT technology has many positive impacts on every stage of ER ops.
- It enhances cooperation between participating organization, improves situational awareness and enables complete visibility.
- This provides faster and more efficient and effective ER ops.
- Acceptance of technology needs to be taken in consideration on future works.
  - Personnel hesitant to use.
  - Privacy risks.