The Development of AudEx: An Audit Data Assessment System

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Purpose

- This study:
  - describes the development and implementation of an advanced expert system used as a decision aid by auditors when making fraud risk assessments
  - follows a design science research methodology, as demonstrated for AIS research by *(Peffers et al. 2008; Geerts 2011)*, in describing the system's functionality and evaluation of the system's usefulness

Motivation

- Researchers have highlighted the many benefits in the use of, and robust need for, expert system implementations in the accounting profession *(Hackenbrack 1992; Eining et al. 1997; Rose et al. 2012)*
- Decision aids that make the knowledge and expertise of partners and managers available to all auditors in the firm have the potential of improving auditor judgments of management fraud risk *(Hackenbrack 1992; Eining et al. 1997; Gillett and Uddin 2005)*
- There is a need to develop knowledge structures in a highly complex system *(Rose et al. 2012)*
- The accounting and auditing profession has not been active in adopting previously constructed expert systems *(O'Leary 2003; Rennie and Gibbins 1993)*

Fraud Risk Assessment Literature

- Previous studies include few technologically advanced methods to assist auditors in making fraud risk assessments
- Methods previously used in making fraud risk assessments included:
  - Brainstorming *(Brazel et al. 2010; Hoffman and Zimbelman 2009; Lynch et al. 2009; Carpenter 2007)*
  - Decompose fraud risk cues using the fraud risk triangle *(Wilks and Zimbelman 2004)*
  - Strategic reasoning *(Hoffman and Zimbelman 2009; Asare and Wright 2004)*
  - Nonfinancial measures *(Brazel et al. 2009)*
  - Documentation and priming *(Hammersley et al. 2010)*
  - Fraud risk checklists and program planning tools *(Asare and Wright 2004)*
  - Strategic dependence *(Bloomfield 1997)*

Some Previous Expert Systems Developed for Use in Audit

Study	System Developed	Limitation(s)
Dungan (1983)	Classic expert system with 36 rules – requires many environmental assessments	Since only 36 rules, system is limited in developing various assessments many possible scenarios experienced in audit
Steinbart (1987)	Expert system used as decision aid in making planning-stage materiality judgments	Used only one partner as the expert – limits generalizability across other scenarios
Trewin (1996)	Expertax – trained by both experienced and less experienced accountants	Potential mismatch in the system developing assessments (exp vs. less exp)

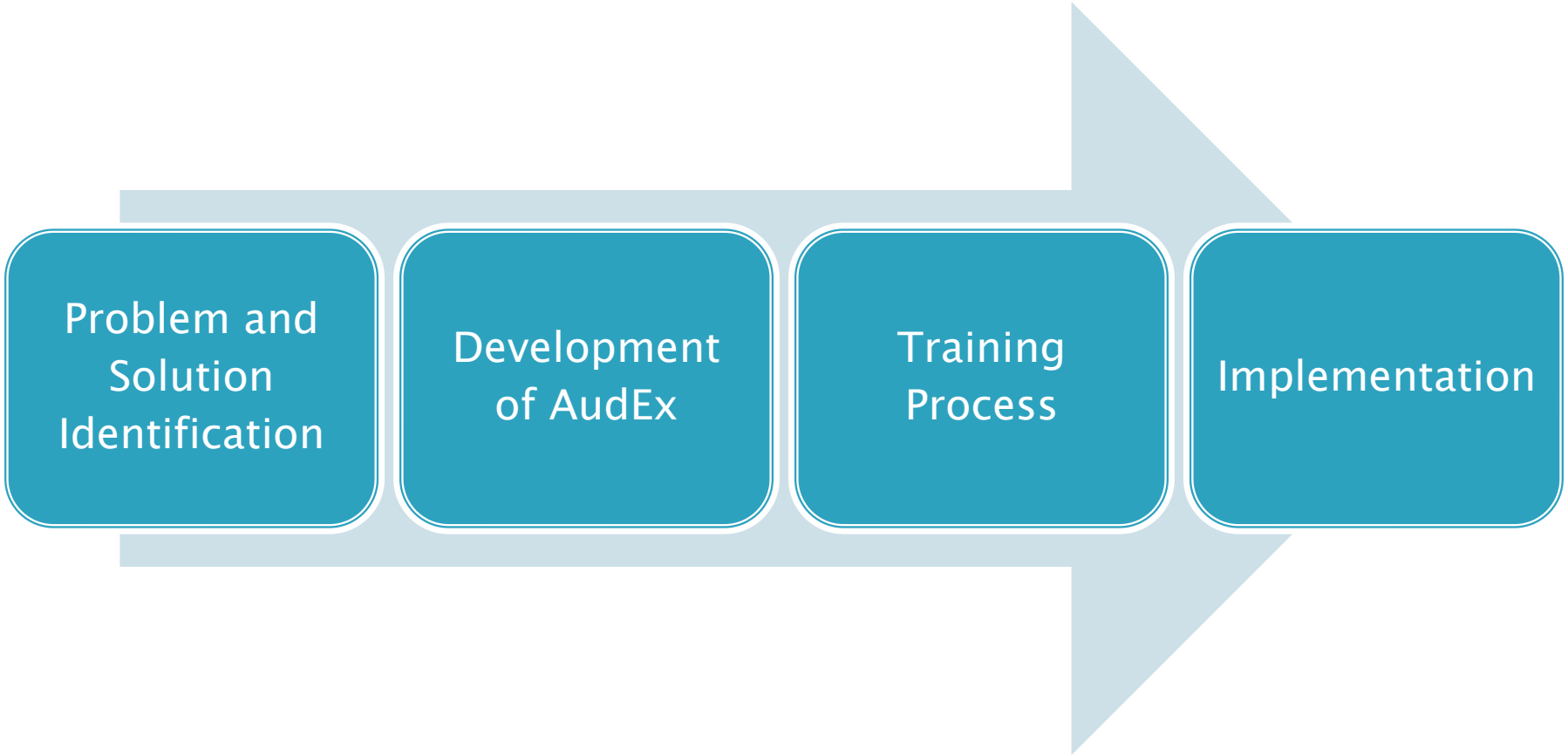
NOTE: Few studies that developed expert systems attempted to account for environmental assessments by using if-then rules *(Hansen and Messier 1986; Dillard and Mutchler 1987; Steinbart 1987; O'leary 2003)*

- Using the if-then rules alone restricts assessments in that the situation must fit into a pre-defined set of rules

Why AudEx

- Unlike previous expert systems in the audit literature (O'Leary 2003; Gregor 2001; Steinbart 1987), **AudEx was designed to aid in risk assessment**, while **helping users learn** about and develop experience in the fraud risk assessment process.
- Using AudEx will **guide the user**, rather than provide the user with a definitive assessment.
- AudEx **interactively takes users through each step of making a risk assessment**, as if an experienced auditor is present teaching the less experienced auditor.
- AudEx **highlights** the area(s) in which the user comes to a **different conclusion(s)** than the range of values proposed by the system, **providing reasoning, rationale, and sources**
- Unlike other expert systems constructed to aid decision-making in auditing, AudEx **captures human expertise** and **effectively augments an auditor's ability to make a fraud risk assessment**

The Lifecycle of AudEx



Problem and Solution Identification

- Problem(s):
  - Recent increase in audit regulations and IFRS convergence approaching
    - One crucial topic, fraud risk, is partially responsible for increased regulation *(Brazel et al. 2010; Wilks and Zimbelman 2004; Hoffman and Zimbelman 2009)*
  - The accounting and auditing profession has had limited success with the development and use of intelligent decision aids *(Hampton 2005)*
- Solution(s):
  - Previous research suggests a flexible expert system used as a decision aid by auditors in making fraud risk assessments would be beneficial.
  - In a broadened search across other industries (i.e. *Conn 2013; Marshall 2012*) the system vMEDEX was discovered
    - vMEDEX was interactive and assisted in training, learning, and understanding, qualities that are consistent with the characteristics desired for fraud risk assessment

Development of AudEx

- Developed a fully functioning, relative to fraud risk assessments, expert system which can be used in the audit industry and has the capability to be reprogrammed for use in different contexts
- Consists of two parts:
  1. Rules-based mechanism, which most expert systems contain
  2. Knowledge discovery, which allows the system to discover and build models of decision making capabilities
- Can be trained to recognize and utilize decision making of any one or group of individuals
- Contains constructive dialogue
  - Constructive dialog creates conversation in which the participants' primary purpose is learning and understanding ***(Eining et al. 1997)***
- Forces auditors to justify final judgments

Training Process

- Trainers: 20 experienced accountants and auditors
  - Averaging 10.32 years experience and 13.21 fraud risk assessments
  - 8 –Big 4; 6 –regional public accounting firm; 4 –private firm; and 2 – internal audit
  - Trained with relevant fraud risk information (i.e. fraud risk assessment cases, fraud risk standards and regulations)
  - A holdout sample was used in validating the system's training
    - No significant differences between the expert system and provided solutions
- Testers: 20 experienced accountants and auditors
  - Averaging 9.8 years of experience and 11.43 fraud risk assessments
  - 12 –Big 4; 4 –regional public accounting firm; 2 –private firm; and 2 – internal audit
  - Tested with 10 fraud risk assessment cases
  - AudEx was able to analyze, grade, and assign an appropriate fraud risk levels to these ten new problems consistent with the textbook solution's assessment

Oltrak, Inc. (a publicly traded company) is one of the leading global electronic security companies in the world. Oltrak designs, manufactures, markets, sells and services innovative electronic products and systems for security and surveillance, industrial video and professional audio markets worldwide. These products and systems include video monitors, switchers, quad processors, digital and analog recorders, multiplexers, video transmission systems, cameras, lenses, observation systems, audio equipment and accessories. Customers range from single location mom-and-pop businesses to universities and government facilities. Sales to the professional security markets are through the Company's channel partners. The Company has increased sales from $1.8 million to $210 million over the last 20 years.

FRAUD RISK ASSESSMENT FORM

QUESTIONNAIRE / ASSESSMENT

Based on the background information provided for Oltrak Inc., please note if the following factors were present for Oltrak, Inc. If present, please rate from 1 (extremely unimportant) to 7 (extremely important) how important each one is in making a fraud risk assessment.	
Domineering management behavior displayed in dealing with the auditor, especially involving attempts to influence the scope of the auditor's work.	(0) Not Present
Unusual rapid growth or profitability, especially compared with that of other companies in the same industry.	(0) Not Present
Excessive interest by management in maintaining or increasing the entity's stock price or earnings trend.	(2) Very Unimportant
Frequent disputes with the current or predecessor auditor on accounting, auditing, or reporting matters.	-- No Selection --
Lack of monitoring of controls, including automated controls and controls over interim financial reporting (where external reporting is required).	
Difficulty in determining the organization or individual(s) that control(s) the entity.	
Formal or informal restrictions on the auditor that inappropriately limit access to people or information or the ability to communicate effectively with the board of directors or audit committee.	-- No Selection --

-- No Selection --
(0) Not Present
(1) Extremely Unimportant
(2) Very Unimportant
(3) Somewhat Unimportant
(4) Neutral
(5) Somewhat Important
(6) Very Important
(7) Extremely Important

Implementation – Is AudEx Effective?

- Less experienced auditors made more appropriate fraud risk assessments when using the expert system, as compared to not using the expert system *(Lombardi 2013a)*
- Using AudEx as a decision aid in making fraud risk assessments mitigated auditor judgment biases demonstrated by less experienced auditors – the dilution effect *(Lombardi 2013a)* and acceptability heuristic *(Lombardi 2013b)*

Implementation – Participant Feedback

- Contrary to previous expert system development literature, Lombardi (2013a, 2013b) provides support that users would use AudEx in practice

	Average Participant Responses		
	Lombardi (2013a)	Lombardi (2013b)	Significant Difference Noted
How important was AudEx in making fraud risk assessment?	5.52*	5.18*	NO
Should AudEx be used in practice?	6.09**	5.82**	NO
What would you modify about AudEx?	No Changes	No Changes	N/A
What issues did you encounter while using AudEx?	Slow to Load***	Slow to Load***	N/A

*Likert scale from 1 (extremely unimportant) to 7 (extremely important)

**Likert scale from 1 (extremely unlikely) to 7 (extremely likely)

***Note this issue was entirely due to the limited configuration of the test server

Conclusion

- AudEx was also able to build a non-linear, complex model of the decision-making process and identify hidden patterns and relationships within the datasets between the different types of questions (i.e. relevance between one to another and how they all affect each other)
- Implementation findings support that AudEx not only works well as a decision aid in making fraud risk assessments, but also that practitioners support its use in practice
- Other expert systems that were tested in previous studies were not implemented in practice and do not include evidence of practitioners' opinions of using them
- Future research should build upon AudEx's ability to serve as a decision aid in making a fraud risk assessment and expand to other audit areas

Thank you