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In the first chapter we present *Application of visualization methods of audit risk assessment in developing an audit strategy*, by SHVYREVA, Olga, PETUKH, Aleksei and PETUKH, Mikhail, with adscription in the Kuban State Agrarian University, as next article we present, *Keys to understanding the El Niño-Oscillation phenomenon in south Mexico*, by NIÑO-GUTIÉRREZ, Naú Silverio, with adscription in the Universidad Autónoma de Guerrero, as a next article we present, *Web business management system*, by GONZÁLEZ-RAMÍREZ, Claudia Teresa, PATIÑO-BUCIO, Alpha Michel, RUIZ-GARDUÑO, Jhacer Kharen and DELGADO-PICHARDO, Mauricio, with adscription in the Tecnológico Nacional de México campus Zitácuaro, as the next article we present, *Plastic grow kit design project*, by DÍAZ-BARRIGA-RODRÍGUEZ, Elisa, MARROQUÍN-DE JESÚS, Ángel, ANGUENOT, Clément and DUMOND, Kévin, with adscription in the Universidad Tecnológica de San Juan del Río and University of Savoie Mont Blanc.

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Application of visualization methods of audit risk assessment in developing an audit strategy

Aplicación de métodos de visualización de evaluación de riesgos de auditoría en el desarrollo de una estrategia de auditoría

SHVYREVA, Olga†*, PETUKH, Aleksei and PETUKH, Mikhail

Kuban State Agrarian University, Krasnodar, Russian Federation.

ID 1st Author: *Olga, Shvyeva* / **ORC ID:** 0000-0002-2964-3187

ID 1st Co-author: *Aleksei, Petukh* / **ORC ID:** 0000-0003-4273-6879

ID 2nd Co-author: *Mikhail, Petukh* / **ORC ID:** 0000-0003-0254-0118

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Abstract

Objectives

This study aims to formalize developing a risk-based audit strategy and planning effective and rational audit procedures that reduce the risks of material misstatements and formalize these in a sufficiently detailed and understandable form to ensure the audit engagement high quality. The applicability of different materiality levels to parameterize the significance of risks of material misstatement is substantiated. A scenario mechanism for sufficient auditor actions in response to specific characteristics of the risk factor based on the risk heat map was developed.

Methodology

The new method of the risk complex visualization – spectrum analysis of the assessed risk factors of material misstatement to develop an audit strategy was proposed.

Contribution

The usefulness of the study results is to develop and test on a specific example of the audit engagement the risk-oriented approach that allows the most rational use of the audit organization resources. The methodology is also applicable for managing the risks of material misstatement in the internal audit.

Risks of material misstatements in reporting. Parameterization of risks. Procedures in response to assessed risks

Resumen

Objetivos

Este estudio tiene como objetivo formalizar el desarrollo de una estrategia de auditoría basada en el riesgo y planificar procedimientos de auditoría efectivos y racionales que reduzcan los riesgos de inexactitudes materiales y formalizarlas de una forma suficientemente detallada y comprensible para garantizar la alta calidad del compromiso de auditoría. Se justifica la aplicabilidad de diferentes niveles de materialidad para parametrizar la importancia de los riesgos de inexactitud material. Se desarrolló un mecanismo de escenario para suficientes acciones de auditoría en respuesta a características del factor de riesgo basado en el mapa de calor de riesgo.

Metodología

Se propuso el nuevo método de visualización del complejo de riesgos: análisis del espectro de los factores de riesgo evaluados de errores materiales para desarrollar una estrategia de auditoría.

Contribución

La utilidad de los resultados del estudio es desarrollar y probar en un ejemplo específico del compromiso de auditoría el enfoque orientado al riesgo que permite el uso más racional de los recursos de la organización de auditoría. La metodología también es aplicable para gestionar los riesgos de inexactitud material en la auditoría interna.

Riesgos de inexactitudes materiales en la presentación de informes. Parametrización de riesgos. Procedimientos en respuesta a los riesgos evaluados

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* Correspondence to Author (E-mail: shvyreva.olga-researcher@yandex.ru)

† Researcher contributing as first author.

Introduction

One of the most important aspects of applying professional judgment in the implementation of the audit engagement is the identification, risk assessment of material misstatement and the further procedures in response to the assessed risks. Risk assessment in the application of International Standards of Auditing (ISA) becomes an element of audit planning and implementing audit procedures for substantive tests, the development, and justification of the audit opinion.

At the same time, scientific works in the areas of risk identification and assessment in the development of audit strategy of domestic (Kochinev, Vinogradova, 2013; Sungatullina, 2014; Itygilova, 2015; Agarkov, Bessonov, Sukhikh, et al., 2016; Shvyreva, Petukh, and Kruglyak, 2016) and foreign scientists (Bowlin, 2011; Bhaskar, 2020), experience in risk parameterization and response scenarios (Curtis, Hayes, 2002; Yuditseva, 2014; Rautiainen, Saastamoinen, and Pajunen, 2014; Kochinev, 2016; Klinova and Sungatullina, 2018; Shvyreva and Petukh, 2018; Lashchinina, 2020) differ significantly in terms of the methodologies and judgments used. The volatility of risk-based approaches applied by different auditors negatively affects not only the audit quality but also the opinion of a wide range of users of audit reports, as it inevitably entails the possibility of manipulating the auditor's opinion (Hollingsworth, Li, 2012; Hoffman, 2016; Vinson, Robertson, and Cockrell, 2019; Páez Calderón, J. T., and Cuadros Flórez, L. J., 2022; Rodriguez Lopez, G. R., 2022).

This study aims to substantiate developing a risk-based audit strategy and planning effective and rational audit procedures that reduce the risk of material misstatements and ensure the audit engagement high quality. Following the paper goal, the following tasks were solved:

- To study the regulatory framework and practical experience in identifying and assessing the risks of material accounting misstatements.
- To develop technology for applying the risk heat map tool to formalize audit procedures for identifying, assessing the probability and significance of risks.

- To determine the appropriate, sufficient, and proper actions of the auditor following the risk position on the risk heat map.
- To model the processes for determining the key parameters of a comprehensive audit strategy, including the workload and competence of audit team members based on the risks of auditing individual balances, groups of homogenous operations, and disclosures.

Methods

The study object was international auditing standards adopted by the International Federation of Accountants (IFAC) and their application by auditing organizations. The study was conducted using the abstract-logical method, content analysis methods, systematization, classification, graphical method of data visualization. A distinctive feature of the author's method is the modeling of identification, assessment of material misstatement risks, and action strategy in response to assessed risks using methods of risk heat map visualization, spectrum risk analysis (developed by the authors), focused on reducing the negative impact of professional judgment in the choice of appropriate sufficient audit procedures through risk scenario analysis.

As a part of the study, the internal audit methodologies of two major audit networks (Deloitte and Ernst & Young), audit tools used in the most demanded Russian auditing programs (AuditXP, IT-Audit) were questioned and critically analyzed. The theory and practice of identifying and assessing risks in the audit and the scenario of the audit engagement caused by them, and the mechanism of influence of the author's risk-based approach on the development of an effective audit strategy were investigated.

Results and Discussion

General approaches to risk identification in auditing

Audit risk management as a set of methods, techniques, and measures that allow a certain degree of prediction of the presence of material misstatements in the accounting (financial) reporting and to take measures to identify them and/or modify the audit report, accordingly, should be based on two interrelated components of probability and significance of the risk.

Under 2019 revised ISA 315, the critical aspects of identifying risks and developing the need for action in response to assessed risks are:

- (1) 1 – Probability of the risk event (unfavorable event).
- (2) 2 – Significance of the risk (degree of impact on the reliability of reporting).

Different models can determine the probability of a risk event. Thus, the model of the Deloitte auditing company includes five levels of risk (Table 1) (Deloitte Insights, 2019).

Risk level	Characteristics of the risk event	Level parameters
5	Very likely	Event probability is 90% or higher
4	Probably	Event probability is from 65% to 90%
3	Possible	Event probability is from 35% to 65%
2	Unlikely	Event probability is from 10% to 35%
1	Rarely	Event probability is less than 10%

Table 1 Probability gradations in assessing audit risk
Source: Search data

Other auditing organizations also use the method of expert assessments because the *historical* accumulation of information about unfavorable events in auditees is usually absent, as well as the certification of internal control systems, including risk management, is very rare (Bowlin, 2011). Therefore, for a more reliable assessment of risk probability, under conditions of *brief acquaintance* with the auditee and limitations inherent in the audit, it is reasonable to apply a three-level model. At that, the most traditional representation for domestic assessment models is *from low to high* (Svitkin, 2010; Risk Assessment according to ISA, 2021) (Table 2).

Risk level	Characteristics of the risk event	Level parameters
1	Rarely	Event probability is less than 35 %
2	Possible	Event probability is from 35 % to 65%
3	Very likely	Event probability is 65% or higher

Table 2 Expert model for assessing the risk probability in auditing
Source: Search data

As for the risk significance, in auditing, the most understandable and transparent criterion that defines its scope may be the materiality of information (Risk Assessment according to ISA, 2021). Deloitte defines five levels of risk significance depending on the expected consequences of events of the risks being assessed: catastrophic, significant, moderate, insignificant, and immaterial (Deloitte Insights, 2019).

In the Russian jurisdiction, the more traditional embodiment of risk significance is the magnitude of misstatement size: potential or detectable already at the stage of familiarity with the accounting system in the organization (Petukh, 2019). An unfavorable event considered in the audit is a material misstatement, which at the stage of developing an audit strategy has a probabilistic nature and can be described by the terms “expected misstatement” and “expected consequences of misstatements”. Expected misstatements are the auditor's predicted deviations in the presentation and disclosure of information in the accounting (financial) reporting prepared by the audited entity from the alternative information in the hypothetical reporting prepared according to the concept of faithful representation. Summarizing the provisions of ISA 450, we can distinguish such accounting estimates of expected misstatements:

- The abnormal misstatement value as a result of a single (atypical) violation of the conceptual principles of accounting and preparation of accounting (financial) reporting.
- The extrapolated misstatement value as a result of systematic (typical) violation of the conceptual principles of accounting and preparation of accounting (financial) reporting.
- Variance between the accounting estimate formed and presented in the accounting (financial) reporting by the management of the audited entity and the expert and/or analytically calculated accounting estimate formed by the auditor or an independent expert of the auditor based on the concept of faithful representation. In the event of possible application of two or more alternative methodologies for reliable determining the accounting estimate, the one with the lowest variance shall be used.

- Analytically calculated impact of the value of uncorrected misstatements at the beginning of the audited period on the balances and turnovers on accounts. Based on this, the data on the accounting (financial) reporting items for the audited period (at the end of the audited period) are formed.

Following the methodology detailed in (Shvyreva, Petukh, 2018), several levels of materiality are defined. However, for the identification, assessment, and interpretation of risks, two seem useful: the materiality level for financial reporting as a whole (ML_{FR}) and the level of clearly trivial misstatement (L_{CTM}) (Table 3). The scenario for determining the materiality level for financial reporting is based on the information needs of the priority users of those reports. ISA 320 recognizes that such users must have a sufficiently high level of competence to use the reporting information for their purposes. The size of the materiality level for financial reporting as a whole is influenced by the selected core indicator and the materiality level for that indicator as a percentage (Lashchinina, 2020). The algorithm for determining the core indicator should be established by the auditing organization's (auditor's) internal standard and may look as follows, for example:

- To establish the priority user(s) of the financial reporting and his (their) key information needs (Hoffman, 2016).
- To determine the most important indicator(s) influencing their economic decisions. This can be both a separate reporting item of the completed period, as well as the planned and calculated, industry average or other calculations-based and significant for users value.
- If the selected indicator is volatile in time or significantly differs from the expected value (industry average, planned, etc.), it is advisable to consider other options for the core indicator.
- If several core indicators are selected, it is advisable to set a materiality level for each of them. Depending on the required level of confidence, take the minimum of them or calculate the average value.

Materiality level	Application at different audit phases		Auditor's duties to establish the value of the materiality level	Calculation of the value
	Planning	Assessment of misstatements on the final phase		
Materiality level for financial reporting as a whole (ML_{FR})	Calculated and used to calculate other levels	The core indicator for deciding on the materiality of cumulative misstatements and modification of the audit report	Mandatory indicator (clause 10 of ISA 320), set at the planning phase, revised as necessary	$ML_{FR} = \frac{B_{00} \times V_{CI}}{100}$, where V_{CI} – the value of core indicator, L_M – level of materiality for the core indicator, %.
Level of clearly trivial misstatement (L_{CTM})	Based on the methodology, it should be established no later than assessing the risks of material misstatement. However, ISA does not set the specific phase of application in a particular audit engagement	Used as a value below which misstatements will be judged as clearly trivial	Mandatory indicator (clause 15 of ISA 450).	$L_{CTM} = \frac{ML_{FR} \times L_{MM}}{100}$, where L_{MM} – minimum level of materiality, % usually set at 5-10%.

Table 3 Materiality levels applicable for assessing the significance of identified risks

Source: Developed by the authors based on content analysis of ISA 320 and ISA 450

The procedure for setting the materiality level as a percentage for the core indicator needs to be fixed in an internal corporate standard (Curtis, Hayes, 2002; Kochinev, 2016). At the same time, the recommended values can be found in the Application Manual and other explanatory materials to ISA 320 (p. A7):

- (1) For volume indicators (value of assets, revenues, costs), it is advisable to use the level of 1-2%;
- (2) For profit indicators – no more than 5%;
- (3) For separate value indicators (structural elements of assets, liabilities, money flows, etc., for example, net assets) – 5-10%.

The level of clearly trivial misstatements is determined by par. 5 of ISA 450: the auditor needs to accumulate distortions, ignoring those that are clearly trivial. The purpose of calculating L_{CTM} is to determine the threshold of values in the examined items that are considered clearly trivial for a given audit engagement. It is usually determined as 5-10 % of ML_{FR} . This interval can be justified by the guidance given in par. A2 of ISA 450: clearly trivial is not another expression for "immaterial". Small distortions are at least 10 times or more below the materiality level, regardless of size, nature or circumstances. Developing the application of the criterion for the audit rationalization, we can recommend its use to exclude from the audit certain obviously insignificant objects at the stage of the audit planning, under the conditions that:

- There is no or negligible risk of fraud in reflecting these accounting items.
- The accounting object is not a marker of important requirements of regulations, which violation may lead to significant financial penalties and/or the threat of violation of the business continuity principle of the organization.

Thus, the risk criteria by the degree of significance can be presented in the audit as follows (Table 4).

Level of risk	Risk characteristic	Criteria	
		in amount	on qualitatively major consequences
1	Insignificant	The size of the expected error is below the level of clearly trivial misstatements	Misrepresentation (violation) does not result in significant financial penalties, and there are no threats to business continuity due to suspension of the organization, license, SPO membership, franchise, loss of key personnel, business reputation
2	Moderate	The size of the expected error is above the level of clearly trivial misstatements but below the level of materiality for financial reporting as a whole	Misstatement (violation) can lead to tangible financial penalties, and there are separate threats associated with changes (restructuring) of activity, loss of key personnel, loss of business reputation
3	Significant	The size of the expected error is above or close to the materiality level for financial reporting as a whole or approaching it	Misrepresentation (violation) leads to significant financial penalties, threats to business continuity arise due to suspension of the organization, license, SPO membership, franchise, loss of key personnel and business reputation

Table 4 Expert model for assessing the significance of risk in the audit. *Source: Author's development.*

Modeling a risk management system of material misstatement using a risk heat map tool

Understanding the probability and significance of risk should be reflected in a comprehensive risk model to establish the necessary and sufficient response to that risk. A risk heat map is an effective solution to the problem of documenting the assessment of audit risks and thereby ensuring the transparency of audit quality, expressed as a necessary and sufficient response of the audit team to the identified risks of material misstatement in the accounting (financial) reporting of the auditee.

In the classic risk management theory, a risk heat map is a visual description of a limited number of organization risks located in a rectangular table. Its one axis shows the strength of the impact or significance of the risk, and the other – probability or rate of its occurrence (Figure 1).

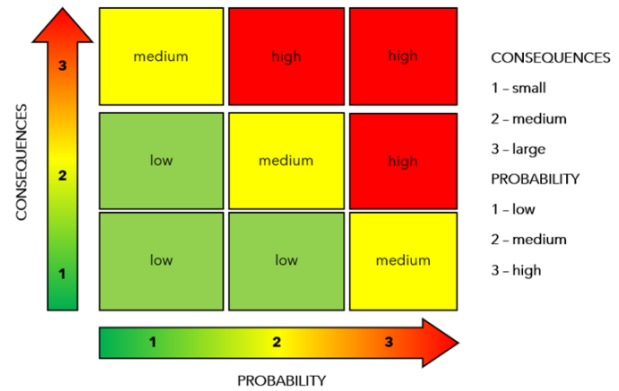


Figure 1 The risk heat map used in risk management theory *Source: Compiled by the authors based on publication (Svitkin, 2010)*

In our view, the methodology of risk map in management is close to the audit methodology: the risk of material misstatements is nothing other than the probability of existence in the accounting (financial) reporting of the audited entity distorted or undisclosed information necessary for management decision making by users; significance, as well as materiality, is a formalized expression of the possible consequences of misstatements. At the same time, a *pure* management theory of risk map in the audit is not applicable. The development of the *audit risk map* methodology requires solving the following applied problems:

- 1) Mapping problems, namely:
 - Establishment of parameters for dividing areas of probability and significance.
 - Specification of the scenario mechanism (in the triplex “object of vulnerability + trigger mechanism (risk factors) + possible consequences”).
 - Definition of the *risk appetite* tolerance (in other words: resistance or tolerance to risk).
- 2) Problems of interpretation of identified and assessed risks – the strategy of auditors' actions in response to assessed risks.

We propose the following risk map format (Figure 2) as documentation for audit risk management.

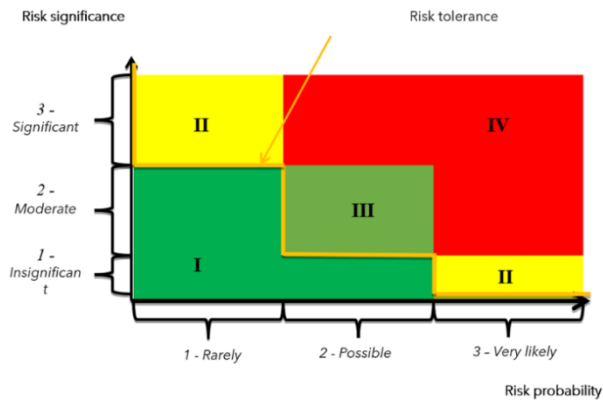


Figure 2 Audit risk management map

Source: Author's development

Thus, the boundaries of analysis in mapping the audit risk management are proposed to be set as follows:

- Axis X (risk probability of material misstatements in reporting) – traditional boundaries of risk assessment of material misstatements: low (up to 0.35), medium (from 0.35 to 0.65), high (from 0.65 to 1) (according to Table 2);
- Axis Y (significance of possible consequences of misstatements) – the parameters given in Table 4 as boundaries of analysis.

The risk tolerance boundary (risk appetite) limits the areas separating factors and events that do not affect audit planning, audit procedures, and finally, the audit opinion and areas requiring the auditor to ensure adequate audit quality by modifying audit procedures. In some cases, it limits the opinions and certainly justification of the investigation final results of the identified factors and events as a result of the substantive audit procedures, whatever they may be - affecting or not affecting the reporting reliability by the auditor's working papers. Audit risk mapping is not an end in itself but a means of justifying the sufficiency and appropriateness of subsequent audit procedures. Therefore, the most important step in the proposed methodology is the auditors' strategy responding to the assessed risks.

In the classical theory of risk management, there are four strategies of action in response to the project assessed risks: avoidance strategy, reduction strategy, transfer strategy, risk acceptance. In auditing, we are talking about the risk of material misstatement of reporting due to misrepresentation and incomplete disclosure of information that can affect the opinion of qualified users of the reporting.

- *Risk avoidance* in the audit context is informing the users of the financial reporting about material misstatements of a highly probable nature, events that threaten the going concern of the audited entity or can significantly change its normal operation.
- *Risk reduction* in auditing involves developing response procedures that confirm or refute an initial judgment about the risk likelihood and significance.
- *Risk transfer* is the possibility of ensuring the auditor's liability provided by the Federal law of auditing activities in case of poor-quality auditing services (in the context under consideration, it is the failure to detect material misstatements, if any). Nevertheless, this type of *risk transfer* cannot eliminate reputational risk.
- *Risk acceptance* is putting aside the risks of the possible impact of misstatements. "Plan B" of the auditor (detailed tests) becomes relevant only when material misstatements in unexpected turnovers, balances, and disclosures are identified.

Let us formalize the auditor's actions in response to assessed risks in the form of a scheme (Table 5).

Graphically, the table identifies four zones: I – inside the tolerance zone to audit risk; II, III, and IV – outside the tolerance zone. The color explanation of the response zones is inextricably linked to the positioning of the risk factor on the map (Figure 2).

Audit risk management tool	Necessary and sufficient reaction procedures in response to assessed risks			
	Reporting to the management and persons responsible for corporate governance of the audited entity on material weaknesses in the Internal Control Service	Modification of audit procedures for substantive tests (detailed tests, inclusion of more reliable audit procedures)	Reporting to the management and persons responsible for corporate governance on the need to correct misstatements and make proper disclosures	Inclusion of information in the audit opinion
Audit risk zone	I	-	-	-
	II	+	+	-
	III	+	+	+
	IV	+	+	+
Standards defining the duties of auditors	ISA 265	ISA 240, 250, 500, 530, 540	ISA 260, 580	ISA701, 570

Table 5 Strategy for auditors' actions to respond to assessed risks. *Source: Author's development based on content analysis of ISA requirements.*

Green zone (I) is the field in which the identified factors and events are positioned, whose occurrence is possible (with a medium degree of probability) but insignificant (the expected consequences are below the level of clearly trivial misstatements or will not lead to changes in the normal activities of the economic entity), or with insignificant expected consequences (below ML_{FR} and the unlikely possibility of occurrence).

Yellow zone (II) includes events and circumstances with potentially high significance (above ML_{FR} but low probability of occurrence, or with high probability but low significance). The *yellow zone* factors require the auditor to increase the degree of professional skepticism and due diligence because of the potential danger of the audited entity's "veiling" of circumstances relevant to risk assessment (ISA 240), lack of objective assessment by the audited entity's management of the consequences of regulatory violations (ISA 250), inadequate recognition and measurement of estimated values (ISA 540), increased likelihood of missing significant audit objects in the audit sample (ISA 530). Then, to provide reasonable assurance, the auditor needs to change the planned procedures to more reliable ones, perhaps increasing the sample or changing the approach to forming it.

Orange zone (III) includes risk factors with a medium degree of probability and significance. This zone is singled out as a separate one, largely since most of the expected misstatements are assessed below the level of materiality, and when in doubt about the probability assessment, its level is defined as medium. Therefore, this zone usually includes the largest number of identified risks.

Due to the potentially high complex effect of the combination of expected misstatements on the reliability of the financial reporting, in addition to action (II), management should be informed about the need to correct misstatements or, if it is a matter of non-disclosure in the notes, to include the necessary disclosures in the notes. ISA 260 requires the auditor to report material misstatements identified that could lead to a modified opinion in the audit opinion. However, here, if it is not possible to accurately assess the impact of misstatements of *average significance*, it is appropriate to inform on a combination of factors or as part of the indication to the causes of potentially material misstatements in the weaknesses of the Internal Control Service (ISA 265).

Red zone (IV), in addition to the above actions, includes factors, events, and conditions that highly likely can lead to a modification of the opinion in the auditor's report or the inclusion of additional information.

In particular, if there are probable and significant risks, whether they relate to – misstatements or the continuation of the entity's normal activities – this information (about risks) may be recognized as qualitatively material to users and subject to disclosure according to IFRS 7 Financial Instruments: Disclosures.

Suppose there are high risks of liquidity and solvency. In that case, even if they are disclosed in the audited entity's reporting, the auditor is obliged, according to ISA 570, to conduct appropriate procedures and include a paragraph "Significant uncertainty about the continuity of operations" in the audit opinion. In case of information non-disclosure (inadequate disclosure), there is an obligation to modify the opinion in the audit report.

When auditing economic entities that issue and place securities on organized markets, auditors have an obligation under ISA 701 to disclose key audit matters in the audit report. Key matters are nothing more than areas of material misstatement risk that require the auditors' attention and the actions taken in response to those risks. Thus, the *red zone* risks, even if the hypothesis of a material misstatement is not confirmed in reporting, require the auditor to form an audit opinion usually different from the unmodified form presented in ISA 700, and, as a result, proper documentation of additional processes to assess the audited entity's business continuity, a more thorough evaluation of qualitatively material disclosures, formulation of key issues in the audit opinion and additional interaction with persons responsible for corporate governance.

Visual presentation of assessed risks of material misstatement is not crucial. The auditor needs to understand in what risk zone the assessed circumstance of the economic life of the audited entity falls, as it allows systematically, according to the standards, to plan effective but at the same time rational actions in response to risks “outside the tolerance zone”, redistributing labor intensity towards verification of the prerequisites of the accounting (financial) reporting, subject to material misstatement.

Technology for comprehensive implementation of risk maps on separate balances, groups of similar operations, and disclosures in developing an audit strategy

Application of this methodology to all *audit areas* makes it possible to perform a spectrum analysis of risks (Figure 3) of different audit objects and prerequisites for reporting on groups of homogenous operations, account balance, and disclosures can contribute to the formation of adequate strategic approaches to audit planning. If to arrange the results of the assessment of audit risks based on separate significant accounting areas: groups of homogenous operations, balances, significant individual assumptions of their formation, in a single *digital* document (spectrum risk analysis), by building a hierarchy of these objects from their tendency to the red spectrum to the green, we can establish and *digitize* at least the following strategic aspects of the audit:

- 1 To determine the *tendency* of the audit area to risk; at this the share of “green zone” factors determined by the significance of “1”, “yellow zone” - “2”, “orange zone” - “3”, “red zone” - “4”.
- 2 To determine the *weights* of the examined accounting area in the total labor intensity of the audit based on the sum of the spectrum analysis values for all the objects.
- 3 To plan the amount of work in person-hours based on the total labor intensity of the audit. For example, in the scheme under consideration, 11 risk factors are assessed concerning the accounting object “Revenue”, of which three are in the green zone (weight – 0.27), three – in the yellow zone (weight – 0.27), one – in the orange zone (weight – 0.09), four – in the red zone (weight – 0.37). Then, the cumulative spectrum score is defined as follows:

$$0.27 + 0.27 \times 2 + 0.09 \times 3 + 0.37 \times 4 = 2.56 \approx 2.6$$

The cumulative level of spectra of all audited objects is 22.4. Then the share accounted for the revenue audit is 11.6%, which at the total labor intensity of the audit engagement of 200 man-hours makes it possible to plan 22 man-hours for this object.

In addition, the positioning of audit objects according to the risk spectrum makes it possible to plan the ratio of the most time-consuming detailed tests and less reliable analytical procedures and the composition of the audit team. For example, it is reasonable to define in the internal regulations of an audit firm the assignment of the most experienced auditors to the objects with a risk spectrum greater than 2.5, and for the least experienced auditors to provide for the possibility to check any objects with a spectrum of 1.5 and below.

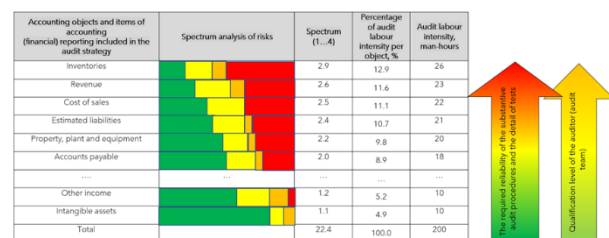


Figure 3 Impact of assessed audit risks on the development of audit strategy

Source: Methodology developed by the authors

Conclusions

With the reform of risk-based audit standards, there is a need for new technologies to identify, assess, visualize risks, and find sufficiently reliable, effective, but rational procedures to identify material misstatements in the reporting of auditees. Modeling the audit risk management system, in our opinion, should be based on the following principles:

- Identification of the maximum possible number of threats to the prerequisites for the formation of accounting (financial) reporting items.
- Assessment of their probability and significance according to the risk heat map of material misstatement model of the 3×3 format, where the horizontal axis represents the probability gradation of occurrence of unfortunate events that may affect the reporting, and the vertical axis represents the significance assessed according to the cost and qualitative criteria of materiality.
- Defining tolerance limits for unlikely and insignificant risks, “sweeping away” substantive testing procedures for assertions where they are found.
- Development of a clear ISA-based response to yellow, orange, and red zone risks planning sufficient substantive test procedures.
- Overall assessment of risk heat maps in the spectrum analysis summary table to build an effective audit strategy aimed at mitigating the risks of material misstatement while also a rational audit strategy.

The developed models of audit risk heat map and generalized map of “spectrum” risk analysis are the most practical tools for the implementation of the following aspects of the audit:

- For developing a scientific-based audit strategy with a focus on high-risk areas.

- For substantiating sufficient appropriate procedures for the risk management of material misstatements at all phases of the audit, from planning to summarizing the results.
- For forming a sufficiently complete and transparent audit file.
- To justify the consistency of the audit opinion with the audit evidence gathered.

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Keys to understanding the El Niño-Oscillation phenomenon in south Mexico

Llaves para comprender El Fenómeno del Niño-Oscilación en el sur de México

NIÑO-GUTIÉRREZ, Naú Silverio†*

Universidad Autónoma de Guerrero, Faculty of Tourism, México

ID 1st Author: *Naú Silverio, Niño-Gutiérrez* / ORC ID: 0000-0001-9250-0798, Web of Science Research ID: AAT-3183-2020, CVU CONACYT ID: 32380

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Abstract

The El Niño-Southern Oscillation phenomenon leaves its mark both in North America and in South America, both in the natural and cultural coastal landscape, where its implications cover the areas: economic, social, political, cultural and institutional. The objective of the present was to expose four keys so that the population understands said phenomenon. The method used was geographical since it exposes the causes, explains the development and its dynamics over time while proposing a solution to mitigate this phenomenon, especially at the local level. The methodology involved office work complemented with field work on the Mexican coast, particularly in Guerrero. Among the results are: a) a global planisphere where the intensity with which the El Niño-Southern Oscillation affects the different continents is shown in different colors and b) the climatic variability is increasing, so the negative effects for some people and positive for others will continue. Conclusions: 1) El Niño-Southern Oscillation is recurrent in an average period of two to seven years; the phenomenon is identified between the months between December-March of each year and 2) The link between environmental protection with sustainable development is urgent in order to protect human health, increase biodiversity, sustainable management of fragile ecosystems present in coastal areas.

Climate variability, El Niño-Southern Oscillation, Vulnerability

Resumen

El fenómeno El Niño-Oscilación del Sur, deja su impronta tanto en América del Norte como en América del Sur tanto en el paisaje natural como cultural costero donde sus implicaciones abarcan los rubros: económico, social, político, cultural e institucional. El objetivo del presente fue exponer cuatro claves para que la población comprenda dicho fenómeno. El método empleado fue el geográfico dado que expone las causas, explica el desarrollo y su dinámica en el tiempo a la vez que se propone una solución para mitigar dicho fenómeno sobre todo a nivel local. La metodología implicó trabajo de gabinete complementado con trabajo de campo en las costas del litoral mexicano, particularmente en Guerrero. Entre los resultados se tienen: a) un planisferio a nivel global donde se muestra en diversos colores la intensidad con que afecta el Niño-Oscilación del Sur a los diferentes continentes y b) la variabilidad climática cada vez es mayor por lo que, los efectos negativos para algunas personas y positivos para otras continuarán. Conclusiones: 1) El Niño-Oscilación del Sur es recurrente en un periodo promedio de dos a siete años; el fenómeno es identificado entre los meses comprendidos entre diciembre-marzo de cada año y 2) La vinculación entre la protección ambiental con el desarrollo sustentable es urgente a fin de, proteger la salud humana, incremento de la biodiversidad, manejo sostenible de ecosistemas frágiles presentes en las zonas costeras.

El Niño-Oscilación del Sur, variabilidad climática, Vulnerabilidad

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* Correspondence author: (E-mail: nsninog@uagro.mx)

† Researcher contributing first author.

Introduction

The earth's surface where man has lived has undergone environmental changes since its origins, but with the passage of time they are increasingly noticeable due to the frequency of some phenomena such as earthquakes, storms, high waves, floods, landslides, droughts, among others, which affect to a greater or lesser extent the practice of various economic activities of the current population. For this reason, studies are carried out from different perspectives and knowledge is applied to contribute to the reduction of risks and disasters, both natural and anthropogenic. The El Niño-Southern Oscillation phenomenon is related to the exchange of heat between the ocean and the atmosphere, a fact that modifies the general circulation of the atmosphere on a planetary level, examples of which are the modification of precipitation, temperatures and the frequency and/or intensity of tropical cyclones (Ledezma, 2021).

The elements of nature located between zero degrees Latitude where the Equator is located and 23° 27' to the north and south, where the Tropics of Cancer and Capricorn are located respectively, boast exceptional hydro-meteorological conditions that allow for the flourishing of biodiversity, which allows for the development of economic activities that bring as a collateral effect, the current climate variability that mainly affects those who reside near the coastal plains in each of the continents of the globe (Pérez-Ortíz et al., 2022). Hence, this article engages with the debate in favour of landscape conservation and sustainable management of existing natural resources to achieve sustainability at a local level, but with global significance.

The global risks and threats that are on the horizon in 2022 are: the current pandemic will persist until 2025; recurrent global natural events such as tornadoes, hurricanes, typhoons, earthquakes, floods (Luna-Luy, 2022), loss of biodiversity, but most seriously, climate inaction on the part of the political leaders who set the guidelines for the world economy, which will mean that the rest of the population will live in the same situation as the rest of the world, the rest of the population will live with greater uncertainty and will need to be more connected than ever and more locally self-sufficient and low-carbon or there will be the possibility of erosion of social cohesion at all levels (WEF, 2021 and WEF, 2022).

The problems faced by the countries located in the spatial fringe where El Niño-Southern Oscillation originates and impacts are linked to the alteration of the natural landscape, often associated with extreme poverty-poverty; the loss of natural resources; water stress (Ortiz-Gaviria, 2022), extinction of flora and fauna; environmental pollution; climate variability; effects of global climate change and the economic indebtedness of its inhabitants. Therefore, the study method used was the geographical approach enriched with the consultation of digital or printed bibliography of articles published in reference databases: Web of Science, Scopus, SciELO, Latindex, among others, and access to remote statistical databases of the National Office of Oceanic and Atmospheric Administration (NOAA). The sections that make up the article are: introduction, methodology, results, conclusions and references.

Methodology

The method used was the geographical approach, given that the causes, explanation, evolution over time and possible solution to the El Niño-Southern Oscillation phenomenon are presented. The methodology employed was of a mixed nature, since qualitative techniques were used initially and later complemented with quantitative techniques, through the information gathered in the field. Thus, the qualitative technique applied during the documentary research involved a first phase of a conceptual nature in which a review of the literature was carried out on topics related to the following: El Niño-Southern Oscillation phenomenon, climate variability and vulnerability; determination of the variables viz: El Niño-Southern Oscillation and Southern Mexico to find the answer to what are the keys to understanding said phenomenon; phase two, comprised the planning of the work through the research design that included the search for sources of information, instruments and affected population. To do this, we proceeded to consult digital reference databases such as: Web of Science, Scopus, Latindex, Redalyc, SciELO, Google Scholar, among others, together with the consultation of printed thematic cartographic material and NOAA digital satellite images, which are updated to 2022 on the area under study; the third phase was of an empirical nature comprising the processing of the selected information, the analysis of the data and information and phase four was eminently interpretative which was set out in the results, discussion, conclusions and references.

Results

Hence, the phenomenon is made up of two key elements: 1) the oceanic component known as El Niño where the behaviour of the Sea Surface Temperature (SST) is of the greatest importance, so meteorologists incorporate physical and technological effort in the collection of data in order to identify the spatial variability of these SST anomalies because this will bring with it more or less intense impacts where these anomalies are appreciated and 2) the atmospheric component (Southern Oscillation), here it is transcendental to identify the spatial variability of these anomalies, 2) the atmospheric component (Southern Oscillation), here the atmospheric pressure of the surface mass of sea water is transcendental, given that atmospheric pressure causes winds to move from higher to lower pressure, which corresponds to an inverse behaviour of temperature. Latin American and Caribbean marine ecosystems boast biodiversity as well as ecosystem services that translate into tangible benefits such as food security and recreational opportunities, among others (ECLAC, 2021).

El Niño-Southern Oscillation (ENSO) refers to the fact that the central Pacific Ocean is experiencing warmer than usual temperatures and is therefore an anomaly in the Pacific climate system. According to Climate Watch Magazine on the Oceanic Niño Index (ONI). It is important to bear in mind that, in order to determine this index, the average of 30 years of informative climate data is taken as a basis to determine whether or not there is any anomaly, for example, the ONI that currently governs was the result of the period 1991-2021, whose influence is global in nature, among which ecological changes in the various ecosystems are cited, which alter other factors that have a negative impact on both time and space, the population and their economies (CPC-NCEP-NOAA, 2020).

Among the elements of weather and climate, which refer to temperature, precipitation and humidity, wind direction and strength, atmospheric pressure, cloud cover, solar radiation and visibility. In other words, weather is the sum total of the physical properties of the atmosphere at a given instant, which is what is known as atmospheric weather. Climate, on the other hand, is the sum total of all the climatic variables expressed above over a minimum period of 30 years to determine precisely the climate of a site on the earth's surface (Garcia, 1989).

Climate factors: latitude, altitude, relief, land and water distribution and ocean currents, any one or all of them, or the combination of some of them, modify the elements that make up the climate. Here, ocean currents and their influence on the world's climates are important, since the El Niño-Southern Oscillation phenomenon is an example of the displacement of large masses of sea water from one part of the ocean to another, caused by the uneven warming of the oceans' waters, This, together with the friction of the winds on the ocean surfaces, causes the surface water to be displaced in the direction of these winds, which can be Trade Winds (global North) and Contra Trade Winds (global South), and even the differences in the total salinity of seawater resulting from the difference between precipitation and evaporation of water from the earth's surface, which among other effects is due to the greater or lesser presence of phytoplankton in the oceanic province (Ayala-Galván et al. , 2021).

It should be remembered that there are marine currents in the Atlantic Ocean where warm currents are located, such as the Gulf of Guinea current which travels from East to West and when it meets Cape San Roque in South America, it divides into two branches, the smaller current follows its trajectory towards the south, thus bordering the eastern coasts of South America, hence it is called the South Equatorial Current, the effects of which are felt in Peru and Chile (Pino-Vargas & Chávarri-Velarde, 2022).

The operational definition of the Niño-Southern Oscillation, according to NOAA, is when seasonal temperatures are 0.5°C warmer than average in the central tropical Pacific (Figure 1) (between 5° north and south latitude at 120°-170° west longitude), between the months December-January-February-March-April or January-February-March-April-May as long as it comprises an average of five consecutive months from Christmas and from there to the end of spring each year in the case of the northern hemisphere. For the Niño-Southern Oscillation to become a full episode and acquire the status of an "anomaly", since this phenomenon comprises twelve months in total (Lindsey-L'Hereux-Halpert-Blunden, 2021).

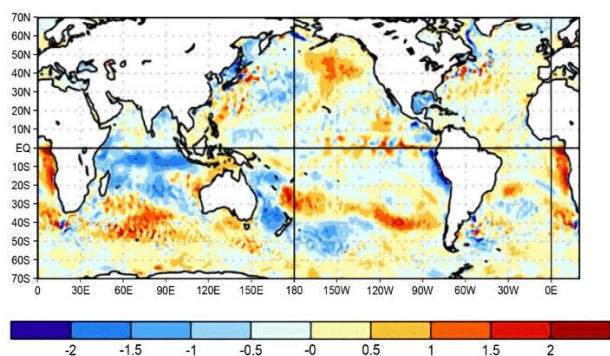


Figure 1 Change in weekly anomalies in (°C) during 19 January to 16 February 2022

Source: CPC-NCEP-NOAA, 2022.

According to the Scientific Committee on Ocean Research (SCOR) of UNESCO, the Niño-Southern Oscillation occurs when sea waters are extremely warm along the Pacific Ocean coastline, as it has been observed that the average monthly temperature in the South Pacific exceeds the annual mean temperature for five months, which makes it an "anomaly" given that it is not common for this to occur over several years (CPC-NCEP-NOAA, 2021).

A severe example of the El Niño-Southern Oscillation phenomenon occurred in 1997, during the month of July in the tropical Pacific at equatorial latitude, with notable warming events of the ocean surface water. In the central-eastern equatorial Pacific, the Sea Surface Temperature (SST) increased from April to May, but as it corresponds to the Southern Hemisphere winter, it would normally have decreased. Meanwhile, SSTs peaked in several parts of the South Equatorial Pacific. Temperature differences were greater than 4°C east of 120°W over the Equator and passed 5°C in the longitude of the Galapagos Islands. It should be noted that the El Niño-Southern Oscillation began in March 1997, and its largest anomaly was recorded in December 1997. Between January and March 1998, the anomaly was decreasing (Ibidem, 2021).

The El Niño-Southern Oscillation of late 1997 was one of the most outstanding natural weather phenomena, developing a power greater than that of a million nuclear bombs. Months later, when it came to an end, it had affected the climate in various parts of the planet, caused the deaths of 2,100 people and caused material damage estimated at 34.8 billion dollars. In 1997, 17 storms were recorded in the eastern North Pacific, 14 of which became hurricanes and seven of which reached great magnitude (Sánchez, 2001).

The years 2009, 2010, 2015, 2016 and 2019 have been recorded as the most evident El Niño-Southern Oscillation phenomena due to their high temperatures and adverse effects on the territories, ecosystems and populations they affected, the consequences of which involved loss of human lives and millions of dollars for restoration and to re-establish the minimum characteristics to keep the population and diversity alive (CPC-NCEP-NOAA, 2021).

The causes of the "Anomaly" are the elevated temperatures of the upper layers of ocean water that in their interrelationship with wind speed result in thermal exchange between the ocean and the atmosphere. Where, the atmosphere emits and receives heat from the oceanic water mass (by releasing heat through evaporation) and the ocean in turn receives heat through solar radiation and heat exchange with the atmosphere. For example, the 2013 El Niño events in Latin America included: severe droughts in Mexico (Niño-Castillo et al., 2020); excessive rainfall in Central America; stages of drought in Colombia; lack of rainfall in the north and centre of Brazil and heavy rainfall in Argentina, Peru and Chile, which affected agricultural, livestock, fishing, energy and transport activities or diseases transmitted to the population by vectors such as dengue fever, transmitted by contaminated water or food such as cholera and typhoid fever; respiratory diseases such as influenza (Hijar et al., 2016).

It should be noted that for the three decades between 1991-2021, NOAA has reliable data that the climate has recently changed abruptly, with warmer temperatures both globally and in the central tropical Pacific, normally between the months of January and June each year, which means that there is a strong possibility of an El Niño phenomenon in 2023. There is always the possibility of coastal flooding due to intense precipitation at the sea-land interface in Latin America (Niño-Gutierrez & Luna-Nemecio, 2021) and the Caribbean, among other territories, as a consequence of current climate variability (Serrano et al., 2016).

Meanwhile, the other branch is known as the North Equatorial Current, which skirts the coasts of South America, the West Indies, the Gulf of Mexico, where in the midst of the 2020 to 2022 pandemic, rainfall, more intense cold in winter will be felt, which translates into a greater number of respiratory illnesses closely related to COVID-19 (Niño-Gutiérrez, 2021) and is incorporated into the Atlantic Ocean through the strait of the Florida peninsula and continues its journey in such a way that it returns to its place of origin. But there are also cold currents such as the Arctic Ocean and Antarctic Ocean cold currents where two small cold currents originate, one of which skirts the southeastern coasts of South America and the other heads towards the southwestern coasts of Africa. There are also the Indian Ocean Sea currents, both cold and warm, especially in the case of the latter, which is related to the transmission of the dengue virus to humans (Stephenson *et al.*, 2022).

For Mexico (Figure 2), the ones that have the greatest impact are the Pacific Ocean ocean currents since: on the western coasts of South and Central America, two warm currents originate from east to west, the N(east) and S(ur) equatorial currents, separated by a countercurrent that travels in the opposite direction from W (west) to E (east) and reaches the coasts of the Equator; This is known as the El Niño current, as it only occasionally manifests itself on the surface because it frequently occurs around 6 January, causing unusual rainfall on the coasts of Peru. This phenomenon lasts nine months on average (García, 1989: 73).

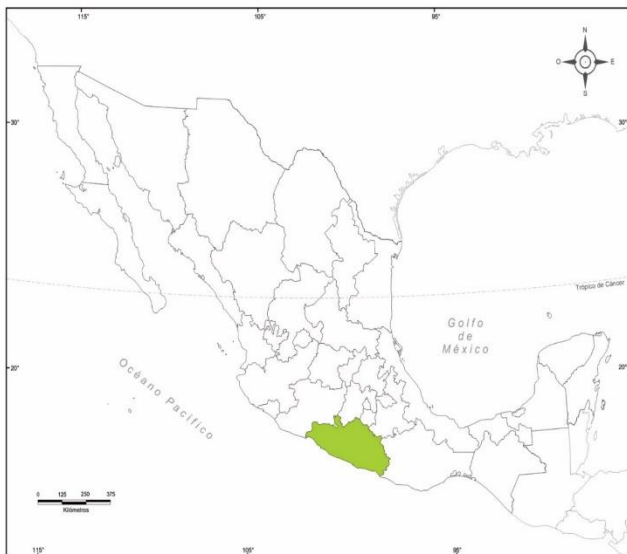


Figure 2 Location of Mexico
Source: Niño-Castillo *et al.*, 2020

The state of Guerrero, one of the 32 entities that make up the United Mexican States, is located in the Mexican South Pacific and was created on 28 October 1847. It is named in honour of General Vicente Guerrero, hero and consummator of National Independence. Guerrero's territory extends over 64,282 km², is located in the south of the country and is bordered to the north by the states of Mexico, Morelos, Puebla and part of Michoacán, to the east by the state of Oaxaca, to the south by the Pacific Ocean and to the west by the state of Michoacán (Figure 3).

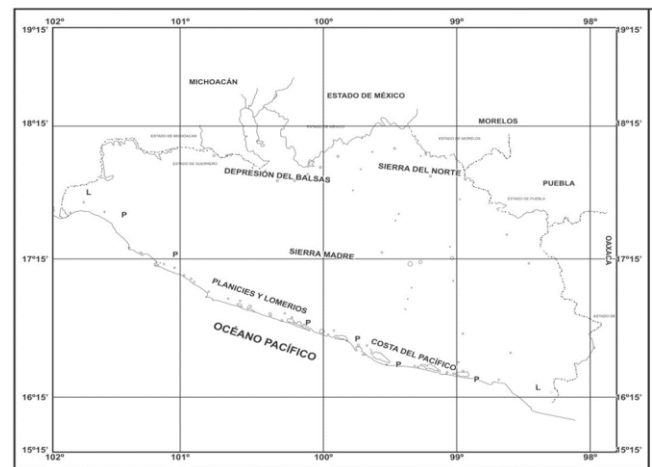


Figure 3 Geographical boundaries of Guerrero
Source: Niño-Gutiérrez *et al.*, 2016

In the state of Guerrero, warm climates with summer rainfall predominate, comprising 58%; temperate climates comprise 25%, while dry climates comprise the remaining 17%. This entity is located in the intertropical zone (Gonzales-Zenteno, 2022), where high temperatures are modified by the altitude of hills and volcanoes such that, at 1,800 m above sea level, the temperature is less than 18°C on average.

Average annual temperatures range from 30°C to 20°C and are hot in the lower portions leading to the coasts and the Balsas Depression. Above 1700 masl and 2400 masl, temperatures between 19°C and 14°C occur in the middle and upper parts of the Sierra Madre del Sur and in the extreme north where there is a transitional portion between the Transverse Volcanic System and the Balsas Depression. Average temperatures below 14°C are found above 2 400 m above sea level, especially in the Sierra Madre del Sur.

Rainfall, to a greater or lesser degree, is linked to the factors mentioned above, as well as to humidity and winds. The summer rains, which last until autumn, are of the monsoon type from warm and humid air masses coming from the sea, or from tropical cyclones associated with ascending convection phenomena originating locally or from the relief. In winter, it is caused by fronts of cold air masses from the north when they collide with warm air masses from the south. From the northeast there are trade winds whose direction changes due to the orogenic barriers that also bring humidity from the sea with east-west orientations, which are also related to cyclones and wind waves from the east.

The dominant climate is tropical with summer rains (Aw), located on the coast and in the Balsas Depression located to the extreme NW, the NNW, Central-East and NE (29%) with maximum altitude of 1750 meters (58%), the temperate climate with summer rains (Cwa and Cwb), located in the Sierra Madre del Sur and Northern mountains and the Volcanic System above 1750 m (26%), the Dry Steppe climate with scarce rainfall in summer, located in canyon areas east of the Balsas Depression, among other places. In the state of has an average annual temperature of 20°C and an average annual rainfall of 800 mm.

A lower average precipitation of 600 mm corresponds to the Balsas River Depression at its limits with Michoacán (Infiernillo Dam), and in the Balsas river basin area in the Central-Northeastern part of the state. The 800 mm isohyet is located in the northwest and in the centre-east in the extreme NE and from Acapulco to the mouth of the Balsas in the coastal portions. It also coincides with the middle to high relief of the Sierra Madre del Sur. A further 1 200 mm is located in the north of the state, north of the parallel 18° 10' N latitude. The 1 500 mm isohyet surrounds high reliefs in the Sierra Madre del Sur, and the 2 000 mm isohyet corresponds to higher reliefs at the eastern end of the Sierra Madre (Correa, 2007).

According to W. Koeppen, Guerrero has the following climates: Awg, hot or tropical rainy with summer precipitation, whose maximum temperature is recorded before June 21 in this case in 2022 also known as the summer solstice and covers the hills located between 1 700 to 1 800 m asl, both on the coastal slope and in the Balsas Depression and a portion of the centre-west of the Sierra Madre del Sur, to the west and another to the east, at the eastern end.

Cwag, temperate with summer rainfall, whose average temperature of the hottest month is higher than 22°C and the temperature of four months or more higher than 10°C, with the maximum recorded before the summer solstice, located between contour lines 1 700 to 1 800 masl and 2 400 masl in the Sierra Madre del Sur, as well as in the north of the state where the municipalities of Ixcateopan and Taxco de Alarcón, Guerrero, are located.

Cwbg, temperate with summer rainfall, whose average temperature of the warmest month is below 22°C and the maximum temperature is before the summer solstice, located between 2 400 and 2 800-2 900 masl in the Sierra Madre del Sur.

Cwcg, temperate with summer rainfall, with mean temperature of the warmest month above 18°C and temperature of four months or more below 12°C, with a maximum before summer solstice located above 2 900 masl, in the eastern and central-western portions of the Sierra Madre del Sur.

BShwg, dry steppe, warm with scarce rainfall throughout the year, less than 800-700 mm, in summer average temperatures are above 18°C and the monthly average of some months is below 18°C. It is located in the NW of the state, next to the Infiernillo Dam and the Balsas-Cutzamala river, on the border with Michoacán, as well as in the canyon area of the Balsas-Tlapaneco river. One result is gastrointestinal illnesses due to the high temperatures, including fevers, diarrhoea, rapid food spoilage, throat problems and now COVID-19 or its variants (Niño-Gutiérrez, 2021).

From the hydrographic point of view, most of the entity corresponds to the Balsas River Basin, where other rivers such as Tlapaneco, Amacuzac and Cutzamala stand out in the continental portion, and in the coastal slope there are surface runoffs integrated by Omitlán-Papagayo, Ometepec-Río Verde; Atoyac River, Nexpa River, among others. In addition to the Chautengo and Tecomate lagoons in Costa Chica, Tres Palos in the municipality of Acapulco and the Coyuca lagoon in the municipality of the same name.

Professionals and health geography professionals are on high alert during the months of May-August each year to warn the population to take responsible individual and collective care as the influence and effects of the El Niño-Southern Oscillation phenomenon are triggered, among the evidence are: cases of dengue, dengue haemorrhagic fever, fevers, diarrhoea, flu and colds, among others. These have resulted in high morbidity rates and saturation of public health care services.

Conclusions

The methodology applied allowed the achievement of the objectives set out, firstly, to characterise the El Niño-Southern Oscillation phenomenon and, secondly, to synthesise the vulnerability of natural elements and the population established in the coastal areas of Latin America and the Caribbean. In the central tropical Pacific, where El Niño-Southern Oscillation occurs, there are exceptional geographical enclaves and reservoirs of biodiversity, and it is therefore important to contribute as far as possible to the mitigation of current climate change.

It is well known that El Niño-Southern Oscillation is recurrent in an average period of two to seven years; the phenomenon is identified between the months of December-March of each year, when normally cold temperatures tend to present anomalies of 0.5°C above average and it is estimated that the next El Niño event in Latin America and the Caribbean will have effects in 2023.

The link between environmental protection and sustainable development is urgent in order to protect human health, increase biodiversity, sustainably manage fragile ecosystems present in coastal areas, among others, and thus promote sustainability through the implementation of activities that mitigate the negative impacts of this phenomenon on the environment.

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Web business management system

Sistema de gestión empresarial por Internet

GONZÁLEZ-RAMÍREZ, Claudia Teresa†*, PATIÑO-BUCIO, Alpha Michel, RUIZ-GARDUÑO, Jhacer Kharen and DELGADO-PICHARDO, Mauricio

Tecnológico Nacional de México campus Zitácuaro

ID 1st Author: *Claudia Teresa, González-Ramírez* / ORC ID: 0000-0002-4106-4583, Researcher ID Thomson: G-6313-2019

ID 1st Co-author: *Alpha Michel, Patiño-Bucio* / ORC ID: 0000-0003-4735-8555

ID 2nd Co-author: *Jhacer Kharen, Ruiz-Garduño* / ORC ID: 0000-0003-3353-7966

ID 3rd Co-author: *Mauricio, Delgado-Pichardo* / ORC ID: 0000-0003-1129-2128

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Abstract

The developed project addresses the existing functional impact of automation and streamlining organizational management systems, through the most ad hoc technological tools for the generation of web systems in an integral way. Organizational Management System on the Web, part of having control of the activities and documents, identified mainly from within the organization's problems, as is the case of Biocenosis A.C. Monarca region, with the purpose of keeping the proper record of the activities to be carried out within the company, in addition to being able to have a space in which they can store and download all the necessary documents to complete said activities, the web system is developed, strengthening with an activity manager application optimizing towards an organization and management of the registration of the different participation activities, calls, monitoring of plans according to the activities of the organization a priori. The web system and application are obtained with technological tools, such as SCRUM, Android

Web system, Comprehensive, Technological tools

Resumen

El proyecto desarrollado aborda el impacto funcional existente de la automatización y agilizar los sistemas de gestión organizacional, a través de las herramientas tecnológicas más ad hoc para la generación de sistemas web de forma integral. Sistema de Gestión Organizacional en Web, parte de tener un control de las actividades y documentos, identificados principalmente de dentro de problemas de la organización, como es el caso de Biocenosis A.C., región Monarca, con el propósito de llevar el registro adecuado de las actividades a realizar dentro de la empresa, además de poder tener un espacio en el que podrán almacenar y descargar todos los documentos necesarios para completar dichas actividades, se desarrolla el sistema web fortaleciendo con una aplicación gestor de actividades optimizando hacia una organización y gestión del registro de las diferentes actividades de participación, convocatorias, seguimiento de planes de acuerdo a las actividades de la organización a priori. Se obtiene el sistema web y aplicación con herramientas tecnológicas, como SCRUM, Android

Sistema Web, Integral, Herramientas tecnológicas

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* Correspondence to Author (E-mail: claudia.lic@gmail.com)

† Researcher contributing first author.

Introduction

Web systems today are widely used, due to the practicality of the web browser as a client, and in the independence of the operating system, allowing optimization of time and not having to learn to use new programs, as well as their creation, administration, maintenance. and data backups, as well as the core point is being able to work from anywhere. We can say that web systems are easy to use, only with basic computer knowledge you can work with them and be used by several users at the same time.

Organizations have multiple activities to perform daily to achieve the success of objectives and goals set, so it is very difficult to keep track of them if you do not have a system that makes it easy to record and view these tasks to be performed, in time and form. In some companies, the control of appointments and tasks to be carried out is carried out in the traditional way, writing the activity data on a piece of paper or notebook, if there is no electronic system, so sometimes these annotations are lost and the company attends late or does not show up for these activities. Based on the importance and impact, the project was developed in BIOCENOSIS A.C. Monarch region in august 2020 - august 2022.

The advantages of this system are the following:

- Record future activities to be carried out.
- View the progress of activities.
- Be able to upload and download documents in the system.
- Register staff within the organization.
- Create a stable and flexible system to future changes.
- Possibility of incorporating new technologies.

Organizational Management System on the Web was strengthened with the development of an intelligent task manager app, which is based on the same importance of having control of activities and documents, identifying the main problems of the organization, in addition, the management system sends a reminder, which will be programmed with the date and time in which you want to receive the notification, obtaining optimal results for the organization Biocenosis A. C.

What is sought with the web and app system is to maintain:

Relevance: Manage call information

Integrity: Always ensure that you are notified of your activities

The two previous features allow the user notifications, warnings and reminders of activities to be carried out or pending, as well as saving documents in the cloud.

Justification

The BIOCENOSIS association located in the center of Zitácuaro, Michoacán, presents the need to have a better control of the processes that are carried out internally in the organization, one of its activities is to carry out activities in areas of origin communities , just like her presentation of projects in the improvement of various communities, presenting the problem of loss of project management and in USB memories with dates stipulated by federal and private organizations for the acquisition of resources.

Generating the option to improve the processes to be carried out inside and outside the organization from the mobile and on the web, the control of the processes supports the option of developing a WEB system. The A association with this technology can achieve reliability in monitoring the information on current calls or potential, due to the importance and relevance of operations and information management of great sensitivity for the same, and the communities of origin, reducing the percentage of incidents of loss of information. On the one hand, linking the Web system with a mobile application offers the user a friendly, light, brief, fast interface and work anywhere.

Problem

The paper record of the tasks to be carried out, which sometimes caused the loss or forgetting of these annotations where said record was made, as well as the forgetting of the date and time of the activity. Sometimes scheduled appointments are delayed or there is a delay in the delivery of activities. with a document stored on the office computer from another location, be it from home, another location, or even across the country, and the only way to access these documents was at the office to get the file. Since there is no dedicated space to store your documents, they are often lost between office computers, as it is not known which computer the file is on.

Hypothesis

Implementing the use of a web system allows users to access information in a simpler way, updated from the comfort of a mobile device at the desired time and place, for any type of organization

Variables

Independent variable

Lack of time.

Lack of time.

Updating of information.

Easy to use.

Resource availability.

Dependent variable

Mobile application for consultation and access to documents to be generated.

Web system to store information on different projects in the cloud and collaborate in the development of documents.

Methodology

The project has the character of application, of mixed and transversal type; It is necessary to carry out a satisfaction survey of end users, as well as to obtain their appreciation of use in optimizing their processes and cross-sectionally, since data from the variables must be observed and analyzed over a period of time (after testing the web system and mobile application) on the sample population. Software development

Methods and tools

Survey through direct interviews with users. Those involved are 10 employees. The organization is BIOCENOSIS A.C from the eastern region of Michoacán

Technologies used

The tool for the design and development of a web system and mobile application, as well as the development environment and the database manager used in the development of the project.

Scrum is an agile and flexible methodology adapted to manage digital solutions, Mysql is a relational database management system developed under a dual license, for web development environments. PHP code is usually processed on a web server by an interpreter implemented as a module, a daemon, or as a common input interface (CGI) executable. Google's Firebase is a cloud platform for web and mobile app development. Hosting is a hosting service for websites . JavaScript, a dynamic, multi-paradigm, single-readed, prototype-based programming with support for object-oriented, imperative, and declarative programming. jQuery is a JavaScript library that simplifies the way you develop web applications. BOOTSTRAP, open source user interface framework, created for faster and easier web development. AJAX refers to a group of technologies that are used to develop web applications. By combining these technologies, web pages appear to be more responsive since small packets of data are exchanged with the server and web pages are not reloaded each time a user makes an input change. Human capital. It has the participation of two young students and three teachers, Technological Zitácuaro, Michoacán all in the formation of computer systems, with necessary and sufficient skills for the achievement of the project.

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Project Engineering

For the development of this project, the Scrum methodology is ideal due to its agile nature.

The sprints developed based on the selected methodology are:

1.Sprint planning

In the first team meeting, the definition of functionality, objectives, sprint risks, delivery deadIn the first team meeting, the definition of functionality, objectives, sprint risks, delivery deadlines, among others, was achieved. Subsequently, a meeting is held between the team to evaluate changes, decision making, improvements and more factors.

2.Sprint backlog

The sprints developed based on the selected methodology are:

1.Creation of the database and user interface.

2: Programming the registration, updating and deletion of users as well as activities.

3: Programming for uploading files to the system as well as downloading them and assigning permissions to users.

4: Choice of host that will store the system and upload it.

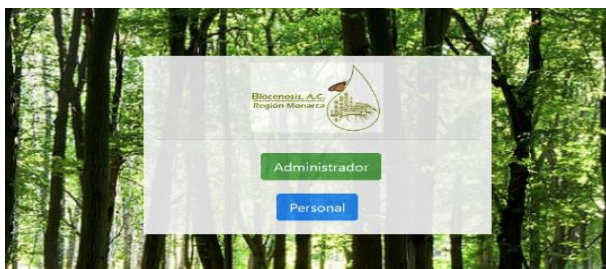


Figure 1 SW Login Menu



Figure 2 SW Admin and Staff Login

Show all the actions that a user with the administrator role can carry out in the system, listing them within a vertical drop-down menu as shown in figures 1 and 2, in the WEB system.

When the work of the sprint is in progress, those in charge must guarantee that last minute changes are not generated that could affect the objectives of the sprint. In addition, it ensures compliance with the established deadlines.



Figure 3 Home screen

Show a submenu with the actions related to managing activities that the administrator can do in the WEB system.



Figure 4 Start Menu Screen with Activities Dropdown

All activities will be displayed registered in the database with the different options that can be done about the activities. It is worth mentioning that the administrator was given the permissions to be able to execute the options that are shown below about the activities regardless of whether the record activity or not, in the WEB system



Figure 5 List of activities

The activities that are controlled in the common application that will be relating to the WEB system, the starting screen. See Figure 5.



Figure 6 Imagen inicio app gestor

User management is important, where it is important to provide the password and access key. See Figure 6.



Figure 7 Manager app startup image

Once you have provided the access keys, the application menu is displayed.

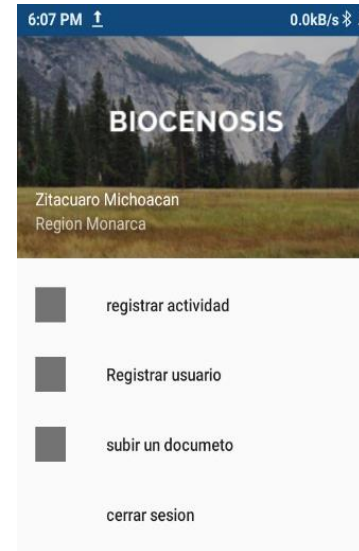


Figure 8 Main menu of the app.

This is the main window which has a menuSlider, clicking on the icon of the 3 rectangles displaying the options menu, figure 7.

3. Sprint review

At the end of the interval development, it is possible to analyze and evaluate the results

- Collaboration between teams, supervisors.
- External analytics are supported as a form of complementation.
- The work team answers what has been developed and what shortcomings they have had.

List all activities

This option shows all the activities registered in the database with the different options that can be carried out on the activities. It is worth mentioning that the administrator was given the permissions to be able to execute the options shown below on the activities regardless of whether the activity was registered or not, in the mobile application, as can be seen in illustrations 8 and 9.

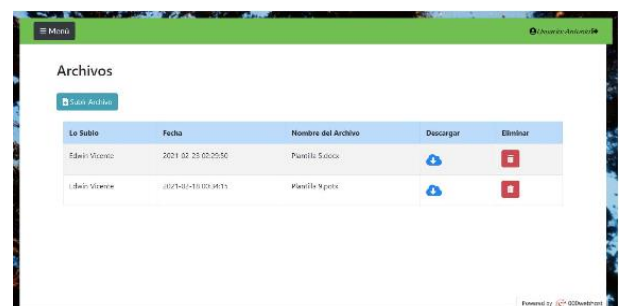


Figure 9 Screen to modify SW activities

Nombre del Proyecto	Actividad	Fecha de Finalización	Status
Proyecto Mariposa Moravia	Convocatoria	2021-02-28 17:14:00	Finalizado
Entrega	Avance 1	2021-02-25 02:22:43	Finalizado

Figure 10 List activities screen finished. SW

Bio

Nueva Actividad

Nombre de la Actividad: _____

Fecha de la Actividad: _____

Ahora de la Actividad: _____

Descripción de la Actividad: _____

GUARDAR LIMPIAR INICIO

Figure 11 View of the activity log window. apps

Feedback

The results are delivered to receive feedback from all those involved in the project. It was considered to add a section of completion of activities. When the finish button is pressed in the activities list, the id is sent by method POST to a file that will take care of doing two queries.

Once verified that the data is unique, they are entered in the corresponding table and at the same time the telephone number, username and password will be obtained, to send the new user through a WhatsApp their username and password with which they can access the system.



Figure 12 WhatsApp message that will be sent with the login data

In accordance with the Scrum methodology, at the end of each sprint the product obtained is evaluated, endorsing its functionality; from there, the client uses it already validated and configured.

There are two developments, one is the web system that is linked to the mobile application to further strengthen the web functionality of the systems. comprehensively.

Results

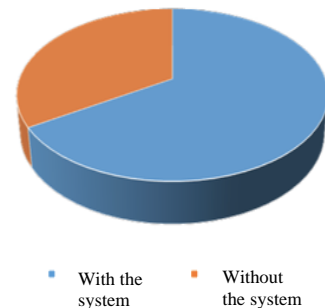
The web system is hosted on an ad hoc host so that the organization could verify the correct operation of the system and the application. In graphic 1, you can see that the loss of documents was greatly reduced, since previously he had no control over his documents. The management of monthly documents is 10, of which there was only control of at least 2, representing 20% control before the SGW, after the system it is 100%.



Graphic 1 Reduction of documents loss

In graphic 2, we can see the improvement in terms of the development of the activities, since now with the system they can visualize the progress of each of their activities and manage to respond to the observations of calls.

Development of activities



Graphic 2 Improvement in the development of activities

Before the system, you only had the opportunity to carry out an activity in a efficient and collaborative of three activities that should be addressed.

Aspects/options	APP	Documents	Percentage of improvement
Event notification	Now from mobile with a notification, which notifies the user of calls.	Forgetting to call, due to omission of registration of the activity.	100% of 10 notifications that were attended. Before, only three out of 10 per month were attended, now with the mobile application and the web system, all calls are covered.
Access to information	Access to information is 24 hours 365 days	Information is only accessible when the office is open, this activity was before the system and the application.	The attention was Face-to-face, having an effectiveness of 20%. With the implementation of the web system and the mobile application, 100% service is provided.
Ease in handling documentation	Documents are available on the server to users at any time	It was attended at times at certain times according to the user or client.	Users took turns using the computer equipment for their use, which generated an effectiveness of 2%, now allowing 90% to be covered, since a project must be handled asynchronously.
hHistories	The database saves all the information at the time the application is accessed	There is a record of the paperwork from the beginning to the end in The organization according to the database in the cloud.	Only 70% of documents correspond to projects. Currently every project has a history, covering 100%.
Job Alerts/ activities	The application notifies the user when there is a new activity	Previously, important dates were forgotten, because the use of the paper agenda was not reviewed and was forgotten in the office.	So far all activities are attended to 100%, previously only 70%.

Table 1 Comparison of application vs. procedure

Web technology with well-designed tools gives certainty to the development of a robust, functional and efficient software product for an organization. BIOCENOSIS A. C. Monarca region is experiencing an integration to digital management.

Gratitude

We thanks to the BIOCENOSIS association. AC monarch region, for considering the teachers and students of the Tecnológico de Zitácuaro, to carry out the project, the Tecnológico de Zitácuaro for making technical and technological agreements with the association, in search of the good of the community of the eastern region of Michoacán. Let's make creative technology to be useful to México.

Conclusions

The use of an agile design methodology in web projects and mobile applications such as Scrum, and software that allows systematic planning, which includes collaborative teamwork, leadership by experts in the area, enriching the developer experience (teachers and students) as the project progresses.

Web technology with well-designed tools, gives certainty to the development of a robust, functional and efficient software product for an organization. BIOCENOCIS AC Monarch region is experiencing an integration to digital management, benefiting the origin communities as in all the region.

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Plastic grow kit design project

Proyecto de diseño de un kit de cultivo de plástico

DÍAZ-BARRIGA-RODRÍGUEZ, Elisa†*, MARROQUÍN-DE JESÚS, Ángel, ANGUENOT, Clemént and DUMOND, Kévin

*Universidad Tecnológica de San Juan del Río.
University of Savoie Mont Blanc*

ID 1st Author: *Elisa, Díaz-Barriga-Rodríguez* / ORC ID: 0000-0002-2949-3406

ID 1st Co-author: *Ángel, Marroquín-De Jesús* / ORC ID: 0000-0001-7425-0625, CVU CONACYT ID: 81204

ID 2nd Co-author: *Clemént, Anguenot* / ORC ID: 0000-0003-1361-176X

ID 3rd Co-author: *Kévin, Dumond* / ORC ID: 0000-0002-8836-1278

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Abstract

Objective: The development of a product aimed at the recreation sector such as toys for children can represent many obstacles due to the public to which it is addressed and the problems that come to reflect with the efficiency of the plastic material and how that can affect the product itself.

Method: Our starting point in this project was to make research about products that were already made, we had to become familiar with the materials commonly used for the invention of toys, know its properties until we find the ideal material for our product which in the end it turned out to be the HDPE of SABIC. Then based of previous knowledge we wrote the functional analysis of the product to characterize the functions offered by our product to satisfy the needs of our users. Next, we capture the ideas in a pulse sketch to be able to later make an electronic sketch with the help of a SolidWorks to make the idea tangible and do the necessary changes to the problems that progressively presented themselves to us. In fact, the invention of the toy evolved as we went along, this was precisely the strongest barrier of the whole assignment.

Furthermore, we decide based on our judgment and research that the best method to make our culture kit was through injection, because it benefits us in the aspects of time and cost of the process. Consequently, we had the task of carrying out mechanical resistance tests in the Mold Flow software to ensure that our design was practical.

Contribution: Finally, we had to obtain the approximate cost of machinery in the production invested on our piece, which gave us a cost of about 4.938 €. And that helped us to obtain countable results from simulations, such as the cycle time.

Plastic material, Injection, Costs

Resumen

Objetivo: Desarrollar un producto dirigido al sector de la recreación puede representar muchos obstáculos debido al público al que va dirigido y los problemas que se reflejan con las propiedades de la materia plástica definida que por consecuente impacta al producto mismo.

Metodología: Una investigación sobre productos en existentes con usos similares fue realizada con el propósito de familiarizarnos con los materiales que comúnmente se utilizan para la invención de los juguetes, conocer sus características hasta encontrar el material idóneo para nuestro proyecto, el cual resultó ser el HDPE de SABIC. Luego el análisis funcional del producto fue minuciosamente redactado para caracterizar las funciones que ofrece nuestro producto y de esta manera satisfacer las necesidades de nuestros usuarios. A continuación, se hizo la creación inicial del diseño a mano alzada y más adelante con la idea más clara, en el software SolidWorks.

Además, decidimos en base a nuestro juicio e investigación que el mejor método para hacer nuestro kit de cultivo es través de la inyección, porque nos beneficia en los aspectos de tiempo y costo del proceso. En consecuencia, diversas pruebas de resistencia mecánica fueron realizadas en el software Mold Flow.

Contribución: Finalmente, tuvimos que obtener el coste aproximado de maquinaria en la producción invertida en nuestra pieza, lo que nos dio un coste de unos 4.938 €. Y eso nos ayudó a obtener resultados contables de simulaciones, como el tiempo de ciclo

Materia plástica, Inyección, Costos

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* Correspondence to Author (E-mail: Elisadbr2000@hotmail.com)

† Researcher contributing first author.

Introduction

A leading company in the toy market, seeks to diversify by offering a brand-new product. This is a small plant growing kit for kids.

The kit includes a shelf with two trays, pots for cultivation, sachets of ready-to-use seeds, potting soil, instructions for use, a game board which presents the cultures of the seeds according to the seasons, and vegetable files.

The company calls on you for your plastics processing skills to help it in its search for solutions. She asks you to study the realization of the shelf only. It expects concrete implementation proposals from you.

Methodology

Functional analysis of the product

Identification of need: A toy company is looking to diversify by offering an innovative product. This is a cultivation kit for children to make them aware of the fauna and flora.

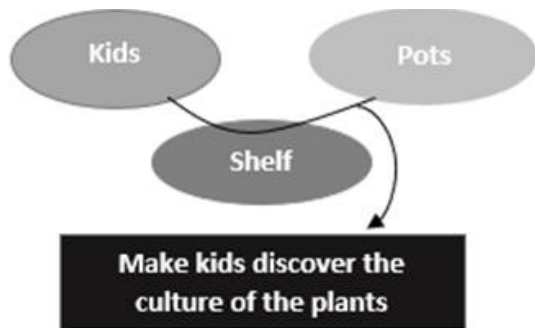


Figure 1 The horned beast diagram

Elements of the external environment:

CF1 (FP): Pots.

CF2: Support the pots.

Below are some elements of the file provided by the company.

Catalog selling price of the complete kit: between 12 and 18 per unit (public price). The shelf with the pots should not represent more than 60% of the total price.

Production forecast of 5000 units over one year.

Maximum shelf dimensions: length; 450, depth: 160, height: 330.

Two removable trays that can accommodate 8 pots each.

CF3: Resistant to shocks, moisture.

CF4: Meet the standards.

CF5: Handle with 2 hands.

CF6: Watering plants.

CF7: Move the shelf.

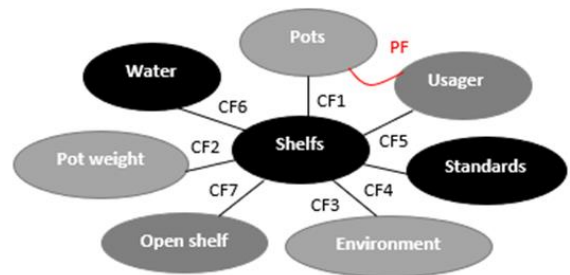


Figure 2 Octopus diagram

Characterization of service functions

Une fonction de service est une fonction attendue d'un objet technique pour répondre aux besoins of a given user (e.g., a child in our case).

Classes of flexibilities:

F0: Zero flexibility, imperative level

F1: Low flexibility, low negotiable level

F2: Medium flexibility, negotiable level

F3: Strong flexibility, highly negotiable level

Service functions	Requirement	Level	Flexibility
FS1: Pots	Support the weight of the elements	Average of 600g per pot	F0
FS2: Support pots	Get an ideal and convenient weight to hold the pots	Average weight of 4.5 kg per tray	F1
FS3: Resistant to shocks, moisture	Resistant to moisture and temperature changes	1-4 years	F2
FS4: Comply with standards	Compliance with standards	ISO standards	F0
FS5: Handle with both hands	Light	About 4 kg per shelf (children over 6 years old)	F1
	Right measurements	A child's hand	F0
FS6: Watering plants	Support the weight added by the water	60g added 2-3 fois/semaine	F2
FS7: Move the shelf	Movement of the shelf and its total weight	Average of 9kg +/- 500g for the whole shelf	F0

Table 1 The service functions and their levels

Implementation

Diagram FAST

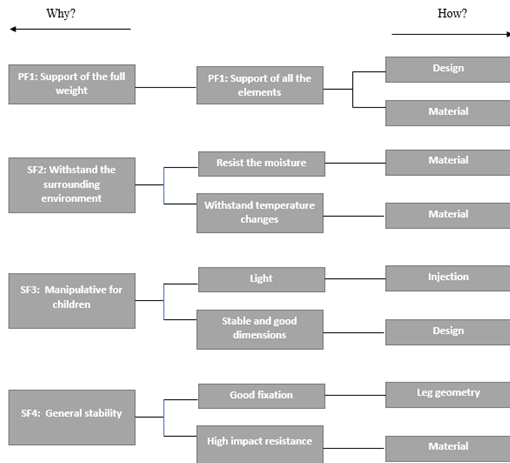


Figure 2 Fast diagram

Product Specifications

The purpose of the specifications is to put in writing the needs so that it is understandable to the different actors by defining all aspects of the project.

Grow kit	
Description :	"Kit for children" / Introducing plants to children
Deadline :	Week 27
Objective:	Create a grow kit for children that will teach them how to grow, the importance of the seasons in growing
Tasks: (Perimeter Elements)	Aimed at children over 6 years old Can be used indoors Easy to handle
Choice of materials:	<ul style="list-style-type: none"> • PPH, good strength/weight ratio, more rigid than the copolymer. • PP, very resistant to fatigue and bending. • PEHD good UV and shock resistance. (defined material)
Constraints :	<ul style="list-style-type: none"> • The project must be completed by week 27. • The budget for the project must not exceed 16€.

Table 2 Grow kit specifications

Sketch/design

Explanation:

Firstly, the idea was to make a design similar to a children's toy with rounded shapes and corners. Or this, we relied on toys shelf- like with two legs and floors that quickly mount / disassemble. For the part of the feet, we considered that it was appropriate that they should be square shaped for better stability on the ground.

Choice of the implementation process

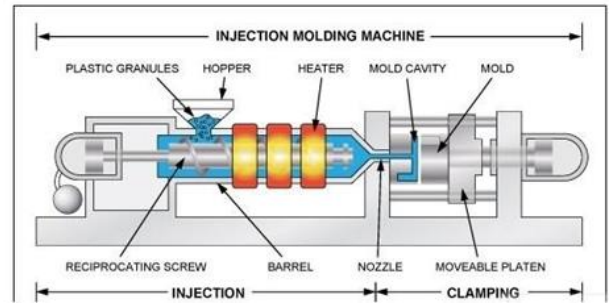


Figure 3 Injection machine scheme

Advantages	Disadvantages
Possibility of manufacturing in one operation	Complex form
Short cycle time	Lack of creativity for the public
Design Freedom/complexity	High tooling costs
Low process budget	Need of draft angles
Most suitable	Large mold

Table 3 Advantages and disadvantages of injection molding

For the rest of the project, we kept the idea of designing one product with the ability of being assembled.

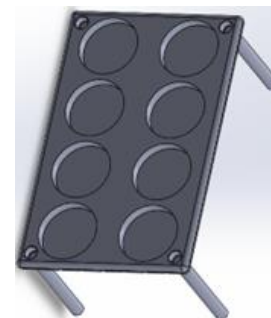


Figure 4

Chosen material

After an arduous investigation we decided that the material that was the most suitable for our application was HDPE for its usefulness being easy to process, tough grade with a good resistance to environmental stress cracking and low notch sensitivity. It has a grade of 28g/10min, which corresponds to an injection grade and the price is 1400€ per tonne.

Final part and simulations

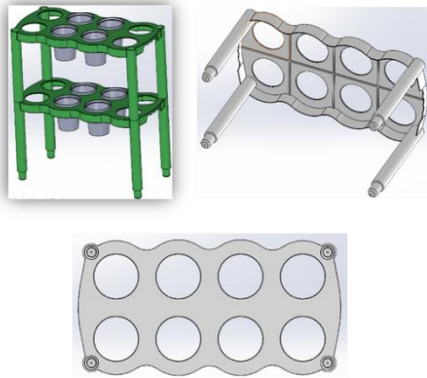


Figure 5

Technical drawing

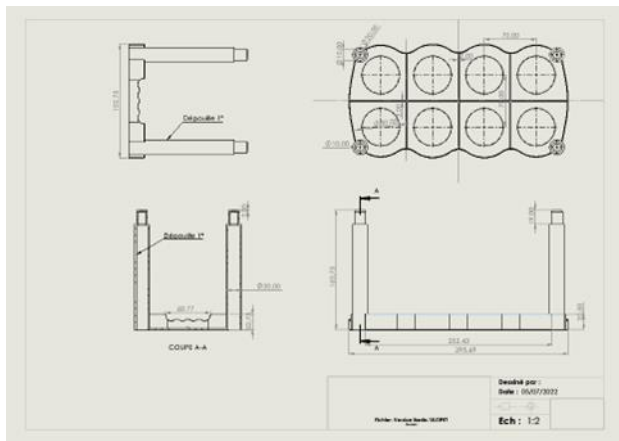


Figure 6 Technical drawing with measurements

To begin with, the shelf is composed of a single piece and therefore an injection in one go is possible which gives us an ahead for an easier implementation, the shape of the piece is simple and more suitable for injection. Above all, it is lighter than expected and has as a major asset to be able to fit together and therefore to assemble / disassemble quickly.

One of the complicated steps was to make sure that our piece was as aesthetic as possible since this product is intended for a childish audience, while respecting the maximum dimensions given by the company. The choice fell on rounded shapes, following the lines of the locations for the pots for more harmony. The grip is done on the sides of the tray, hand shapes have been drawn for a practical and aesthetic side also.

For the interlocking of the feet, the analysis of the existing was used for the realization. It was decided to make a system with a shoulder at the end of our feet. The margin left will be enough so that it is not a strong fit. In addition, the tips of the feet that will be used for assembly are stripped with two angles. One by a few millimeters with an angle identical to those of our interlocking holes. A second larger angle on the rest of the foot to further facilitate nesting. Finally, a hole at the exit of the feet has been added to allow air to escape easily and not to make a "suction cup" effect which would complicate the disassembly for a child

Standards

Given the fact that we are producing a product that its destined to the general use of the public we had to consider the following standards while designing our product: European Directive No.2009/48/EC consists of setting out the essential safety requirements applicable to toys, such as:

Physical and mechanical properties.

Flammability.

Chemical and electrical properties.

Hygiene and radioactivity.

The EN 71 standard sets that the toy must withstand the constraints linked to their use by a child and to be protected from the toxicity and flammability.

Results

Mechanical strength tests

To prove that our piece has the necessary characteristics, we had to carry out various studies.

SolidWorks simulation

Shifting

At most, the displacement will be 0.22 mm at the center of the part.

Deformation

From a deformation point of view, the maximum is $2.28e-04$. The part can therefore support this load easily.

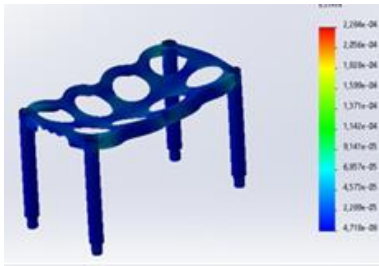


Figure 7

MoldFlow tests

Injection point

The first step was to determine the ideal location for the injection point. In our case, the optimum injection point is at the center of the plate.

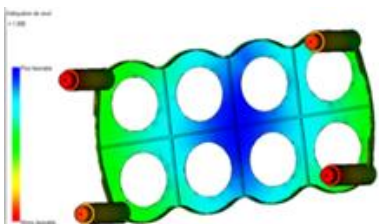


Figure 8

Filling time

Secondly, once our injection point has been placed, we must study the filling of our part. Fill time is 1.6 seconds. In addition, we can see that the part fills up in a balanced way including the feet.

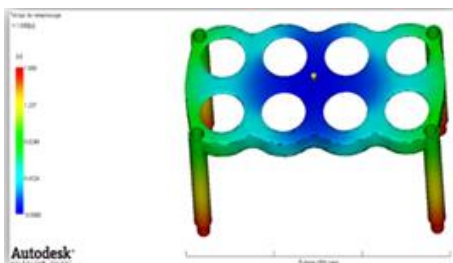


Figure 9

Switching pressure

Studying the switching pressure allows us to know the pressure that will be present inside the cavity when the machine will pass from the dynamic phase to the static phase: 390 bars.

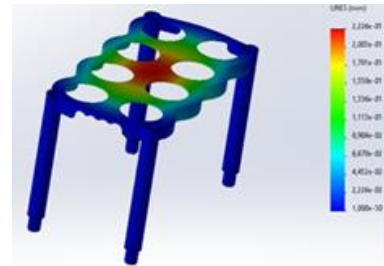


Figure 10

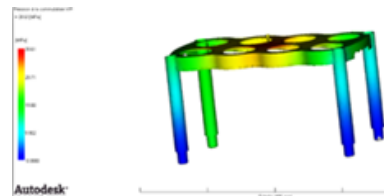


Figure 11

Pressure at the end of filling

The pressure at the end of filling allows us to know the pressure that will be there when switching to cooling: 310 bars.

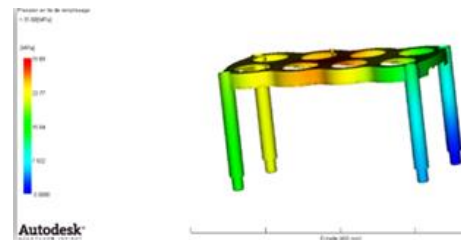


Figure 12

Weld line estimate

The estimate of the weld lines allows us to see where they will be located. Since our part has several holes (pots, interlocking, etc.), we will necessarily have welding lines.

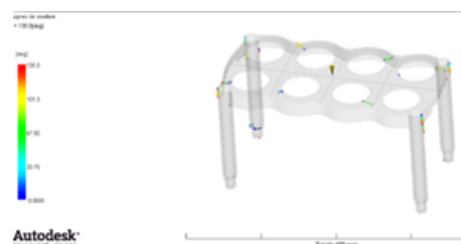


Figure 13

Flow front temperature

The temperature at the flow front complements the previous study. Indeed, we have the presence of a large number of weld lines but our material will have a temperature of around 220°C where the weld lines are most critical.

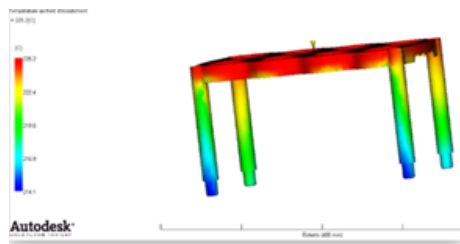


Figure 14

Warping

The legs retracted inwards by 6mm which was not acceptable given that we have an assembly.

Our first job was to reduce this warping, we noticed that the displacement increased according to the length of the legs. We have concluded that if the board no longer flexes, the legs will remain in their positions.

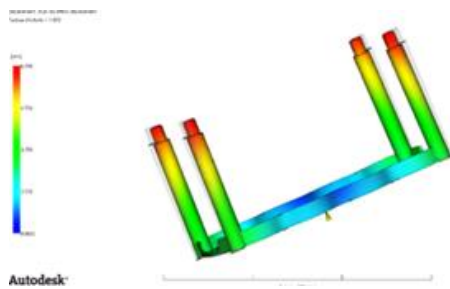


Figure 15

In addition, we standardized the thicknesses because we had big changeset at the start.

Finally, we relaunched a study and with these modifications we have a warping of 0.44mm maximum which is largely acceptable knowing that we have more than 2mm of margin in the interlocking of the legs.

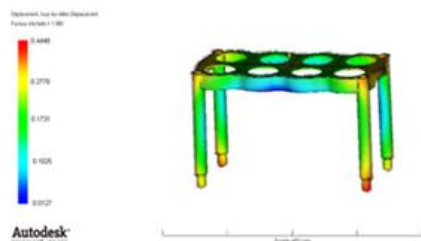


Figure 16

Costing and manufacturing method

Locking force required:

To choose the press that will accommodate the mold and ensure this production it is necessary to know what locking force is necessary.

The projected area is about 442.5 cm² and a pressure in the footprint of 420 bar. A locking force of 230T is therefore required.

Tooling costs:

The tooling cost includes the study price, supplies, and the manufacturing price as well. Adding all these costs the price of the tooling is 4500 €. On the other hand, a simulation on the HASCO site was carried out and we arrive at a tooling price of about 6500 € which seems more plausible given the dimensions of our mold which are still quite large.

Calculation of cycle time:

The calculation of the cycle time is important to be able to calculate later the theoretical cost price of our part. This is 26 seconds considering the injection time, cooling time, holding time and empty cycle time. The cooling time was established thanks to the CATIC diagram, it is 12 seconds.

Theoretical cost price piece:

The theoretical cost price will make it possible to know how much a piece will cost to produce, knowing that in our case it takes two pieces to make a shelf. For this, the depreciation of the production was taken into account, the cost of a launch, the cost of molding and that of the material.

The depreciation is 1.81€. The cost of material per piece is 0.179 €, knowing that pfor the material we started on a price of 1400 € / T (which is very variable at the moment) and that our mold is 128g. The launch cost is 0.15€, the molding cost is 0.33€.

Finally, thanks to this data we deduce a theoretical cost price of € 2,469 per piece. Knowing that our shelf must have two floors we only have to multiply it by two to obtain the theoretical cost price of our final product which will be 4.938 €.

Annexes

SABIC® HDPE M1053		PROSPECTOR®	
High Density Polyethylene		www.prospector.com	
SABIC			
Technical Data			
Product Description			
SABIC® HDPE M1053 is an easy-to-process, tough grade with good resistance to environmental stress cracking (ESCR) and low notch sensitivity. SABIC® HDPE M1053 is typically used for e.g. caps, closures and pails.			
This product is not intended for and must not be used in any pharmaceutical/medical applications.			
General			
Material Status	• Commercial - Active		
Search for UL Yellow Card	• SABIC		
Availability	• Africa & Middle East	• Europe	• North America
	• Asia Pacific	• Latin America	
Uses	• Industrial Applications • Rigid Packaging		
Physical			
	Nominal Value	Unit	Test Method
Density	0.953	g/cm ³	ISO 1183
Melt Mass-Flow Rate (MFR)			ISO 1133
150°C/2.16 kg	10 g/10 min		
190°C/5.0 kg	28 g/10 min		
Environmental Stress-Cracking Resistance (ESCR) ¹			Internal Method
40°C, 1.00 mm, 10% Igepal CO-630, Compression Molded	25.0 hr		
Mechanical			
	Nominal Value	Unit	Test Method
Tensile Modulus			ISO 527-2/1BA/50
2.00 mm, Compression Molded	1100	MPa	
Tensile Stress			ISO 527-2/1BA/50
Yield, 2.00 mm, Compression Molded	26.0	MPa	
Break, 2.00 mm, Compression Molded	16.0	MPa	
Tensile Strain			ISO 527-2/1BA/50
Break, 2.00 mm, Compression Molded	200	%	
Flexural Modulus (Compression Molded)	1200	MPa	ISO 178
Flexural Stress (Compression Molded)	26.0	MPa	ISO 178
Impact			
	Nominal Value	Unit	Test Method
Notched Izod Impact Strength			ISO 180/A
23°C, Compression Molded	3.0	kJ/m ²	
Hardness			
	Nominal Value	Unit	Test Method
Shore Hardness (Shore D, Compression Molded)	61		ISO 868
Thermal			
	Nominal Value	Unit	Test Method
Heat Deflection Temperature ²			ISO 75-2/B
0.45 MPa, Unannealed	81.0	°C	
Vicat Softening Temperature ³	124	°C	ISO 306/A
Melting Temperature	132	°C	ISO 11357-3
Crystallinity Change	203		ISO 11357-3
Notes			
¹ Typical properties; these are not to be construed as specifications.			
² 6 bar internal water pressure			
³ Compression Molded			

Acknowledgment

I would like to thank both of my participating universities in the process of this study, which are the University of Savoie Mont Blanc and the Technological University of San Juan del Rio. As well as the teachers and classmates who guided me during the process of succeeding this investigation.

Conclusion

This project has continued to evolve over time with new design ideas to ensure that the product meets the specifications. The idea of general design with the interlocking of our trays generated some problems that we had not thought of. The phenomenon of warping of the feet was the most complicated problem to solve and the help of professional helped greatly. Some points of improvement are always possible, especially at the aesthetic level it would be necessary to improve the design of the shelf with decorations, color, attractive elements for children. At the level of the forms and given the general idea, it was complicated to make a childish conception.

In the end, the project respects the specifications provided by the company (dimensions, number of trays, pots). As for the price, it had to represent 60% of the total selling price of the shelf, knowing that it is between 12 and 18 €. The theoretical cost price is 4.938 € which is in line with expectations.

[Title in Times New Roman and Bold No. 14 in English and Spanish]

Surname (IN UPPERCASE), Name 1st Author†*, Surname (IN UPPERCASE), Name 1st Co-author, Surname (IN UPPERCASE), Name 2nd Co-author and Surname (IN UPPERCASE), Name 3rd Co-author

Institutional Affiliation of Author including Dependency (No.10 Times New Roman and Italic)

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Text in Times New Roman No.12, single space.

General explanation of the subject and explain why it is important.

What is your added value with respect to other techniques?

Clearly focus each of its features

Clearly explain the problem to be solved and the central hypothesis.

Explanation of sections Article.

Development of headings and subheadings of the article with subsequent numbers

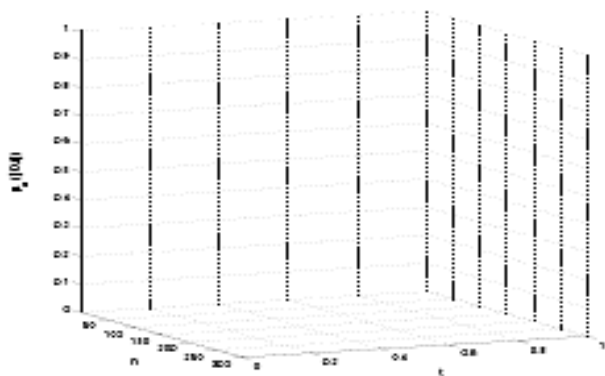
[Title No.12 in Times New Roman, single spaced and bold]

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In the article content any graphic, table and figure should be editable formats that can change size, type and number of letter, for the purposes of edition, these must be high quality, not pixelated and should be noticeable even reducing image scale.

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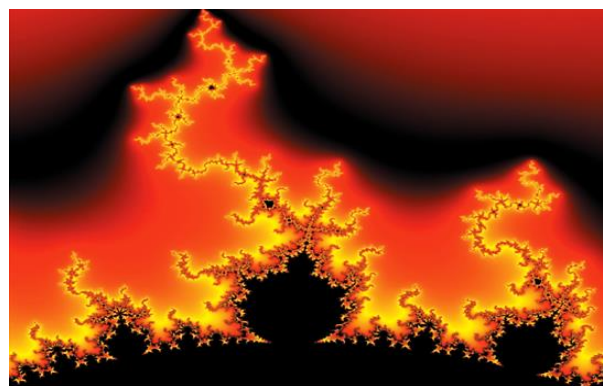


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Each article shall present separately in **3 folders**: a) Figures, b) Charts and c) Tables in .JPG format, indicating the number and sequential Bold Title.

For the use of equations, noted as follows:

$$Y_{ij} = \alpha + \sum_{h=1}^r \beta_h X_{hij} + u_j + e_{ij} \quad (1)$$

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Methodology

Develop give the meaning of the variables in linear writing and important is the comparison of the used criteria.

Results

The results shall be by section of the article.

Annexes

Tables and adequate sources

Thanks

Indicate if they were financed by any institution, University or company.

Conclusions

Explain clearly the results and possibilities of improvement.

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- Article sections, for example:

1. *Introduction*
2. *Description of the method*
3. *Analysis from the regression demand curve*
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