EXTENT OF THE APPLICATION OF LESSONS LEARNED IN CONSTRUCTION PROJECTS: THE NIGERIAN EXPERIENCE

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ABSTRACT

The aim of the study is to analyze lessons learned practices as is applicable in the Nigerian construction industry with a view to delivering construction projects to fruition. Specifically the study determines and evaluates the extent of lessons learned effort deployed in construction projects, determine and evaluate the lessons learned enabling tools that would aid in the successful delivery of construction projects in Nigeria. The study deployed a survey research design method, while a snow balling sampling technique was used in arriving at a sample size of 111 respondents from a population of two hundred (200) practitioners consisting of engineers, architects, builders, project managers and quantity surveyors, etc from construction firms located in Port-Harcourt, Rivers State. A questionnaire modeled using a five point Likert scale was used for data collection. The collected data were presented with the aid of figures and charts, while Cronbach's alpha test, frequency distribution, relative importance index were deployed in the analyses of the key issues in the study using IBM SPSS Statistics version 20. The findings from the study show that there is a general low level of application /adoption of lessons learned as affirmed by 80.39% of the respondents, while 85.29% of the respondents have not deployed any lessons learned activity of late. Findings from the use/deployment of lessons learned enabling tools in construction project delivery by the practitioners shows that face to face meetings (RII=0.32), brainstorming (RII=0.31), project files and minutes of meetings for tender approvals (RII=0.30), technical forums/training workshops (RII=0.29) and post project reviews/performance reviews (RII=0.27) were the most deployed lessons learned enabling tools.

Key Words: *construction projects, lessons learned, lessons learned tools, relative importance index*

INTRODUCTION

Learning in most organizations according to Chaves, Silva de Araújo, Teixeira, Rosa, Júnior and Nogueira (2015) is an issue that existed long before now and still attracts attention these days. Chaves et al. (2015) further describes organizational learning as a situation where people continually expand their knowledge to achieve the results they truly desire, where new and expansive patterns of thinking are nurtured, as well as where collective aspiration is set free and people are continually learning how to work together. The main challenge most organizations face of recent and specifically as it relates to project-oriented organizations is the lack of incentives or the lack of a framework for a long-term organizational learning. Even when these organizations provide the appropriate framework for learning, it is unusual for project team members to deploy stored knowledge from previous projects. This cumbersome issue can be nipped in the bud by the use of adequate lessons learned (LL) management consisting of social

interactions, informal dialogue and modern technologies (Chaves et al., 2015). Adequate information and knowledge is needed to drive a project throughout it's shelve life as each project requires enough contribution and integration of knowledge from the various multidisciplinary team members to bear on the project.

As stated by Duffield and Whitty (2012), there is a general and significant dissatisfaction associated with lessons learned processes. They further stated that whilst the lessons learned process seems to be popular, one of the noticeable short comings associated with it, is its inability to deliver the needed results as lessons that are identified are most often followed through to the latter and applied within most organizations. Most project-based organizations according to Wiewiora, Trigunarsyah, Murphy and Chen (2009), are faced with issues bordering on serious knowledge needs in their projects. Mistakes are bound to be repeated too often largely due to the lack of adequate knowledge dissemination that could be found in other projects within the same organization. Inadequate performance of knowledge dissemination often gives rise to knowledge being wasted and unsuitable for reuse in other related projects. The dearth of efficient knowledge dissemination often results to unnecessary reinventions, errors, and time wastage amongst others (Iringe-Koko, 2018; Wiewiora et al., 2009). According to Chin, Gao and Low (2015), one of the useful tool for capturing knowledge is the lessons learned (post-project review), which has been adjudged to have been deployed in most project based industries to elicit learning and knowledge about a project during close out. Given this revelations, some firms have remained slow in adopting this concept when implementing their projects.

With the dearth of research on lessons learned, most especially in the Nigerian context, as well as its low deployment in the Nigerian construction industry, this study intends to explore and analyze lessons learned practices as applicable in the Nigerian construction industry for purposes of successfully delivering construction projects to fruition. It is the belief that this study will crystallize into a broader project that will be of immense benefits to the Nigerian construction industry via the articulation and dissemination of lessons learned practices more effectively for the successful delivery of construction projects. The objectives of this study are to determine and evaluate the extent of lessons learned efforts deployed in the successful delivery of construction projects, to determine and evaluate the lessons learned enabling tools that would aid in the successful delivery of construction projects in Nigeria.

REVIEW OF RELEVANT LITERATURES

One of the ways of ensuring effective and efficient knowledge dissemination amongst projects is to capture and disseminate lessons learned beyond the project activities. Most projects are geographically dispersed and at times, the use of a lessons learned becomes inevitable and the only way out is to get information about other projects. According to Wiewiora et al., (2009), it is important to ensure that a complete lessons learned process that ensures the proper documentation of lessons learned, and the regulation of that aspect of the transfer of lessons

learned by involving other projects and organizations. Lessons learned is defined as any key project experiences that possess certain general business relevance that is of importance to future projects (Wiewiora et al., 2009). Lessons learned according to Vignos (2014), is defined as "the shared knowledge that allows project managers and the organization to grow and projects to mature" (p.9). Vignos (2014) further defined lessons learned as "key project experiences which have certain general business relevance for future projects. They have been validated by a project team and represent a consensus on a key insight that should be considered in future projects" (p.10).

The PMBOK Guide according to Marlin (2008) defines lessons learned as the learning accruing from executing a project. It may be identified at any point in the life of a project. Learning can ensue from successes where something creative or imaginative took place and it would be nice to see it replicated on subsequent projects. Learning can also emanate from failures where what was achieved initially fails to meet the desired expectations and as such one would like to improve on and not repeat the same mistake again. In a nutshell, "most of the learning comes from our successes, but the reality is that most of the learning comes from our failures"(Marlin (2008), p.1). As stated by (Albano, Kane & Thomas, 2011, p.1), "the successful project manager prides his or her self on having a record of finishing on schedule, under budget, and meeting requirements". Hence, when faced with some unexpected impediments, they need to resolve such an impediment with the outmost zeal becomes eminent. The project manager should as a matter of necessity and urgency deploy lessons learned activity prior to and at the end of the project.

Construction Projects and Lessons Learned Practices

The construction industry plays a very significant and dominant role in the economy of any nation. The industry in any nation, straddles all human endeavours Ayangade, Wahab and Alake (2009). Its activities include the procurement of goods and services as well as the execution of a variety of physical infrastructures. It has helped in contributing to Gross Domestic Product (GDP), Gross fixed capital formation and the creation of high level employment to a myriad of professionals. According to Ayodele and Alabi (2011), a healthy economy usually experiences an increase in construction activities, but in a depressed economy, the incidence of project abandonment tends to be prevalent. This situation applies to Nigeria where construction investments account for over 50% of the gross fixed capital formation. Ayodele and Alabi (2011) qualitatively reasoned that some of the causes of project abandonment in Nigeria are as a result of the death of a client, inability of client to attract funds and lack of good planning. The construction industry is a subset of the national economy that is associated with the preparation of land for construction, alteration of roads and buildings, structures and facilities. It is the fourth largest contributor to GDP in the Australian economy and plays a major role in determining economic growth (Oyedele, 2013).

One of the major criticisms facing the Nigerian construction industry according to Aibinu and Jagboro (2002) is the growing rate of delays in project delivery. Delay is a situation where the contractor and the project owner jointly contribute to the non-completion of the project within the original or the stipulated or agreed contract period. In countries such as United State of America (USA), United Kingdom (UK) and Western Germany, studies have shown that 'construction time' is better, but in Nigeria the performance of the construction industry time-wise is poor. Prior investigations on construction projects show that seven out of ten projects suffered delays in their execution. Timely delivery of projects within budget and to the level of quality standard specified by the client is an index of successful project delivery (Aibinu & Jagboro, 2002). The construction industry in the UK as opined by Paranagamage, Carrillo and Ruikar (2012), is highly competitive with clients demanding that innovative construction projects be delivered to meet key performance targets on time, at reduced cost, with quality and fewer accidents. In other words, the construction industry is attempting to embrace a culture of continuous improvement. The effective use of existing knowledge from previous projects or lessons learned could facilitate such continuous improvement resulting in better performance (and profits) with less mistakes, improved project team relationships and improved client relationships (Paranagamage et al., 2012).

While Chin et al., (2015) likened lessons learned to a process whereby participants look at the outcome of the project retrospectively with the intention to learn from the project's successes and failures. The benefits of lessons learned are tempting; however challenges are encountered when implementing lessons learned and given that it does not typically have a culture of innovation and learning (Chin et al., 2015; Iringe-Koko, 2018). While Morro (1991) is of the view that lessons learned in the construction phase of a project are not effectively fed back into the design and construction phases of other projects. Morro (1991) further concludes that constructors need to improve on their documentation of lessons learned related activities with a view to communicating effectively to the appropriate authorities. Paranagamage et al., (2012) opined that lessons learned are not always used to the best advantage of improving future projects; there is a disjoint in the effort spent obtaining lessons learned and their dissemination and use in most construction projects. According to Ferrada, Núñez, Neyem, Serpell and Sepúlve (2016a), it is important to consider that most studies regarding lessons learned in the construction industry have been conducted in developed countries.

Lessons Learned Enabling Tools for Construction Projects

According to Che Munaaim, Abdul-Rahman, Low and Yahya (2007), the new era of knowledge and technology based construction projects have increasingly become complex and fragmented in terms of size, construction methodologies, designs, human relationships, and clients' needs. Significant amount of information and knowledge are required throughout the project's life span. Thus, each project requires contribution and integration of knowledge from multidisciplinary professionals along with their knowledge and experiences from past projects. In construction

projects however, several systems and tools have been proposed to capture lessons learned. Paranagamage et al., (2012) suggest typical questions that arise during construction processes and encourages the use of risk management approaches to extract project knowledge for effective future use. Some maturity model matrix has also been developed to assess a company's lessons learned programme and enable the identification of gaps that need to be improved. While Ferrada et al., (2016a) opined that despite the provisions made by knowledge creation in construction project lessons learned activities, most construction firms have failed in effectively transferring project information and as such have not yet been able to develop a learning culture that takes into consideration the duo of technology and people. This is a cumbersome situation, as moving learning to intending projects enables practitioners to use already known knowledge to solve problems, instead of having to create new knowledge which generally consumes time.

The most commonly used practices for lessons learned activities as opined by Paranagamage et al., (2012) include both explicit and tacit methods such as post project reviews, company intranet/ extranet, and face to face meetings. Apart from these three tools and techniques, others includes; telephone conversations, brainstorming, knowledge repositories, project files and minutes of meetings, technical forums and communities of practice. In addition to the listed practices, the respondents from the study by Paranagamage et al., (2012) identified methods such as company Wikis, appraisals, tender approval meetings, customer satisfaction surveys, performance reviews, subcontract reviews, personal development reviews and training workshops as other commonly used methods for lessons learned.

Constructability, the early integration of construction knowledge into all phases of a project, can be improved upon by effectively utilizing lessons-learned. The traditional methods of collecting and disseminating construction lessons-learned have enjoyed limited success due to the unmanageable format, the lack of a meaningful classification system and difficulty integrating the new system into existing operations and procedures. According to Morro (1991), recent hardware and software environments provide powerful tools for constructors to document and communicate lessons from the field more effectively. While Carrillo (2005), adjudged project reviews as one of the tools for lessons learned.

Ferrada et al., (2016a) in a survey made to major construction contractors in the UK identified the current practices of lessons learned to include: the use of both explicit and tacit methods such as post project reviews, company intranet/extranet, and face-to-face meetings, the most informative practices includes; communities of practice, brainstorming sessions, and knowledge repositories, this is followed by post project reviews and face-to-face meetings and to a lesser extent technical forums; and face-to-face meeting and post project reviews were commonly used and most informative.

Other lessons learned enablers as opined by Ferrada, Núñez, Neyem, Serpell and Sepúlve, (2016b) include; mobile cloud shared workspace (MCSW) which allows recording, representing

and distributing organizational knowledge during the construction project management process. Chin et al., (2015), advocated information technology tools to aid and support the sharing and dissemination of knowledge within an organization, the institutionalization of tasks, such as project debriefing meetings, lessons-learned workshops, and a final project report are strong factors in achieving the capture and use of project knowledge.

Che Munaaim et al., (2007) in a study identified ways to impart knowledge in projects to include; proper documentation and storage of knowledge gained throughout the project period, lessons-learned refresh session at the end of a project and before the start of a new project, the use of camera and multimedia equipments to capture the real life experience of problem solving, knowledge sharing session among employees for the success and failure factors of projects, divide the project team members into several groups and select a lessons-learned communicator leader for each group who is responsible for transferring lessons-learned, and a storytelling on mistakes and ways of doing tasks.

From the literature search carried out ab initio, it is evident to state that there hasn't been any study that has been done on lessons learned practices as is applicable in the Nigerian construction industry for purposes of successfully delivering construction projects to fruition. Hence, this study will determine the extent of lessons learned effort deployed in the delivery of construction projects; determine lessons learned enabling tools application.

RESEARCH METHODOLOGY

A descriptive survey research design was used because descriptive research design does not involve modifying the situation under study. It involves the acquisition of information about a certain aspect of the population and getting information on their characteristics, opinions or attitudes (Kothari, 2004). This research design has been chosen for this study because it enabled the researchers to obtain the opinions of professionals handling construction projects within the industry in their natural setting.

Snow-balling sampling technique was used to elicit response from the respondents (population), hence there was no sampling frame (infinite population) for selecting the various respondents. One hundred and twenty five (125) questionnaires were retrieved and from an estimated population of two hundred (200) and this formed the sample size based on the snow-balling sampling technique. Snow-balling sampling was used to select the sample from targeted population as it is commonly used when it is difficult to identify members of the desired population (Saunders, Lewis & Thornhill, 2007). The units of analysis consist of architects, builders, engineers, project managers and quantity surveyors. On the whole one hundred and eleven (111) questionnaires were later collated for the data analysis representing 56% response rate, while one hundred and two (102) were found to be useful for further analysis.

A questionnaire was deployed as the key means of eliciting data from the respondents about the projects. The questionnaire was categorized into various sections. The first section deals with soliciting information about the demographic characteristics of the respondents, while the second section seeks to look at the extent /level of application of lessons learned activities in the delivery of construction projects as well as the tools and techniques for enabling lessons learned activities in successful delivery of construction projects. The questionnaires consist of close-ended questions and a few open-ended ones that were incorporated with the sole aim of getting the details of the respondents and better insight on some of the issues in context. A Likert five point scale was used to formulate the questionnaire containing factors from 1-5 intervals. The structured questionnaire is easy to quantitatively capture the results and measure enabling data analysis and presentation lucid and faster. Some selected ongoing construction projects in Port-Harcourt in Rivers State were used in data validation using practitioners working on the projects. In a bid to ensure the validly of the instrument, a pilot study was deployed via the assistance of the supervisor and other experienced experts in the industry and academia in the area of construction project management. The instruments were both subjected to face validity; content validity and construct validly test via previous researches done in the past (Somekh & Lewin, 2004). Reliability (Saunders, Thornhill & Lewis, 2009) is the ability of the questionnaire to consistently produce similar results under the same conditions. In a nutshell, for a questionnaire to be reliable, it must first be valid. Reliability test was carried out via a Cronbach's alpha technique with the aid of IBM SPSS statistical package version 20 to compute the Cronbach's alpha coefficient which is a coefficient that measures the consistency of results across variables.

Both primary and secondary methods of data collections were deployed. The data includes both quantitative and qualitative data and can be located quickly and inexpensively. Questionnaires were used to collect data from the respondents from the construction firms visited in Port Harcourt, Rivers State. The questionnaires were designed based on the information needed, as well as who needs the information, method of communication.

Descriptive statistics was used to analyze quantitative data. Frequency tables were used to present and explain the results. The data analysis method involved the use of descriptive and inferential statistical analysis using IBM SPSS Statistic version 20. Frequency distribution and ranking was used to analyze the extent of lessons learned effort deployed in construction project delivery in the study area. While relative importance index (RII) was used to analyze the lessons learned enabling tools that would aid in the successful delivery of construction projects in Nigeria. Relative Importance Index RII has been used in construction related studies.

$$RII = (5n5 + 4n4 + 3n3 + 2n2 + n1)/5N \qquad (1)$$

Where n1=response for "strongly disagree"; n2 = response for "disagree"; n3 response for "undecided, n4 = response for "agree", n5= response for "strongly agree" and N= total number of respondents involved in the study.

RESEARCH FINDINGS

The population for the study consists of 200 practitioners from some construction firms located in Port-Harcourt, Rivers State. The construction firms were consulted via a snow balling sampling technique where 125 questionnaires were retrieved thus forming the sample size. 111 questionnaires were later collated for data analysis. In the tail end, 102 questionnaires were found to be usable for further statistical analysis.

The level of consistencies of each item in each category of the questions on lessons learned tools application and the barriers to lesson learned application for successful construction project delivery was carried out with the aid of Cronbach's alpha. The Cronbach's alpha coefficient has been adjudged to be a critical tool for determining the reliability and validity of data. Table 1 below depicts the outcome of the internal consistency of the various categories of items under study using IBM SPSS version 20.

Table 1: Cronbach's Alpha Coefficient

Reliability Statistics	
Cronbach's Alpha	N of Items
.872	13

The outcome of the Cronbach's Alpha coefficient of all the thirteen (13) criteria for lessons learned tools for successful construction project delivery that were identified from the literature *ab initio* are 0.872. The outcome of this exercise indicates that the instrument is in good standing in terms of reliability, hence an indication of an adequate proof of internal consistency. As stated by Gaur and Gaur (2009); Pallant (2005), a Cronbach's Alpha coefficient reliability value of 0.6 to 0.7 is adjudged acceptable for further analysis. Hence, the data for this study were adjudged to be reliable given the outcomes of the reliability values shown in table 1.

Knowledge of Lessons Learned

Research findings relating to the respondent's knowledge of lessons learned indicated that 20 (19.61%) have heard of lessons learned in the past, while 82 (80.39%) have not heard about it.

Where Lessons Learned was Heard

Findings on where the respondent's heard about lessons learned indicated that on the whole 85 (83.33%) heard of lessons learned from this study, while 17 (16.67%) heard about it from other literature sources and works previously.

Extent of Organization's Deployment of Lessons Learned Related Activity

Research results on the extent of deployment of lessons learned related activity in the past indicated that about 87 (85.29%) have not deployed any lessons learned activity of recent, while 8 (7.84%) were about to deploy lessons learned activity, while about 7 (6.86%) have already deployed lessons learned in the past.

Deployment of Lessons Learned in Future Projects

Findings on the respondent's response on whether they would like to deploy lessons learned in their projects in future indicated that about 93 (91.18%) agreed that they would want to deploy lessons learned, while 9 (8.82%) were not certain, while none of the respondents stated that they would not deploy lessons learned.

Table 2: Relative Importance Index for Lessons Learned Tools

Lessons learned tools	SA 5	A 4	N 3	D 2	SD 1	SUM	RII	Rank
Post project reviews/performance reviews	21	59	19	2	1	403	0.27	5th
Face -to -face meetings	66	35	1	0	0	473	0.32	1st
Brainstorming	64	36	2	0	0	470	0.31	2nd
Knowledge repositories	2	68	28	4	0	374	0.25	8th
Project files and minutes of meetings for tender approvals	63	30	2	4	3	452	0.30	3rd
Technical forums /training workshops	53	38	2	5	4	437	0.29	4th
Video conferencing	6	14	65	17	0	315	0.21	11th
Skills and expertise database	8	62	32	0	0	384	0.26	6th
Communities of practice	5	63	27	7	0	372	0.25	8th
Company intranet/ extranet/wikis	6	5	58	33	0	290	0.19	12th
Telephone conversations	11	61	28	2	0	387	0.26	6th
Customer satisfaction surveys	3	69	29	1	0	380	0.25	8th
Mobile cloud shared workspace	2	4	11	64	21	208	0.14	13th

Table 2 shows that the most deployed lessons learned tool as stated by the respondents is face to face meetings with a RII value of 0.32 and ranked first. While on the other hand the results show that the use of mobile cloud shared workspace has the least RII value of 0.14 and was ranked thirteenth. Brainstorming and project files and minutes of meetings for tender approvals were the next in the list of the highest ranked factors.

DISCUSSION OF RESEARCH RESULTS

The results of the level of consistencies of each item of the questions on lessons learned tools application for successful construction project delivery was conducted with the aid of Cronbach's alpha. The Cronbach's alpha coefficient was adjudged one of the critical tools for determining the reliability and validity of data. Table 1 depicts the outcome of the internal consistency of the various categories of items. The results of the Cronbach's Alpha coefficient of all the thirteen (13) criteria for lessons learned tools for successful construction project delivery was 0.872. The result of this exercise is a clear indication that the instrument is reliability and as such it is an indication of an adequate proof of internal consistency. This in a nutshell, agrees with Gaur and Gaur (2009) and Pallant (2005), stance on Cronbach's Alpha coefficient reliability value of 0.6 to 0.7 as acceptable limit for further analysis.

In terms of the respondent's knowledge of lessons learned, 20 (19.61%) have heard of lessons learned in the past, while 82 (80.39%) have not heard about it. The results of the findings could largely be attributed to the low level of awareness of what lessons learned construes. Another reason for the large proportion of respondents affirming to not have heard of lessons learned may be that the respondents don't know that lessons learned is a project management tool for ensuring previous mistakes that occur in the life of a previous project does not re-occur on an intending project and as such concerted effort should as a matter of necessity be made towards inculcating on project managers and other team members on the need and gains ensuing from the application of lessons learned in successful project delivery. The outcome of this is a reflection of the lack of literature works emanating from Nigeria specifically on lessons learned. On the extent of deployment of lessons learned related activity in the past, about 87 (85.29%) of the respondents have not deployed any lessons learned activity of recent, while 8 (7.84%) of the respondents were about to deploy lessons learned activity, while a paltry 7 (6.86%) of the respondents have already deployed lessons learned in the past. This is an indication that majority of the respondents have not been applying lessons learned in their project delivery processes. It also pertinent to state that majority of the respondents were also ignorant of the fact that they are using some of the lessons learned tools and techniques unknowingly given that they deploy face to face meetings as well as brainstorming sessions to address some of their project management problems. Another reason for the low level of deployment of lessons learned in construction project delivery could be adduced to the comments by Chin et al., (2015) who opined that lessons learned has been adjudged as one of the most effective means of enhancing organizational learning by firms via gaining of a competitive advantage in a knowledge driven economy. The outcome of this assertion however, has not been visible in the construction industry, largely as a result of the temporary nature of most projects and their associated bottlenecks. The findings from the most deployed lessons learned tool as stated by the respondents and shown in table 2 indicates that face to face meetings with a RII value of 0.32 was the most deployed and was ranked first. It was followed by brainstorming with an RII value of 0.31 and ranked second. While on the other hand the results indicate that the use of mobile

cloud shared workspace had the least RII value of 0.14 and was ranked thirteenth. The outcome of this study agrees with that of Paranagamage et al., (2012); Ferrada et al., (2016a) who were of the opinion that face to face meetings is one of the explicit and tacit means of reviewing previous projects and as such, the method has helped a lot. It is also pertinent to state that most advanced countries of the world as stated by Ferrada etal., (2016b) deploy mobile cloud shared workspace (MCSW) that enables the recording, representation and distribution of organizational knowledge during construction processes with a view to ameliorating challenges emanating there from.

CONCLUSIONS AND RECOMMENDATIONS

From the outcomes of the results, the study now concludes that; There is a poor knowledge of lessons learned and its deployment in the delivery of construction projects in the Nigerian construction industry given the fact that 85.29% of the 102 respondents opined that they have not deployed lessons learned, while 80.39% of the respondents further affirmed that they have not heard about the concept. The most deployed lessons learned enabling tool for the successful delivery of construction projects includes; face to face meetings. This is followed in that order by the use of brainstorming, use of project files and minutes of meetings for tender approvals amongst others. There is need for a concerted effort made towards creating the needed information available through briefs and from project charters for the professionals within the Nigerian construction industry to get abreast with the deployment of lessons learned as one of the key critical ingredient for construction project realization. Given that lessons learned is a life saver of a project, a lot of awareness needs to be created via professional association gatherings, workshops, conferences etc to help drive the much needed consciousness about lessons learned to help put a check on the constant and consistent problems of project failure and collapse that has bedeviled the Nigerian construction space.

In delivering construction projects successfully using the most recent lessons learned enabling tools is eminent. Adequate attention and emphasis should be accorded to the use of performance reviews of a project as well as brainstorming sessions that would help bring out some of the underlying issues that may tend to affect subsequent projects in the future. Knowledge repositories/databases of past prior projects should also be kept so as to help in carrying out a proper lessons learned exercise.

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