CERTIK

Security Assessment

Coinversation-KACO

Sept 7th, 2021

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Disclaimer

About

Summary

This report has been prepared for Coinversation-KACO to discover issues and vulnerabilities in the source code of the Coinversation-KACO project as well as any contract dependencies that were not part of an officially recognized library. A comprehensive examination has been performed, utilizing Static Analysis and Manual Review techniques.

The auditing process pays special attention to the following considerations:

- Testing the smart contracts against both common and uncommon attack vectors.
- Assessing the codebase to ensure compliance with current best practices and industry standards.
- Ensuring contract logic meets the specifications and intentions of the client.
- Cross referencing contract structure and implementation against similar smart contracts produced by industry leaders.
- Thorough line-by-line manual review of the entire codebase by industry experts.

The security assessment resulted in findings that ranged from critical to informational. We recommend addressing these findings to ensure a high level of security standards and industry practices. We suggest recommendations that could better serve the project from the security perspective:

- Enhance general coding practices for better structures of source codes;
- Add enough unit tests to cover the possible use cases;
- Provide more comments per each function for readability, especially contracts that are verified in public;
- Provide more transparency on privileged activities once the protocol is live.

Overview

Project Summary

Project Name	Coinversation-KACO
Description	A token and liquidity pool
Platform	Ethereum
Language	Solidity
Codebase	https://github.com/Coinversation/kaco-farm/blob/283c57506e0a638f64d0a612c4c8b78ec54f7f23/contracts/KacoToken.sol https://github.com/Coinversation/kaco-farm/blob/283c57506e0a638f64d0a612c4c8b78ec54f7f23/contracts/MasterChef.sol https://github.com/Coinversation/kaco-swap-core/blob/56a12afde6e66a3ebf70468fbed443f8d83973ec/contracts/PancakeFactory.sol
Commit	

Audit Summary

Delivery Date	Sept 07, 2021
Audit Methodology	Static Analysis, Manual Review
Key Components	

Vulnerability Summary

Vulnerability Level	Total	Pending	Declined	Acknowledged	Partially Resolved	Resolved
Critical	0	0	0	0	0	0
Major	5	0	0	5	0	0
Medium	0	0	0	0	0	0
Minor	1	0	0	1	0	0
Informational	5	0	0	5	0	0
Discussion	0	0	0	0	0	0

Audit Scope

ID	File	SHA256 Checksum
KTC	kaco-farm/KacoToken.sol	805c1fa857d3736b583622ec8de4de10474a0d41ef0ffed2287fe70fe053d574
MCC	kaco-farm/MasterChef.sol	3016ff6b822cacc336f753d9d4ae60e6d346c6a991c64677827fabab866c737e
PFC	kaco-swap-core/PancakeFactory.sol	0ece467faeafbdfd09530b0043bf122a2573e8c3ceb05b789816e722573cf872

It should be noted that the system design includes a number of economic arguments and assumptions. These were explored to the extent that they clarified the intention of the code base, but we did not audit the mechanism design itself. Note that financial models of blockchain protocols need to be resilient to attacks. It needs to pass simulations and verifications to guarantee the security of the overall protocol. The correctness of the financial model is not in the scope of the audit.

To bridge the gap of trust between owner and users, the owner needs to express a sincere attitude regarding the considerations of the administrator team's anonymity.

The owner of `KacoToken` has the responsibility to notify users with the following capability in `KacoToken`:

- transfer `Kac` tokens from any account to the contract address account through `lock()`
- mint `Kac` to any account through `mint()`

The owner of `Masterchef` has the responsibility to notify users with the following capability in `PoolStorage`:

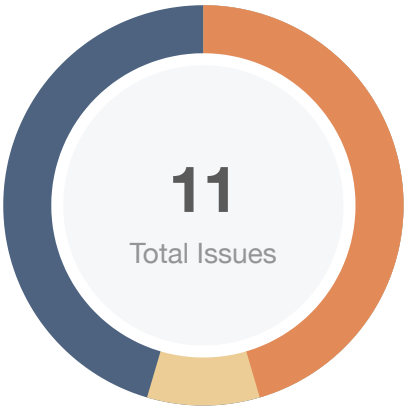
- update key parameters used in reward calculation including `cakePerBlock`, `BONUS_MULTIPLIER`, `allocPoint` of a specific pool through `updateKacPerBlock()`, `updateMultiplier()` and `set()` respectively.
- set the migrator contract through `setMigrator()`

Client response: The `owner` role of `KacoToken` has already been transferred to the `MasterChef` contract so that `lock()` is no longer accessible by anyone and `mint()` can only be called by `MasterChef` for mining rewards. While the `owner` role of the `MasterChef` has been transferred to a timelock contract which would set up a delay period of at least twelve hours for any aforementioned sensitive transactions.

Note that this audit only includes the three contracts listed in the scope exhibit, namely `KacoToken`, `MasterChef` and `PancakeFactory`. The other contracts in the codebase are assumed to be functionally correct and are not audited.

The contract is serving as the underlying entity to interact with third-party PancakeSwap libraries. The scope of the audit would treat those 3rd party entities as black boxes and assume their functional correctness.

Findings



Critical	**0** (0.00%)
Major	**5** (45.45%)
Medium	**0** (0.00%)
Minor	**1** (9.09%)
Informational	**5** (45.45%)
Discussion	**0** (0.00%)

ID	Title	Category	Severity	Status
KTC-01	Delegation Not Moved Along With Tokens	Logical Issue	Major	Acknowledged
KTC-02	Centralization Risk	**Centralization / Privilege**	**Major**	Acknowledged
KTC-03	Function Visibility Optimization	Gas Optimization	Informational	Acknowledged
MCC-01	Variable Naming Convention	Coding Style	Informational	Acknowledged
MCC-02	Missing Emit Events	Gas Optimization	Informational	Acknowledged
MCC-03	Unknown Implementation of migrator.migrate()	Logical Issue	Informational	Acknowledged
MCC-04	Logic Flaw In `emergencyWithdraw()`	Logical Issue	Major	Acknowledged
MCC-05	Centralization Risk	**Centralization / Privilege**	**Major**	Acknowledged
MCC-06	Function Visibility Optimization	Gas Optimization	Informational	Acknowledged
MCC-07	Incompatibility With Deflationary Tokens	Volatile Code	Minor	Acknowledged
MCC-08	`add()` Function Not Restricted	Logical Issue	Major	Acknowledged

KTC-01 | Delegation Not Moved Along With Tokens

Category	Severity	Location	Status
Logical Issue	Major	kaco-farm/KacoToken.sol: 48, 83, 95, 114	Acknowledged

Description

The voting power of delegation is not moved from token sender to token recipient along with the `transfer()` and `transferFrom`. Current `transfer()` and `transferFrom()` are from `BEP20` protocol and don't invoke `_moveDelegates()`.

Similarly, the `lock()`, `unlock()` and `transferAll()` functions all move tokens without moving voting power.

Besides, the reimplemented `mint()` function with `_moveDelegates()` should properly override the `mint()` function from `BEP20`.

Recommendation

We advise the client to properly reimplement and override `_transfer()` and `_mint()` functions and always move voting power along with tokens unless there are other considerations.

Alleviation

[Client]: We would not use the current voting modules but will conduct safer community governance by other means.

KTC-02 | Centralization Risk

Category	Severity	Location	Status
Centralization / Privilege	**Major**	kaco-farm/KacoToken.sol: 48, 114	Acknowledged

Description

In the contract `KacoToken`, the role `owner` has the authority over the following function:

- `lock()`
- `mint()`

Any compromise to the `owner` account may allow the hacker to take advantage of this and:

- maliciously lock tokens of any account to this contract through `lock()`
- mint `Kaco` tokens to any account through `mint()`

Recommendation

We advise the client to carefully manage the `owner` account's private key to avoid any potential risks of being hacked. In general, we strongly recommend centralized privileges or roles in the protocol to be improved via a decentralized mechanism or smart-contract-based accounts with enhanced security practices, e.g., Multisignature wallets.

Indicatively, here is some feasible suggestions that would also mitigate the potential risk at the different level in term of short-term and long-term:

- Time-lock with reasonable latency, e.g., 48 hours, for awareness on privileged operations;
- Assignment of privileged roles to multi-signature wallets to prevent a single point of failure due to the private key;
- Introduction of a DAO/governance/voting module to increase transparency and user involvement.

Alleviation

The client responded that they have already transferred the `owner` role to the `MasterChef` so that `lock()` could not be called by anyone and 'mint()' could only be called by `MasterChef`. Meanwhile `owner` role of `MasterChef` has been transferred to a `Timelock`.

KTC-03 | Function Visibility Optimization

Category	Severity	Location	Status
Gas Optimization	Informational	kaco-farm/KacoToken.sol: 28, 36, 40, 44, 83, 95, 120	Acknowledged

Description

The following functions are declared as `public`, contain array function arguments, and are not invoked in any of the contracts contained within the project's scope.

- `unlockedSupply()`
- `totalBalanceOf()`
- `lockOf()`
- `lastUnlockBlock()`
- `unlock()`
- `transferAll()`
- `cap()`

The functions that are never called internally within the contract should have external visibility.

Recommendation

We advise that the functions' visibility specifiers are set to `external` and the array-based arguments change their data location from `memory` to `calldata`, optimizing the gas cost of the function.

Alleviation

The client responded that since no other contracts call these methods, user's gas consumption would not be affected.

MCC-01 | Variable Naming Convention

Category	Severity	Location	Status
Coding Style	Informational	kaco-farm/MasterChef.sol: 68	Acknowledged

Description

The linked variables do not conform to the standard naming convention of Solidity whereby functions and variable names utilize the format unless variables are declared as constant in which case they utilize the format.

Recommendation

We advise that the naming conventions utilized by the linked statements are adjusted to reflect the correct type of declaration according to the Solidity style guide.

Alleviation

The client responded that they would optimize the naming in the future.

MCC-02 | Missing Emit Events

Category	Severity	Location	Status
Gas Optimization	Informational	kaco-farm/MasterChef.sol: 116	Acknowledged

Description

The function that affects the status of sensitive variables should be able to emit events as notifications to customers.

- `setMigrator()`
- `updateMultiplier()`

Recommendation

We advise the client to add events for sensitive actions and emit them in the function.

Alleviation

The client responded that they would call these methods only very rarely, at which they would notify users days in advance. The `owner` role of this contract has been transferred to a time lock so that calling either these methods would incur the `QueueTransactionEvent` emit event and at least twelve-hour delay.

MCC-03 | Unknown Implementation of migrator.migrate()

Category	Severity	Location	Status
Logical Issue	Informational	kaco-farm/MasterChef.sol: 164	Acknowledged

Description

`setMigrator()` function can set migrator contract to any contract that is implemented from `IMigratorChef` interface by the owner. As result, invocation of `migrator.migrate()` in function migrate() may bring dangerous effects as it is unknown to the user. However, the project may lose the ability to upgrade and migrate if `setMigrator()` and `migrate()` are removed. We would like to enquire on the precautions against abusage of the migrate functionality.

Alleviation

The client responded that the migration functions are reserved for special situations and would not be used lightly. The `owner` role of this contract has been transferred to a time lock so that calling either of these methods would incur the `QueueTransactionEvent` event and at least a twelve-hour delay. Besides we would validate our source code before setting `IMigratorChef` and would notify all users in advance in case they want to verify.

MCC-04 | Logic Flaw In `emergencyWithdraw()`

Category	Severity	Location	Status
Logical Issue	Major	kaco-farm/MasterChef.sol: 300	Acknowledged

Description

When `msg.sender` calls `enterStaking()` , `syrup` token will be minted to `msg.sender` when `pool.lpToken` is staked in the contract. However, if the `msg.sender` calls `emergencyWithdraw()`, the `pool.lpToken` can be transferred back to the `msg.sender` but the `syrup` token that has been minted to the `msg.sender` will not be burnt. Therefore, `msg.sender` can call `enterStaking()` and `emergencyWithdraw()` repeatedly to ultimately mint a huge amount of `syrup` tokens, with just the same amount of pool.lpToken.

Recommendation

We advise the client to burn the same amount of `syrup` tokens along with the withdraw of `pool.lpToken` when calling the `emergencyWithdraw()`. i.e:

```
function emergencyWithdraw(uint256 _pid) public {
    PoolInfo storage pool = poolInfo[_pid];
    UserInfo storage user = userInfo[_pid][msg.sender];
    uint256 userAmount = user.amount;
    user.amount = 0;
    user.rewardDebt = 0;
    syrup.burn(msg.sender, userAmount);
    pool.lpToken.safeTransfer(address(msg.sender), userAmount);
    emit EmergencyWithdraw(msg.sender, _pid, userAmount);
}
```

Alleviation

[Client]: We reviewed this issue and decided that it will not affect our normal functionality because the `syrup` tokens are only used to help demonstrate the user's staking of `KAC` tokens. The `syrup` tokens are worthless by themselves and we would not use them for voting or other things that matter.

MCC-05 | Centralization Risk

Category	Severity	Location	Status
Centralization / Privilege	**Major**	kaco-farm/MasterChef.sol	Acknowledged

Description

In the contract `MasterChef`, the role `owner` has the authority over the following function:

- `updateKacPerBlock()`
- `updateMultiplier()`
- `add()`
- `set()`
- `setMigrator()`

Any compromise to the `owner` account may allow the hacker to take advantage of this and:

- set `cakePerBlock` without community consent through `updateKacPerBlock()`
- set multiplier without community consent through `updateKacPerBlock()`
- maliciously set allocation points to increase or decrease the reward of a particular pool through `set()`
- add a new lp to the pool without community consent through `add()`
- determine the destination and manner of migration through `setMigrator()`

Recommendation

We advise the client to carefully manage the `owner` account's private key to avoid any potential risks of being hacked. In general, we strongly recommend centralized privileges or roles in the protocol to be improved via a decentralized mechanism or smart-contract-based accounts with enhanced security practices, e.g., Multisignature wallets.

Indicatively, here is some feasible suggestions that would also mitigate the potential risk at the different level in term of short-term and long-term:

- Time-lock with reasonable latency, e.g., 48 hours, for awareness on privileged operations;
- Assignment of privileged roles to multi-signature wallets to prevent a single point of failure due to the private key;
- Introduction of a DAO/governance/voting module to increase transparency and user involvement.

Alleviation

[Client]: The `owner` role of this contract has been transferred to a time lock so that calling either of these methods would incur the `QueueTransactionEvent` event and at least a twelve-hour delay. Besides, we would soon introduce multi-signature and DAO modules to improve security and transparency.

MCC-06 | Function Visibility Optimization

Category	Severity	Location	Status
Gas Optimization	Informational	kaco-farm/MasterChef.sol: 108, 116, 126, 141, 153, 158, 216, 238, 259, 280, 300	Acknowledged

Description

The following functions are declared as `public`, contain array function arguments, and are not invoked in any of the contracts contained within the project's scope.

- `updateKacPerBlock()`
- `updateMultiplier()`
- `add()`
- `set()`
- `setMigrator()`
- `migrate()`
- `deposit()`
- `withdraw()`
- `enterStaking()`
- `leaveStaking()`
- `emergencyWithdraw()`

The functions that are never called internally within the contract should have external visibility.

Recommendation

We advise that the functions' visibility specifiers are set to `external` and the array-based arguments change their data location from `memory` to `calldata`, optimizing the gas cost of the function.

Alleviation

[Client]: We would improve on visibilities in the future.

MCC-07 | Incompatibility With Deflationary Tokens

Category	Severity	Location	Status
Volatile Code	Minor	kaco-farm/MasterChef.sol: 229, 251	Acknowledged

Description

The MasterChef contract operates as the main entry for interaction with staking users. The staking users deposit LP tokens into the pool and in return get a proportionate share of the pool's rewards. Later on, the staking users can withdraw their own assets from the pool. In this procedure, `deposit()` and `withdraw()` are involved in transferring users' assets into (or out of) the protocol. When transferring standard ERC20 deflationary tokens, the input amount may not be equal to the received amount due to the charged (and burned) transaction fee. As a result, this may not meet the assumption behind these low-level asset-transferring routines and will bring unexpected balance inconsistencies.

Recommendation

We advise the client to regulate the set of LP tokens supported and add necessary mitigation mechanisms to keep track of accurate balances if there is a need to support deflationary tokens.

Alleviation

The client responded that they would review the liquidity providing token to prevent deflationary tokens from being added by one of their pools.

MCC-08 | `add()` Function Not Restricted

Category	Severity	Location	Status
Logical Issue	Major	kaco-farm/MasterChef.sol: 126	Acknowledged

Description

When the same LP token is added into a pool more than once in function `add()`, the total amount of reward in function `updatePool()` will be incorrectly calculated. The current implementation is relying on the operation correctness to avoid repeatedly adding the same LP token to the pool, as the function will only be called by the owner.

Recommendation

We advise the client to detect whether the given pool for addition is a duplicate of an existing pool. The pool addition is only successful when there is no duplicate. Using mapping of `addresses` -> `booleans`, which can restrict the same address from being added twice.

Alleviation

The client responded that they would review the liquidity providing toke to prevent it from being added repetitively.

Appendix

Finding Categories

Centralization / Privilege

Centralization / Privilege findings refer to either feature logic or implementation of components that act against the nature of decentralization, such as explicit ownership or specialized access roles in combination with a mechanism to relocate funds.

Gas Optimization

Gas Optimization findings do not affect the functionality of the code but generate different, more optimal EVM opcodes resulting in a reduction on the total gas cost of a transaction.

Logical Issue

Logical Issue findings detail a fault in the logic of the linked code, such as an incorrect notion on how block.timestamp works.

Volatile Code

Volatile Code findings refer to segments of code that behave unexpectedly on certain edge cases that may result in a vulnerability.

Coding Style

Coding Style findings usually do not affect the generated byte-code but rather comment on how to make the codebase more legible and, as a result, easily maintainable.

Checksum Calculation Method

The "Checksum" field in the "Audit Scope" section is calculated as the SHA-256 (Secure Hash Algorithm 2 with digest size of 256 bits) digest of the content of each file hosted in the listed source repository under the specified commit.

The result is hexadecimal encoded and is the same as the output of the Linux "sha256sum" command against the target file.

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