

# Through-life Accountability: Managing complex services

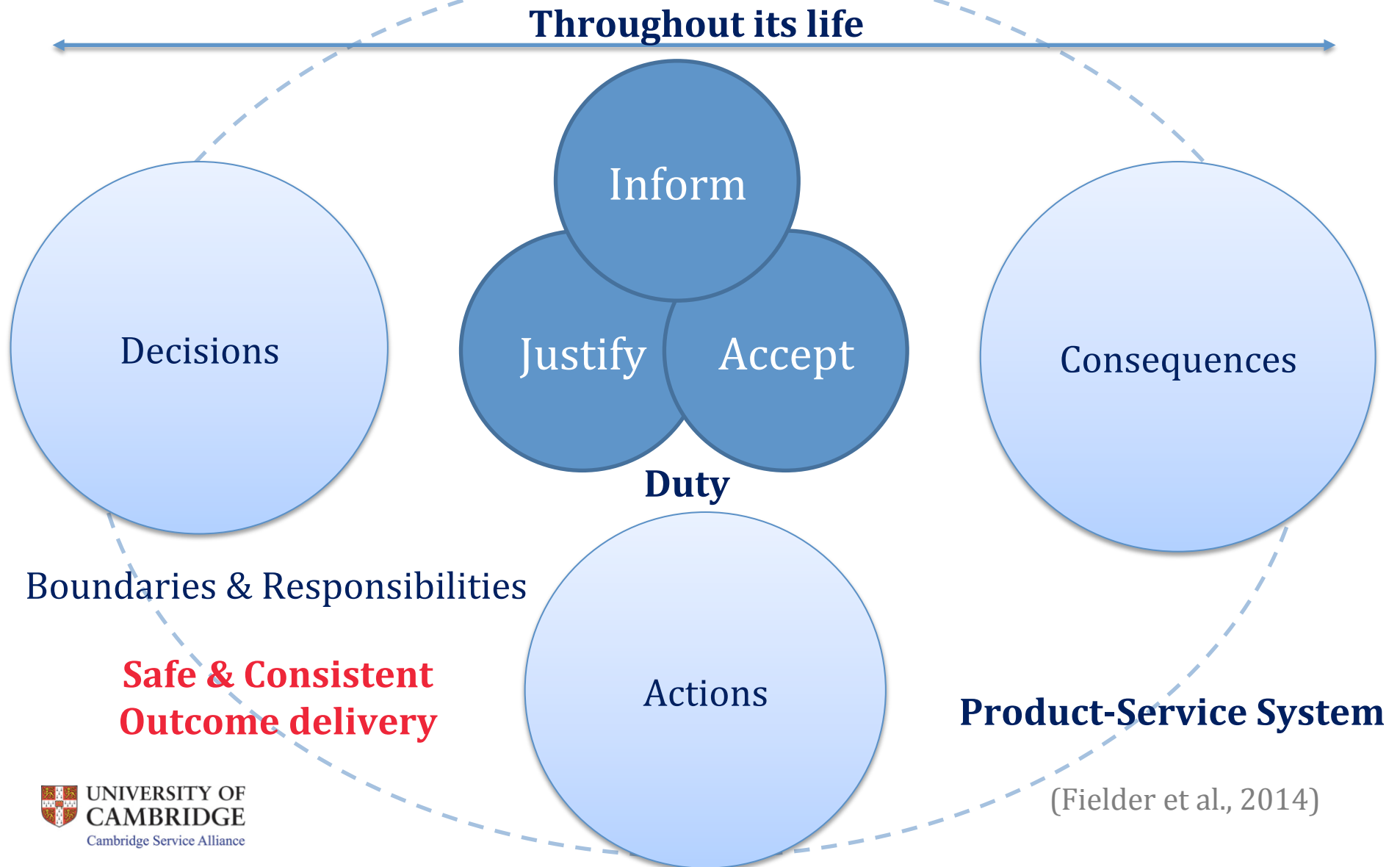
Chara Makri, *PhD Student*  
Prof. Andy Neely, *Supervisor*



**BAE SYSTEMS**

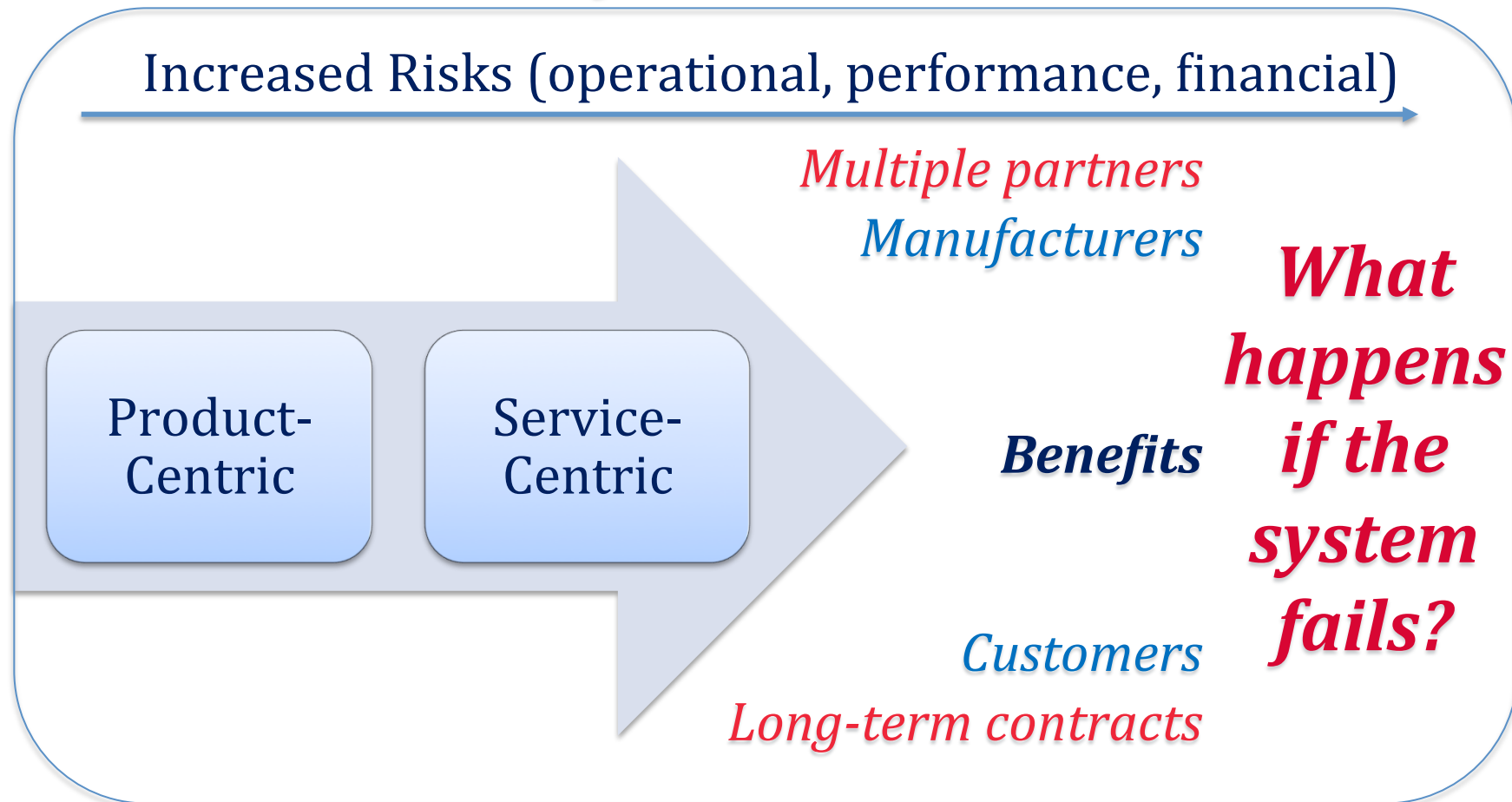


# Through-Life Accountability - Definition



# Through-Life Accountability - Importance

## *Shift to Services*



# Accountability in today's world...

Design Issue

- DCH-Twin Otter

**Manufacturer**

Failed - Worn

- Elevator control cable

**Maintenance Staff**

Maintenance Checks

- Elevator Control Cable

**Manufacturer**

Jet Blast

- Elevator Control Cable

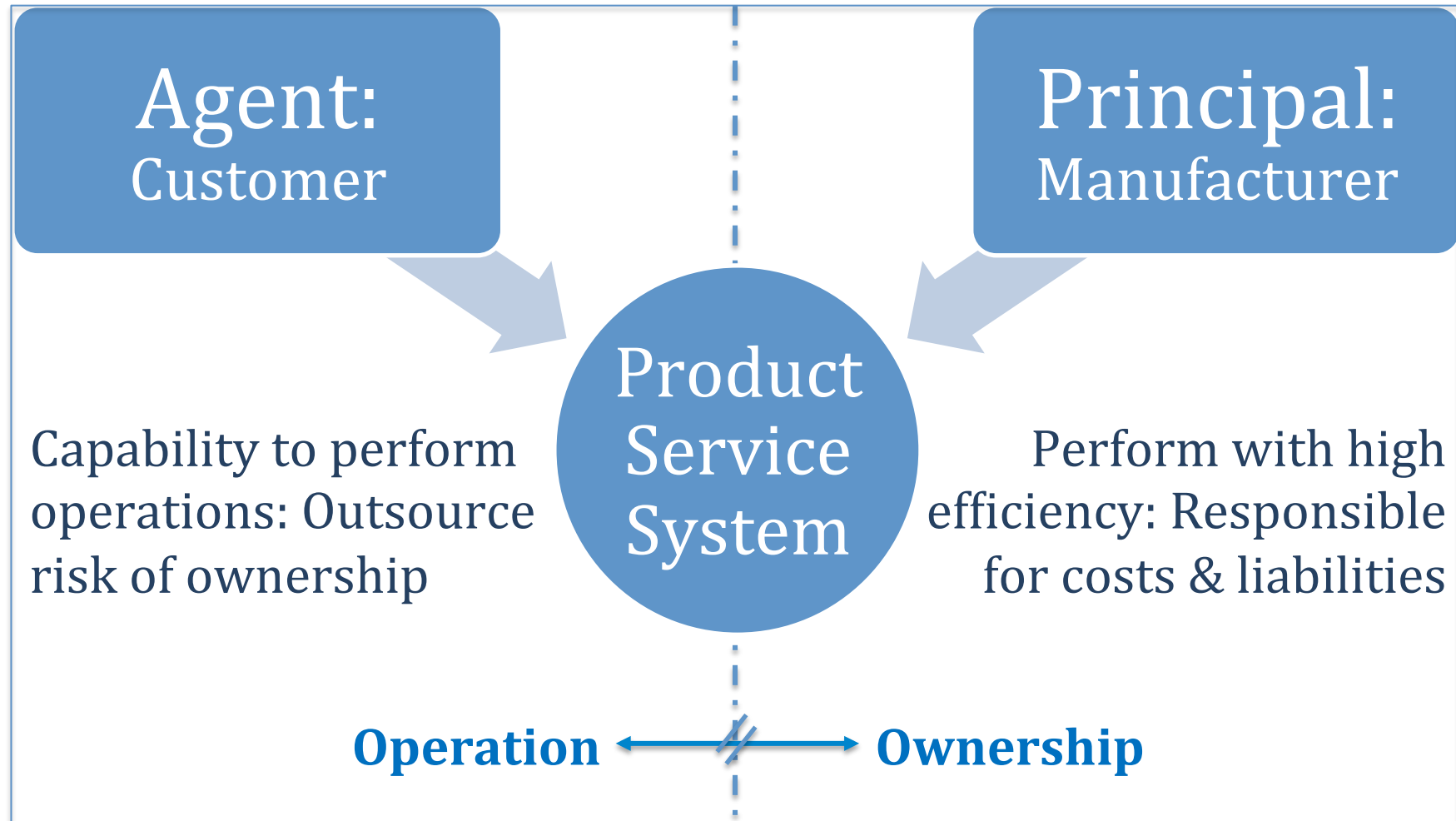
**Airport**

Loss of pitch-control

- No proper training

**Airline**

# Problem Definition & Agency Theory



# Analysis: 17 Commercial Aircraft Accidents

- Multiple organisations
  - Safety-critical environment
  - Long-term service contracts
- **For every accident:**
  - Official investigation
  - Official detailed report
- **Information for:**
  - Decisions – actions - consequences
  - All actors involved

# Methodology – analysis example (1/2)

	Decisions		Actions		Consequences	
Time	What	Who	What	Who	What	Who
	<i>'The available charts on board the aircraft did not contain information relating to the "Bogor" Area and the nearby terrain'</i>	Operator	No proper actions taken	Operator		
07:14	Standard procedure		<i>'...the pilot requested to taxi'</i>	Crew		
07:26	<i>'...the pilot contacted Jakarta Approach and requested for descent to 6,000 feet and subsequently requested to make a right orbit'</i>	Crew	<i>'...the pilot contacted Jakarta Approach and requested for descent to 6,000 feet and subsequently requested to make a right orbit'</i>	Crew		
					<i>'All occupants were fatally injured and aircraft was destroyed'</i>	AOB

# Methodology – analysis example (2/2)

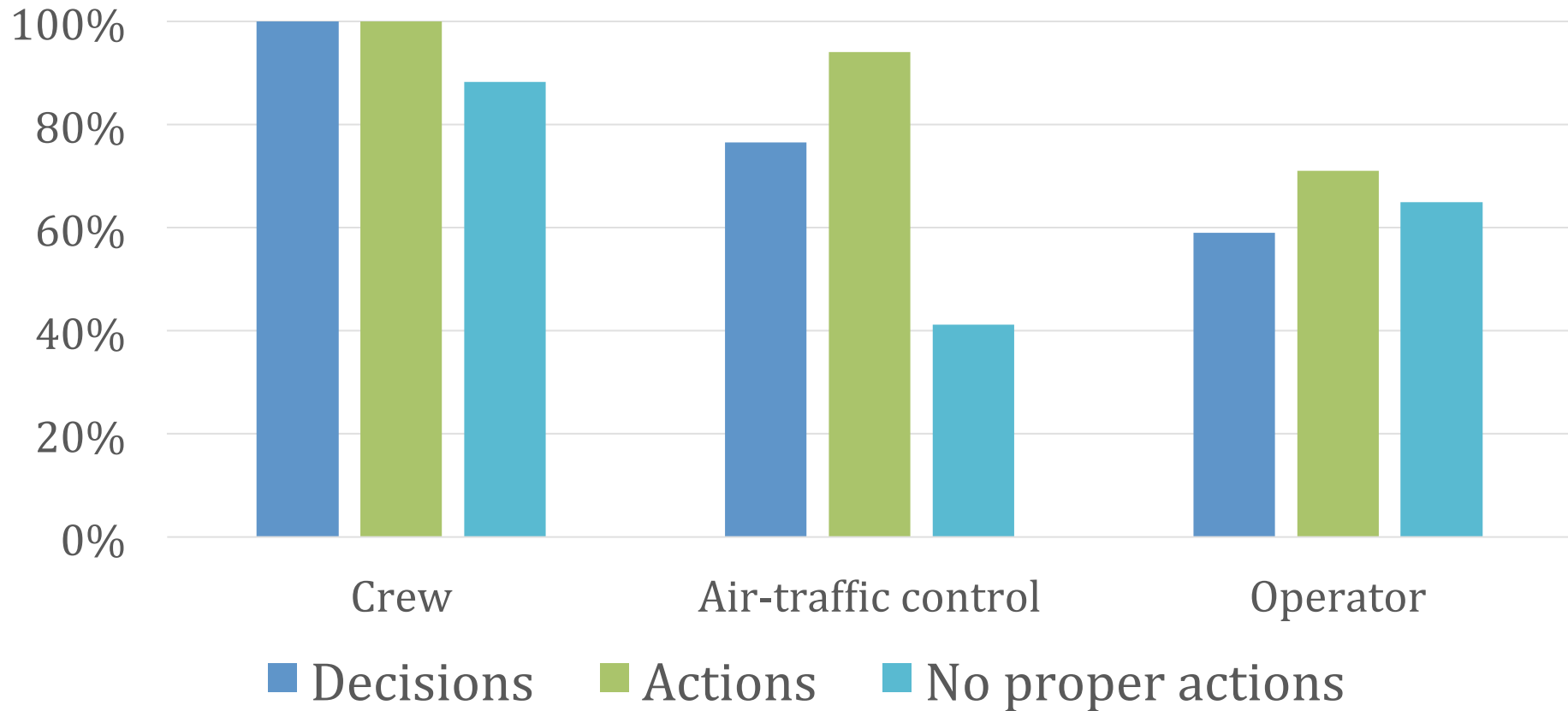
	<b>Decisions</b>	<b>Actions</b>	<b>Consequences</b>
<b>Crew</b>	58.8%	58.0%	22%
<b>ATC</b>	29.4%	30.0%	22%
<b>Airport</b>	5.9%	8.0%	11 %
<b>Operator</b>	5.9%	2.0%	0%
<b>Rescue Team</b>	0.0%	2.0%	0%
<b>AOB</b>	0.0%	0.0%	45%

## No proper actions taken

<b>Crew</b>	61.5%
<b>Airport</b>	23.1%
<b>ATC</b>	7.7%
<b>Operator</b>	8%

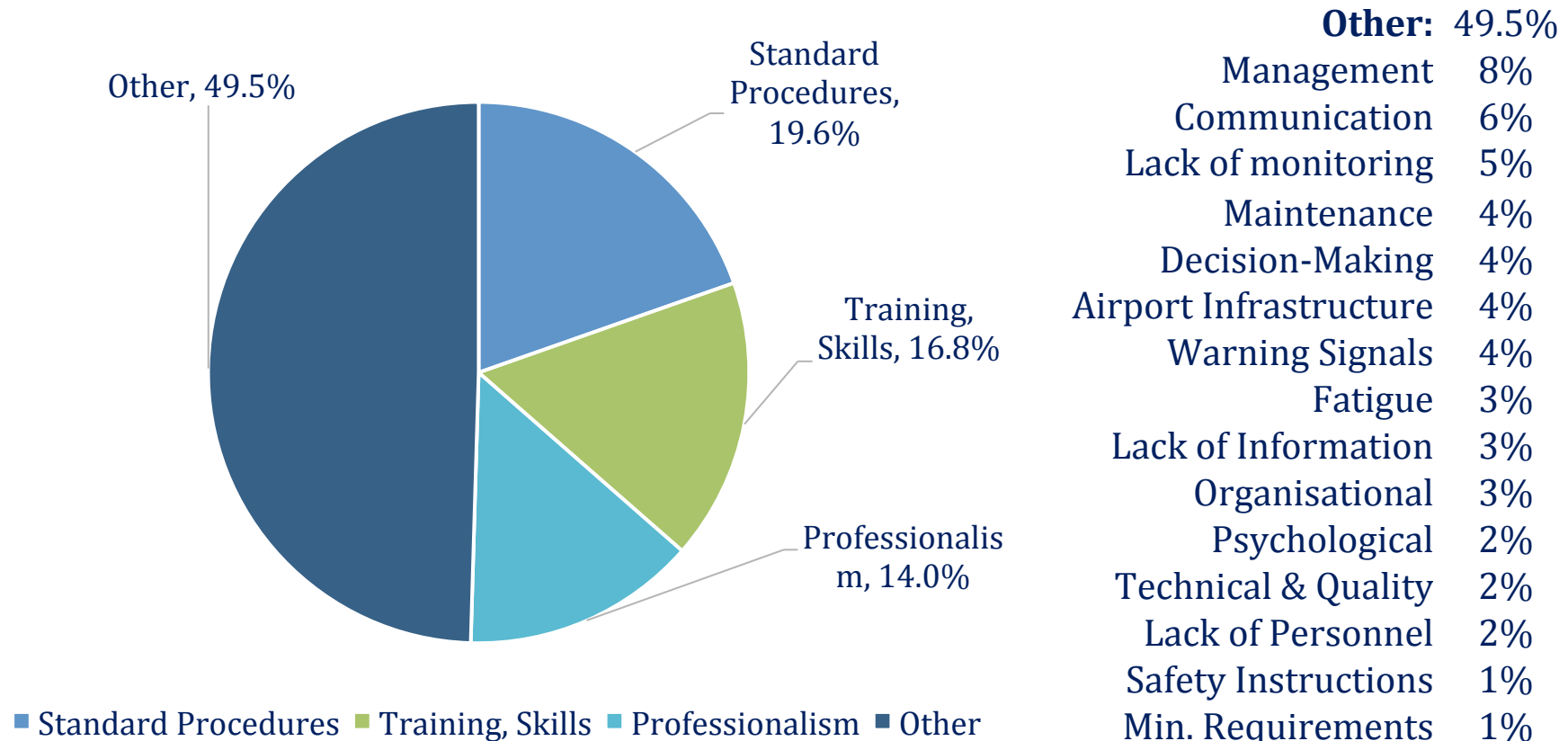


# Actors' involvement in the accidents



- Shared accountability
- Human Redundancy Issue

# Accident Causes – Human Error



- Lack of culture of reporting failures
  - Inability to question authority

HRO attributes Human Errors	Commitment to results and safety	Min. Requirements	Reward systems for reporting failures	Effective communication	Flexible structures & organisational expertise	Culture of continuous learning	In-built redundancy	Outstanding technology	Standard procedures
Standard procedures	X	X	X	X					X
Training and skills	X	X	X			X			
Low levels of professionalism	X	X							
Low levels of flight and/or operational management	X	X	X	X	X				
Poor communication	X			X					
Lack of monitoring of flight parameters	X								X
Airport infrastructure	X							X	
Poor decision-making skills		X		X	X				
Maintenance issues	X		X						
Lack of, or ignored, warning signals			X						
Fatigue							X		
Lack of information			X	X					
Organisational issues					X				
Psychological issues	X	X				X			
Lack of personnel	X	X					X		
Poor technical & quality system	X	X				X		X	
Airport: Lack of minimum requirements		X							

# Discussion

Clearly defined accountabilities, share liabilities

- **Through-Life Accountability**

(Fielder et al., 2014)

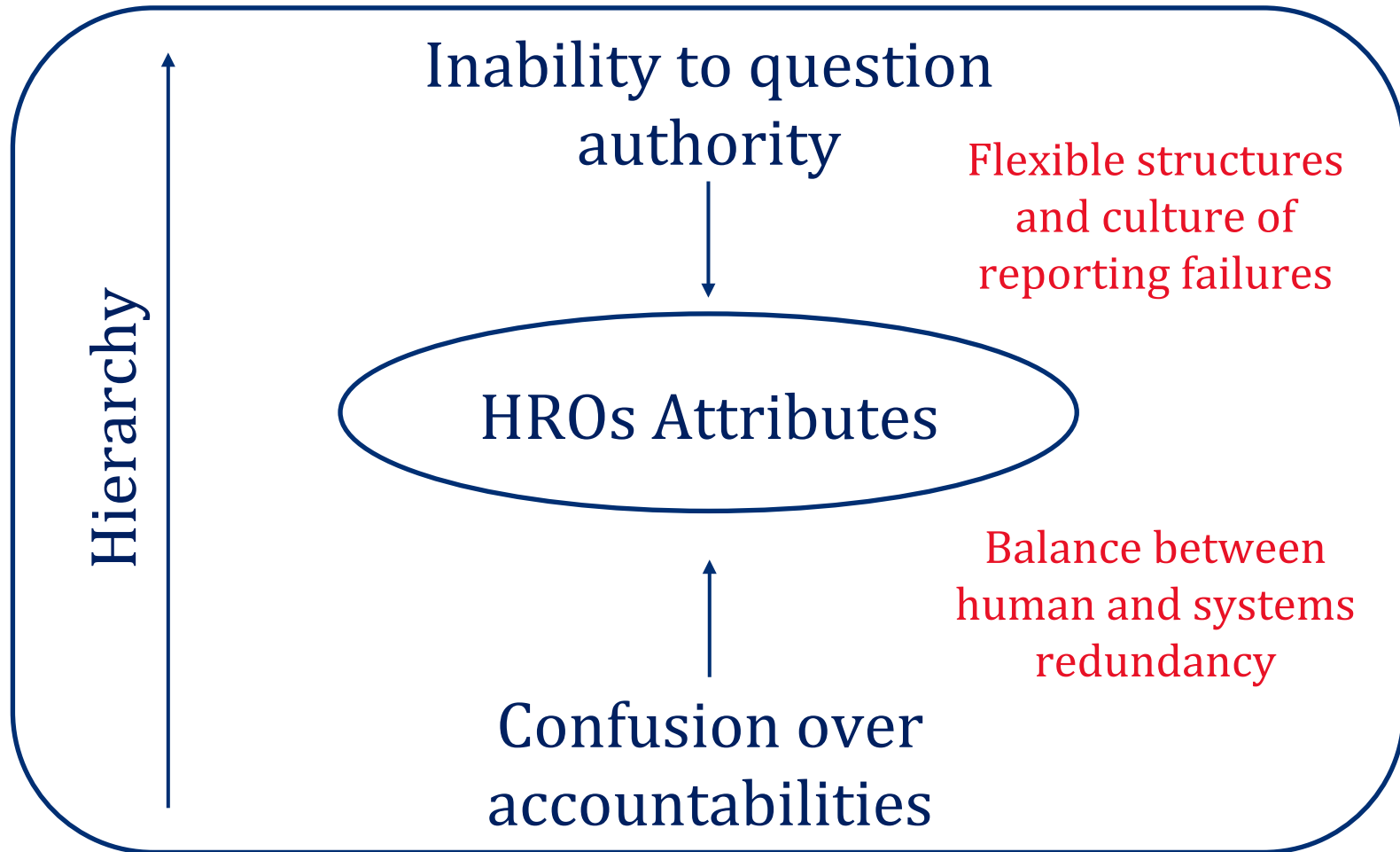
Adopt high-reliability organisations' (HROs) attributes

- **Focus on high-reliability**

(e.g., Tranfield et al., 2003; Hopkins, 2007; Sullivan & Beach, 2009; Saleh et al., 2010; Lekka & Sugden, 2011; Sutcliffe, 2011)

# Framework

Product-service system



# Thank You

## **Through-Life Accountability: Managing complex services**

You can access the full paper [here](#)

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**Prof. Andy Neely, Supervisor**

More Questions?  
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# Forthcoming Webinars

## The Cambridge Service Alliance

Date 14:30hr GMT	Topic	Invited speaker
May 11 <sup>th</sup> 2015	Data and analytics - data-driven business models: A blueprint for innovation	Dr. Mohamed Zaki
June 8 <sup>th</sup> 2015	Through life accountability: managing complex services	Chara Makri
<b>July 6<sup>th</sup> 2015</b>	<b>A capability-based view of service transition</b>	<b>Dr. Ornella Benedettini</b>
Sept. 14 <sup>th</sup> 2015	Critical success factors on the shift to services	Dr. Veronica Martinez
Oct 12 <sup>th</sup> 2015	The transition towards a data-business model	Dr. Mohamed Zaki, Dr. Tor Lillegraven and Prof. Andy Neely
Nov. 16 <sup>th</sup> 2015	Making and sustaining the shift to services in the animal health industry	Dr. Veronica Martinez and Veronique Pouthas
Dec. 14 <sup>th</sup> 2015	The Future of Servitization: The Technologies that will make a difference	Veit Dinges, Florian Urmetzner, Veronica Martinez, Mohamed Zaki, Andy Neely

# References (1/2)

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- Goedkoop, M.J., van Halen, C.J.G., te Riele, H.R.M., Rommens, P.J.M., 1999. Product Service systems, Ecological and Economic Basics, Den Haag.
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# Appendix

# Background



- Motives of servitization:
  - **Strategic, Economic, Environmental**  
(Vandermerwe & Rada, 1988; Wise & Baumgartner, 1999; Goedkoop et al., 1999; Labuschagne & Brent, 2005)
  - Reduce **cost of ownership** for customers  
(Ward et al., 2005)
- Product-service systems:
  - **Long-term** contracts
  - **Large number of suppliers and partners**  
(Neely, 2008)
- Through-life management manufacturer's obligation
  - **Operational, performance, financial** risks  
(Nordin et al., 2011)

# TLA is...

*'...the duty to inform, justify and accept the **consequences of decisions and actions** taken during the entire lifecycle of assets and associated services. Critically it involves understanding the boundaries of and responsibilities for safe and consistent outcome delivery over an extended service contract involving multiple organisations.'*

*(Fielder et al., 2014)*

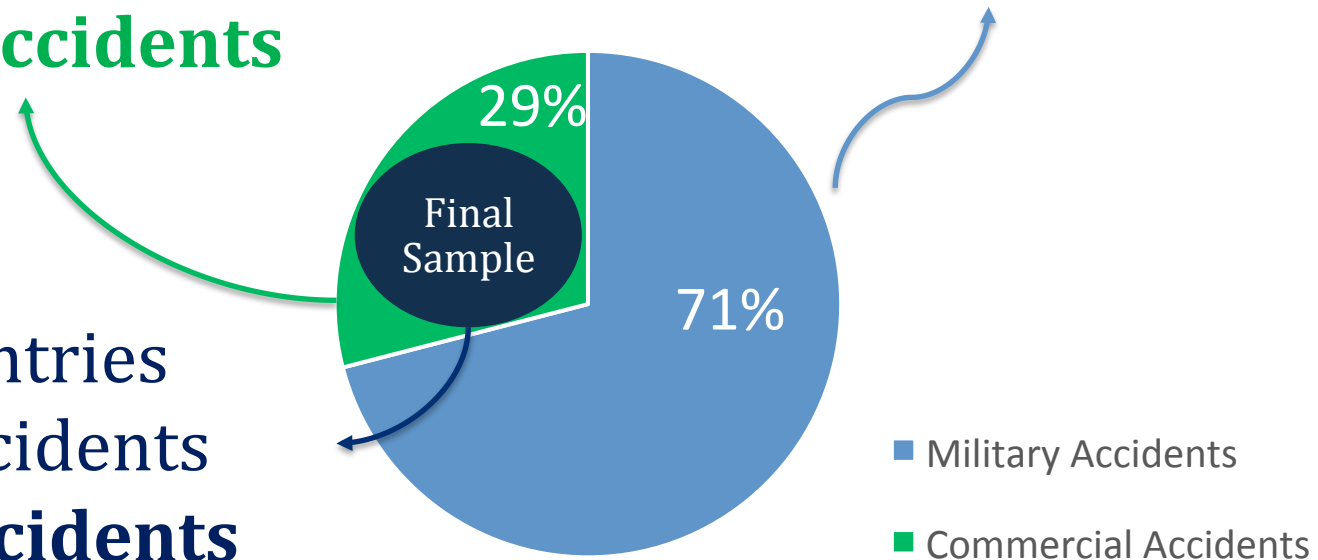
# Data and final sample

## 503 Aircraft Accidents Globally 2006 -2013

- 68 Countries
- 25 Manufactures
- 128 Operators
- **146 Accidents**

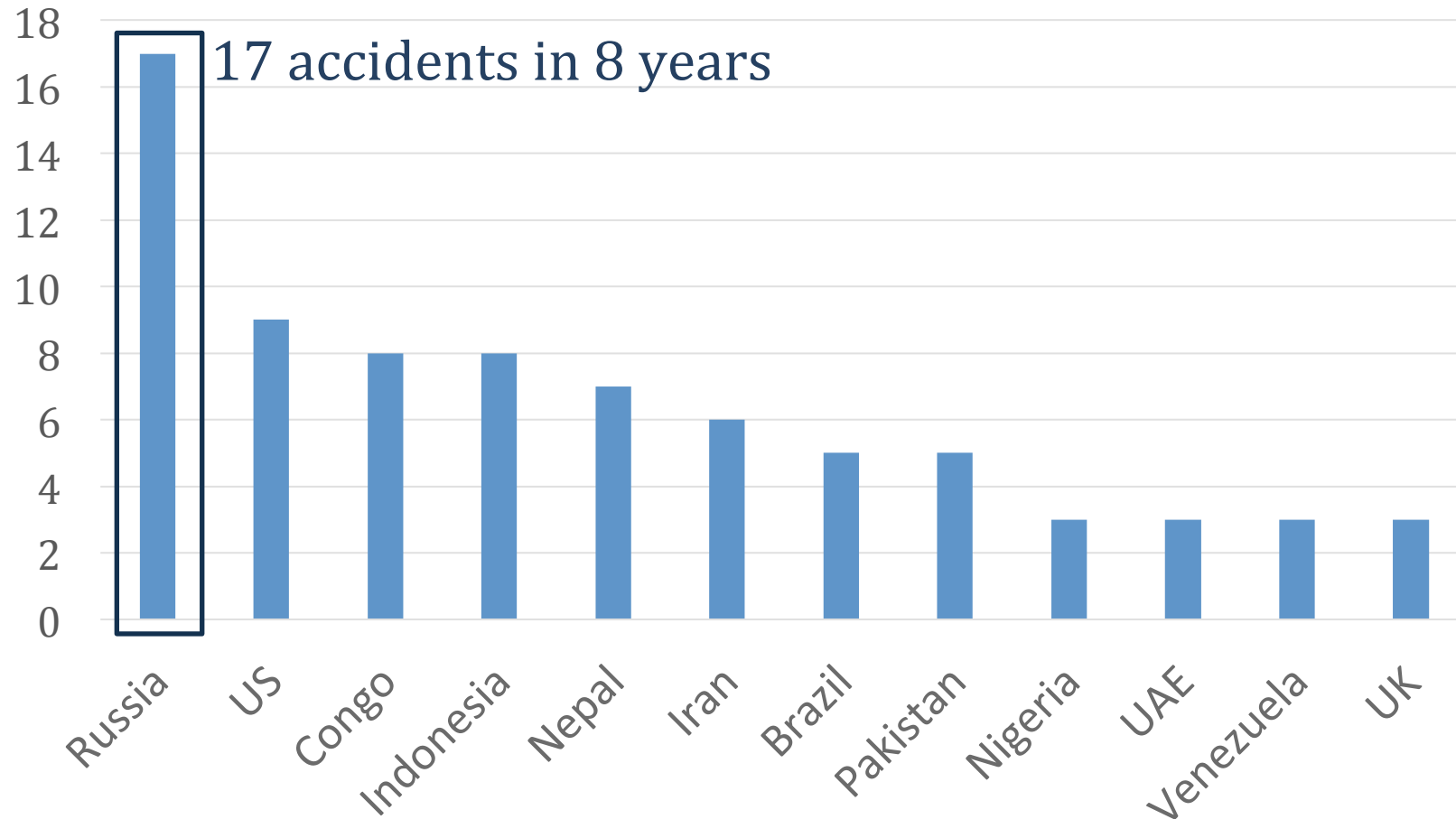
- Limited information
- Confidential reports
- **357 Accidents**

- 6 Countries
- >3 Accidents
- **17 Accidents**

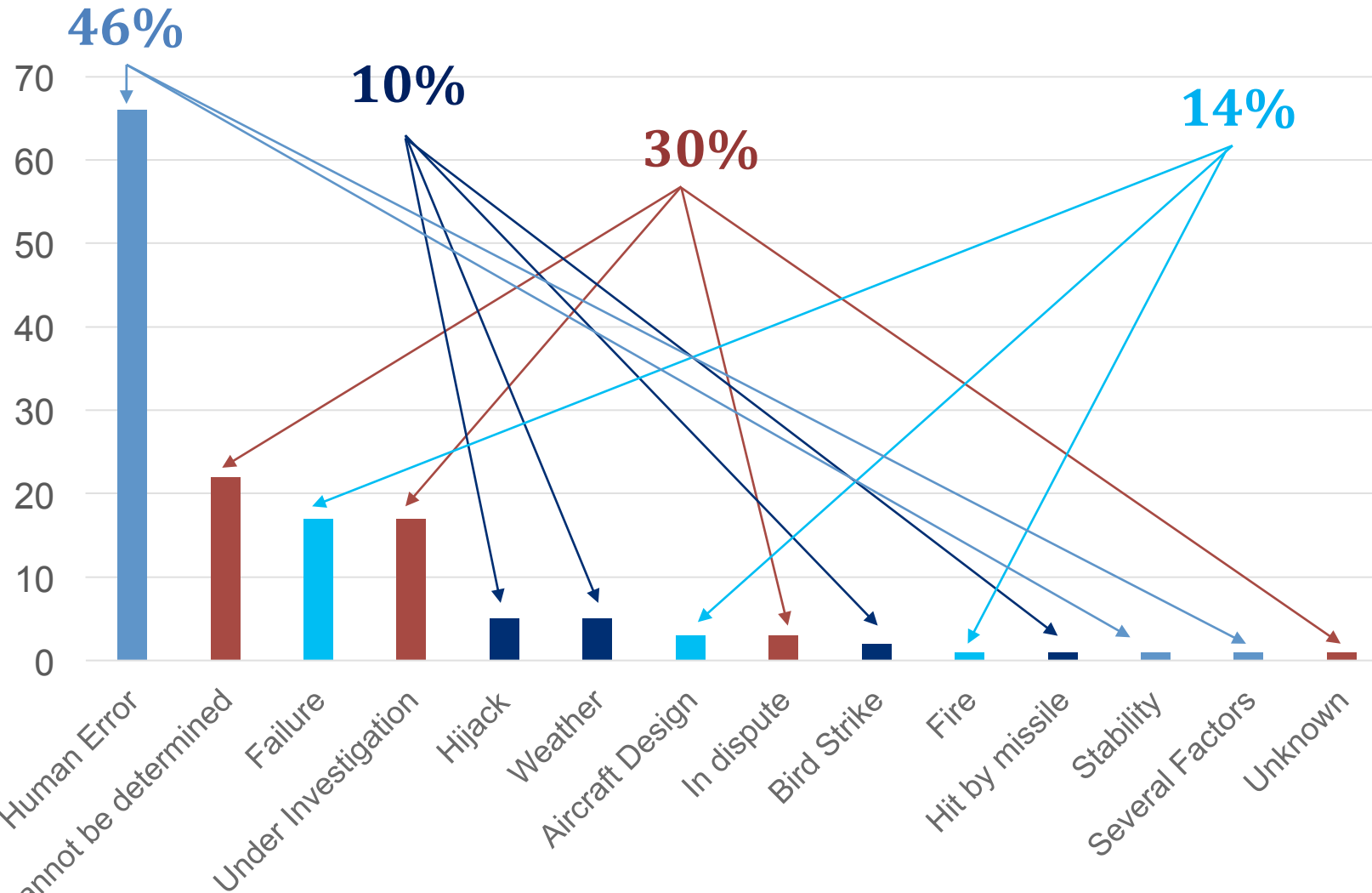


Country	Date of accident	Operator involved	Type of aircraft	Fatalities	Cause of accident	Length of report	Official Regulator
Russia	03/05/06	Armavia	A320	113	Human Error	64	Interstate Aviation Committee
	09/07/06	S7 Airlines	A310	128	Human Error	128	
	14/09/08	Aeroflot	Boeing 737	88	Human Error	141	
	02/04/12	UTair	ATR-72	33	Human Error	207	
USA	27/08/06	Comair	CRJ-100	49	Human Error	174	National Transportation Safety Board
	20/12/08	Continental Airlines	Boeing 737	0	Human Error	117	
	15/01/09	US Airways	A320	0	Bird Strike	213	
	12/02/09	Colgan Air	DCH-8-400	50	Human Error	299	
Indonesia	01/01/07	Adam Air	Boeing 737	102	Human Error	98	National Transportation Safety Committee
	21/02/07	Adam Air	Boeing 737	0	Human Error	26	
	07/03/07	Garuda Indonesia	Boeing 737	21	Human Error	107	
	09/05/12	Shukhoi	SSJ-100	45	Human Error	91	
UK	17/01/08	British Airways	Boeing 777	0	Failure – Engine	243	Air Accidents Investigation Branch
	01/04/09	Bond Helicopters	AS332	16	Failure – Main Gearbox	209	
Brazil	29/09/06	Gol Transportes Aéreos	Boeing 737	154	Human Error	282	Aeronautical Accident Investigation And Prevention Centre
	17/07/07	TAM Airlines	A320	199	Failure - Mechanical OR Pilot Error	119	
Congo	04/04/11	Georgian Airlines	CRJ-100	32	Poor Weather Conditions	68	Ministry Of The Transportation And Ways Of Communication

# Number of accidents per country(>2)



# Common causes of accidents

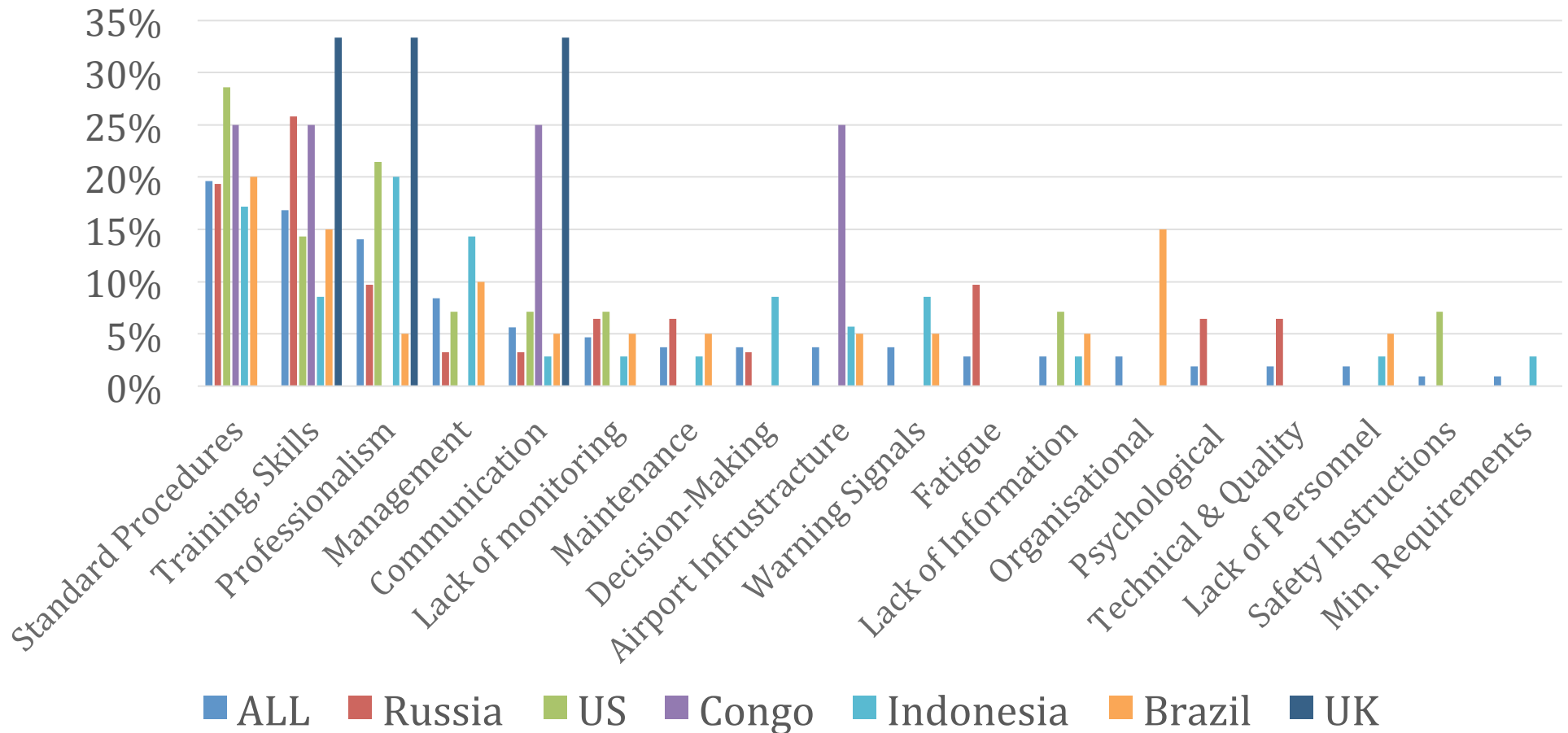




# Frequency of different human errors



Frequency of different human errors - per country



# HROs Attributes



1. Culture of continuous improvement
2. Commitment to procedures, results and safety
3. Shift decision making to experts as required  
Shift between bureaucratic, high-tempo & emergency
4. In-built redundancy in case of failure
5. High technical competence
6. Effective communication
7. Reward Systems for reporting failure and near misses
8. Commitment to standard procedures
9. Establishment of minimum requirements

(e.g. Tranfield et al., 2003; Hopkins, 2007; Sullivan & Beach, 2009; Saleh et al., 2010; Lekka & Sugden, 2011; Sutcliffe, 2011)

# Low levels of professionalism

- *‘During the problems with the navigation instruments the pilots believed they were off track and were concerned and confused, but did not raise any concerns with ATC’*
- *‘The cargo manifest was sent to Yogyakarta from the Garuda office in Jakarta, arriving 33 hours after the accident. A cargo manifest contains vitally important information needed by rescuers and aviation safety investigators in order to know what dangerous goods might be on board an aircraft’*
- *‘The flight crew was not aware of the mountainous area in the vicinity of the flight path due to various factors such as available charts, insufficient briefing and statements of the potential customer that resulted in inappropriate response to the TAWS warning’*

# Types of human errors identified

## ... from the TLA mapping methodology analysis

<b>1. Lack of, or failed to follow, standard procedures</b>	<b>2. Lack of, or poor quality, of training and skills</b>
<b>3. Low levels of professionalism</b>	4. Low levels flight and/or operational management
5. Poor communication	<b>6. Lack of monitoring of flight parameters</b>
7. Airport infrastructure	<b>8. Poor decision-making skills</b>
9. Poor, or lack of, maintenance	<b>10. Lack of, or ignored, warning signals</b>
<b>11. Fatigue</b>	<b>12. Lack of information</b>
<b>13. Organisational issues (e.g., the operator has centralised procedures with no flexibility)</b>	<b>14. Psychological issues (e.g., no proper psychological tests set by operator or psychological break down by the crew)</b>
<b>14. Lack of personnel</b>	<b>16. Poor technical and quality system</b>
<b>15. Lack of minimum requirements at the airport (e.g., minimum altitude)</b>	<b>18. Passengers' limited attention to safety instructions</b>

# Limitations

- Sample only includes aircraft accidents
- Focus only on accident investigation reports
- Number of flying hours is not taken into account

# Suggestions

- Expand sample & include additional sectors
- Use case studies, surveys & service contracts
- Include flying hours in the analysis