Motivating the Citizens to Transact with the Government Through a Gamified Experience

Vasileios Yfantis, Klimis Ntalianis, Peter A. Xuereb, and Lalit Garg

Abstract— The current paper explores the implementation of gamification in the government as a way to win back trust from the citizens. The motivation of the citizens to interact with the public authorities through e-government, requires a suitable gamification framework. Octalysis framework is chosen among the available gamification frameworks due to its motivation orientated nature. Octalyis is used a tool for a pilot study to gamify the Greek taxation information system TAXIS and reveals that TAXIS requires entertaining web aspects for its long term use by the citizens.

Keywords— Gamification, Social Trust, Social Computing, Motivation, E-government.

I. INTRODUCTION

THE mutual trust between two parties is established by relying on each other's actions and mitigating the risk of events that can affect negatively the interests of both parties. Although, on humanitarian level this is a simple concept, when one of the parties is an organization then the situation becomes complex. The argument behind this complexity is the fact that an organization is an entity consisting of many people with different modes of thought. A public organization might have multiple stakeholders with different interests, how easy is for citizens to trust it based on their personal interest?

Trust in the government is an issue that has been explored from several scholars from different perspectives [1], [2], [3]. Moreover, it is really important to also examine the research that was conducted by reputable organizations such as The Organisation for Economic Co-operation and Development (OECD). According to an OECD research that was published in 2017, only 43% of the citizens trust their government [4]. Also in the same research it is obvious that the citizens trust the public services more than the government itself. The lack of trust from the citizen's side (social trust) is an issue that government has to deal with.

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Several scholars have identified causes of insufficient trust in the government, such as financial spending in wrong sectors [5], [6]. OECD supported the argument that six areas would help government to win back trust: Reliability, Responsiveness, Openness, Better regulation, Integrity & fairness, Inclusive policy making [7]. Those six areas of government's behavior could be implemented by an innovative way of delivering the services because innovation creates value and sustains a competitive advantage [8].
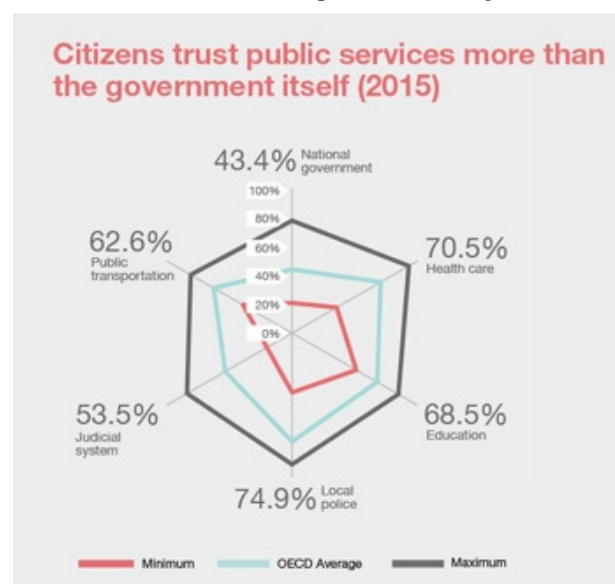

Fig. 1 Trust in the government according to OECD (Source: OEECD)

Nowadays, governments are trying to become trustworthy and improve citizens' lives by using innovative methods of delivering electronically the public services. A recent report by OECD acknowledges the key trends of innovation in government, on three levels: Identity, system and approaches, inclusiveness and vulnerable populations [7]. The concept of the digital identity is recognized as a requirement for the citizens and the businesses to transact with the government and identify their unique skills and experiences. One of the key trends for the exploration of the identity in the public administration is the use of the digital badges. The Belgian federal agency Selor launched Be Badges, a platform where employers, schools and training centers can officially identify skills and experiences earned by individuals [7]. Be Badges is a series of portable badges with embedded metadata about the skills and the experiences of the citizens.

II.   GAMIFICATION IN THE GOVERNMENT

The use of badges along with other game elements such as leaderboards, points and challenges are elements of the concept known as gamification [8]. Gamification is defined by Deterding and other scholars as "the use of game design elements in non-game contexts" [9].

The implementation of gamification in the government is still a problem because it is hard to persuade the executives about the value of this concept. Tolmie and other scholars believe that gamification in relationship with e-government have not been researched extensively [10]. However, several scholars argue that gamification affects positively the operation of the government. Escoban and Urriago in 2014 published a paper where they discuss about the potentiality of the gamification in the public sector as a tool of engagement [11]. Moreover, according to Coronado, gamification is a useful tool to promote civic engagement and improve the relationship between the citizens and the government [11].

Except the conceptual approach of gamification in the public sector, there are governmental entities who decided to implement it practically. An example of gamification in the government, is the gamification of education. Eric Nelson, a teacher at North Lakes Academy Charter School in Forest Lake, Minnesota created an online game called Fantasy Geopolitics [12]. The scope of this game was to make high school students familiar with the world news and encourage them gamify the news stories. During the session of the game, the students choose a team of three countries and they win points for every mention of a country in a news story [12]. Nelson started a crowdfunding campaign at Kickstarter.com and managed to gather $12,706 by 12 contributors who helped bring this project to life.

Points are a game element or goal metric that is used to measure the performance of the players [13]. Several scholars did not find a positive effect of points on performance [14] and intrinsic motivation [15] while testing points as a tool on education. However, it seems that there is limited research on the impact of points in the context of e-government level and it worth exploring it.

The Hawaiian government introduced a gamified system called "My.hawaii.gov" in order to persuade the citizens to adopt the e-government services. One of the game elements was a progress meter at the Business One-Stop section which showed users the stages they reach in completing the required information [16]. Moreover, the designer added a points system which showed how much paper, miles and other resources are saved by conducting e-government transactions. Specifically, the scope of the government was to create a one stop shop for the available online services and notify the citizens about the resources they save by using this platform [17]. Keone Kali, the State of Hawaii Chief Information Officer (CIO), stated that they applied game-design thinking so as to make resources more engaging [18]. Kali admitted that the result was a 20 percent increase in adoption over one year.

The civic engagement that the Hawaiian authoririties tried to implement through gamification is a topic that several scholars have examined. Kahne and other scholars argued that there is a positive correlation between teen engagement games and political engagement [19]. Therefore, Gordon and Hassan state that civic games create civic engagement and increase trust in the government [20],[21]. If gamification affects trust as the scholars state, then it worths exploring it to reduce the lack of trust mentioned previously. However, the problem lies in the fact of how to transform a governmental site with the use of gamification, so that social trust is cultivated and social computing methods grow ?

Fig. 2 My. Hawaii.gov website (Source: https://portal.ehawaii.gov)

A discussion of tranforming the e-government services through gamification, has started by Al-Yafi and El-Masri [22]. The authors suggest "gamification as a facilitator to enhance the maturity level of current e-Government systems" [22]. The maturity of e-government as is proposed by Layne and Lee refers to the level of the e-government completeness from a technical and organizational perspective [23]. Apparently, in their words, the transformation of e-government services through gamification lead to the completeness of e-government. Al-Yafi and El-Masri, add that the transformation of e-government could be implemented with personalized e-government services. By taking into account the research of of Din and Keh, the personalized services have a high impact on people with hedonic goals [22]. Consequently, gamification which is based on the hedonic function of gaming [24], could be used as a tool for personalized services and e-government completeness.

III.   CHOOSING A GAMIFICATION FRAMEWORK

The choice of gamifying the e-government services requires the appropriate design framework of gamification. Before we result in the chosen model, we have to define the goal of the system and perform a literature review of the available systems. The scope of the gamified system is to win back trust in the government since lack of trust is a big issue as it is analyzed at the introduction part.

Mora and other researchers performed a literature review of the available design frameworks for gamification [25]. The authors initially identified twenty one design frameworks but they ended up at eighteen frameworks that included the definition of a formal structure. The remaining eighteen frameworks were categorized based on five categories of design elements [25]: 1.Economic, 2.Logic, 3. Measurement, 4. Psychology, 5. Interaction. While all these frameworks have its advantages and disadvantages, we decided to use a model that emphasizes on motivation. The reasoning behind this decision is the fact that motivation has affected positively trust and adoption of information systems [26], [27]. So, motivation as a gamification aspect is important to create trust between the citizens and the government. The design framework which is mainly focused on motivation is the Octalysis framework by Yu-kai Chou [28].

Fig. 3 Octalysis gamification framework (Source: http://yukaichou.com)

Octalysis is using the process of "Human-Focused Design," instead of the "Function-Focused Design" as the author states [28]. This is a process which focuses on human motivation and not on efficiency because efficiency is just a speedy type of getting the things done. Thus, Octalysis includes eight core drives on design level:

A. Epic Meaning & Calling

This is the core drive where the player feels that he was chosen to do something great. This type of players is a community driven person and he spends a lot of time creating things for the benefit of the community.

B. Development & Accomplishment

This is the core drive where the player intends to progress, develop skills and face challenges.

C. Empowerment of Creativity & Feedback

This is the core drive when players try to solve problems by using different combination s of knowledge, so they have to be creative. Moreover, during this drive, players require feedback about their creative actions.

D. Ownership & Possession

This is the core drive where the players feel that they own something and improve it. On gamification level, virtual goods have to be offered to the user a type of ownership.

E. Social Influence & Relatedness

This core drive includes all the social elements that influence the player, including: Companionship, social responses and competition.

F. Scarcity & Impatience

This is the core drive where the players need something because they do not have it available at the moment. For instance, the system offers a reward to the user of he/she is going to log into the system afterwards.

G. Unpredictability & Curiosity

This is the core drive when the user remains focused on the flow of the system because he/she does not know what is going to happen next.

H. Loss & Avoidance

This is the core drive which depends on the avoidance of a negative incident. The system's user may afraid of losing data unless he acts immediately regarding a technical issue.
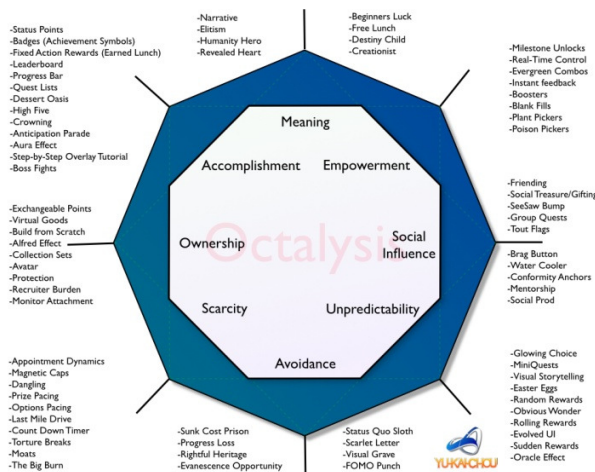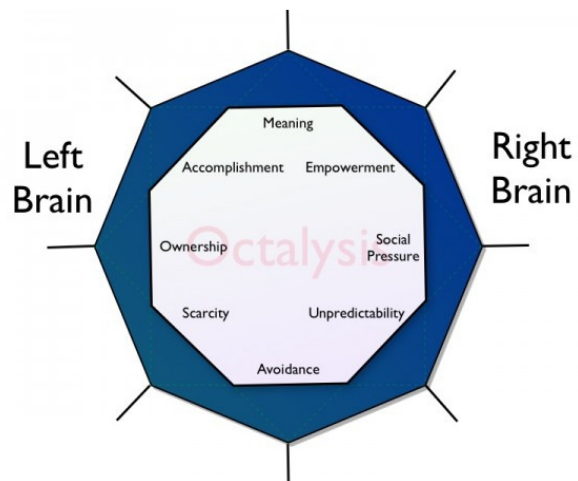

Fig. 4 Left and Right Brain Drives (Source: http://yukaichou.com)

Another categorization of the core drives according to Yu-kai Chou, is the set of Left Brain and Right Brain core drives. The Right Brain drives of the Octalysis model are the drives that are relevant to the creativity, self-expression, and social aspects. The Right Brain drives are based on intrinsic motivation [29]. Intrinsic motivation is the motivation to adopt a type of behavior due to internal rewards. If the Octalysis

model is examined by detail, then factors such as unpredictability and empowerment are considered internal aspects that could motivate the system's user. The Left Brain drives of the Octalysis model are relevant to the logic, calculations, and ownership. These drives are based on extrinsic motivation [30]. Extrinsic motivation is the motivation to adopt a type of behavior due to external rewards such as money, fame and other external aspects. On Octalysis model, extrinsic motivation refers to adopt a behavior because you want to own something.

Thus, there is the categorization of the core drives on Black Hat and White Hat drives. White Hat drives are the drives that are considered positive motivations, while the Black Hat drives are considered negative. White Hat drives include drives that refer to positive motivations such as creativity, meaning and accomplishment. On the other hand, Black Hat drives include motivation with a negative nature such as avoidance, scarcity and unpredictability.
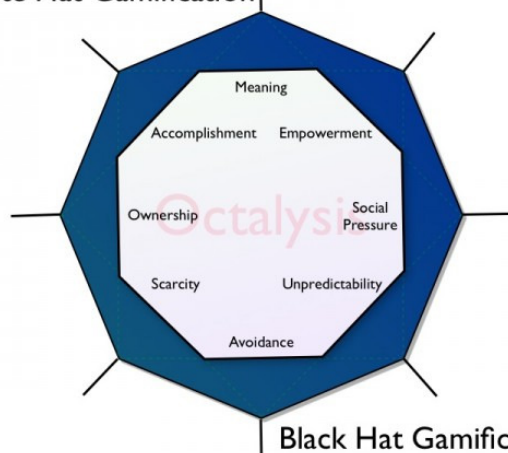

Fig. 5 Black and White Hat Brain Drives (Source: http://yukaichou.com)

IV. APPLYING THE GAMIFICATION FRAMEWORK

The choice of the Octalysis framework for the implementation of Gamification in the public sector is based on the fact that it is a motivation orientated model and motivation leads to the establishment of trust. If the goal is win back trust in the government, then it is required to identify the public services with less trust from the citizen's side.

The country of Greece is chosen as an example due to the available statistics from international organizations that show the country's low performance on e-government acceptance and trust in the government. According to the available statistics about Greece from the most recent OECD report in 2017 [31]:

A. Low adoption of innovation

There has never been a strategy/policy in place for innovative goods, which means that there is low trust in new technologies and other forms of innovation.

B. Low adoption of e-government

Only the 26% of the Greek individuals are using the Internet for sending filled forms via public authorities' websites in the past 12 months of 2016.

C. Low trust in the government

Only the 13% of the Greek citizens are satisfied from the general government.

The performance of Greece in terms of low trust, innovation and e-governance construct an interesting case study for the use of gamification. In order to gamify a Greek authority website with the Octalysis framework, we have to identify which of the core drives are present in the website. Then, we evaluate how strong the website is based on the existence of the core drives in the website's operation. Although evaluation is a method with strict criteria, it would be interesting to implement a pilot study by evaluating a public authority website based on the online tool of Octalysis which could be found here: http://www.yukaichou.com/octalysis-tool/.
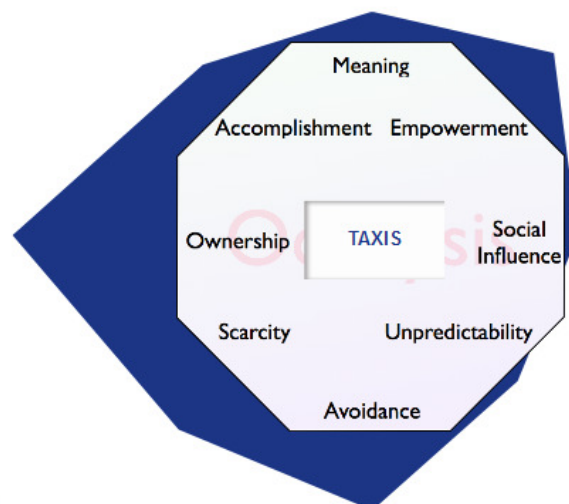

Fig. 6 TAXIS on Octalysis level

The choice of the Greek public site is TAXIS (gsis.gr), the Greek taxation information system provided by the Ministry of Finance. Several authors such as Gouscos, have explored the evolution of TAXIS by focusing on the system's e-government elements [32]. Additionally, Tsiavos and other researchers explored Taxis and found that the system reduced the queues at the public offices [33]. Moreover, Floropoulos with other scholars performed an empirical research and found that in TAXIS there are strong connections between the constructs of information, system and service quality, perceived usefulness and user satisfaction [34]. One of the constructs which was not supported in this research, was that TAXIS system's quality affects the user's satisfaction. As system quality, it is considered the performance of the system towards transferring the symbols of communication [35], including interaction of the system [36] and user friendly interfaces [37]. Octalysis might be a gamification tool that could have an impact on the interaction of TAXIS by

including Black Hat core drives that force the citizen to interact with the system in order to avoid a fine. Thus on White Hat drive level, missions of accomplishment could enhance the users to interact with the system so as to be proud of their achievements. Regarding a user friendly interface, counters that show the percentage of a tax filling process would make the interface an entertaining interface. Based on the subjective observation of TAXIS, we result in the schema and score of the system illustrated in Figure 6.

The total Octalysis score for TAXIS is 181 if we rate each core drive from 0 to 10, based on the drive's performance in the system. White Hat and Black Hat core drives are almost balanced, while Left Brain drives are stronger than the Right Brain drives. This means that the user's experience is mainly based on extrinsic motivation and once a task has been accomplished, users will not visit TAXATION again. Probably, we have to add more Right Brain core drives in order to make the system entertaining and enhance the users to log in the system more frequently.

V. CONCLUSIONS AND FUTURE WORK

We explored the lack of social trust in the government by suggesting gamification as a tool to win back trust from the citizen's side. The implementation of gamification in the government still lacks behind compared with private sector; however several governments have already tried it. The lessons we learned from its implementation are very impressive, resulting in: (a) less queues at the public offices, (b) saved resources and (c) many more social computing capabilities.

The implementation of gamification is the public sector requires a motivation orientated framework to affect the motivation of the citizens to transact online with the authorities. Octalysis is a suitable model because it includes aspects of intrinsic and extrinsic motivation that may affect trust in the government. We performed a pilot study to gamify the Greek taxation information system with the help of Octalysis. The results reveal the advantaged and disadvantages of the system including the focus of the system's designer on extrinsic motivation aspects.

The next step for our work is to create a new public service based exclusively on the Octalysis model and the mission of this service. Hypothetically, this action could be implemented by outsourcing the design tasks at web designers as a mission of crowdsourced gamification. Moreover, we can improve the Octalysis model by taking into account the experience gained from the construction of the website and the user's feedback.

REFERENCES

[1] S. Walle, "Explaining Citizen Satisfaction and Dissatisfaction with Public Services" In The Palgrave Handbook of Public Administration and Management in Europe, E. Ongaro, & S. Thiel. London: Palgrave Macmillan, 2018, pp. 227-241.

[2] I. Mehree, N. Nabila, & R. Afrin, "E-Government Service Adoption and the Impact of Privacy and Trust" In Encyclopedia of Information Science and Technology, Fourth Edition, M. Khosrow-Pour, Hershey: IGI Global, 2018, pp. 3579-3590.

[3] M. Parent, C. Vandebeek, & A. Gemino, "Building Citizen Trust Through e-Government," Government Information Quarterly, vol. 22, pp. 720-736, December 2005.

[4] OECD, Trust and Public Policy: How Better Governance Can Help Rebuild Public Trust. Paris: OECD Publishing, 2017.

[5] J. Nye, P. Zelikow, & D. King, Why People Don't Trust Government. Cambridge: Harvard Press, 1997.

[6] M. Baldassare, California in the New Millennium: The Changing Social and Political Landscape. Berkeley: University of California Press, 2000.

[7] OECD, Embracing innovation in government: Global trends 2018 report. Paris: OECD Publishing, 2017.

[8] A. Baregheh, J. Rowley, & S. Sambrook, "Towards a multidisciplinary definition of innovation," Management decision, vol. 47, pp. 1323-1339, 2009.

[9] S. Deterding, D. Dixon, R. Khaled, & L. Nacke, "From game design elements to gamefulness: defining gamification," in Proc. of the 15th international academic MindTrek conference: Envisioning future media environments, Tampere, 2011, pp. 9-15.

[10] P. Tolmie, A. Chamberlain, & S. Benford, "Designing for reportability: sustainable gamification, public public engagement, and promoting environmental debate," Personal and Ubiquitous Computing, vol. 18, pp. 1763-1774, October 2014.

[11] J. Escobar, & A. Urriago, "Gamification: an effective mechanism to promote civic engagement and generate trust?" in Proc. ICEGOV '14 Proceedings of the 8th International Conference on Theory and Practice of Electronic Governance, Guimaraes, 2014, pp. 514-515.

[12] K. Bohyum, "Gamification in Education and Libraries," Library Technology Reports, vol. 51, pp. 20-28, February 2015.

[13] P. Zagal, M. Mateas, C. Fernandez-Vara, B. Hochhalter, & N. Lichti, "Towards an ontological language for game analysis," in. Proc. of International DiGRA Conference: Changing Views – Worlds in Play, Vancouver, 2005, pp. 3–14.

[14] Y. Attali, & M. Arieli-Attali, "Gamification in assessment: Do points affect test performance?," Computers & Education, vol. 83, pp. 57-63, April 2015.

[15] E. Mekler, F. Brühlmann, K. Opwis, & A. Tuch, "Do points, levels and leaderboards harm intrinsic motivation?: an empirical analysis of common gamification elements" in Proc. of the First International Conference on Gameful Design, Research, and Applications, Toronto, 2013, pp. 66-73.

[16] S. Bhagowalia. (2014, November). 3 Lessons Hawaii Learned from Gamifying Government. TRANSFORM HAWAI'I GOVERNMENT. [Online]. Available: http://transformhawaiigov.org/3-lessons-hawaii-learned-from-gamifying-government/#more-443

[17] M. Zica, A. Ionica, & M. Leba, "Gamification in the context of smart cities" in Proc. International Conference on Applied Sciences (ICAS2017), Hunedoara, 2018, p. 012045.

[18] NIC Inc. (2015, February). My.hawaii.gov Recognized as 2015 Harvard Ash Center Bright Idea in Government. NIC [Online]. Available: https://www.egov.com/news/press-releases/2015/02/23/my-hawaii-gov-recognized-as-2015-harvard-ash-center-bright-idea-in-government

[19] J. Kahne, E. Middaugh, & C. Evans, The civic potential of video games. Cambridge: MIT Press, 2009.

[20] E. Gordon, S. Walter, & P. Suarez, Engagement games: A case for designing games to facilitate real-world action. Boston: EGL, 2014.

[21] L. Hassan, "Governments should play games: Towards a framework for the gamification of civic engagement platforms". Simulation & Gaming, vol. 48, pp. 249-267, December 2016.

[22] K., Al-Yafi, & M. El-Masri, "Gamification of e-Government Services: A Discussion of Potential Transformation," in Proc. Twenty-second Americas Conference on Information Systems, San Diego, 2016, pp. 1-9.

[23] K., Layne, & W. Lee, "Developing fully functional e-government: A four stage model," Government Information Quarterly, vol. 18, pp. 122-136, Summer 2001.

[24] F. Xu, D. Buhalis, & J. Weber, "Serious games and the gamification of tourism," Tourism Management, vol. 60, pp. 244-256, June 2017.

[25] A. Mora, D. Riera, C. Gonzalez, J. Arnedo-Moreno, "A literature review of gamification design frameworks" in Proc. 2015 7th International Conference on Games and Virtual Worlds for Serious Applications (VS-Games), Skövde, 2015, pp. 1-8.

[26] A., Akhlaq, & E. Ahmed, "The effect of motivation on trust in the acceptance of internet banking in a low income country" International Journal of Bank Marketing, vol. 31, pp. 115-125, 2013.

[27] A. Alalwan, K. Dwivedi, P. Rana, B. Lal, & D. Williams, "Consumer adoption of Internet banking in Jordan: Examining the role of hedonic motivation, habit, self-efficacy and trust," Journal of Financial Services Marketing, vol. 20, pp. 145-157, June 2015.

[28] Y. Chou, (2013). Octalysis – complete Gamification framework. Yu-kai Chou: Gamification & Behavioral Design [Online]. Available: http://yukaichou.com/gamification-examples/octalysis-complete-gamification-framework/#more-2275

[29] M. Ryan, & L. Deci, "Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being," American psychologist, vol. 55, pp. 68-78, February 2000.

[30] J. Vallerand, "Toward a hierarchical model of intrinsic and extrinsic motivation,"Advances in experimental social psychology, vol. 29, pp. 271-360, December 1997.

[31] OECD, Government at a Glance 2017. Paris: OECD Publishing, 2017.

[32] D. Gouscos, G. Mentzas, & P. Georgiadis, "Planning and implementing e-Government service delivery: Achievements and learnings from on-line taxation in Greece," in Proc. of the 8th Pan-Hellenic Conference on Informatics, Nicosia, 2001, pp. 439-446.

[33] P. Tsiavos, S. Smithson, & S. Kotyvos, "A path of discontinuity: The TAXIS case as a transition from e-Government to e-Regulation," in Proc. Legal Knowledge and Information Systems. Jurix 2002: The Fifteenth Annual Conference, Amsterdam, 2002, pp. 53-62.

[34] J. Floropoulos, C. Spathis, D. Halvatzis, & M. Tsipouridou, "Measuring the success of the Greek taxation information system," International Journal of Information Management, vol. 30, pp. 47-56, February 2010.

[35] E. Shannon, & W. Weaver, The mathematical theory of communication, Urbana: University of Illinois Press, 1949.

[36] A. Maes, & C. Poels, "Evaluating quality of conceptual modelling scripts based on user perceptions," Data and Knowledge Engineering, vol. 63, pp. 769–792, 2007.

[37] E., Bailey & W. Pearson, "Development of a tool for measuring and analyzing computer user satisfaction," Management Science, vol. 29, pp. 530-545, May 1983.

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