УНИВЕРЗИТЕТ У НОВОМ САДУ
ФАКУЛТЕТ ТЕХНИЧКИХ НАУКА У НОВОМ САДУ
ДЕПАРТМАН ЗА ИНДУСТРИЈСКО ИНЖЕЊЕРСТВО И МЕНАЏМЕНТ

Мр Марио Ђаковић

SYSTEMATIC RISK MANAGEMENT MODEL IN THE PROJECT INITIATION PHASE / СИСТЕМАТСКИ МОДЕЛ ЗА УПРАВЉАЊЕ РИЗИЦИМА У ФАЗИ ИНИЦИРАЊА ПРОЈЕКТА

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УНИВЕРЗИТЕТ У НОВОМ САДУ ● **ФАКУЛТЕТ ТЕХНИЧКИХ НАУКА**
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Врста рада, **ВР**:	Докторска дисертација
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Ментор, **МН**:	др Бојан Лалић, ванр. проф.
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Извод, **ИЗ**:	*Рана идентификација при управљању ризицима је важан процес доношења одлука, неопходан за успешну испоруку пројеката. Ипак, у пракси, систематски прилаз у управљању ризицима се још увек не спроводи током фазе иницирања пројекта. Сходно реченом, ова дисертација акцентује систематски приступ у почетним фазама иницирања пројекта,односно, успостављање ограничења којима се могу контролисати ризици, по капијама модела ризика, као и анализа специфичних ризика, по идентификованим фазама. Резултати истраживања указују на потребу за предложеним моделом управљања ризицима, акционим планом ублажавања таквих ризика, као и потребу за правовременим подизањем свести о поменутим ризицима, у почетним фазама иницирања пројекта. Дисертација се ослања на практичне аспекте управљања ризицима, методе анализе ризика и приступе за смањење ризика од непредвидивости, за главне елементе пројекта, са фокусом на вероватноћу појаве ризика и ригорозности идентификације и евалуације ризика у фази иницирања пројекта. Истраживање се заснива на студији случаја два индустријска пројекта, са приступима као што су: иницијација / извршење и припрема / извршење.*
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TABLE LIST

CHART LIST

SYMBOLS AND ABBREVIATIONS LIST

- (RIO) Risk Identification Oversight
- (FAM) Functional Area Manager
- (SCOPE or SOW) Scope of Work
- (WBS) Work Break Down Structure
- (RWBS) Risk Work Break Down Structure
- (MSP) Microsoft Project
- (ConOPS) Concept of the Operation
- (SWOT) Strength, Weakness, Opportunity and Treat
- (PERT) Project Evaluation and Review Technique
- (P&I) Probability and Impact
- (MSC) Monte Carlo Simulation
- (AHP) Analytical Hierarchy Process
- (LR) Likelihood Occurrence of Risk
- (FZ) Fuzzy Logic
- (SRA) Society for Risk Analysis
- (PMBOK) Project Management Body of Knowledge
- (SQL) Structured Query Language
- (HTML5) Markup Language
- (CSS3) Cascading Style Sheets
- (JavaScript) Interpreted Programming Language
- (C Sharp, C #) Programming Language
- (NNA) Neural Network Approach
- (SRM) Software Risk Management
- (SEI) Software Engineering Institute
- (SRE) Software Risk Evaluation
- (CRM) Continuous Risk Management
- (TRM) Team Risk Management
- (MCD) Multi Criteria Decision
- (FTA) Fault Tree Analysis
- (HAZOP) Hazard and Operability Analysis
- (HAZID) Hazard Identification Study
- (ETA) Event Tree Analysis
- (FETI) Finite Element Tearing and Interconnect
- (AHP) Analytic Hierarchy Process
- (ISO) International Organization for Standardization
- (IT) Information Technology
- (IEC) International Electro Technical Commission
- (PMI) Project Management Institute
- (PRM) Project Risk Management
- (PUMA) Project Uncertainty Management
- (RAMP) Risk Analysis and Management for Projects
- (TPRM) Two-Pillar Risk Management
- (ATOM) Active Threat and Opportunity Management

- (SHAMPU) Shape, Harness and Manage Project Uncertainty
- (PRAM) Project Risk Analysis and Management
- (IRAM) Information Risk Assessment Methodology
- (RM) Risk Management
- (IJE) International Journal of e-Education
- (IJPM) International Journal of Project Management
- (JISE) Journal of Information Science and Engineering
- (IJEST) International Journal of Environmental Science and Technology
- (PERT) Program Evaluation and Review Technique
- (PO) Owner of the project
- (GM) General / Management
- (TM) Technology / Methods
- (MO) Monetary
- (EN) Engineering
- (PV) Procurement - Vendors
- (OP) Operational
- (EX) Execution
- (HR) Human Recourse
- (LE) Legal
- (PC) Project Controls
- (BD) Business Development
- (IIS) Internet Information Services
- (RBOE) Risk Base of Estimate
- (POP) Period of Performance

РЕЗИМЕ

Индустрија и планирање великих пројеката су генерално изложени несигурном окружењу због фактора као што су сложеност планирања ризика, присуство различитих интересних група (носилац пројекта, фунционални менаџер, спољашњи и унутрашњи консултанти, главни извођачи, испоручиоци, итд.), недоступност извора, економско и политичко окружење и законске регулативе. Све ове несигурности су уско повезане с осталим факторима ризика као што су сложеност пројекта, потребни критеријуми и брзина његовог спровођења, локација пројекта и непознавање свих детаља. Све ово води једном циљу, а то је да се пројекат заврши на време, с одобреним трошковима и очекиваним квалитетом. На основу наведенога неопходно је увести још један систематски корак у раној фази управљања ризицима на пројекту.

Потреба за управљањем неизвесношћу и променама је незаобилазна у пројектном менаџменту који захтевају формално извођење. Уколико пројекат дефинишемо по Турнеру као "Подухват у коме се људски, материјални и финансијски ресурси организују на нов начин у циљу предузимања јединственог обима рада, датог спецификацијом, у оквиру ограничења, трошкова и времена, како би се постигла јединствена корисна промена, путем испоруке кванититативних и квалитативних исхода процеса рада", онда према датој дефиницији, под појмовима организације на нов начин, јединственост свих промена, а унутар ограничења, јасно је да се може очекивати одређени број неизвесних појава и пропуста што је једна од тема истраживачког рада дисертације. На основу свих вероватноћа појаве ризика у раној фази дефинисања и припреме пројекта, доследност и утемељење њихове анализе даје могућност да се таквим приступом процесу рада омогући успешан завршетак пројекта.

Ако гледамо са становишта управљања ризицима на пројекту имамо следећих шест главних процеса:

- ✓ Планирање управљања ризиком,
- ✓ Идентификација ризика,
- ✓ Квалитативна анализа ризика,
- ✓ Квантитативна анализа ризика,
- ✓ Планирања и деловања на идентификоване ризике,
- ✓ Контрола и праћење ризика.

Концепт управљања ризицима на пројекту је заснован на самој дефиницији ризика, те теоријским основама који се заснивају на:

- ✓ Ризик, као основни постулат,
- ✓ Идентификација ризика (вањски и унутрашњи могући догађаји),
- ✓ Процена ризика,
- ✓ Евалуација ризика,
- ✓ Третирање ризика,
- ✓ Постојећи алати за управљање ризиком,
- ✓ Постојећи модели за управљање ризиком,
- ✓ Те утицај свих наведених ризика на укупни процес управљања ризиком пројекта.

Као главне факторе успешности завршетка неког пројекта често се наглашава приступ управљања ризиком у пројектима. Успешност вођења пројеката још увек је актуелна тема истраживачких радова. Главни узроци промене насталих унутар пројектног плана су недовољно учешће заинтересованих страна у идентификацији и управљању ризиком, као и недостатак знања и коришћења систематског приступа управљању ризицима. Евидентан је недостатак истраживања у којима се озбиљно разматра приступ упраљања ризиком у раној фази иницијације пројекта. То је довело до формирања самог предмета истраживања докторске дисертације. У пракси се ризици углавном укључују у пројекат методом непредвиђених активности (трошкова, времена) без свеобухватне анализе ризика на микро нивоу. У многим случајевима пројектног менаџмента такав приступ није довољан да се покрију последице ризика које се појављују у фази имплементације пројекта. Резултат су често повећани трошкови и кашњење. С обзиром на актуелно стање у области према коме се у третману свих трошкова тежи минимуму, јасно је да није применљив прилаз у коме се за непрredвиђене активности издваја значајан део буџета, израженог у времену или ангажовању запослених.

Према подели ризика, категоризација тежине ризика, могућност његовог појављивања и ублажавање требало би да буду укључени на свим корацима припреме и реализације пројекта и пропраћени проценом ризика на основу критеријума података. Докторска дисертација обухваћа проблеме управљања ризиком користећи приступ који се базира на стеченом знању и истраживању литературе, обједињеним у посебан модел за третман ризика у раној фази дефинисања пројекта. Докторска дисертација представља могућност примене “*stage-gate”* РИО модела као процеса третмана ризика у раној фази припреме пројекта. Резултати “*stage-gates”* корака, након примене стратегије одговарања на ризик, те самих нивоа евалуације истих ризика, укључујући све функционалне дисциплине, доводи до максималне елиминације свих грешака у моделу, на основу задатих вероватности “*stage-gate”* процеса.

На основу наведеног, да би се спровео ефективан и ефикасан приступ управљању ризиком, неопходна је адекватна и систематична методологија. Резултати ранијих истраживања показују да ни носиоци пројекта, ни извођачи, не примењују на систематски начин поступке управљања ризиком, што негативно утиче на успешност пројекта. Као основу дисертација користи квантитативни приступ управљању ризиком, тако што се овај приступ примењује и на нивоу појединачних активности и у функционалним областима у припремној фази пројекта. Квантитативан приступ управљању ризиком укључује препознавање ризика, оцену ризика, уз идентификацију стратешких корака за управљање ризиком и примену корективних мера или ублажавање ризика помоћу менаџерских ресурса као и датих критеријума.

У предложеној докторској дисертацији, кроз РИО модел користиће се следећи квантитативни кораци у управљању ризиком:

- ✓ Постављање циљева и контекста самог окружења ризика,
- ✓ Идентификација ризика,
- ✓ Анализа идентификованих ризика кроз критеријуме *„stage gates“* процеса,
- ✓ Оцена и евалуација ризика те доношење корективних мера,
- ✓ Надзор и преиспитивање ризика кроз дате кораке и критеријуме и,
- ✓ Стално ажурирање и извештавање.

Циљ системског прилаза у управљању ризицима, је фокус на ризике којима се може управљати користећи познате и непознате инструменте у фази иницирања пројекта. Након примене свих наведених корака долазимо до ублажавања ризика, који елиминишу пројектне неизвесности, који би се, у противном, морали обрадити кроз накнадну евалуацију пројекта. Стратегија одговарања на ризик и проценат ране идентификације или елиминације ризика који је повезан с овом методологијом представља истраживачки простор у докторској дисертацији.

Таква структура модела са свим наведеним корацима има за циљ да непрекидним процесом дође до дубине и саме структуре ризика. РИО модел користи алате са постојећим традиционалним процесима у управљању ризиком, а то су:

- ✓ (RWBS) расчлањена структура ризика,
- ✓ (PERT) техника евалуације и преглед пројекта,
- ✓ (FTA) анализа стабла грешака,
- ✓ (HAZOP) анализа опасности и оперативности,
- ✓ (HAZID) студија идентификације опасности,
- ✓ (ETA) анализа стабла догађаја,
- ✓ (AHP) процес аналитичке хијерархије.

Ова дисертација ће се бавити проблемима управљања ризиком у области пројеката у енергетици. Приступ се базира на знању и предложеној систематској методологији која има три главна сегмената. Управљање ризиком кроз РИО модел ће се пратити тако што ће се систематски рашчлањивати на следеће *„stage gates“* критеријуме:

- ✓ Дефинисање могућности ризика,
- ✓ Оцењивање могућности познатог ризика,
- ✓ Побољшање иницијалне стратегије, ублажавања ризика и подношење извештаја о анализи и,
- ✓ Извештавањем и надзором идентификаованих ризика (РИО).

Непрекидним процесом РИО модела, разгранатих кроз стабло одлучивања, те коришћењем (FAM) функција у управљању ризиком, укључујемо комбинацију одређених критеријума, евалуација и могућност да се у презентовани модел уведе систематична пракса. Та систематична пракса је подржана на основу саме дефиниције и обима пројекта те следећих докумената:

- ✓ Документ оцене ризика,
- ✓ Документ о регистру оцене ризика,
- ✓ Документ о улогама и одговорности тима за оцену ризика,
- ✓ Историјски документи о оцењивању ризика (познати, непознати ризици),
- ✓ Документ о функционалним менаџерима (FAM),
- ✓ Концептуални оперативни документ,
- ✓ Документ о развоју познатог ризика у пословању,
- ✓ Позивање на моделе ризика из пројеката и његове расподеле вероватноће,
- ✓ Иницијалну листу с историјским подацима непознатих непознатих,

- ✓ Приказ разјашњења/квалификација/изузетака/девијација/утицаја и,
- ✓ Образац за процену непредвиђених ризика.

Оваквим приступом који узима у обзир квантитативне факторе у управљању ризиком, систематичне припреме ће бити спроведене корак по корак што ће у коначници резултирати бољим управљањем пројектним ризицима током имплементације.

РИО веб модел је структуриран са детаљима и дефиницијама на основу датих елемената:

1. Методолошка процена корака која укључује унапред дефинисане услове за сваку фазу „stage gates“ и

2. Ниво процене за сваки корак „stage gates“ са детаљним дефинираним величинама.

Презентовано стабло РИО веб модела имати ће три главне корективне групе:

- ✓ Прва група *: Систематска процесна мапа с корацима „stage gates“ од 1 до 6
  - Укључује основне унапред дефинисане кораке по заданим активностима
- ✓ Друга група **: Регистрација ризика и контролни план тока
  - Укључује (FAM) све заинтересоване стране где се заинтересоване стране могу додати или искључити из плана тока
  - Укључује детаљан план тока, као матрицу са јасно дефинисаним критеријумима.
- ✓ Трећа група***: Документи о ризику и подаци са примењивим методама и алатима
  - Укључују документе који су основа за РИО модел и матрицу дијаграма тока

У инцијалној фази процеса, у сврху улазних података, користиће се и сакупљати квантитативни подаци из радне структуре пројекта (WBS):

- ✓ Детаљан приступ управљању ризиком допринеће развоју описа пројекта с активним укључивањем носилаца означених пројектних група или детаљно назначених представника где су сви менаџери укључени у процес.
- ✓ Историјски подаци или постојећи подаци ће се класификовати хијерархијски према плану тока РИО модела.

Сваки сет докумената с прикупљеним улазним подацима о ризику (трећа група***) мора проћи кроз (друга група**) регистрацију ризика и контролни план тока пре преласка на следећи корак. Систематска процесна мапа (прва група*) је развијена до детаља да би се креирало више критеријума за одлуке на основу плана тока (друга група**) и подржана је подацима о ризику и примењивим методама/алатима (трећа група***). На сваком кораку пролази се кроз различите задате критеријуме, који имају утицај на завршне резултате. Циљ ових корака и докумената је да смање проширивање додатне документације и да се постојећа документација учини што једностванијом и кориснијом.

Ако сагледамо горе наведено долазимо до закључка да РИО веб модел има доста елемената квалитативних фактора. Потребно је нагласити да представљени модел није софтверски алат. Један од главних разлога зашто је РИО модел генерисан на основу веб апликације је због услова ограничења које има генерички софтвер. Ако погледамо са становишта хијерархије софтверско управљање ризиком (SRM) има две функције: набавка софтвера и развој софтвера. Генерално, на основу Института софтверског инжењеринга (SEI), оквир за управљање ризиком софтвера подржавају три главне групе:

1. Софтверска процена ризика (SRE),
2. Континуирано управљање ризиком (CRM) и
3. Тимско управљање ризиком (TRM).

Добра страна примене софверских решења у области разматране проблематике се огледа у напретку микро-рачунарске технологије како у софтверском тако и у хардверском делу. Могуће је развити генеричке програме који уз једноставну интеграцију у постојеће моделе могу бити примењиви у систему управљања ризицима. Такав пакет програма се може лако користити као решење за постојеће алате, који су много флексибилнији од већ одређених критеријума софтверских алгоритама. Чак и са таквим приступом, софтверско решење остаје на постулату аналитичко математичког моделирања.

Морамо нагласити да математичко моделирање процене ризика није лак задатак. То се може сагледати кроз две маргине. Једна маргина су заинтересоване стране (FAM) или менаџер пројеката, а друга маргина су програмери. Будући да не постоји специфичан приступ који би програмер или менаџер пројекта требао следити у вези с развојем пакета програма, јер сваки од пројеката је специфичан сам за себе, стога празнине или недостатци софтверских модела у многим случајевима се ублажавају подацима статистичког приступа. Адекватност оваквог приступа резултира великим бројем математичких и статитичких података који сам софтверски алат чине сложеним.

Докторска дисератција обухвата 10 поглавља, те је структурирана према следећим целинама и поглављима:

Увод структуре дисертације или прво поглавље обухвата опис предмета истраживања и потребе за истраживањем, циљеве истраживања, задатке и очекиване резултате истраживања, хипотезе истраживања као и приказ структуре дисертације. У првом делу дат је преглед кључних истраживања и потешкоћа с којима се сусреће академска заједница, заснован на тренутним технологијама и основним изазовима нових алата. Наведен је опис метода истраживања и прикупљања података, квалитативни и квантитативни недостаци система ране процене ризика и њихов међусобни однос, те недовољна ефикасност софтверских решења да пруже коначне резултате у управљању ризиком, као и могућност неукључености заинтересованих страна. У овом делу представљене су: основна идеја и предмет истраживачког проблема, циљ истраживања, обим истраживања и постојећа ограничења, хипотезе, питања и фазе истраживања. У овом делу дисертације приказана је и структура дисертације. Дисертација је хронолошки организована кроз десет поглавља на начин који методички следи фазе истраживања. Први део представља општа разматрања и опште концепте дисертације. Други део представља теоријске основе и преглед литературе о идентификацији ризика и повезаност с управљањем ризицима пројекта.

Састоји се од три дела:

1) идентификација ризика и повезаност са управљањем ризиком пројекта,
2) постојећи недостаци квалитативних и квантитативних метода ране процене ризика,
3) систем неопходан за спровођење и реализацију управљања ризиком пројекта и концептуални систематски модел с нагласком на хипотези.

Трећи део представља методе истраживања ризика и прикупљања података. Четврти део приказује резултате представљеног модела и могућност интеграције резултата у оквир постојећих алата за процену ризика. Пети део представља веб могућности модела за управљање ризицима и везе РИО (Risk identification oversight) модела. Шести део представља дискусију и анализу резултата као и практичну импликацију модела. Седми део представља закључке, запажања и смернице за будућа истраживања. Употреба литературе је у осмом делу. Прилози и извештаји с другим релевантним детаљима значајним за истраживање налазе се у деветом делу, а на крају докторске дисертације, у десетом делу, укључени су основни резултати извештаја.

Потреба за истраживањем у овој области огледа се у следећем: Ризици, управљање разицима и утицај људског фактора су кључне теме истраживања у области управљања пројектима. Постоји много истраживања на тему третирања ризика, али је мање истраживања на тему раног систематског приступа управљању ризицима у фази иницирања пројеката и утицаја субјективног фактора у процесу третирања ризика, који у условима реализације или имплементације пројекта постаје пресудан фактор успешног резултата донетих одлука. Нагласак је на квантитативној анализи, али комбинација квалитативне и квантитативне анализе је та која је основа за проучавање постојећих систематских приступа управљању ризицима у фази иницирања пројеката. Успех комбинације две анализе систематског раног приступа третирању ризика путем презентованог модела је предмет савремених истраживања. Потреба да се пројекти заврше у што краћем року утиче на потребу за променом размишљања и одлучивања о што ранијој припреми и третирању ризика. Систематски приступ процени, одлучивању и анализи ризика у раној фази је суштина и савремена тенденција у управљању ризиком.

Теоријске основе у другом делу докторске дисертације су повезане на основама за ризике и управљање пројектима. Овај одељак описује теоријске основе и преглед литературе потребан за извођење и реализацију ове дисертације. Организован је у четири поглавља. Веза овог дела са осталим деловима је постављена на самом почетку (део 2), где је системска идентификација ризика изграђена у управљању пројектима и заснива се на принципима теоријске идентификације ризика. Затим се у дисертацији изграђује систем информисања о ризику с аспекта управљања и анализирања успеха модела и методологије (део 3). Четврти део (део 4) укључује детаље софтверског учења, развијеног на основу система моделирања ризика, организованог као облик идентификације, дефиниције и интерактивног третмана ризика. На крају овог дела дат је преглед претходног истраживања фокусираног на моделе ризика и хипотезу (део 5). Овај део рада повезан је с претходна четири дела кроз осврт на системе за управљање ризиком, постојеће алате, постојеће моделе и све остало што описује тему ове дисертације. У овом делу рада су назначене основне карактеристике ризика, главни разлози третирања ризика на основу теорије, информациони системи и начин комуникације. Осврт је постављен кроз квантитативну и квалитативану корелацију те тренутна постигнућа ових метода. Нагласак је стављен на постојеће алате и методе третирања ризика, компатибилност с РИО (Risk identification oversight) моделом, утицај софтвера у анализи ризика, те саму успешност истих. Све горе наведено детаљније је приказано након детаљног проучавања релевантне литературе и претходно објављених радова истраживача и научника који се баве овом облашћу. Процес концептуалног модела и хипотезе користи реалне примере из праксе.

На основу предмета и циља истраживања, издвојене су следећа истраживачка питања и хипотезе:

Истраживачко питање 1: Да ли су тренутне разлике у неефикасним алатима за управљање ризицима главни разлог тренутне ситуације у неефикасности управљања ризицима пројекта?

У оквиру наведеног истраживачког питања формулисана су додатна истраживачка питања:

Истраживачко питање 1.1: Да ли је претходно предложено питање основа за управљање ризицима пројекта или су недостатак систематског приступа у раној фази започињања пројекта, неукљученост свих учесника и понекад недостатак знања, стварни разлози?

Истраживачко питање 1.2: Какве везе произилазе из истраживања и како управљати празнинама ако управљање ризиком у раној фази није довољно озбиљно?

Истраживачко питање 1.3: Да ли ће представљени модел бити одговарајуће решење и да ли може премостити горе поменуте недостатке?

Узимајући у обзир досад постигнуте резултате у предметној истраживачкој области са утврђеном теоријском позадином, а ради успешног проналажења одговора на скуп истраживачких питања, дефинисане су хипотезе:

Хипотеза 1: Примена систематског модела управљања ризиком значајно смањује број неидентификованих ризика у фази имплементације пројекта.

Хипотеза 2: Примена модела систематског управљања ризиком значајно ће смањити одступања у временском распореду.

Хипотеза 3: Примена систематског модела управљања ризиком подстиче благовремено укључивање свих заинтересованих страна у пројекат.

На основу датих истраживачких питања и хипотеза у дисертацији је детаљно описан истраживачки део. Истраживачки део рада обухваћа преглед концептуалног модела који је произашао из прегледа литературе и разматрања у претходна два поглавља. Након дефинисања модела истраживања примењене су планиране методе истраживања. У складу са сугестијама претходних истраживача и научника, у истраживање су укључене квалитативне и квантитативне методе истраживања. Комбинацијом различитих техника довели смо до стварања синергије метода. Овим приступом, на најбољи могући начин ће се тестирати дефинисане хипотезе и открити важни детаљи који утичу на ширење знања и напредак у области раног систематског управљања ризиком. Представљени успех, тј. ефикасност постојећих информационих система који се могу интегрисати у одабрани модел је детаљно елабориран. Дефинисан је критеријум успеха систематског приступа третирању ризика (РИО - Risk identification oversight). Приказана је основна карактеристика (РИО) модела, као и претходна истраживања, с представљеним резултатима, закључцима и методама истраживања у овој дисертацији. Резултати истраживања - представља главни концепт и процену модела. Посебан нагласак стављен је на развој, употребу и утицај примене модела на постојеће алате за управљање ризиком. Разрађен је систематски осетљив приступ модела. Посебно су представљени резултати испитивања који се могу интегрисати у модел, с нагласком на хомогеност.

РИО (Risk identification oversight) везе с веб моделом, представљена је анализа резултата истраживања с нагласком на тестирању хипотеза и одговорима на главна истраживачка питања. Поред тога, представљено је поређење добијених резултата истраживања, поређење теоријске позадине и практичних импликација које произилазе из резултата два пројектна примера, кроз капацитет и могућности РИО (Risk identification oversight) модела. Представљено је основно тестирање, ограничења и додатна вредност самог РИО (Risk identification oversight) веб модела. Пружено је више увида у структуру веб модела и могуће импликације. Такође су приказане могућности појединачних веза у моделу те су елабориране и демонстриране импликације истих.

Примена резултата истраживања дата је кроз преглед резултата са фокусом на анализу и тестирање капацитета самог модела. Такође су упоређени резултати упоређивањем два пројекта, користећи основне критеријуме пројектног менаџмента. У сврху дисертације, РИО (Risk identification oversight) модел извршава поређење реалних пројеката и очекиваних резултата с могућом познатом анализом одступања. Оба пројекта су дефинисана, припремљена и изведена од истих чланова тима кроз модел на начин да се анализа врши по завршетку пројекта. Објективна поређења ризика су узета у обзир. Фокус је био само на задацима повезаним с ризицима који су препознати у фази дефинисања пројекта. Такав метод се користи за тачна и прецизна поређења. Није узет у обзир ниједан ризик који је имао корективне мере током фазе примене. Резултати и сазнања из анализе узимају се у обзир у будућем процесу планирања пројеката како би се избегла друга одступања у планирању.

Закључна разматрања и упутства за даље истраживање је представљен коначни закључак и дискусија о резултатима добијеним истраживањем. Описане су практичне импликације и ограничења истраживања и резимира се научни допринос дисертације. Осим тога, назначени су правци за будућа истраживања.

Истраживање спроведено у дисертацији је довело до следећих резултата:

Основни циљ истраживања је побољшање систематског третирања ризика у раној фази дефинисања пројеката, користећи најбоље доступне алате, те знање свих кључних учесника или заинтересованих страна. Вероватноћа појаве ризика у раној фази дефинисања и припреме пројекта и његова озбиљна анализа у овој фази дају могућност да се таквим приступом повећа шанса за успешан завршетак пројекта. Основни разлог овог истраживања је вредновање и одређивање граница до којих се ризик може контролисати и одређивање нивоа до ког су ризици одређени тј. специфични за одређену анализу у раној фази дефинисања и припреме пројекта. Категоризација тежине ризика, могућност његовог појављивања и ублажавања су евалуирани на свим корацима (stage gates) и пропраћени проценом ризика на основу критеријума података.

Систематски приступ модела који третира ризик кроз систематске кораке има за циљ побољшање припреме и имплементације будућих пројеката, како у погледу трајања, тако и с циљем отклањања непредвидивих ризика. Систематски процесни модел омогућава (stage gates) стратегију за поступање с ризиком селективном елиминацијом која се заснива на релевантним доступним критеријумима (узимајући у обзир непредвиђене догађаје), укључујући објективну вероватноћу да се пројекат заврши с успешним резултатима. Овакав приступ и коначни резултати показују да модел генерише мање одступање ризика, што унапређује имплементацију пројекта. Методологија РИО (Risk identification oversight) модела може да обједини побољшања у анализи ризика откривањем грешака и недостатака кроз целокупну систематску процену ризика. Очекивано побољшање је свест о раном управљању ризиком с нагласком на детаљнији приступ у раној фази пројекта. Корективне мере су дате кроз lean систематску идентификацију и категоризацију. Показано је да је модел података интегрисан путем веб апликације, користећи могућност интеграције коначних резултата у MS Excel и MS Project, с главним циљем да скрати временски оквир (POP - period of performance) и могуће случајне трошкове у дефинисаном буџетском трошку. Дисертација представља развој модела систематског управљања ризиком с референцама, систем квантитативних алата колаборације и утицај поменутог систематског система на решавање недостатака и грешака у вези са организационим учинком који је заснован на успешним моделима за управљање ризиком. Дисертација јасно оцртава потребе индустрије за свеснијим управљањем и третирањем ризика у што ранијој фази. Јасно и прецизно дефинише везу с инжињерском индустријом која се бави управљањем ризичним пројектима, како би побољшале ефективност третирања ризика у било којој инжењерској технологији. Све ово има за циљ повећање свести о ризику и о стратешкој предности припреме / извођења пројеката и постизања или одржавања нивоа укључености свих заинтересованих страна.

С практичног становишта, ова дисертација предлаже нови модел раног систематског управљања ризиком. РИО (Risk identification oversight) модел практикује методу прикупљања историје података која смањује понављање случајева ризика и побољшава управљање ризиком. У представљеном моделу дефиниција објективних параметара у комбинацији са субјективним ставовима заинтересованих страна доноси још једну додатну вредност коначним резултатима. На основу претходних резултата истраживања очигледно је да се велике празнине ублажавају. Успех модела управљања ризиком заснован је на показатељима из оперативних побољшаних резултата и општем емпиријски потврђеном решењу. Истраживање представља валидан и поуздан корак ка унапређењу мерења система за смањење појављивања ризика.

На крају докторске дисертације су дати и резултати. У овом делу рада на основу резултата презентовано је примена резултата са аспекта теорије и праксе.

<u>Теоријска примена</u> се огледа у ослањању на основе ставова изнетих у теоријском делу, те се предлаже побољшани приступ третирању ризика у раној фази иницирања пројеката. Овим приступом ће се постићи боља реализација и имплементација пројеката. Резултати истраживања за потребе дисертације, као и сам начин спровођења истраживања, проширују сазнања у домену инжењерског третирања ризика пројеката и дају могућност да буду репродукована и проширена.
Добијени резултати имају и практичну примену која може бити корисна за било који вид пројектног менаџмента. Резултати приказују да је модел тестиран у реалним условима, да је компатибилан с постојећи алатима, те показују напредак у третирању ризика и скраћење трајања пројеката. Стога се препоручује строжа систематска контрола третирања ризика у фази иницирања пројеката. Такође, препоручује се детаљна истраживања унутар овог модела, фокусирана на анализу финансијских резултата пре и после спровођења пројеката.

<u>Практични резултати</u> постигнути овом дисертацијом доприносе бољем разумевању тога како се мери или процењује ефикасност управљања ризиком пре покретања (иницирања) пројекта. Истраживање у оквиру дисертације је извршено на узорку од два субјекта. Истраживање је остварено применом адекватних алата за

прикупљање података. Коришћен је иновативан начин прикупљања података путем историјских података, као и унапређених поставки алата који се користе при идентификацји ризика у домену инжењерског одлучивања. Резултати добијени истраживањем су јасно и прегледно приказани, анализирани и тумачени применом релевантних и оправданих научних метода и алата прикупљања, обраде, приказивања и анализе квантитативних података. У раду су коришћене одговарајуће математичке и квантитативне методе за тестирање хипотеза, док је опис узорака приказан уз помоћ показатеља дескриптивне статистике. За детаљнији и свеобухватан приказ резултата и исхода приказано је дрво одлучивања те сам РИО (*Risk identification oversight*) веб модел. Избор наведених метода и начина њихове примене је, у потпуности, прилагођен карактеру предмета истраживања који је у дисертацији постављен.

Резултати који произлазе из ове дисертације су:

- ✓ дисертација мења и допуњава постојеће моделе систематске процене успеха управљања ризиком - ефикасност у контексту структурираног систематског система, и пружа информације о односима између заинтересованих страна,
- ✓ постигнути резултати дисертације су у складу с претходним истраживањима и додатно се потврђују,
- ✓ приступ прикупљању података који користи две различите врсте пројеката, завршени и тренутни, довео је до развоја нове мере за управљање ризиком и указао на недостатке модела који су тренутно присутни у литератури,
- ✓ нови рани систематски инструмент за мерење ризика може постати практично средство за системе управљања ризиком који процењују перформансе примене информација о ризику, омогућавајући тачније мерење улазних и излазних величина ризика и смањење могућих грешака, додатних учења и накнадних корективних процеса,
- ✓ осетљивост РИО (Risk identification oversight) модела јасно показује колико је потребан систематски приступ те евидентно показује коначни исход управљања подацима с прескоченим корацима,
- ✓ резултати ове дисертације отварају нову димензију истраживања, и пружају довољно информација за будућа проучавања бавећи се свешћу о раном дефинисању ризика пројеката, бржом реакцијом, те успешним и ефикасним остварењима задатих циљева пројекта.

Представљени модел је подигао свест о управљању ризиком у пројектима на следеће начине:

a) допринео је да се развије свест о постојању ризика у фази дефиниције/нницијације пројекта,

b) подигао је свест о ризику у фази припреме пројекта,

c) те пружио трајне вредности:

1. Константно знање
2. Стечено искуство
3. Иновација
4. Вештине
5. Одговорност, те свест о ризичном понашању.

На крају је одговорено на сва предметна истраживања (истраживачка питања и хипотезе):

Истраживачко питање 1: Да ли су тренутне разлике у неефикасним алатима за управљање ризицима главни разлог тренутне ситуације у неефикасности управљања ризицима пројекта?

Истраживачко питање 1: Укључивањем свих заинтересованих страна, те раним и систематичнијим приступом управљања ризицима пројекта се побољшава неефикасност алата за управљање ризицима.

Истраживачко питање 1.1: Побољшања се одражавају на рану свест управљања ризиком са фокусом на детаљнији систематски приступ у раној фази пројекта, коришћењем базе податакa и учесника током целог процеса управљања ризицима пројекта.

Истраживачко питање 1.2: Са свим горе наведеним, резулитрало је стварним и реалнијим побољшањима целог процеса.

Истраживачко питање 1.3: Систематичнија идентификација и категоризација ризика, укључивање РИО модела, те повезивање са постојећим алатима је довело до ублажавања (ПОП) времена трајања пројекта те смањења непредвиђених трошкова пројекта.

Хипотеза 1: Примена систематског РИО модела управљања ризиком доказано је да се значајно смањује неидентификовани ризик.

Хипотеза 2: Примена систематског РИО модела управљања ризиком доказано је да се значајно смањује одступања у временском распореду.

Хипотеза 3: Укључивање свих заинтересованих страна током целог процеса систематског управљања ризиком РИО модела значајно побољшава резултате.

У овом делу докторске дисертације представљени су коначни резултати детаљног извештаја са свим улазним и излазним параментрима.

На самом крају докторске дисерaтије наведена је литература која је коришћена током истраживања. Литература обухвата 95 цитирана наслова, те такође указује на добру структуру тока исраживања. А у задњем делу рада представљени су главни прилози докторске дисертације. У прилозима су приказани графикони и табеле који систематски прате структуру дисертације.

CONTENT

I. Introduction

1. SYSTEMATIC RISK MANAGEMENT MODEL IN THE PROJECT INITIATION PHASE

1. Introductory considerations

Understanding and managing the risk is essential for any type of the risk management. The risk is present in every aspect of our lives therefore risk is unavoidable. All humans' endeavors involve uncertainty and risk [1]. The risk presents exposure to the consequences of uncertainty [2]. In general, it includes the possibility of loss or gain, or variation from a wanted or planned outcome, as a consequence of the uncertainty associated with following a particular course of action. The risk thus has two elements:

- ✓ the likelihood or probability of something happening,
- ✓ and the consequences or impacts if it does.

Any types of project management involve risk. In the project management or any other such an organization, it is better to understand the real nature of the risks so that it can be managed more effectively, furthermore, not only to avoid unforeseen disasters but also have a possibility to work with constricted margins. Thus, on the end as a result it should give a less contingency, freeing resources for other undertakings, and being able to seize opportunities and rejected the owns that are too risky.

Based on that, the project management has evolved over recent years. For many years, until recently, risk management in overall has been considered as an 'add-on' instead of being integral part to the effective practice of the project management. One of the disciplines that is tightly connected with risk is the Project Risk Management (PRM). The risk management refers to a coordinated set of activities and methods that are used to direct an organization and to control as many risks that can affect its ability to achieve certain objectives. The risk management intends to manage such a risk by systematically applying management policies, procedures, applying management components, approaches and stakeholder resources [3]. Thus, risk management is universal but, in most circumstances, it is an unstructured activity, based on common sense, relevant knowledge, experience and instinct. The risk management should be based on the best available knowledge.

In general, Project Risk Management is divided into nine-stages entitled as a Project Risk Analysis and Management (PRAM) [4]:

- ✓ define,
- ✓ focus,
- ✓ identify,
- ✓ structure,
- ✓ ownership,
- ✓ estimate,
- ✓ evaluate,
- ✓ plan and manage.

From the detailed or quantified approach, risks could be avoided, retained, reduced and transferred by suitable techniques in carrying risk management practices. During the last periods, risk management as a discipline has gained attention both from academicians and practitioners. The Project Management Institute (PMI) included risk management discipline as one of the knowledge areas in (PM) Project Management science and described the following six main processes [4]:

- ✓ Risk Management Planning,
- ✓ Risk Identification,
- ✓ Qualitative Risk Analysis,
- ✓ Quantitative Risk Analysis,

- ✓ Risk Response Planning,
- ✓ and Risk Monitoring and Controlling.

Many authors emphasized that essential part of risk management is response action plan assuring the proactive problem solving [5, 6]. The various studies have shown the need for project risk management and underlining its benefits. Different authors revealed that quality of cost-estimates, decision making, and scheduling are significantly improved within risk management models, while more reliable risk allocation is being presented [7, 8, 9].

Although the existing literature covers the importance of risk management models, there are only few studies on risk management application success when it comes to the early initiation project phase. Considering previously said, the aim of this study is to identify the major needs for a systematic risk model approach in the energy projects initiation phase and its impact on (time constraints) schedule with the emphasis on the model systematic sensitivities. The results of different authors suggest that in the engineering industry, project risk management is still ineffective. This is due to the stakeholders' lack of participation in the risk management assessment, as well as failure of projects with some specific elements of the outcome presented through the study of various risk tools and their technological doubts [3, 12, 13]. The authors Dale, Stephen, Geoffrey and Phil stating that risk should be considered at the earliest stages of project. Such a planning will avoid correction later on in the execution phase. Other authors mention that risk management events should be continued through an entire project duration [12, 14, 15]. One of the author's general doubts was inadequate participation of all stakeholders from the initiation stage or project planning until project finishing [3].

The other reason for the study comes from research gaps where such a risk treatment in early stage is not taken seriously enough: in the project initiation phase. At the present time risk analysis and risk treatment on the project level has considerably improved within the existing risk management tools [6, 37]. Nevertheless, the existing risk management tools are not perfect, where faults and gaps still exist, therefore improvements in risk management field is still required. These should include a more detailed or quantified approach, early reduction of risk and risk avoidance, and prompt systematic action of suitable integrated techniques to improve risk management practices [7, 8, 9]. Systematic risk identification and classification: the most common problem of risk management practices in project initiation stage is the insufficient risk identification practices [10]. Unfortunately, many projects do not follow a formal risk management approach [11, 17]. Therefore, many organizations find themselves in the unexpected state of crisis, characterized by an inability to make any effective decision. Many cases show that crisis risk managements approach is taken to address the issues but not from the reactive point on the contrary action is taken after risk become problem as a corrective point. The project managers or project teams in such a case may rely on the aggressive risk reaction with the little understanding of the impact of their decision [12]. Regrettably such a case is just waiting to happen and cause the schedule delays, quality issues and budget overruns [13, 25]. The risks occurrences can happen in three phases of project existence. Those project phases are initiation phase, definition phase and implementation phase. It is important to mention that in the first two phases; risk treatment can be handled as the proactive action versus the third phase where only corrective actions could be applied. Therefore, conclusions of recognized authors, that risk should be considered at the earliest phases of project planning. By this approach potential correction actions in the execution phase can be avoided [7, 8, 9, 11]. Considering the risk from project perspective, project risk is always in the future. If risk is managed systematically and methodically in the earliest phase of definition, then project implementation should not have a significant correction.

The scientific evidences illustrate that although there are sophisticated, planned and applied processes of project (RM) Risk Management in engineering project experience failure is always ascribed to a risk event [7, 27]. Such a risk processes are described through the:

- ✓ management planning,
- ✓ identification,
- ✓ assessment,
- ✓ analysis,
- ✓ response planning.

The Risk Management is critical in the definition stage of a project with the reflection on its scope of work where complexity increase as the project moves towards the implementation phase, while decline in the final closeout phase [28]. Therefore, it is recommended to reduce the likelihood of the risk in the initiation phase of the project, to be capable to respond to risk in timely manner. Not assessing and identifying the risk in the initiation project phase by using the risk standardized management approach can overlook both threats and opportunities [12]. Accordingly, more time and resources will be expended on problems that could have been avoided. This comes from practical knowledge working on the active projects at the field. When it comes to the practical cases, risk impacts are handled through contingencies (estimated reserves) or time deviations, constrains that are not resolute in a systematic and complete risk analysis. Vice versa, in such a case both of the estimated reserves and time deviations are inadequate to cover the costs of unmanaged risks that are consuming corrective action in project implementation.

1.1 Problem and subject of the research

Although Risk Management has been considered an important issue in the project management, risk management in the initiation phase of the project is rarely actively and explicitly applied in practice. There are few models on the risk management market that covers methodologies such as qualitative and quantitative. Recognized authors highlight, that both of the methods probability's models suffer from two key limits [15].

The one of model limitation comes from the needs of detailed quantitative requirements. Usually in phase of the project initiation, definition or preparation information's availability is not provided on time. The applicability of such models to real project risk analysis is restricted. Restriction comes either from the not adequate risk workshops, or at early project stage its difficulty of making accurate risk conclusions or the ability of subject matter expert's opinion in correlation to the systematic risk analysis. The second constraint comes from the undefined and vague risk identification; therefore, at that stage subjective evaluation is required, which conventional models cannot handle it. So, considering previous statement, applying the risk models in the early stage of project management is not such an easy task to achieve. The similar concern has been reflected in a software development where significant contribution to risk management have been made over the past decade but on the other hand most of the risk management approaches in software engineering use simplistic approaches and fail to account subjectivity for the biases common in a risk perception [16]. In the same vein software limitations are frequently not acknowledged or addressed by the stakeholder users or by practitioners. Nevertheless, failure to account limitations in the risk management practice may result in serious bias in final risk management results. Therefore, in 2004 studies report indicates that 53 percent of the software project failed in terms of delivering the schedule, within the budget and with the required function [17]. Another study refers that in 2008 only quarter of software projects succeeded [18]. In the risk project management real situation are doubts in software analytical approach of managing risks, where managers referring that above issues are managed quite efficiently, but lack of the management of software developments is recognized even by leading software developers [15, 19].

Founded on all above studies there is an obvious deficiency of the current market solutions that are friendly use and can offer better-quality results. Evidently there is a need for early systematic risk managing in the definition project phase. To be proactive in the engineering industry and to overcome potential risk problems early initiation of risk identification and treatment is needed [20]. The purpose of the early risk definition phase is to prepare contingency plan of mitigation and narrow all recognized risks before implementation stage. Resolving such an issue by software tools, in the initiations project phase from the qualitative point of view approach will not be different then project planning is done with maximum available data. Nevertheless, the degree of risk complexity, differs based on the size looking in terms of schedule, budget and location [15]. In the dissertation few presented studies in area of risk management outlines the developers' perspective. Outlines is integrating attempts of software development sequence with the involvement of concerned Functional Area Managers (FAMs). Key message from all of presented studies is successful project managers trying to determine and mitigate all potential risks before they occur. That should be purpose of risk project management and goal of dissertation [21]. The outline of risk standard demands process improvements. Based on the recognized authors risk standards comparison has its limitation. It is obvious that risk standards have a great deal in common, but it is universal consensus that presented gaps should be covered by systematic risk management [21]. Few major general gaps and differences between them are presented:

- ✓ general observation that none of the existing risk standards covers all subjective fields regarding the functional area managers (FAMs) or stakeholders' involvement, relationship of communication into organization and systematic risk implementation.
- ✓ some of the standards cover only the risk management process. Integration of the risk management process into organization is not applied.
- ✓ the literature risk definition and distinction where risk is considered to be threat and opportunity or only a threat.

What follows from all the above said is that there is an extensive agreement regarding the generic project risk management process. Also, there is wide range of opportunity for a completely new method that will cover major identified gaps. Considering the current standards, the research contribution is applied through the continuous involvement of stakeholders. The efficiency is evident through the entire risk management process. The established and defined tangible steps resolve any systematic system faults with accuracy and practicality. The results show a narrow project time reserve approach, condense schedule deviations with less contingency on project.

1.2 Objective and extent of the research

The probability of risks occurrence and inflexibility of taking risk analyses in the early definition and preparation stage turn process useful for the successful delivery of any project. The purpose of the research is presented by the methodology approach in which quantitative technique, some partial qualitative technique will be used. Additionally, by ways of existing techniques stakeholders or Functional Area Managers (FAMs) will be actively involved through entire risk management process [69, 74]. Proactive participation of the stakeholders through the process, will continuously improve the results based on the given project objectives. Based on the author Ward Chapman, the efficiency is not only defined by ways of the existing techniques, it is also dependable on the subject matter efficiency, capability and experience to undertaking any task in risk management process. The methodology approach is based on early systematic risk management phase. The early phase contributes before any stages of project preparation and implementation. The early systematic risk model will provide defined steps and stage gates. The risk systematic model will support doctoral dissertation research from the point of literature, existing tools, and quantitative approach with the most objective effects on decision-making actions. Based on the recognized authors part of the quantitative risk management is integration of the risk recognition and assessment [22].

The Risk Identification Oversight (RIO) model involves planned steps to manage risks and use the mitigation modifications risks by the stakeholder's knowledge, their means as well as model predefined criteria's [23]. The quantitative methodology approach considering all quantitative risk aspects incorporated in the risk management, shall improve risk preparation process through defined steps which will support future implementation of the project, and expand the risk management system. The systematic risk management model of the project is a major problem in the industry [24]. It is evident that there is a concern with the procedure's usage, their objective with considerable elaboration of what systematic risk management should be used and how such an approach effects on inducements and corrective measures. The idea of doctoral dissertation and the model RIO in risk analysis is a level of 'more systematic approach'. It will be clarified through the model how the corrective measures are differing from existing risk systematic models. The corrective measures are defined and applied to all stage gates. The stage gates in the RIO model are predefined by criteria of the formulas to make certain option through given checks by exclusion of any unsystematic selections. The definition is also innovative, as opposed to the consideration of the existing random choice sets. The RIO model provides conditions where a stakeholder has an option to disapprove certain step for a firm defined reason. Such an approach gives risk treatment much more systematically behavior [3, 13, 69, 75, 94].

The systematic choices in the RIO model flow tree presents the stakeholders involvement and risk predictability. The model consists of external and internal factors with the focus on all risk elements. The risk elements categorization and mitigation are included in all stage gates. The weighted probability is established by the tree criteria. The main aim of the RIO model is to appraise and institute to which level risks are controllable and the degree of specific or certain risk analysis is needed in early initiation project phase [9, 12, 25, 76, 94]. The dissertation is concentrated on schedule deviation improvement by the systematically presented model approach with the guidance for future project preparation and implementation. The main motivation for the dissertation comes from the literature research where risk treatment in the early preparation stage is not systematically considered [7, 9, 76, 77]. Dissertation addresses the gaps in risk management in field of energy industry. The selected projects are using a knowledge-based approach, and process of chosen systematic methodology consist of five section [37]:

- ✓ systematic process, including flow tree,
- ✓ risk data register,
- ✓ predefined flow tree plan,
- ✓ risk history data with the supported documents,
- ✓ database with appropriate criteria.

The expected outcomes of stage-gate strategy are to eliminate gaps, uncertainties of unwanted risks, mitigation response and future lessons learned evaluation. The challenge is forming function area managers (FAMs) responsibilities, evaluation criteria, and the possibility of integrating it into the risk management model. The one of the intentions comes from practice on the field through the years of the experience being on various projects. In practice, majority of the risk occasion are handled through the sets of contingencies or reserves, time deviations that could not be seen in risk analysis. In many cases such a result is not sufficient to cover all corrective consequences on project objective. Therefore, these cases usually end with costs overruns and being late [32].

The expected model outcome of the risks stage gates after applying the risk response strategy with the level of risk evaluation criteria involving all functional disciplines in the matrix tree should result with the maximum elimination of any faults towards the matrix model success per the given stage gate process probability. The risk response strategy and percentage of the early identification or elimination associated with the risk behaviors response strategy is key success of the risk process matrix steps criteria model. This involves definition and preparation of all uncertainties for the project duration, impact on work breakdown activities and risks response mitigation activities associated with the stage gates activities [37]. Therefore, the RIO systematic process flow tree criteria include [18, 26]:

- ✓ risk measures,
- ✓ risk elimination and reduction effects,
- ✓ interfaces between the stage gates with emphasis on risks,
- ✓ decision and risk mitigation efforts.

The systematic criteria for forming the process in the RIO model enables phase strategies per the presented stage gates, in a way of or by selective elimination risk management. The selective elimination is based on relevant data sources and available mitigation criteria, including the objective probability of projected project results. The anticipated successful project results are specified through gates of systematic approach by developing all identified risks into model criteria. The methodology and the final results show that selected systematic process model generates not as much of gaps, shows different levels of sensitivity resilient results with the improved project implementation [20, 78]. Additional outlooks of the application and proposed approach allows stakeholders business users to influence on project risk management functionality. Influence is based on stakeholders' best practices by raise awareness of the risk existence [37].

1.3 Research question and hypothesis

Based on the research objectives, the main research question is formulated:

Research question 1: ***Are the current gaps in ineffective risk tools are the main reason of the current situation in project risk management inefficiency?***

Within the aforementioned research question, two additional research questions were formulated:

Research question 1.1: *Are the previously proposed question just a base of the project risk management issue or the lack of participation in early risk management assessment, systematic monitoring in early initiation project phase, noninvolvement of all participants and sometimes lack of knowledge are the cynics as well?*

Research question 1.2: *What kind of relationships comes from the research and how to manage the gaps were such a risk treatment in the early stage is not taken serious enough?*

Research question 1.3: Whether the presented model will be a suitable solution, and can it bridge the above-mentioned gaps?

From the subject of the research, taking into account the results achieved so far in the subject research field with the established theoretical background, and in order to successfully find answers to the set of research questions, a hypothesis has been defined:

Hypothesis X1: The application of a systematic model for risk management significantly reduces the number of unidentified risks in the project implementation phase.

Hypothesis X2: The application of a systematic risk management model will significantly reduce deviations in the schedule.

Hypothesis X3: Applying a systematic model for risk management encourages the timely involvement of stakeholders in the project.

1.4 Research results

Within the research, a detailed analysis and review of existing literature has been completed. The previous research results in the field of risk management system and possible existing tools of the risk treatment was incorporated. The link was established between the qualitative risk management and quantitative risk management systems with the general observation of the results, which showed that both of the systems have necessary elements for improvement. After a certain literature connection was recognized between the two systems, an analysis of the success of the information systems was carried out and the key outcomes were identified.

In the first phase of the research, a theoretical theorem was developed to prove the need for a better risk treatment in the missing initiation phase. In order to develop the measuring methodology, a detailed analysis of the existing literature and previous research results in the field of risk management systems and existing tools of the risk treatment was piloted. After analysis, it has been found that majority of the scientific write ups explicitly underline the need for the systematic risk management solution. The result of the analysis was used to develop a theoretical theorem that shows inconsistency of current tools for the risk treatments.

This gave the answer to the research question 1.1 (*Are the previously proposed question just a base of the project risk management issue or the lack of participation in early risk management assessment, systematic monitoring in early initiation project phase, noninvolvement of all participants and sometimes lack of knowledge are the cynics as well?)*

In the second phase of the research, a theoretical theorem was developed to prove presence of some gaps in the existing models and the determination how to be treated. There has been a doubt that risk treatment is not taking seriously enough, not early enough and not in such a systematic way. Therefore, it has been concluded that there is a gap existence in risk treatment and therefore it has to be managed.

This gave the answer to the research question 1.2: *What kind of the relationships comes from the research and how to manage the gaps were such a risk treatment in the early stage is not taken serious enough?*

In the third phase of the research, systematic risk model was developed using the method of risk register, work break down structure a use of the stakeholder’s relationships, and basic elements of the success model structure based on the standard risk treatment collaboration. The main connection gaps have been established through:

- ✓ the systematic quality of the model and usage of the system,
- ✓ technical quality of the systematic system and stakeholder’s satisfaction,
- ✓ the ability of the early risk assessment and the systematic approach based on three controls: given criteria, stakeholder’s interaction and involvement and the structural phases of the document,
- ✓ Usage of the tool with the web performance,

- ✓ Model ability to connect WBS, RWBS, early schedule and the main critical risks,
- ✓ Easy applicable integration in any project management tool,
- ✓ Building the history data base reachable from any share point,
- ✓ Bridging the gaps of the current not so sophisticated tool options,
- ✓ Integration of the missing elements such as:
  - *a.* Early risk assessment in the initiation phase,
  - *b.* Involvement of the stakeholders through all phases of the risk assessment,
  - *c.* Tool that it's simply integrated in the schedule and possibility of the history data usage.

Founded on above it's a confirmed hypothesis 1, 2, 3 and auxiliary hypotheses 1.1, 1.2 and 1.3. Based on the answers to the research questions 1.1, 1.2 and 1.3 it has been deeply analyzed the need and improvement of the research results. It has been considered the best indicators of success, the effectiveness and the system implementation possibilities.

Based on that it has been implemented:

- ✓ early risk identification dimension,
- ✓ systematic system quality,
- ✓ systematic system uses and the quality control model,
- ✓ end user detailed involvement from the start,
- ✓ model web performance and the benefits of the presented model.

The new model confirms:

- ✓ association between the missing elements of the quantitative and qualitative modeling system with two steps bridging the gaps, early systematic assessment and systematic model tool quality control performance.

1.5 Structure of dissertation

The dissertation is organized through ten chapters in a way that methodically follows the research phases and gives the reader a chronological trace. The first part presents general considerations and general concepts of the dissertation. The second part presents the theoretical basics and a literature review of the risk identification and the correlation to the project risk management, structured in three parts: the risk identification and correlation to the project risk management, the existing qualitative and quantitative deficiency of early risk assessment system necessary for the implementation and realization of the project risk management and conceptual systematic model with the emphasis on the hypothesis. The third part presents the risk methodology of research and data collection. The fourth part shows the results of the presented model and the possibility of useful results collaboration within the existing risk assessment tools. The fifth part presents the RIO model web possibilities and connections. The sixth part presents discussion and analysis of results as well a practical model implication. The seventh section presents conclusions, observations and a guideline for future research. At the very end of the dissertation, the use of literature is in section eight. The enclosure contributions with other relevant details significant for research is in section nine and on the end of the doctoral dissertation which is section ten are included the basic report results.

Chapter 1 presents an overview of the key research and objective glitches in a risk management society, based on the current technologies and the basic challenges of new tools as well. Overview of the methodology description, research and data collection. Qualitative and quantitative deficiency of early risk assessment system resource and their collaboration. The software ineffectiveness to provide the final risk system results and model possibility of non-involvement of stakeholders. In this section it has been presented: the basic idea and the subject of research problem, the aim of the research, the scope of the research and existing limitations, the hypotheses, questions and the phases of research.

Chapter 2 shows a theoretical background with the collaboration of risk management and correlation to the project management. The collaboration is within information risk treatment systems; existing collaboration tools, existing collaborative models, and other terms that describe the topic of this dissertation. All of the mentioned in greater detail are shown after a detailed study of relevant literature and previously published works by researchers and scientists dealing with this area. The process of the conceptual model and hypothesis using the real examples.

Chapter 3 provides an overview of the conceptual model that arose from a review of literature and considerations in the preceding two chapter. Present the success or effectiveness of information systems that can be applied to the selected model approach. The definition of the model system success has been defined. The basic of model characteristic, as well as previous research is presented, with the presenting results, conclusions and research methods for this dissertation.

Chapter 4 presents the concept and assessment of the model. The particular emphasis has been put on the development, usage, and impact of applying the model to the existing risk management tools. Systematic and sensitivity approach has been elaborated. It has been specifically presented the collaborative testing system results with the emphasis on the homogeneity.

Chapter 5 presents the synopsis of RIO model capacity and possibilities. It presents basic testing, restriction and added value of the RIO web model itself. Provides the more insight of the model web structure and implications. Also discuss the model individual connections and model pattern demonstration.

Chapter 6 provides an overview of the given results analyzing and testing the capacity of the model itself. Also discuss the results and comparison of the two examples as a key structure of any project in the project management.

Chapter 7 presents final conclusions and discussion of the results obtained by research. Practical implications and limitations of research are described and summarizes the scientific contribution of the dissertation. In addition, the directions for future researches are indicated.

Chapter 8 show the scientific literature that has been used during the research, also indicates the good structure of the due diligence path towards the findings.

Chapter 9 presents the doctoral dissertation main enclosure. Enclosures shows the charts and tables that are systematically follow the structure of dissertation.

Chapter 10 presents the final detailed report results of the doctoral dissertation.

II. Theoretical backgrounds

This section describes the theoretical bases and a literature review necessary for the performance and realization of this dissertation, organized around four chapters. At the very beginning (Chapter 2) a system risk identification built in the project management is based on the principles of the theoretical risk identification characteristic, then further in the dissertation a risk information system is built from the aspect of managing and analyzing the success of models and methodologies (Chapter 3). The fourth chapter (Chapter 4) of the literature review details of the software learning, developed on the basis of the risk modeling system, organized as a form of identification, definition and interactive risk treatment. At the end of this chapter, an overview of the previous research focused on risk models and the hypothesis is given (Chapter 5).

In order to review past results and theoretical backgrounds, Mendeley[2] portal with related services has access to the electronic journals of the following publishers: "*International Journal of e-Education*" "*Science direct*", "Emerald insight", "*Elsevie*r", "*IJEST*", "*International Journal of Project Management*", "*JISE*", "*IJPM*". Key words such as "Risk", "Risk management", "Risk modeling", "Project risk management", "Mitigation model", "Qualitative risk management", "Quantitative risk management", "Risk systematic identification", "Risk analysis", "Integrated risk management", "Risk knowledge", "Enterprise Risk Management Models, "Risk mapping tools", "Risk evaluation" , "Early Systematic Risk Evaluation", were used to search for the theoretical assumptions of the results of previous research.

Mendeley[2] – research manager and academic social network

2. The risk identification with emphasis on project risk management

This section presents a risk overall definition and the basic principles based on the project management system. Concept is based on the:

- ✓ risk,
- ✓ risk identification (external and internal events),
- ✓ risk assessment,
- ✓ risk evaluation,
- ✓ risk treatment,
- ✓ risk tools,
- ✓ risk models,
- ✓ risk impact on the overall project risk management process,

and other terms that describe the topic of this dissertation in greater detail is presented after a detailed study of relevant literature and previously published papers by researchers and scientists dealing with this area.

Based on the recognized authors, Chapman and Ward conclusion, came that risk identification is both important and difficult. The goal of risk identification is to identify a risk before it's become a problem, for that reason originates the motive of why the early stage is necessity [27]. The risk identification and quantification are a basic stage and learning curve in the project management. The risk identification and quantification are essential to understand what could go wrong in the all project development phases (initiation, definition, preparation and implementation) at any given point of time [28]. The risk identification and quantification in general relies on the three main factors [29]:

- ✓ the risk breakdown structure with several levels in hierarchical order (RBS) of project,
- ✓ the corporate history,
- ✓ the opinion of the subject matter experts improved with the identification.

However, study suggests that the most valuable asset for the possible risk's identification is the utilization of the corporate risk history data. To achieve more efficient results in risk identification, corporate risk history data uses its ability to combine the links between the risks and technical elements, based on earlier experience with the references of the reusing the knowledge acquired from same type of risks in similar projects. Thus, comprehensive risk identification provides an important first step in the project risk management, but unfortunately, identifying and understanding the risks and its effect on project is not always a straightforward task. Since we are dealing only with the project initiation phase, those risks can affect a project in different way including different phases of the project life cycle. Therefore, this process and its tool is very important to be done correctly and must include a broad view of the project stakeholders to understand the risks and to apply all possible mitigation through various project life cycle [30]. On the other hand, the next logical sequence is the sources of risk and potential consequences. This can be accomplished by the check lists, risk work breakdown structure or other tools, but before risk can act in behalf of the risk mitigation the experts in their own domain have to intuitively recognize a risk situation. Such a risk identification tool that will be later presented in this section, have in nature the focus for a collaborative approach so that all aspects of the project risk identification are examined for each risk situations.

Currently the main focus of needs and contributions are in area of project risk management, with emphasis on systematic early risk identification or awareness [31]. From the point of contributions view there are constructive path forwards in field of project risk management. Such a contributions reflects in substantial operation flexibility and cost deviations. The practice of the earlier risk identification contributes in a way of competencies and basis of company's setup, which is a strategy developments, competitive acuity and firm approach in the execution phase. The risk management must be collectively address from the initial definition of projects, and constantly updated and used through the project lifetime [38].

In general, project risk management is the one part of the comprehensive process of the project management with the task to identify, analyze and to respond to any risk that is related to the project during the life cycle duration and to keep or help project to stay on track in the defined boundaries. Since the project risk management is not only the responding tool, but on contrary it has to be considered as a planning process to figure out the risk upfront that might happen in project and then use the possibility of responding. There is a numerous classification of the risk identification in the literature but the general one is presented as a brainstorming, check lists, organizational charts and mapping. The risk identification steps that will be used in the dissertation are based on the selected authors [25]:

Chart II-1. Steps in risk identification and risk management [25].

Therefore, the overview of the risk management and the correlation with the risk identification its key requirements. For the upright risk management effectiveness, a risk identification is needed. First it is a need for clear understanding of what is meant by the term 'risk' and the second is to be able to distinguish risks from non-risks. In particular it has to be segregate from their causes and effects. Amongst other thing stated the focus has to be on risk that can be identified, since not all risk can be identified or quantifiable from the beginning [25].

2.1 The main theoretical characteristic of the risks

The risks can occur at any stage of the project and as an outcome, risk identification and analysis is important in project management for successfully finish of any project. There are several definitions of the risk, exist in common use from the Project Management Institute (PMI), Project Risk Management (PRM), International Organization for Standardization (ISO 31000) and etc. But for the purpose of the dissertation we will use the definition based on the Project Risk Management (PRM) [4].

The risk is an exposure to the concerns of unpredictability [2, 32]. In a project context, it is the chance of something happening with an impact upon given objectives either positive or negative [2]. Thus, risk includes the possibility of loss or gain, or variation from a desired or planned outcome, as a consequence of the uncertainty associated with following a particular course of action. Also, risk might be positive or negative. The risks with the negative impact on project goals are classified as an uncertainty, where risks with the positive impact on project objectives are considered as opportunities. The positive or negative risks can likely occur in the short term, in an imminent stage of the project works, or risks may be unlikely occur until a later stage in the project. All these possibilities give alert and need that risk has to be taken very seriously. Since dissertation will focus on the early identification of the risk and their treatment, such an approach will give enough information for the future project implementation when such a risk occurs in the imminent or later stage of the project. Nevertheless, action to manage the risk in the immediate future can take a more passive or corrective form [33].

Therefore, the main aim of the dissertation is to focus on risks in the early stage of the project initiation. The risk can occur in the initiation phase, preparation phase and execution phase. Considering authors: Dale, Stephen, Geoffrey and Phil risk must be considered at the earliest stages of project. That includes early planning with the final goal of not having many corrections in the execution phase. The authors also stating that risk management treatment is constant throughout the project Period of Performance (POP) [32, 94]. The project risk is considered to be always in the future. Based on the authors if the risk is managed systematically in the early phase, then the risk management will not need significant corrections in the implementation phase. The corrections are related to not having significant deviation and corrections later on.

In general project risks are usually classified as known and unknown. Based on the recognized authors much more detailed breakdown is provided [27, 34]:

- ✓ **Known,** this is actually the easiest risk to cope with its controllability,
- ✓ **Unknown,** uncertainties caused by ambiguity or a lack of information. In the context of risk management this includes any risk that is not identified and managed,
- ✓ **Know-knowns,** are things we know that we know. Our general knowledge,
- ✓ **Know-unknowns,** more troublesome are things we know from phenomena which are recognized, but poorly understood that we don't know,
- ✓ **Unknown-known,** even more troublesome are things we do not know, or we don't know their potential risks,
- ✓ **Unknown-Unknowns,** those are usually unexpected or unforeseeable conditions. Kind of risk that pose a potentially greater risk simply because it cannot be anticipated based on past experience or investigation. It is considered as a worst kind of risks; we don't even know that we don't know. We are aware of the existence and the unexpected impacts that such a risk could have. These are the kind of risk that on one side may look a risk as known unknown, but the other side maybe completely unaware of it, an unknown-unknown.

The risk exposure may arise from the possibility of economic, financial or social loss or gain, physical damage or injury or delay. When we are looking of the risk exposure based on the project management then risk arise from the different disciplines such as: business development, operational, information technology (IT), financial, procurement, technical, planning, market, legal, external/internal, quality, safety, cost and time [35, 94]. There is a possibility that project events will not occur as planned. The unplanned events could be that risks will occur with negative impact on the project and could have all above defined risks. The risk has two components, the uncertainty of an event, which is measured by its probability, and its potential impact on the project. The magnitude of uncertainty that an organization can accept is measured by its risk appetite. The magnitude of impact the organization can accept is measured by its risk tolerance. Therefore, the combination or the uncertainty and the probability give you the magnitude of the called contingency to handle those risks [37].

The key message of the given formula is importance of risks typically rests on other factors besides probability and impact, and different considerations can apply in different phases of the risk management process, where later on, in the dissertation it will be elaborated more into details of the risk element and behaviors in the different risk treatment scenarios [33].

2.2 Key reasons for risk treatment based on the theoretical approach

In a theory risk may be addressed through the couple of disciplines, non-technical, technical, economical, safety, financial, operational, etc… [79]. Simply, few of the theory definition that are used widely across the disciplines, risks are [25]:

1. An ***unwanted*** *event* which may or may not occur.
2. The ***cause*** of an unwanted event which may or may not occur.
3. The ***probability*** of an unwanted event which may or may not occur.
4. The statistical *e**xpectation** value* of an unwanted event which may or may not occur.
5. The fact that a decision is made under conditions of ***known probabilities*** (“decision under risk” as opposed to “decision under uncertainty”).

Those main risks which impact the projects significantly should be viewed as critical with the most influence on the project objectives. It is consequently important to identify risks as early as possible, in order to mitigate a risk’s probability and/or impact or to take advantage of any potential opportunities. Simply looking through the performance, scope and quality risk can be considered as the possibility of an unintended future events with potential undesirable consequences. Therefore, for this reason, theory says that project risks are difficult to manage, because they relate to events that may or may not occur. In the perspective of project risk management, risk has several dimensions [25, 90, 95]:

- ✓ scope related risk,
- ✓ cost related risk
- ✓ schedule risk,
- ✓ risks to the environment, safety, or health.

Within the said above, the risk is field that has to be effectively managed. When there is a risk, there must be something that is unknown or has an unknown outcome. For that reason, knowledge about risk is knowledge about deficiency of knowledge. To be able to reach the level of the effectiveness and efficiency project-specific risk management strategies requires the use of risk assessment. Such a risk assessment has a decision technique that systematically incorporates consideration of adverse events, event probabilities, event consequences, and vulnerabilities. From the theoretical aspect risk categorization can take different forms and may vary between the contexts. In a broad segregation risk can be divided into operational and financial risks. Since risk is related to some probability of its occurring and the impact, risk response can be divided into basic three elements of probability ROYER 2000, [36]:

- ✓ High
- ✓ Medium
- ✓ Low

For the purposes of the systematic and detailed approach in the dissertation it will be used definition of more detailed elements [79]:

- ✓ High-High
- ✓ High
- ✓ High-Medium
- ✓ Medium-Medium
- ✓ Medium
- ✓ Medium-Low
- ✓ Low
- ✓ Low-Low

Therefore, from the main root cause three possible responses to a risk occur, but in the vein of the probability of its occurring, it has been used some of the more detailed concept of the break down for the purpose of planning risk management on a project. Highly rated risk will receive more attention from the risk managers then lowly rated risk. From the point of the risk managers how to response on the important or none important risks; to explore the particular risk in more or less details, developing the responses to the particular risk and determine how much resources are worth investing to those particular responses.

2.3 Risks, information system and communication

The modern project management largely relies on information systems as an essential resource for supporting project risk management methodology resources and their development. The risk information system is a system using formal procedures and steps. The risk information system provides management at all levels, helps with appropriate information obtained from basis data with incorporated internal and external sources. The information system enables timely and effectively decision-making process related to planning, management and control of activities [30, 37]. The fundamental precept of the risk information system is to support the project risk management in any organization, but in general in all industry organizations, where project have been exposed to some king of the uncertainties. Some of those impacts do have negative effect on the project management system. Managing those uncertainties is not an easy-going task. Sometimes the limited information system or limited recourse of the information can cause the damage to projects and make the mitigation or even any kind of the analysis impossible. Therefore, at the market there are many methods and ways of the supported tools for managing the organizational risks.

We will have to mention just few of them that have similar method strategies:

- ✓ Project Uncertainty Management (PUMA) [70],
- ✓ Risk Analysis and Management for Projects (RAMP) [83],
- ✓ Two-Pillar Risk Management (TPRM) [79],
- ✓ Active Threat and Opportunity Management (ATOM) process [80],
- ✓ Shape, Harness and Manage Project Uncertainty (SHAMPU) [81],
- ✓ Project Risk Analysis and Management (PRAM) [82],

- ✓ Information Risk Assessment Methodology 2 (IRAM2)

The organizational awareness is one of the crucial steps for any project risk management system. The organizations have to be aware and be involved from the beginning and upfront promptly informed about potential treats. Many of the project risk management systems has been unsuccessful do to the not prompt information system in place or not involving the stakeholders on time. There are few gaps in the information technology of the project risk management level. Some of the organization do not take seriously enough the risk management even if the tools do exist in the organization [37, 40]. The majority of the information system do not involve entire functional area managers or the stakeholders from the beginning, on contrary the systems are not set up to be directly in contact with the key members.

Recently organizations becoming aware of the risk information system aspects and importance of constantly collection of the risk information within the groups internally or the externally. The significant amount of effort is needed for the maintenance of a risk information system. The enterprise risk management processes allow firms to use this risk information to identify possible risks resulting from an organization's decisions, and to address proactively such a risk. Also, the systematic risk management information system involves effective processes, an appropriate infrastructure, accurate information, and timely prepare reports for the management to make knowledgeable decisions. On the other hand, developments in information and communication technology have allowed many organizations to implement systems that can be directly accessed [38]. In a number of instances such an approach allows organization to gain a competitive advantage over other business rivals. It also gives possibility of the creating the history data base for the purposes of the new risk treatments or the lessons learned. The collected information's contribute to a knowledge base which is the assembly of all legitimate evidences and views that the relevant group of stakeholders take as given. Such a data can benefit in further research and analysis in this field.

2.4 Risks management system modeling

The risk management is one of the vital management tools in the project management system. The risk management is all about predicting the unpredictable. Term of the risk management in the literature has few different definitions based on the recognized authors or recognized institutes. For the purposes of the dissertation it will be used: "*Risk management is systematic process of set of the methods and activities designed to reduce the unpredictable"* (PMBOK) [4]. Therefore, it is very important to choose the applicable method and develop the strategies of the risk management, based on the selected strategies risk management with essentially influence to successful project performance. Over the last few decades several contributions or developments have built project risk management processes.

Therefore, risk management system or the methods have very similar processes. Their aim is to understand the characteristics and objectives of the project, project issue and planning based on the scope, and purpose. The intermediate steps aiming to identify risks together with their causes, effects, and how risk relates to each other, assess their probabilities of occurrence and impacts. Also, they intend to priorities risk, prepare the risk response strategies, and establish contingency plans [39]. In overall on the end or at the final stage, risk management systems are dedicated to carrying out the recognized responses to risks by monitoring and refining them, identifying, evaluating, and treating new emerging risks. As one big part of the post evaluation in risk management systems is having usage to communicate results of the risk management process and managing and recording the new knowledge, experience, and on the end, conclude with the lessons learned after any project implementation. In the same vein, risk-management system is designed to improve the company's ability to manage or contain the risk events should they occur. The risk management is added value to the companies in the way from not undertaking risky ventures; but to the contrary, it would enable companies to go into projects with the higher-risk and higher-reward ventures [40]. Based on the Project Management Institute (PMI 2008) the risk management has six steps: management planning, risk identification, qualitative risk analysis, quantitative risk analysis, risk response planning, risk monitoring and control [4]. By contrast, the International Standards Organization (AS/NZS ISO 31000:2009) only reference the five steps for the risk management as a: establish the context, identify the risks, analyses the risks, evaluate the risks and treat the risks.

Since the project risk management is topic of the major project management process, it has been actively addressed in majority of the professional project management associations. Jus few of them will be mentioned [32]:

- ✓ Project Management Institute (PMI), USA (2003) - Project Management Body of Knowledge, Chapter 11 on risk management;
- ✓ Association for Project Management, UK (1997) - PRAM Guide;
- ✓ IEC 62198 (2001), Project Risk Management - Application Guidelines;
- ✓ International Organization for Standardization - ISO 31000, ISO/IEC 31010:2009 – Risk Management – Risk Assessment Techniques

Basic breakdown or the so-called structure of the risk management is given per the PMBOK [4]:

1. Risk management planning
2. Risk identification
3. Qualitative risk analysis
4. Quantitative risk analysis
5. Risk response planning
6. Risk monitoring and control

Since the risk management approach will be focused on the quantitative risk management process it will be used further detailed elaborations of the breakdown meaning [41]:

1. The risk identification is the first stage of the risk management process. It is identification of risk-related variables that may appear in projects. Such a risk identification path structure comprises of vulnerability, different risk source, risk event and risk consequence chains as well as weakness source of those attributes.

2. The risk assessment and analysis is the second stage where magnitudes of vulnerability sources are assigned by the decision makers in this case stakeholders or the called functional area managers (FAM's). At this stage, stakeholders will assess the magnitude of each vulnerability source shown on the risk map structure.

3. The risk evaluation and response is the next stage of the risk management process where the all findings of the risk assessment process are evaluated. The presented map tool allows the evaluation of risk assessment results in few groups; risk rating results, risk elaboration, risk probability results and the initial cost overrun results.

4. The risk mitigation development of risk reduction and reaction to the threats or so-called risk response. During the risk management some of the mitigation action

are defined to eliminate the critical vulnerabilities. Sensitivity of the mitigation and analysis is used to find out the most critical elements of the contributors to the project objective deviations.

5. The implementation of risk management plan as a risk monitoring and control is mainly about capturing risk events that actually can occur in project by conducting different levels of the audits and the status meetings. Risk monitoring is critical toll for the future formation of the lessons learned database.

6. The communication is part of the different report approaches where transparent and timely reports are shared between the parties involved in the risk management with the purpose of the possible decision implications based on the given information. Communication can be conducted through the many ways that are part of the presented model, sharing, email, web based, conference or the live interaction.

7. The review and correction of risk assessment is the final phase of the process model. All recorded risk reviews and documentation of the post project appraisal stage are actualized based on risk ratings, time and cost overrun percentage. The final risk events and results are captured and stored in the main database. The acknowledged and documented risk event histories can be shared and transferred within the organization by using an automatic report generation system per the presented model.

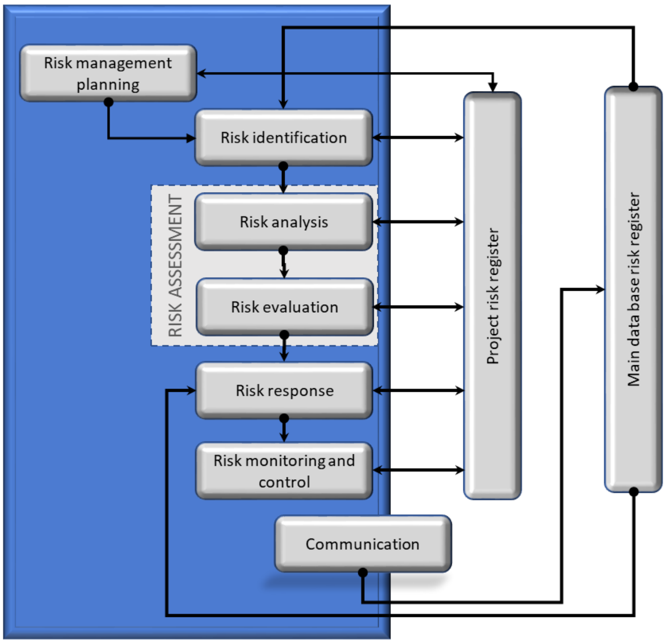


Chart II-1. Risk management process [42, 94].

The review of the articles based on S.M. Renuka, concluded that earlier risk identification in the project and assess in the pre project phases will lead to the better estimation of the cost and time overruns [31]. Until 2000 there has been only few attempts of the early identification and assessment of the risk factors in the industry project. As a final result there was a lack of the systematic approaches to identify and manage the risks in construction projects [43]. After the 2000 there was a sharp increase in the number of the risk management approaches. More sophisticated models have been developed by the various researches. The sophisticated techniques brought the use of the workshops, with the integrated approach which includes brain storming, checklist, probability impact matrices, subjective judgment and risk registers. The reports showed that has been positive move forward. It has been concluded that there is an urge for the knowledge map which depicts the sources of the critical risk factors and its impact on the project objective. The knowledge map had to represent the predictive factors to be forecasted during the earlier stage of the project. From the review of the literature a number of systematic models have been proposed for use in the risk evaluation phase of the risk management process. The author Dey has suggested the new quantitative approach through the analytical hierarchy process and decision tree analysis, but the argued the probability existing models such as Project Evaluation and Review Technique (PERT), Probability and Impact (P&I), Monte Carlo simulation (MCS), Analytical Hierarchy Process (AHP), Likelihood occurrence of risk (LR), and Fuzzy Logic (FZ) [15, 26].

The above proposed models carried out some of the knowledge map techniques and have showed good results in assessing the project risk based on projects objective. Among all of them, Analytical Hierarchy Process (AHP) model was most effective [42, 50]. Reason was since model used the systematic approach to structuring risk assessment problems by providing hierarchical approach. While assessing the project risk at the initial stage of the project, practitioners may not have sufficient data at that time. So, it is essential to develop a simple regression model for each project specific task. Moreover, simplicity is a key factor for encouraging professionals to use risk assessment tools in practice. It is unfortunate that there is a wide gap between the theory and the practice, as a result at the present time conclusion is: there is a need for the better systematic risk management approach. This dissertation will present the systematic risk management model that will include majority of the missing theory gaps and to be applied into practical model. One of the needs comes from the many scientific proofs, where even well developed, designed and implemented processes of the Project Risk Management (PRM) such as risk management planning, risk identification, risk assessment, risk analysis and risk response planning, in the construction industry experience failures, and such a failures are in majority of time credited to the risk events [84]. As a reference the risk management is crucial in the planning stage of any project, by its scope and depth increase, as on the contrary when project moves towards the execution phase, while rapidly decrease in the conclusion phase [27, 39].

3. Risk assessment methodology successes

The risk assessment and management were established as a scientific field some 30-40 years ago [44]. The principles and methodologies were developed on basis how to conceptualize, assess and manage risk. At the present time, existing principles and methods still represents to a large extent the foundation of this scientific field. In the past 30-40 years many improvements have been made, reflecting both the theoretical platform and practical models. The risk assessment methodology success is based on the trends in perspectives and approaches but also reflects on further development of the risk project management field. There is a large extent of the ideas and principles still in practice and they are the basic for the risk assessment and usage. Society for Risk Analysis (www.sra.org) is one of the sites that covers different disciplines of the risk assessment methods.

One of the crucial messages in any project risk management is that methodology has to be established primarily and then everything else afterwards. The main aim of such a message is that user should be aware of the chosen tool ability before it is used. The reason of such an approach could be that tool can have the methodology that is completely inappropriate for the selected organization. For that reason, it should be chosen the risk assessment tool that fits methodology.

In overall speaking project risk management is very challenging process. The risk management process requires dedicated and qualified resources and appropriate tools. In the past few decades project risk management techniques improved the project management performance. Each and every day there are examples showing that risk management is needed in the project management. It is hard to even consider that at present time risk tools or the risk assessment tools are not part of the project management at any stage. Some of the articles referring that in the engineering industry majority of project risk management tools are still very ineffective and that the main cause of such a, situation is the lack of the usage of the tools, function area managers participation and not correctly chosen methodology [45].

When we are looking from the standpoint of the methodology assessment there are some basic suggestions which should be used to maximize the effectiveness of the risk management process. Some of those perspectives are related to the early phases, some to preparation [46]:

- ✓ Try to keep it simple as possible,
- ✓ Identification of risks has to be aligned with the project process objectives,
- ✓ Start risk management from the very beginning, ***early beginning***,
- ✓ Keep it continuously updated during the development process,
- ✓ Encourage the others project management processes by using the result of the risk management process,
- ✓ Make sure that procedure and responsibilities are developed for the Project Risk Management from the very beginning,
- ✓ Make sure that all functional area managers are involved in risk identification and control strategy definition,
- ✓ Provide and define the project team clear responsibilities assignments,
- ✓ Boost a proactive attitude towards risk.

Few of the scientific articles mentioned such an approaches where the organizations implementing the risk assessment without the methodology (ISO 27001 risk assessment & treatment – 6 basic steps). Whatever or whichever methodology is chosen it falls down under the two main approaches in the risk management and they are qualitative and quantitative assessment methodology. Some of the Risk Project Managements are focusing on qualitative approach, some on quantitative and some on both [27]. They are the most suggested methods in the literature, and it will be elaborate each one of them in the section 3.1 and 3.2. Both of the methods are interconnected by the effectiveness and efficiency. The quantitative analysis is driven to a certain extent by the quality of the qualitative analysis and then later one the both are jointly interpreted. Since in the literature it is mentioned that majority of the key motives for formal risk analysis seems to be driven directly by quantitative risk analysis, we cannot underlie the role of the qualitative analysis. It is important to mention that some of the key corporate learning motives are met by the qualitative methodology of the process [27]. There are clearly different strengths and weaknesses when we are comparing or analyzing the differences in qualitative and quantitative research but combining them, they can generate complementary knowledge [47].

3.1 Qualitative risk management system definition

An explicit corporate culture of the risk management can use the major benefits by consuming the full potential of any kind of risk system analysis. Risk measurement tools are the vital process especially in the project management, looking from the improving the dysfunctional organizational behavior or from the operational point of view, set up the performance maximization targets by commitments and expectations that will bring the project to the completion. Qualitative methods and its documentation can also help to capture corporate knowledge in an effective fashion, for usage in both current and future projects [27].

The qualitative risk system definition is the process of assessing individual project risk sources, characteristics and identification based on the scale of probability of occurrence and impact. The main purpose of the qualitative risk system analysis is prioritizing risks according to their scale of probability and impact. During the qualitative risk application, a project can be exposed to a large number of different risks. Therefore, the qualitative risk has a purpose to improve the understanding of project risks. Improved risk understanding helps in developing more effect risk response strategies. Such a qualitative risk assessment can be done, for example, with the aid of check lists, interviews or brainstorming sessions. This is usually associated with some form of assessment tools and methodology techniques [48].

The emphasis taking place from the possibility of the using the simplest techniques. In the literature there are many different methods that are considerably objective or subjective to the decision makers, even they are relatively simple, transparent and easy to use. For the purpose of the dissertation, the definition of the qualitative system or qualitative methods will be used. It will be based on the PMBOK3 authors where the Qualitative risk system definitions is: Qualitative Risk Analysis evaluates, first the importance of identified risks, adds likelihood of occurring, mitigated impact, as well as timelines durations and risk acknowledgement [4, 85].

When we are talking about the major key elements of the risk management approach based on the qualitative risk method it can be divide it into roles and responsibilities. Each one of them has the elements of the [4, 85]:

- ✓ risk managements as a budget,
- ✓ schedule activities for the risk management,
- ✓ risk categories definition of probability and impacts,
- ✓ the probability impact matrix,
- ✓ involvement or the stakeholders risk input tolerance.

Based on the selected methods PMBOK is giving the basic breakdown of the few of them, which will be used through the dissertation:

Risk probability and impact assessment is a method for <investigating the likelihood risk events> where the method is based on the: if and when the risk will occur. Then a method investigates the possibilities of the risk potential effects on the project which can be positive or negative.

Probability and impact matrix merge the estimated values of the probability and impacts, then computes the importance by multiplying the values. Based on the impureness gives the level of the impacts from highest to the lowest scale.

Risk and data quality, then the assessment methodology to evaluate the quality of the given data.

Risk categorization based on the identified disciplines and evaluated risks into the Risk Breakdown Structure or Work Breakdown Structure.

Risk urgency assessment is a method approach to classify the risks that has been already reclassified by the probability-impact-matrix with respect to the time. Many events show that even a lower classified risk can become more important.

Each one of the selected methods have a task to estimate the risk on the qualitative way using the different techniques. Modern science has become more and more detailed and demanding regarding the risk project management. Consequently, the qualitative techniques or the methods requires more innovative methods to bridge the possible differences in data and as well taking the advantage of the full spectrum of the variety information available [49].

3.2 Quantitative risk management system definition

The other risk measurement tool that is vital for the process especially in the risk project management is quantitative risk system. Even if the qualitative risk analysis is mostly used, whether sufficient data is available, the risk assessment can be performed through a quantitative risk assessment. Using the quantitative approach in the risk management assessment framework requires the definition of the few aspects.

One of them is definition of the probabilistic value of each risk factors occurrence, within the main task of determination and achievement of a specific project objective. Therefore, the quantification of the risk exposure for the project objective, and determination of it's, include the additional elements of the quantitative assessment and they are the contingency of cost and schedule. The other is the quantitative definition of the potential impacts, where identified risks requiring most consideration by quantifying their relative contribution to the project risk objective. Thus, conclusion is to identify the realistic and achievable costs that includes contingency, schedule or scope targets.

Based on the selected methods (PMBOK) is giving the basic breakdown of the few of them, which should be part of the dissertation subject [4, 85]:

Risk management plan is a tool for the process used to identify how to conduct the risk management activities for the project objective.

Cost management plan is a tool that provides processes and controls that can be used to help identify risk across the project objective, with the purpose of the planned, structured control of the project cost.

Risk register - risk register tool is used to identify, assess, and manage risks. The purpose of a risk register tool is to record the details of all risks that have been identified along with their analysis and plans for how those risks will be mitigated.

Enterprise environmental factors - Enterprise environmental factors are a tool that refers to conditions, not under the control of the project team. Enterprise environmental factors are considered inputs to most planning processes, may enhance or constrain project management options, and may have a positive or negative influence on the outcome.

Organizational process assets - Organizational process assets are a tool that plans, processes, policies, procedures, and knowledge bases specific to and used by the performing organization. Elements of such a tool include any artifact, practice, or knowledge from all of the organizations involved in the project that can be used to perform or govern the project. These processes include formal and informal plans, processes, policies, procedures, and knowledge bases, specific to and used by the performing organization, such a lesson learned, historical information, include completed schedules, risk data, and earned value data.

Each one of the selected methods have a task to mitigate the risk on the quantitative way using the different techniques. In the further dissertation chapters, it will be elaborated more into details.

3.3 Academics research and assessment of the success or risk management tools and techniques

The risk is a complex issue within academic methods related to decision-making process. Each one of the selected methods has focus to improve the application of the risk assessment tools. For the purpose of the dissertation few international journals studies, are collected and analyzed covering the key literature of the tool applications in various engineering industries [50]. Each method of risk assessment is used in a different situations, depending of the engineering disciplines or the nature. In the risk management market, there any numerous tools that are classified as risk assessment, we will be mentioned only most used with their mayor surroundings.

The tools currently used for the risk assessments are:

Table II-1. Tools in the risk management [50]

No.	Approaches	Authors	Applications	Specific Areas
1	FMEA – FTA	Moss et al (1983)	Offshore	Reliability Analysis of TLP
2	FTA	Geum et all (2009)	Industry	Service Process Selection
3	HAZOP	Pitt (1994)	Manufacturing	Safety Assessment
4	HAZID – Structural Reliability Analysis	Stiff et atl (2003)	Offshore	Comparative Risk Analysis of Mooring
5	FETI-HAZOP-FTA	Roy et al (2003)	Material	Quantitative Risk Assessment in Production Facility
6	FTA – ETA	Jacinto & Silva (2009)	Offshore	Ship Building Industry
		Dianous & Fievez (2005)	Industry	Methodology for Risk Assessment
		Targoutzidis (2009)	Safety	Methodological tool in the process of risk assessment
7	HAZID - ETA	Petruska et al (2009)	Offshore	Mooring MODU Risk Assessments
8	ETA	Ghodrati et al (2007)	Mining	Spare part selection
9	HAZOP – FTA – ETA	Deacon et al (2010)	Offshore	Risk Analysis in Offshore Emergencies
		Cockshott (2005)	Chemical	Risk Management Tool

In the field of the risk management under the framework of the quantitative assessment there are numerous techniques that are used. In the table it will be mentioned major ones.

Methods and techniques [15]:

- ✓ *Influence diagram:* dealing with the risk identification, brain storming and Delphi techniques, and relationship of variables (Ashley and Bonner 1987)
- ✓ *Monte Carlo simulation*: distribution form, variables correlation, (Yingsutthipun (1998) Songer et al. (1997) Chau (1995) Wall (1997))

- ✓ *PERT*, Distribution form, Variables correlation (Dey and Ogunlana (2001, Hatush and Skitmore (1997))
- ✓ *Sensitivity analysis*, Network scheduling, deterministic, variables correlation (Yeo (1990, 1991) Woodward (1995))
- ✓ *MCDC:* multi-objective, subjectivity (Moselhi and Deb, 1993)
- ✓ *AHP:* systematic approach to incorporate subjectivity, consistency of judgment (Dozzi et al. (1996), Dey et al. (1994))
- ✓ *Fuzzy set approach (FSA):* Vagueness of subjective judgement – (Mustafa and Al-Bahar (1991) Zhi (1995) Nadeem (1998) Kangari and Riggs, 1989, Diekmann,1992)
- ✓ *Neural network approach (NNA)*: implicit relationship of variables (Chua et al.,1997)
- ✓ *Decision tree:* expected value (Haimes et al.,1990)
- ✓ *Fault tree analysis:* accident analysis, safety management, (Tulsiani et al. ,1990)
- ✓ *Risk checklist:* from experiences (Perry and Hayes, 1985)
- ✓ *Risk mapping*: two dimensionalities of risk (Williams, 1996)
- ✓ *Cause/effect diagram:* risk identification (Dey, 1997)
- ✓ *Delphi technique:* subjectivity (Dey, 1997)
- ✓ *Combined AHP and Decision:* probability, severity and expected monitory value (Dey, 2001.c)

As per the above it is obviously that in the risk assessment market there are quite a bit tools, methods and techniques. For the purpose of dissertation, in following chapters few of the techniques and methods will be mentioned and elaborated into details.

3.4 Definition of the risk management model structure

The definition of the risk model as a simple statement is a structure of model with logical framework that outlines the relationships between individual causes of ranges, of the possible uncertainty and the likelihood uncertainty in overall project measures. The risk models are in general based on conventional planning and forecasting tools, such as project activity networks or the maps, cost-estimating frameworks or process flow charts. The basic risk models structuring foundation forms address and identifies in detailed the view and the issues of the risk. Any risk model detailed identifications are based on the detailed analysis of how individual risk affecting project objectives. In the risk model process sensitivity is being used to support the evaluation of the likelihoods and consequences of events [32].

The details in a risk model may be higher than in a typical forecasting risk structure. Since risk models are concerned with the uncertainty measures, not just its base value, therefore the level of the details needs to be on the proper scale to get the attention and focus where the risks are greatest. A preferred method is to identify the uncertainty associated with each risk unit and apply it consistently through the model. Usually it is done by isolating the relevant and irrelevant risk units on the basis of defined model parameter criterion. Since it has been mentioned two basic approaches the qualitative and quantitative it is important to say that different model representations can be reconciled with one another. The relationship between these models in a way of inputs and the outputs of a risk model results, must be understood through the analysis. Even if the single approach is taken it is required to construct a risk model with dependent modelling technique and their selected tools that will support the entire process. Any taken approach will typically involve the implementation of the structure discussed above. On the other hand, the computer-based tool such as a spreadsheet will be populated with:

- ✓ Probabilities representing uncertainty in the occurrence of events,
- ✓ Probability density functions representing the model parameters,
- ✓ Correlations and other relationships between parameters.

Such a risk models structure, in which are the quantities and rates combined for each element, based on the matrix has much greater and simpler results then trying to form an evaluation where the drivers for correlations have not been organized in this way.

4. Risk management software successes

In the market there are number of software tools available to help in identifying and assessing the risks threats. All software's cannot be implemented and applied without very high level of the information technology (IT) involvement, extensive trainings and the major data integration [15]. Usually the success of software development depends on the criteria: functionality, quality and timeliness. The software's in general are developed to perform a specific function. Those functions are demanding ambiguous requirements, demand of the resources, hardware, networking, and security system to be in place. These are just basic of the common risk elements in software project improvement program. Therefore, in couple of cases it has been proposed to a software risk analysis process for IT by combining qualitative and quantitative methodologies to improve the software successes. As well, there are needs in the risk management to develop software development from the owners or developers' perspective, for the interactive involvement of the stakeholders, referencing the consideration of both qualitative and quantitative risks approaches and integrating the risk management process with the software development cycle in the risk project management. In general, institutionalized risk management and decision support within the software acquisitions from the management point of view can make the organization aware of the best practice and improve the risk management technology.

Within said generically software have their own limitations, but with the rapid leas achieved through the micro computer technology in software and hardware, it is possible to develop more general programs that can be applied in risk management system and with easy integration to any appraisal model. Such a package can be easily used as a solution for the existing tools that are much more flexible than the already designated software algorithms criteria. Even with such an approach, software are based on the analytical mathematical modeling [86]. The mathematical modeling of risk assessment is not an easy task. This can be looked through the two margins, where one side is a stakeholders or project management and the other is the developers. Since there is no specific approach that a designer or project manager should follow regarding the development, thus the given fact that software models usually are hard to develop or the gaps in many cases are mitigated by the running statistical approach data. The accuracy of the statistical data approach outcomes to more none competitive and realistic results failing to address effectively uncertainties and risks. Chaos Report of 2009 (The Standish Group 2009), finds that only 32% of the software projects are successful (i.e., delivered on time, within budget & with quality) and the trend remains the same throughout the decade from year 2000 to the year 2009.

The hierarchy of Software Risk Management (SRM) have two classes of functions: software acquisition and software development. In general, based on the Software Engineering institute (SEI) the framework for software risk management is supported by three groups of practices [52]:

1. Software Risk Evaluation (SRE)
2. Continuous Risk Management (CRM)
3. Team Risk Management (TRM)

For the purpose of dissertation, in following chapters comparison of the risk software tools and the risk model tools will be elaborated into more details.

4.1 Definition of the analytical system for risk management in engineering

The analytical system approach in risk engineering management is the approach of managing risks in software development ensuring effective delivery of projects to clients. The approach involves probability analysis and severity of risk events using analytical framework from software developer perspectives [53]. The analytical system illustrates a formal way to allocate limited risk mitigation resources to events considered as a most critical to be addressed on project. When it is talked about the ways of the approaches, analytical system first supports the filters given by the software (network flow) that support decision-making (option valuation). In any way software filters cannot be replacements for human judgment or creativity of project management. The results, such as those generated in such a way should be consider as an option, or to be applied by the creative ways. The innovative ways can address critically impacting risks given through the limited risk mitigation actions. It is advisable concerning the analytical approach to have an expert who are skilled and working through the basic modeling methods. Especially, be alerted to developing knowledge that could adjust the risk system configurations.

Referring to authors Evans and Olson one of the tools in the analytical system is the Monte Carlo [87]. The simulation of such a software gives better understanding of calculations in analytical methods, quantifies the risk of a model in the form of a probabilistic distribution, but to run such or the similar methods requires a large amount of data. The most of data is unavailable or require significant time to obtain, but despite this major obstacle, simulation methods are among the most useful and practical tools. Thus, such a gap is usually bridge either by analytical exercises or the use of professional software tools. If we are looking from the analytical point of view such a gap may arise for a multitude of reasons, dichotomized from different analytical methods to the differing information sets or different philosophical approaches.

The analytical methods, combination of procedures often leads into mathematical and behavioral approaches, even sometimes in risk engineering management practice it might involve some aspects of each. As a standpoint the mathematical selection of methods consists of processes or analytical models that operate on the individual probability distributions. Such a mathematical selection can range from the simple summary measures (arithmetic or geometric) to the complex approaches. The complex approaches quality inputs depending on the opinion from multiple experts in the probability way in averages [54].

According to the (Kim et al. (2004)), the mathematical model is easy to understand and the analytical analysis can be performed with common software tools that are easy to access and handle, but still there are some gaps and limitations that occurs from the point of analytical view [86]. The mathematical modeling of risk mitigation and estimation in usually should fit into the available historical data, and then it is the matter of decision for the designer or the project risk manager, how to use the model and how to use the data for the best fit of the project deliverables. So, in any case software designer or the project risk manager needs to be aware of the requirement to build certain types of equations for the regression analysis model and acquire certain type of data, which would be suitable to perform the analysis.

5. Conceptual model and hypothesis

Currently there are many methods and evaluation programs at the market that are used to analyze the time activities or the called schedule risks. In this dissertation, we will name some of them by name. Since all these programs are used for the probability cases where time, cost and scope description need to be aligned, our goal is to improve the early systematic risk management, show possibility of the model sensitivity, and to reduce it in percentage of its probability. Unlike of the existing methods such as grounded theory, systematic overview of literature and simulation of project management software, the dissertation research method of the proposed model will effectively include the uncertainty of the risk assessment at the early stage of each project according to the given model criteria [55]. The study will also use a case study method that should outline how the proposed mapping process can have a positive impact on project results and project performance.

The aim of the research is on early risk managing, which can improve the way of risk control in energy projects by developing reliable estimates and correct timing of the project. The aim of this study is not to develop new software but to improve the initiation of the project and to carry out simulations on the prepared models and thus get better project results. In other words, a systematic approach of risk management at early stage can be a reliable means of checking a significant number of unforeseen risks using the proposed risk management model. The risk management has become a key element for successful completion of projects within the given time, the given scope and the planned budget. Many studies states that risk management must be carried out throughout the all project duration. This research will not deal with risk control during the project implementation phase.

The focus is on the preparation or the initiation of the project prior to, its project definition and the future control and update of the system periodically during the implementation of the project. The last step is the answer to the risk where the results of the previous steps as well as the corresponding risk mitigation activities are discussed [25]. These steps are taken before creating a strategy of managing the recognized risks. The expected results of the research are related to the failures and gaps which will be corrected by implementing the presented risk management model in the early phase of the project initiation with the results of the project, delays and deviations from the original project plan. Other methods will be compared with the results of the proposed model and through reports illustrated application of the MS Project, Software Project Management Tool using the compatibility of preparatory project data of risk management [55].

In accordance with the aim of the research, the previous results and the theoretical bases discussed in Chapters 1, 2, 3 and 4, the basic hypothesis is defined:

Hypothesis X1: The application of a systematic model for risk management significantly reduces the number of unidentified risks in the project implementation phase.

Hypothesis X2: The application of a systematic risk management model will significantly reduce deviations in the schedule.

Hypothesis X3: Applying a systematic model for risk management encourages the timely involvement of stakeholders in the project.

The auxiliary hypotheses for proving the main hypothesis, which relate to the assumed relationships in the model, are presented below:

Research question 1: ***Are the current ineffective tools the main reason of the current situation failure of treating risk in project management?***

Within the aforementioned research question, two additional research questions were formulated:

Research question 1.1: *Are the previously proposed question just a base of the project risk management issue or the lack of participation in early risk management* *assessment, systematic monitoring in early initiation project phase, non-involvement of all participants and sometimes lack of knowledge are the cynics as well?*

Research question 1.2: *What kind of relationships comes from the research and how to manage the gaps were such a risk treatment in the early stage is not taken serious enough?*

Research question 1.3: Whether the presented model will be a suitable solution and can it bridge the above-mentioned gaps?

III. Research part

After defining the research model, planned research methods were carried out. In accordance with the suggestions of previous academics, qualitative and quantitative research methods have been included in the research [56]. The combination of different techniques leads to the creation of methods synergy. In the best way it will tests the defined hypotheses and disclose important details that influence the expansion of knowledge and the progress in the field of early systematic risk management.

6. Methodology of research and data collection

The choice of appropriate research methods takes into account the fact that the research method influences the way that data is collected and that specific methods of research involve different skills, assumptions and research practices (www.sra.org) [56].

6.1 The choice of input data (data management) system

The project risk management is an activity which integrates recognition of risk, risk assessment, development of strategies to manage it, and finally mitigation of risk by using managerial resources. Therefore, some of the traditional risk management choices concerning data collection, is focused on risks stemming from the engineering, technology, operational, financial, safety, logistic or humans causes. Such a data has to be managed using the existing instruments. Objective of data collection in risk management has a task to reduce different wider pre-selection of the groups to acceptable level [57]. The pre-selection may refer to numerous types of threats caused by different selected disciplines but on the end, it has to be narrow towards the project objective. The data management is one of the crucial steps in the risk project management. It is usually structured as a set of policies and procedures that occur over the complete life cycle of projects. There are many existing approaches of minimum data requirements and they are used and included into system risk models with the purpose to perform the risk management.

In the project objective scope various attempts and researches have been made to propose the best way for identifying and preparing input data regarding project risks [42]. One of the possibilities has a highly significant role, and it is called risk registers. Such a risk register has its own characteristics and possibilities in the overall risk project management. Different methods have been introduced in project management with the base purposes, in which way such a register should be integrated into the risk management process. Numerous authors have interpreted risk registers in many ways, and their approaches can broadly be classified into three categories:

1. Risk register is a discipline – a document that contains information about risks,
2. Risk register is a useful tool for risk management,
3. Risk register is the central part of the risk management process.

The one of main principal requirements relating to project objectives is the risk register and the quality of input data. Through dissertation it will be shown why the risk register must be adjusted to the risk management project objectives with the positive effect to the project management companies. In another word the structure, content and functionality of risk register must correspond to the expected level of use. The aim of such a tool is to have accurate inputs per the define tools and techniques, managed thorough initial input data into the output quality results. Non-adequate or incorrect data selection approach of the known or unknowns in the project definition phase can lead to the misleading conclusions and give the incorrect directions/guidance of the final project objectives. The choices of the input data it usually based on the history database; management knowledge and experienced mapping criteria following the risk categorizations. The management knowledge ensures an understanding of critical issues, quality responses, and consequently better survey outcomes. The presented risk management systematic tool by mapping criteria follows the systematic decision matrix set by the defined procedures that use a corrective tool in the process risk management. This will filtrate some of the risk packages where it doesn't have to be taken into consideration due to the already mitigation familiarities. Overall input data (history or the existing) comes from the main breakdown criteria of the risky identification given on the defined project objectives. This includes internal and external impacts on the selected project objective cases and all direct and indirect risks bases.

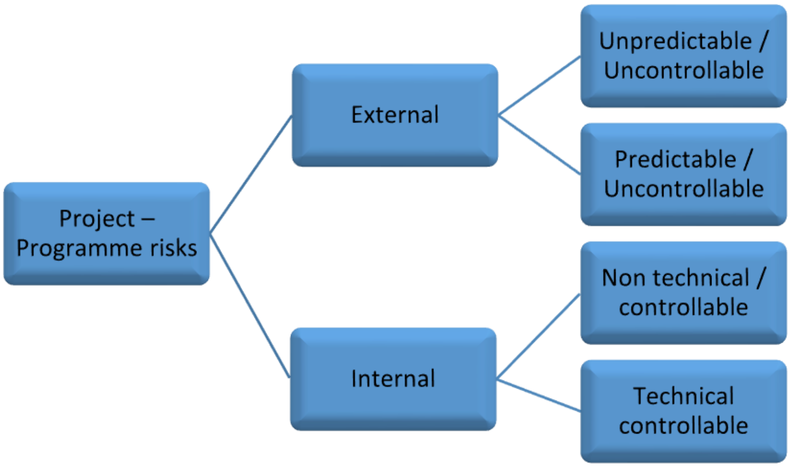


Chart III-1. Main breaking risk criteria [58].

According to the risk categorization given by Kim in the systematic risk matrix tree, risks are divided into (1) unknown, (2) known, (3) known-unknown, (4) unknown-known, and (5) unknown-unknown [51, 88]. The categorization of the severity of the risk, the possibility of its occurrence and mitigation should be included in all steps of project preparation and implementation and accompanied by a risk assessment based on the data criteria. For the purpose of the dissertation we will focus only on the (1) unknown and (2) known risk [88].

6.2 Overview impact of the process preparation criteria for the presented model

In the energy industry, focusing on large scale project planning are generally exposed to an uncertain environment due to factors such as [59]:

- ✓ complexity of risk planning,
- ✓ the presence of various stakeholders (project owners, functional manager, external or internal consultants, main contractors, suppliers, etc.),
- ✓ inaccessibility of resources,
- ✓ economic and political environment,
- ✓ and legal regulations.

All these uncertainties are closely related to other risk factors such as [59]:

- ✓ the complexity of the project,
- ✓ the necessary criteria and the speed of its implementation,
- ✓ the location of the project,
- ✓ the lack of knowledge of not knowing all the details.

All this leads to one goal, and that is to finish the project in time, with approved costs and expected quality. It is necessary to introduce one more systematic step in the early phase of risk project management. The need for managing uncertainties and changes is indispensable in most projects that require proper guidance [27]. Even the Tuner definition says if we define the project as: "*A venture in which human, material and financial resources are organized in a new way in order to undertake the unique workload specified by the specification, within the limits, costs and time, in order to achieve a unified beneficial change, through the supply of quantitative and qualitative the outcome of the process*" (Turner, 1992). According to the given definition, and in terms of new, unique, limitation, it is clear that a number of uncertain phenomena (gaps) can be expected, which is the central theme of the research undertaking proposed.

The possibility of risk occurrence in the early stage of project definition and preparation within consistency and the foundation of analysis gives the opportunity for delivery of project successful completion. The risk management in projects is still problematic assignment. The main causes of change in the project plan are the insufficient participation of stakeholders in identifying and managing risk, as well as the lack of knowledge and the non-practice of an early systematic approach in risk management. The lack of research with the concern of risk treatment or consideration at early stage of the project preparation has obviously influenced the formation of the presented model. In practice, risks are mainly included in the project by the method of unforeseen activities (costs, time) without a comprehensive risk analysis at the systematic level. In many cases such an approach is not enough to cover the effects of the risks deviations that occur during the project implementation phase. The result are often increased costs and delays. Considering the current state in industry, in which all the costs are aimed to be at the minimum level, it is very clear that approach is not applicable where significant part of the budget, expressed in time or engaging the employees is allocated for the unforeseen activities. The need for research comes from the fact that evaluating and determining the level of risk control and the level of risks identification, or specific risk method to the particular analysis, needs to be realized at early stage of project initiation and project preparation [25]. It is necessary to develop a model that treats risk through the systematic process with aims to improve the initiation and implementation phase of projects.

Managing project risk actively throughout the early process, phase definition will ensure that the end user can and will have much better knowledge of the possible risk impacts. The functional area managers (FAMs) involvement, management commitment, clear risk direction and systematic model mapping approach with the appropriate planning, realistic expectations, and competence can give much better understating, clear vision and objectives of the next step in the project preparation [54]. Like in any other process of project preparation, risk identification and mitigation development can have inherent risks of not achieving its final objectives. Therefore, an early systematic risk management plan is necessary in order to achieve future commitment based on time, cost and quality for the future project implementation. Even there are numerous tools and techniques for managing risks (identifications, analysis, developing responses, and controlling) in project implementation phase, effectiveness of the project management depends on developing a systematic model framework of risk management in the definition or like we like to call it early initiation phase. Integrating such a process criterion can reflect later in the project management cycle with lean control of the all potential risk frameworks that can be used/shown in practice.

Implementation of such a process, concerning the risk management criterion requires involvement of stakeholders in interactive ways. The interactive approach will gain experience in the best means for managing risk along with a quantitative framework. The risk management should also be integrated or easily institutionalized [15]. The chosen method aim is to have a systematic risk model with user friendly setup and without complexities. Within the decision-making preparation processes, all steps are organized to involve all stakeholders concern regarding the risk analysis and risk derivation of responses. By the quantitative approach systematic risk model will take both subjective and objective approaches to derive specific responses for future managing of risks.

6.3 The main characteristics of factor selections in the presented model

Selection factors embodied in systematic model will affect the model choices. Characteristics of project type, its complexity, primary objectives, and the identified given factors priority, are the basic elements and generally presented in flowchart, matrix, or risk worksheet forms. There are several elements in the project management industry that can impact the implementation of the energy projects [22]. In the given dissertation emphasis will be on risk with negative impact, therefore it is essential to do asses the risk advance by implementing the finest resolutions. For that reason, the risk assessment in the initiation or the early risk definition project phase in advance is vital for any given project tasks.

The factor characteristic of the presented model approach sets out improvement of project risk process definition for the implementation of huge or minor project. In another way it can be useful tool assisting project management or decisions makers [25, 59]. Therefore, the main selections and factors of the research is to make an overview of the two selected energy industry projects based on two capital / complex case studies. The basic selection of such an approach came from the needed improvement in the project definition phase where one of the factor data selection was already finished project including all constrains with main risk database, and the second factor selection was a new project in the definition phase. Such a factor selection of the main characteristics in the model by using the data knowledge systematic system, aiming to improve the preparation and in the future execution or implementation of any industry projects [25, 59]. Among the other characteristic of the two selected projects and the early systematic risk model approach, in the presented model one more primary factor is established and that is the project stakeholder practice and their individual knowledge-based skills. Through the many years of experience, firms continuously learn how to capture, shape, merge and share their risk knowledge with the traditional resources and capabilities into some new and distinctive approaches. For that reason, by the selected model it can be provided more value to their final results [59]. The selected characteristic will have aim to enhance organizational risk awareness and competitiveness. Even it is well known that each project is unique in terms of how professionally stakeholders manage, share and use knowledge. The presented model goal is examination/preparation of the future improvements in industry project implementation [25]. Avoiding repetition of mistakes from the past, and narrowing the uncertainty by this factor selection, through the model it will be introduce not such a constant look for the same question but more systematically acknowledgment through the early systematic risk model approach [59]. No matter how important the definition and assignment of the actions is, the most important factor for an effective risk management plan is to apply the actions.

6.4 The main impact of the selected approach

Highlighting the importance of early project planning phase and design is critical from the risk point, because significant percentage (%) of a risk can be specified in this early planning phase. The main strategic decision or the main impact at this phase requires the necessary expertise to be built into the process. For the purposes of this research, the term "*early risk model process project preparation and the systematic risk management process*" will be used to encompass all project activity prior to the any lean preparation or development implementation. The main impact of the proposed conceptual model framework is within the collective group process, managed effectively through the designated steps. The project definition generally refers to the front and end planning. In addition, it refers to the importance of the upright project risk process preparation, since in most of the cases project is not so in detail planned from the risk point of view. Therefore, it has to be some steps of the determination and purposes of the prioritization in the project risk management. Since we have established the quantitative approach of the process to be primary in the model, such a selected approach will generate the requirements for the involvement of some qualitative criteria fragments as well. As a decision, it will be used collaborative process through the data collection and definition by support of the existing methods. Such a process is elaborated through the next few steps:

Firstly, one of the effects is the active model proposition in order to manage all risk group action. The selected approach considers the project definition group as a learning organization by focal points, and the selected risk process map characteristics per definition of criterion [8, 60].

Secondly, another effect is a mapping tree development model, which illustrates the iterative nature of risk identification and managed by selected criteria definition [25]. In order to moderate purpose of related risk processes in group of databases, a selected approach is bringing the defined documents and proposed history revision to developed selection of criteria definition.

Thirdly, the mapping model framework proposes detailed quantitative and productive inquiry through the necessary assumptions embedded within the certainty and values given by the presented systems. Therefore, the flow plan is the collective knowledge of thinkers in the group. Based on that direction to understand the complexity of the groups, in the model it is proposed a cognitive mapping approach where group correction and returned correction function are acceptable within the presented stage gate step phases.

Fourthly, objective of definition is to maximize successful risk project preparation in the early stage, before the detailed preparation and realization is done. To be achieved in such a manner the production of strategic information within all functional area managers (FAMs) and the process owners will include: applying and the developing the systematic risk analysis implementation solutions [11, 22].

Such a solution in the early stage of risk definition is recognizing [59]:

- ✓ non-critical elements of risk information,
- ✓ creation of the awareness,
- ✓ building the knowledge,

and later own its transfer them between and during the detailed preparation and execution of the project. At the end the main impact of the presented model and project process preparation approach is [50]:

- ✓ development of advance integrated multi-disciplinary and datable facts
- ✓ established methodology,
- ✓ tool for identification,
- ✓ tool for validation,
- ✓ structured and deployed risk knowledge,
- ✓ Independently tool used within the companies.

6.5 Potential of the model in risk mitigation

As the main definition of the risk mitigation actions and possibilities are to reduce the probability of occurrence or reduce the impact of the risk. The risk mitigation has the two ways of the appearance. In either ways' mitigation model aim or means to smooth the recovery of the project after the appearance of the risk. The model mitigation possibility will focus firstly on type of action called preventive risk mitigation. Since the model is proposing the early systematic risk mitigation therefore the effectiveness of the preventive risk management plan is most crucial. The assignment of mitigation actions initiates the risk process where the risk management team has to cope with the identified and top ranked risks. The mitigation model actions should target those risks associated with high weight by minimizing the residual risk. The risk weight is minimized afterwards by acceptations of mitigation actions. The next stage after preventive actions, comes in the implementation phase of the project, and continues as a second phase called corrective stage. When we look the project entirely both actions should be considered, as they are complementary [29].

One of the advantages through the risk mitigation model is team developed strategies to reduce the possibility or the loss impact on risk. The interaction of the stakeholders and ability of the risk elimination resolves main drives through the two main actions as a risk avoidance or the risk protection. The risk avoidance is applied where such a mitigation is not known or the risk protection where team can cover the risk based on some kind of contingency level [19]. Since the risk mitigation is the final stage of the risk management process, this model will involve prioritizing, evaluating, and implementing the appropriate risk-reducing controls that have been identified during the risk analysis process in the preventive actions. The model will follow the risk mitigation processes of the monitoring and evaluating the effectiveness of risk controls as well (ISO/IEC 27001, 2005) [61]. The model will have corrective tools per the predefined structured matrix. Each of the mitigation steps through the stage gates have predefined criteria, documents and designated stakeholder's tasks. The possibilities of the corrective actions are introduced through the entire process, but strictly managed by the task owner and representative. In general, the application model will be tool of correctives and quality control for the entire systematic risk management process.

6.6 Multi-criteria model, decision making methods

This part of the dissertation is dedicated to model and methods with multiple purposes decision making. Conventionally, there is a strong relation between choosing appropriate decision-making methods to improve the risk models. The aim of the model is to have appropriate Multi Criteria Decision (MCD) models, to evaluate each criterion and do a critical comparison to assess the shareholders point of view and their criteria of classifying different techniques. The MCD model with multi criteria assesses, provides a framework of selected approaches for the risk project management.

The presented modeling map with multi criteria or the decision-making approach use the aggregation of probability distributions that are not necessarily always identical. The multi criteria is used for the useful matters gathering of both individual assessment and dependence of the data collection past history. By this mapping approach, model is capturing information about the occurrences of actual outcomes. So, in fact, this approach is perhaps most suitably termed as a joint calibration, because it produces probability distributions that are based on a multivariate stage gate with aim that risk management analysis is to convey the versions of the traditional single-expert calibration approach (based on the data) to support other methodologies [50]. A number of important issues should be kept in mind when we are comparing these approaches and choosing an approach for a given application. The main reasoning is that model allows functional area managers (FAMs) contribution to the chosen method and ability to exclude the unneeded variance, vs. where the software development methodology is usually fixed and it is hard to add any additional criteria [19, 62].

This is the reason why the risk works shops are needed for teams, to individually perform the aggregation of probabilities by the defined structured model [63]:

- ✓ the risk assessment team, a single decision-maker or analyst. Or some other set of individual elaborations,
- ✓ the degree of modeling to be undertaken:
    - I. assessment of the likelihood function, consideration of the experts' judgments quality,
    - II. the form of the combination, rule which could follow directly from modeling or could be taken as a simple task,
    - III. the data collection of parameters per the combination rule.

The workshops behavioral and combination methodologies require experts to interact in some way. Some possibilities include group meetings, interaction by sophisticated information technology (IT) equipment, or sharing of information by other audio/video ways [64]. The functional area mangers (FAMs) group may assess probabilities or forecasts, or simply discuss relevant issues and ideas with only informal judgmental assessment [63]. The emphasis is placed on attempting to reach agreement, or consensus, within the group of experts; at other times it is simply placed on sharing of information and having the experts learn from each other, but in any case all of these results has to be consistent with the general message that has been derived from the greater empirical literature on the combination minimum and maximum points of forecasts [64]. By the presented model, message is sent; in general, simpler systematic structured aggregation methods perform better than methods that are more complex. In addition, structured map model will provide some of the past history data of the risk accuracy for the future criteria decisions.

The approach and decision-making methods with combination of experts', probability distributions in risk evaluation is valuable for capturing the accumulated information for risk analyses per the presented model case and decision-makers through stage gate phases [62]. It is important to all FAMs to provide the current state of expert opinion regarding important uncertainties. Combining of methods can lead to improvements in the quality of probabilities and improvement of the quantitative method approach [63]. This multi model criteria approach can lead to a better understanding of the reasoning and thinking of group decisions and functional area managers (FAMs), with the goal of further developing useful behavioral aggregation procedures. But this will not be the primary aim of the dissertation.

In the model there is a five gates or algorithms that are developed and used to find feasible solutions for mitigating the risks: from the define risk opportunity, assessment the known risk opportunity to the refine risk pursuit strategy and the least final risk activities results. The model multi criteria decision (MCD) will include the main risk parameters and establish the risk factors according to three parameters:

- ✓ weighted score,
- ✓ risk likelihood,
- ✓ risk consequence.

It will be used the quantitative assessments to carry out the quantify numerical values of these three parameters. The quantitative assessment is and will be performed with the data obtained from two projects with calculation of numerical values. The qualitative assessment is conducted when it is not possible to generate numerical values through quantitative assessment. Multi criteria decision will follow the opinion of the FAMs, engineers and other stakeholders in gathering information, which is stored and continuously updated in the knowledge data center.

The weighted score or significance multi criteria decision will have sensitivity of a particular risk factors to the functional area managers (FAMs). In some of the cases, a technical risk might be more important than a network risk in the modeling risk process or the other processes might be more sensitive to other risks rather than technical risk [65, 66]. Therefore, different risk factors have different measurement units, which by the structured model and the suitable owner changes can be applied in the model. The objective function in the model multi criteria, decision introducing gaps with the task to minimize the difference between the upper bound mitigation risk ratio and the mitigation risk ratio generated from the existing known data. This can determine the practical recommendation for mitigating the risks. The final result will indicate which risk factors were used and what was the main mitigation effective approach but to satisfy the main three constraint time, quality and to predict the future cost.

6.7 Information systems that support the analysis of the model

There are many ways or evaluation programs at the market that are used for the purposes of the schedule risk analysis. The majority of programs uses the probability cases where time, cost and scope of work needs to be aligned. Through the information system, goal is to improve early risk management system and to reduce its probability by percentage. The study will also use a case study method that should outline how the proposed mapping process can have a positive impact on project results and project performance. Based on the information system we can say that the purpose of risk management research is in what manner will improve risk control in industrial projects by developing reliable estimates and timelines for project goals. The aim of this study is not to develop new software but to improve the initiation of the project and to carry out simulations on the prepared models and thus get better project results.

In other words, a systematic approach in risk management at the early stage of project definition, can be a reliable means of checking a significant number of unforeseen risks using the proposed risk management model. The risk management has become a key element for successful completion of projects within the given time, the given scope of work and the planned budget. The studies states that risk management must be carried out throughout the entire project duration (preventive and corrective phase). This research will not deal with controlled/corrective risk during the project implementation phase. The focus is on the preparation phase of the project, prior to its definition. The control and update of the system is done periodically during the implementation of the project. The last step is the answer to the risk where the results of the previous steps as well as the corresponding risk mitigation activities are discussed [25]. These steps are taken before creating a strategy for managing the identified risks.

The base for the modeling structure will be developed through the presented mapping model. This will be standalone web application that will be feed with separate input tools for the matrix model purposes. Through the proposed model, anyone can access the data in the system anywhere in the world, at any time with any PC device. The methodology used for the background of the model preparations was:

- ✓ reviewing existing approaches to risk analysis and decision making how in domestic so in the international industry projects,
- ✓ establishing, integrating an efficient approach applicable,
- ✓ developing the system mapping or architecture of a “web-based risk management model” that has thoroughly allied with each phase or the stage gate with key decisions using documentation analysis and previous case reviews,

- ✓ implementing a web-enabled model through data collection of few project samples,
- ✓ testing and demonstrating the system through the comparisons of two cases.

The other methods will be compared with the results of the proposed model and through reports illustrated application of the MS Project Software Project Management Tool using the compatibility of preparatory project data of risk management [55]. Like it was mentioned before the aim is not to create one more software the aim is to create structured systematic model of the risk controls that can be run through the similar data in other applications [50].

6.8 Main improved impacts of the model based on contingency and mitigation

The improvements and development of the project mapping flow chart will try to resolve potential problems in the early risk management stage. This should be the lean approach of risk management. The proactive risk manager tries to resolve issues before they occur vs. proactive project manager tries to resolve potential problems after they occur, or they try to react and manage the existing risks [25]. Not all risk issues can be seen ahead of time. That is the reasoning why we have rough segregation of known and unknown risks were furthermore some potential problems that seem unlikely to occur, may in fact happen [25]. However, many risks can be seen ahead of time where they should be resolved through a proactive risk management process. The presented model and the main task of risk management can be resolved systematically by breaking it down with the main aim to identify and to mitigate the risk. Furthermore, there are debates of the applicability of such models to the real project risk analysis. With this model, we will present some systematic approach to achieve narrow and aligned real modeling to the future risk management decisions that are more precise.

The main category of improvements in risk management framework will be [58]:

- ✓ in an analyzing functional requirement in the stage gate 1,
- ✓ identifying risky work packages in stage gate 2,
- ✓ identifying risk events, analyzing risk and the probability in stage gate 3,
- ✓ where in stage gate 4 will be developing the risk management plan with controlling of risks by planning of future possibilities,
- ✓ stage gate 5 is focused only on other unresolved mitigation actions with the conclusions of the further actions towards the stage gate 6.

The presented risk management model, with the detailed process map is about evaluating risks to assess the range of possible risk outcomes. This will help the project risk owners or managers to systematically develop an effective risk management plan. At the current time there are various quantitative tools and techniques at the market. Such a tools are currently working to analyze risks, but there are not so many of them in the early definition stage of the project. Therefore, this dissertation adopts systematically risk-mapping method to determine probability and severity of identified risk events in the early definition project phase [15]. This will be monitored as a way of assessing the preparation of the process, and later in the detailed preparation and implementation of the project. Although there are numerous tools and techniques for managing risks (identifications, analysis, developing responses, and controlling) in the project implementation and preparation project phase. It cannot be forget that effectiveness of management depends on early developing and establishing a framework of risk monitoring management. The presented model of risk management requires involvement of stakeholders in interactive ways, by means of experience, means of managing risk along with a quantitative framework. As it is presented in the mapping model risk management is also integrated with the decision-making processes for the purpose of future lean project managing [15, 50]. As a result of such an approach the risk management development model work plan is absolutely necessary in order to achieve time savings, future cost savings and quality of the future projects implementation. By introducing the main matrix skeleton of the model it will be established systematic tree of the decision with the development of the documents such as work breakdown structure, time estimation, risk identification and the structured correction steps where each development step under the stage gate should have the owner's representatives identified through the predefined roles, tasks, criteria, with the goal of the quantitative examination of the identified risks.

6.9 Detailed model work strategy

The degree of predictability and the ability to manage the appropriate strategy, varies but in any case, doesn't depend on the status of a risky occurrence. One of the utmost significant roles of each project manager is the project risk management. This role becomes particularly complex and inefficient if risk management process doesn't start at the project initiation stage. Based on the above, in order to implement an effective and efficient approach to risk management, an adequate and systematic methodology is needed. The results of previous surveys show that neither project carriers nor contractors do not systematically apply risk management procedures, which negatively affects the performance of the project. The essence of a quantitative approach in risk management is in making decisions that contribute to the achievement of the organization goals, thus such an approach is applied at level of the individual activities and within functional areas in the preparatory phase of the project. The quantitative risk management is described as an activity that involves risk identification, risk assessment by identifying strategic steps for risk management and the application of corrective measures or risk mitigation through managerial resources and given criteria [22, 23]. On the other hand, regardless of the all mentioned individual activities, it is necessary to focus on the risks that can be managed using known and unknown instruments at the project definition stage.

After risk identification, risk assessment and risk mitigation, project uncertainty factors are eliminated through the steps, which would otherwise have to be addressed through a subsequent evaluation of the project. The risk response strategy and the percentage of early identification or risk elimination associated with this strategy is a research space that has not been sufficiently explored. According to some authors, the conventional approach to project management is no longer satisfactory [26]. Such an approach does not allow the implementation team to adequately react and co-ordinate at all stages of the project. There is no key approach that would help in better systematic forecasting of project implementation and help in decision making in an objective way using the available database and tools [61]. At present time more and more organizations appreciate the benefit of risk management in the implementation phase of projects where risks are mitigated and controlled [26]. However, models for formal risk analysis and management techniques are rarely used due to lack of knowledge, and sometimes because of the suspicion of the adequacy of these techniques.

The main goal of the research is to improve the systematic risk management process at the early stage of the project definition. The likelihood of risk occurrence in the early stage of project definition, preparation and the seriousness of its analysis at this stage gives the opportunity to increase the chance of successful completion of the project. The main reason for this dissertation work strategy research is to evaluate and determine the limits to which the risk can be controlled and to determine the level to which the risks are resolute, i.e. specific for a particular analysis at early stage of project definition and preparation [25]. The model derived from the study will show the level of presence and level of risk predictability, including external and internal factors with emphasis on all known risk elements, unknown, known unknown and unknown unknowns. The categorization of the risk weight, the possibility of its occurrence and mitigation will be evaluated at all stages (stage gates) and accompanied by a risk assessment based on the criteria of the given data. The basic principle, just because something is unpredicted does not necessarily mean that it is unforeseeable. Through appropriate systemic analysis, it is possible to recognize and reduce some unknown unknowns which can be actually knowable [68]. A systematic approach to the model that treats risk through systematic steps aims to improve the preparation and implementation of future projects both in time and in order to eliminate unacceptable risks.

By using early risk identification and risk management model, risk mitigation techniques at different time stages eliminates uncertain factors, which would otherwise have to be processed through a subsequent post evaluation of the project. The expected stage (stage gates) steps, results, after applying the risk response strategy, at the identical level of risks evaluation, including all functional disciplines, leads to the maximum elimination of all systematic errors in the model based on the specified stage process steps. The risk response strategy and the percentage of early identification or risk elimination associated with this strategy are the key to the success of this model. Within this approach, the presented model will have the ability to comply with certain changes or differences in relation to existing software packages such as the Microsoft Platform. This is based on the analysis of activities and the selection of specific responses (data from project documents such as a schedule) [68]. The responses minimize unwanted aberration deviations - keeping within defined limits of deviations (defined in percentages), but satisfies and defines faults.

The systematic process model will include:

- ✓ risk events,
- ✓ procedures to reduce or eliminate risks and their impact,
- ✓ interactions among risk-taking steps,
- ✓ decision-making,
- ✓ and risk mitigation efforts.

The model allows a (stage gates) strategy for managing risk by selective elimination based on relevant available criteria (taking into account unforeseen events), including the objective probability that project will end with successful results. The anticipated successful project results are given through a detailed (stage gates) systematic approach by identifying all risks according to model criteria. This approach and the final results will show that the model generates a smaller deviation of risk with the improvement of project implementation. In the doctoral dissertation correlation between the software influences from qualitatively standpoint will not be studied. Also, correlations of qualitatively in relation to quantitative methods will not be will studied. It will be applied quantitative approach with small fragments of the qualitative parts [15, 22, 65]. The expectations from the presented quantitative tool application with the proposed methodology will enable stakeholders to improve early project risk management role and to promote awareness of early detection of risks.

The model will be developed with details and definitions based on elements [37]:

1. Methodological assessment of steps which includes predefined conditions for each phase
2. The level of assessment for each step with its magnitudes.

The RIO mapping tree have three groups:

- **First set *:** Early systematic process, including stage gates one through five,
    - o **Including** the main predefined activity steps
- **Second set **:** Risk identification and flow control tree

- **Including** stakeholders where groups can be added or excluded from the flow plan
- **Including** flow plan, as a matrix/mapping with clearly defined criterions.

- **Third set ***:** Documents, risk database, applying risk methods and existing tools.
    - **Including** sets of the document that are base for the model, and the matrix flow chart.

** Full detailed notes can be seen under the X. Results, (Report results - Model detailed notes per the Stage Gate I through VI)*
*** Full detailed charts can be seen under (Enclosures 1 through 6).*
**** Full detailed list of documents can be seen under the X. Results, (Report results - Model list of the documents Stage Gate I through VI)*

Before moving to the next step each set of risk documents (***) is studied through the (**) risk identification and flow control tree. The early systematic process (*) is technologically built in detail with note of clarifications, with purpose of systematic control in the flow control tree (**) and supported by risk documents and the applied methods (***). The objective of risk documents (***) is to reduce the number expansion of total database, control of functionality with goal of unification and simplicity of its usage. With this approach RIO model map flow tree will not be bulky and complicate. Data purity will help in visualization, simplicity of risk analysis taking into account combinations of corrections. The model (RIO) systematic process is based on quantitative methods, with some aspects of qualitative methods, too [37].

Chart III-2 shows the stage gate No. 1. It is a first step in the RIO model process. From this point towards all functional area managers are involved [69]. At the stage gate No. 1 all project related risks are registered. This includes all known and unknowns [27, 34]. Data base history documentation including relevant project scope data is included. Risk are put together by the disciplines, with detail elaboration of risks, mitigation approach, the probability of occurrence and the focal point or the accountable persons with precisely given tasks and duties. Additionally, in the decision flow tree, risks are given levels of the scale elements beginning from the higher to the lower and categorized by the known, unknown and new risks [27, 36]. Initial estimated cost effects for each recognized risk based on the previous categorization are allocated. The risk final document is called RWBS [23, 29]. The stage gate No. 1 has in total fourteen activity steps under the stage gate criteria. Further down the mapping tree shows the flow chart with the predefined activities following the registers of the eleven documents. Activity steps are numbered (*) 1.1, 1.2, 1.3, 1.3a, 1.4, 1.4a, 1.5, 1.6, 1.7, 1.8, 1.9, 1.10, 1.11 and 1.12. Each one of the steps has defined classification of the given tasks. Further down into the mapping tree flow chart (**), the steps are defined based on the blocks including the legend. Each one of them is categorized and introduced through the entire RIO model. Following the third (***) set, the documents are numbered 1, 1a, 1b, 2, 3, 4, 2c, 5, 6 and 7. The RIO process starts with the clear given project task. Owner in the stakeholders' or FAMs group of the risk RIO model is appointed based on the project selected discipline. Defined risk opportunity can start. Owner initiate the documents [23, 17]:

- ✓ 1, stakeholders populate the initial risk register (risk category and risk classification) based on the project scope. Owner locks the document and approves the next step.
- ✓ 1a, stakeholders populate the probability of occurrence <10%-90%> based on the project scope. Owner confirms the document and approve for the next step.
- ✓ 1.b, stakeholders populate the responsibility acknowledgment. Owners confirms the initial risk register data and approve it for the further steps or returns the document to the beginning of the Stage gate No 1. Data is not accepted and has to be updated from the step 1.0.
- ✓ 2, stakeholder owners describe the details of the risks and strategy of the mitigation. Owner locks the document and approve for the next step.

- ✓ 2a, stakeholder owners assign the Risk Manager Roles and Responsibilities. Owner locks the document and approves the next step.
- ✓ 3, owner upload the history Risk Assessment Documents (knowns). Stakeholders confirms that history is relevant per the disciplines and the given project scope objectives. Owner locks the document and approves the next step.
- ✓ 4, owner upload the history Risk Assessment Documents (unknowns). Stakeholders confirms that history is relevant per the disciplines and the given project scope objectives. Owner locks the document and approves the next step.
- ✓ 2c, owner introduce the full risk register containing the tasks from 2a and adding the history 3 and 4. Owner locks the document and approves the next step.
- ✓ 5, stakeholder owners adding the Roles and Responsibilities of the Risk Assessment Team. Owner locks the document and approves the next step.
- ✓ 6, owner with the stakeholders input create the initial WBS (work breakdown structure) with the initial baseline durations. Owner validate the document and approves the next step.
- ✓ 7, stakeholder owners associate the risk category and the risk weight <only to the new added risks>. Owner confirming the document with action Item list and confirms with the FAMs the added data. If the data is approved by all FAMs owner locks the document and approves the next stage gate. If not, then process is returned to the first step in the stage gate No. 1.

Chart III-2. Stage Gate Matrix No.1 (*Enclosure No.1*)

Chart III-3 shows the stage gate No. 2. It is a second step in the RIO model process. At this step only the unknown risks are selected and taken into account. The presented stage gate is established on defined flow tree including step checks with possible alterations. Part of stage gate are risk workshops, risk analysis, including integration of brainstorming, worksheet, probabilities and objectiveness. A set of tools and the supported template documents are implemented in the RIO process. Such a tools are RWBS, RR, PI, AHP and FTA [42, 50]. The results of the stage gate No. 2 leads to selection of all unknowns. Result of unknown's risk category includes all new identified risks that are selected as unknown risk with emphasis of applicable risks history defined as a unknown category. The results of stage gate No. 2 include initial estimated cost of unknowns. At the end of the stage gate No. 2 document of unknown risks are authorized and approved towards the next stage gate by the functional area managers. Stage gate No. 2 has in total eighteen activity steps under the stage gate criteria. Activity steps are numbered (*) 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.8a, 2.9, 2.10, 2.11, 2.12, 2.13, 2.14, 2.15, 2.16, and 2.17. Each one of the steps has defined classification of the given tasks. Further down into the mapping tree flow chart (**), the steps are defined based on the blocks including the legend. Following the third (***) set, the documents numbered 8, 8a, 9, 10, 10a, 11, 12, 13, and 13a. Owner initiate the documents [23, 17]:

- ✓ 8, risk register objective document is uploaded by the owner and the stage gate No.1 initial risk strategy report is confirmed. Owner validate the documents and approves the next step.
- ✓ 8a, owners creates document with only the unknown associated risks from the history and with the all associated new risks. Owner validate the document and approves the next step.
- ✓ 9, stakeholder owners propose the unknown risks registers list from the newly created ones. Owner validate the document and approves the next step.
- ✓ 10, Concept of Operations for the project objective is created by the owner. Owner validate the document and approves the next step.
- ✓ 10a, Concept of Operations for the project objective created by the owner with the impact of the associated risk register to be confirmed by the stakeholders. Owner

validate the document and approves the next step.
- ✓ 11, owner prepare the risk register only with the Unknown Risk Process Development Data. Owner locks the document and approves the next step.
- ✓ 12, stakeholder owners propose the mitigations and updated the unknown's matrix document. Owner and stakeholders confirm the first stage gate risk form and comparisons report of the compared mitigation actions. In case that the mitigation action is not approved the owner returns the risk assessment to the stage gate No. 1. Owner validate the document and approves the next step.
- ✓ 13, stakeholder owners propose the initial contingency associate values based on the initial approved mitigations and update the unknown's matrix. Owner validates the document for the next step.
- ✓ 13a, stakeholder owners and the owner of the risk process rechecking the all approved developed scenarios, propose the additional corrections and approve the document. If document is not validated, then process is returned to the first step in the stage gate No. 2. Owner validate the document and approves the next step in the stage gate No. 2.

Chart III-3. Stage Gate Matrix No.2 (*Enclosure No.2*)

Chart III-4 shows stage gate No. 3. It is a third step in the RIO model process. At this step only the known risks are selected and taken into account. The presented stage gate is established on similar flow tree including step checks with possible alterations. Tools and documents introduced and implemented in the RIO process of stage gate No. 2, are in good manner identical as in the stage gate No. 3 [42, 50]. The results of the stage gate No. 3 lead to selection of all known. Result of knows risk category includes all new identified risks that are selected as known risk with emphasis of applicable risks history defined as a known category. The results of stage gate No. 3 include initial estimated cost of known. At the end of the stage gate No. 3 document of known risks are authorized and approved towards the next stage gate by the functional area managers. Stage gate No. 3 has in total eleven activity steps under the stage gate criteria. Activity steps are numbered (*) 3.1, 3.2, 3.2a, 3.2b, 3.2c, 3.3, 3.4, 3.5, 3.6, 3.7, and 3.8. Each one of the steps has defined classification of the given tasks. Further down into the mapping tree flow chart (**), the steps are defined based on the blocks including the legend. Each one of them is categorized and introduced through the entire RIO model. Following the third (***) set of the documents numbered 14, 14a, 15, 16, 17, and 17a. Owner initiate the documents [23, 17]:

- ✓ 14, risk register objective document is uploaded by the owner and the stage Gate No.2 initial risk strategy report is confirmed. Owner validate the documents and approves the next step.
- ✓ 14a, owners create only the known associated risks from the history and the all associated new risks. Stakeholder owners propose the known risks registers list from the newly created ones. Owner prepare the risk register only with the known Risk Process Development Data. Owner validate the document and approves the next step.
- ✓ 15, stakeholder owners propose the initial contingency associate values based on the initial mitigations and updated the known's matrix. Owner validate the document and approves the next step.
- ✓ 16, owner propose the initial known risk associated values based on the initial mitigations. Owner validate the document and approves the next step.
- ✓ 17, stakeholder owners propose the initial mitigation based on the initial mitigations and updated the known's matrix. Owner validate the document and approves the next step.
- ✓ 17a, stakeholder owners and the owner of the risk process rechecking the all approved developed scenarios, propose the additional corrections and approve

the document. Owner and stakeholders confirm the first stage gate risk form and comparisons report of the mitigation actions is compared. If document is not validated then process is returned to the first step in the stage gate No. 3. Owner validate the document and approves the next step in the stage gate No. 3.

Basic formula in RIO process for the risk validation [37]:

IF (AND(^="✓"), AND(NOT(^=""),NOT(^=""))),"OK","")

IF (AND(^="✓"), AND(NOT(^=""),NOT(^=""))),"OK","") (1)

Where is:
^ Cell location in the excel file.

Formula of risk exposure factor [29, 37, 79, 89]:

$$E = P \cdot I \qquad (2)$$

Where is:

E – Risk exposure
P – Risk probability
I – Risk impact

Formula of risk exposure factor including risk mitigation (cost) [34, 35, 37, 90, and 91]:

$$E = P \cdot I\left(\frac{RV}{PSF/8}\right) \cdot IC \qquad (3)$$

V – Risk weight
IC – Initial cost
PSF – Proportional scale factor

Chart III-4. Stage Gate Matrix No.3 (*Enclosure No.3*)

Chart III-5 shows stage gate No. 4. It is a fourth step in the RIO model process. At this step preliminary reports are gotten. Next process actions will require detailed analysis of risk which involves deeper knowledge about the project. The basis of detailed analysis and risk mitigation lays down in initial WBS with associated schedule timelines. All connections between any documents are accomplished using the built-in excel variables. Any start p of the documents it will require an update [42, 50]. Such an accomplishment is realized through formulas (1 and 4) [37]. The first mitigation on all known and unknown risks reflecting on timeline is applied. At the end of the stage gate No. 4 document of known and unknown risks are authorized and approved towards the next stage gate by the functional area managers. The stage gate No. 4 has in total eighteen activity steps under the stage gate criteria. Activity steps are numbered (*) 4.1, 4.2, 4.2a, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 4.10, 4.11, 4.12, 4.13, 4.14, 4.15, 4.16, and 4.17. Each one of the steps has defined classification of the given tasks. Further down into the mapping tree flow chart (**), the steps are defined based on the blocks including the legend. Each one of them is categorized and introduced through the entire RIO model. Following the third (***) set of the documents numbered 18, 18a, 19, 18b, 20, 21, 22, 22a, 23, 24 and 25. Owner initiate the documents [23, 17]:

- ✓ 18, risk register objective is uploaded by the owner and the stage Gate No.3 initial risk strategy report is confirmed. Initial risk data contains all knows, unknowns and the new associated risks. Owner validate the documents and approves the next step.

- ✓ 18a, owner and stakeholders confirm acceptance of the second and third stage gate risk form and mitigation comparisons report. At this stage internal and external key factor are aligned. Owner validate the document and approves the next step.
- ✓ 19, owner with the stakeholders input create the corrected WBS (work breakdown structure) based on the risk alignment factors. Owner validate the document and approves the next step.
- ✓ 18b, owner and the stakeholders review entire risk unknown/known in detail (mitigation review). Insert all reviewed information to risk matrix based on the previous steps and locks the document. If document is not validated then process is returned to the first step in the stage gate No. 4. Owner request independent review and approves the next step.
- ✓ 20, Concept of Operations for the project objective created by the owner is updated with the impact of the associated risk register and to be confirmed by the stakeholders. Owner validate the document and approves the next step.
- ✓ 21, owner with the stakeholders propose changes to the risk document including all relevant changes made by the independent reviewers. Owner validate the document and approves the next step.
- ✓ 22, stakeholder owners and the owner update the schedule based on the all above approved developed scenarios. Owner validate the document and approves the next step.
- ✓ 22a, stakeholder owners and the owner propose the additional corrections and approve the schedule changes with only critical items correction. Owner validate the document and approves the next step.
- ✓ 23, stakeholder owners and the owner propose the additional contingency corrections with reflection on the document 18b. Owner validate the document and approves the next step.
- ✓ 24, stakeholder owners and the owner propose the additional contingency corrections with reflection on the document 23. If the results are not acceptable by the stakeholder owners and the owner step is returned to the CONOPs document for revalidation. Owner validate the document and approves the next step.
- ✓ 25, the owner and stakeholder owners propose the final correction taking into account all relevant independent, internal and external changes. In case that results are not acceptable, owner has a possibility to return the process to the beginning of the stage Gate No.4. Owner validate the document with the stakeholders and approves the next step in the stage gate No. 5.

Chart III-5. Stage Gate Matrix No.4 (*Enclosure No.4*)

Chart III-6 shows stage gate No. 5. It is a fifth step in the RIO model process. At this step all data is collected. The given set of risk analysis reports and results is studied. At this step confirmation of all risk mitigation actions is given by the functional area manages. FAMs or stakeholders proposing further actions of the critical segments. The critical segments of the risk analysis contain known and unknown risks that are still highlighted as an unresolved impact. Flow chart enable possibility of the corrections through the workshops [30, 92]. At this step, the emphasis is given on risks with still high category. At this stage of RIO process much detailed corrections are applied. All corrections are based on schedule timeline impacts structure. Through the workshops all possible corrections are clarified. At the end of the stage gate No. 5 results of the known and unknown critical risks are authorized by the functional area managers and final data is presented in Table 1 & Table 2 - Major risks for the Project No. 1 & No. 2. Stage gate No. 5 has in total twelve activity steps under the stage gate criteria. Activity steps are numbered (*) 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9, 5.10, 5.11, and 5.12. Each one of the steps has defined classification of the given tasks. Further down into the mapping tree flow chart (**), the steps are defined based on the blocks including the legend. Each one of them is categorized and introduced through the entire RIO model. Following the third (***) set of the documents numbered 26, 27, 28, 29, and 30. Owner initiate the documents [23, 17]:

- ✓ 26, risk register objective document is uploaded by the owner and the stage Gate No.4 initial risk strategy report is confirmed. Initial risk data contains all knows and unknowns associated risks. Owner validate the documents and approves the next step.
- ✓ 27, owner and stakeholders owners confirming that still high, high level of the risks are critical. At this level only high-high risk are subject for the additional mitigation/possible corrections. Owner validate the document and approves the next step.
- ✓ 28, owner with the stakeholder owners reviewing (technical/commercial) the high-high risk and suggesting all possible changes and mitigations, based on the all associated elements with the key reasoning. If the results are not per the minimum required project objectives, owner has possibility to return the step from the beginning of the Stage gate No.5 process. Owner validate the document and approves the next step.
- ✓ 29, owner and the stakeholders review entire risk document. Applying final mitigation, correction, probabilities with all reviewed information. Owner request independent review and approves the next step.
- ✓ 30, owner upload all relevant data into the final RWBS and the schedule. Owner finalize the risk schedule report document. The schedule deviation impact report is created with all associated risk, but with the focus on only the risk that having the impact on the schedule project durations. Owner request the validation from all stakeholders involved. If the results are not acceptable owner has a possibility reinstate the entire stage gate No 5. process. If the results are acknowledged by the all involved stakeholders, owner validate the document and approves the next step in the stage gate No. 6.

Chart III-6. Stage Gate Matrix No.5 (*Enclosure No.5*)

Chart III-7 shows stage gate No. 6. It is a sixth and final step in the RIO model process. At this step all obtained data of risk analysis including reports and results is combined, and all associated project risk results are locked. At the stage gate No. 6 final risk analysis reports are prepared. Obtained data and the files are archived and saved on share drive. The stage gate No. 6 has in total three activity steps under the stage gate criteria. Activity steps are numbered (*) 6.1, 6.2, and 6.3. Each one of the steps has defined definition of the given tasks. Further down into the mapping tree flow chart (**), the steps are defined based on the blocks including the legend. Each one of them is categorized and introduced through the entire RIO model. Following the third (***) group the set of the documents such a final project documents and the server database. At this stage, reports are locked, uploaded on servers and shared as a final reporting outcome [23, 17].

Chart III-7. Stage Gate Matrix No.6 – reports (*Enclosure No.6*)

Based on the above charts, in order to implement an effective and efficient approach to the risk management, adequate and systematic methodology is needed, and more importantly, knowledge and experience. The results of previous surveys mentioned earlier in dissertation show that neither project carriers nor contractors do not systematically apply risk management procedures, which negatively affects the performance of the project. This research will demonstrate that the model will integrate a risk assessment tool better than individual risk assessment workshops [50]. The details of the stage gate steps will support this research from the moment of the initiation by making a decision from the standpoint of a quantitative approach with the aim of maximizing effectiveness [50].

The quantitative risk management is an activity that involves risk identification, risk assessment, where in the presented model will develop strategic steps for risk management and the application of corrective measures or risk mitigation by functional management teams and certain criteria [22, 23]. The entire methodology is obtained by the case studies, with one example in the project development phase and one example of the implemented project case. Both of the cases are implemented in Croatian organizations, discipline of the public energy industries sector.

With this quantitative approach, which takes into account quantitative risk factors and risk management, the preparation phase will be carried out step by step, which will result in better implementation of project risk management. At the inception phase of the process, for the purpose of input data, the quantitative data from the Work Breakdown Structure (WBS) will be used to collect [26]:

- ✓ A detailed approach to risk management will contribute to the development of a project description by actively involving the stakeholders of designated project groups or detailed designated representatives where all managers are involved in the process.
- ✓ Backup data or existing data for the description of the step of the map will be classified hierarchically according to the plan of the risk identification stream.

The choice of input data is made on the basis of a historical database. The management knowledge and knowledge of mapping criteria through the model will be used in risk categorization. Some risk packages will not be taken into account due to already known mitigation. The systematic risk management requires interactive stakeholder's involvement, as, besides the quantitative framework, experience is the best tool for risk management. The risk management model and the approach are integrated or established at an early project stage [15]. The model is based on uncomplicated tools and is easy for users. During the preparatory process, decision-making will encompass all involved risk analysis stakeholders and provide responses. A quantitative approach should also include a subjective and objective approach in order to obtain specific responses to future risk management.

6.10 Methods to be applied in the model

The interests in risk management came in the late XX century, and in the XXI early authors state that risk management was a significant step in most organizations [69]. Logical model and the structure are the part of the research study of existing practice involving tools like risk registers, risk management spreadsheets, brain storming sessions, etc… [60]. For the purpose of the presented model, few of the support tools techniques and method application are used in the risk mapping tree such as Risk Work Breakdown Structure (RWBS), Risk Registers (RR), Probability and Impact (PI), Analytic Hierarchy Process (AHP) and Fault Tree Analysis (FTA) [42, 50]. Each one of them is driving the same objective, which is to support the presented model and to be effective in capability of including the uncertainty of risk judgment in any projects per the given criteria. The proposed mapping process includes the tools which are applied in any project risk management with the task to improve implementation of project and to prove its validity. The focus of the used methods in the presented risk management model is how to improve the way of risk control in industry/energy projects. The details of the task are based on contribution in probabilistic scheduling through conduction of simulations with the more powerful outcome results. The model is aligned with the common judgment, where controllable and uncontrollable risks can only be responded by utilizing risk management process. The existing method focus is about earlier detailed startup of the project predetermination, preparation and subsequently, control. That includes an update of the model methods as well periodically during the project execution. The risk response is the last risk management step in the model tree, where the results of the preceding steps are discussed and suitable to risk mitigation actions [25]. These steps are taken before facing any risks corrective measures. All associate methods will not focus on the economic effects rather on technical scheduling approach.

6.11 Model outcomes and criteria for mitigation of model possible faults of the model

In doctoral dissertation, the accent is not given on computer results, then it is presented integration of the existing risk management tool. As an additional contribution, who are the functional area managers (FAMs) with the systematic model interactions and predefined RIO criteria delivers an effect of improvements in project timeline results. The RIO model map tree diagram allows several conditions that influence on failures. The failures are usually the gaps in choices, investigation and selection of information data [9, 37, 76]. The identified methodology failures have constructed connections that allows FAMs to use return possibility function “If Yes, continue to the next step or stage gate”, or “If Not, return to the designed step in the stage gate”. The RIO model evaluates all failure possibilities at any stage-gate or the step in the current stage gate before moving on next task. As an addition, information data failure is dealt with the precision of next steps:

- ✓ predefined documents,
- ✓ predefined sets of the equations in excel,
- ✓ model’s ability to rechecks the status of documents,
- ✓ and the confirmation of documents prior moving to the next step [37]:

$$\begin{aligned}&\mathrm{IF(OR(OR(}\sum_{n=1}^{\infty} C_n = \text{"X"});\mathrm{OR(}\sum_{n=1}^{\infty} D_n = \text{"X"});\mathrm{OR(}\sum_{n=1}^{\infty} E_n = \text{"X"});\\&\mathrm{IF(OR(OR(}\sum_{n=1}^{\infty} C_n = \text{"X"});\mathrm{OR(}\sum_{n=1}^{\infty} D_n = \text{"X"});\mathrm{OR(}\sum_{n=1}^{\infty} E_n = \text{"X"});\\&\mathrm{OR(}\sum_{n=1}^{\infty} F_n = \text{"X"});\mathrm{OR(}\sum_{n=1}^{\infty} G_n = \text{"X"});\mathrm{OR(}\sum_{n=1}^{\infty} H_n = \text{"X"});\\&\text{);"Check data!";"Document OK ✓")}\end{aligned} \tag{4}$$

The risk identification oversight model (RIO) include a quantitative evaluation of the probabilities of various faults or failure events leading eventually to calculation of probability at the top event, the system failure (Wang et al, 2000). The main advantages of risk identification oversight model (RIO) are [37]:

- ✓ flow decision tree is not big,
- ✓ decision tree is not complicated,
- ✓ visualization of analysis including all sets of corrections is friendly use,

The RIO flow tree is based on systematic and logical method. The model method tries to mitigate and take iterative correction of all possible gaps, faults prior the next step approval is given [9, 37, 67, 76]. The method flow tree has significant challenging portion in entire process. The flow tree has to predict the consequence potential risk events based on size, complexity and uniqueness of given project objectives. As an additional added value to the process are risk key owners or functional area managers with main task to enforce and control improvements before and after final document approval. The risk owners has an option to accept the final document, present the following consequences by using the systematic steps in RIO model. It is important to underline that all results, consequences of mitigation criteria are given risk owners or stakeholders for comments, review and approval. For that reason, all possible faults (tool or human) are automatically mitigated. The model faults are mitigated through the steps of quality control before any document is upload into the model. Taking into account human error the faults are mitigated by the constant participation of risk owners or stakeholders. The risk owner participation and contribution are given through the selection of probability decision and possibility of the steps repetition with main target to gain realistic results.

The RIO model assessment and analysis of the risk is measured by [12, 22, 25]:

- ✓ cost (RBOE or the base of the risk budgetary estimate),
- ✓ time (delay risks, described in timeline),
- ✓ quality (generally risks that are associated with the contract definition and it is applied through RBOE of improvement).

Therefore, following the above breakdowns emphasis in the dissertation is given on time and delays. One of the reasoning of the selected model is well given fact that many risks remain unidentified, and proper risk management becomes impossible. These are the key reasons why such a research is important to be developed in the early stage of the process preparation.

Useful acknowledged techniques in identifying risks, are part of the presented model, including brainstorming as well with the objective or subjective inputs. In addition to that the model can apply the external consultants if it is needed or relevant guidance for the independent project objective needs. The model effectiveness is part of the systems that is depending on a comprehensive understanding of how the business operates in practice. Thus, even the presented model is not a standalone tool, where usually software's or any other 'standard solutions' should be approached with attention. The structure of the model is built on the preventive action to lean the uncertainty. It is inevitable to have preventive actions, since projects are very unique and temporary undertakings are based on assumptions and constraints. However, with the risk management pre-process approach through the presented systematic method, model delivers the project results to the stakeholders with a different detail for the further implementation. Details are upfront knowledge and narrows of any possible faults to the bare minimum. Further down the model is trying to attempt the control of uncertain environment by the preset-up variable and the limitations on faults side. The use of structured criteria variables will be systematic techniques such as:

- ✓ estimating,
- ✓ planning,
- ✓ cost control,
- ✓ task allocation,
- ✓ monitoring,
- ✓ and corrective review actions.

The some of the faults will be mitigated through the systematic risk model, and some of the faults will be mitigated by the predefined risk tools. The model inputs and the model outcomes are focused on the high identified risks, where such a risk can be described as the distance between the objective's expectations and the current situation [25]. Since the model is based on the risk management and if we look from the project management view concerning high risk identified, the risks are considered to have at least one cause and at least one effect, thus risk is typically represented based on probability vs. impact [25, 63].

The model will follow the standard risk management logic, with prioritization of risks, provided action-oriented information to the next steps in the stage gates. The results will have effects that all of risk events should end with real contingency events, were contingency is referring to as an unplanned probable future deviation which will not occur unless risks occur [86]. The systematic risk management model criteria aim is not to eliminate all risks faults, but to focus actively in identifying those faults and mitigate them in the early risk's assessment phase. The mitigation and enhancement are the most widely applicable and widely used response strategies. By the systematic early risk management model criteria actions, it will be targeting those risks associated with high leverage towards minimizing the residual risk [25].

IV. Results of the research

7. Possibility of applying the quantitative model

The proposed research includes current risk management inefficiency using an approach based on acquired knowledge and literature research, consolidated into a specific risk management methodology: at early stage in defining the project objectives. The focus of research is possibility of applying a "stage-gate" model as a risk-treatment process in the early phase of project preparation. The stage-gate of the quantitative model is defined in the literature by Cooper in early 1990. Expected results of the quantitative model will follow stage-gate steps, after applying the risk response strategy, at the very detailed levels of risk evaluation by including all functional disciplines. The results should point the maximum elimination of all errors in the model, based on the specified probability in the "stage-gate" process.

A review of the literature has shown need for a systematic approach in risk management by defining the preparatory phase of the process. Since the engineering industry requires proactive behavior, potential problems must be solved at early stage of the project definition and implementation phase. The objective of the early definition phase is to prepare a mitigation plan and to limit all known and unknown risks before it moves to the next step. However, the risk degree level depends on complexity, size (and in terms of period of project performance (POP) and budget) and location [15]. There are not too many studies from the perspective of developers that represent a risk management framework with integrated software development and involved shareholders [15]. The basic message of all studies is that successful projects ability to foresee the potential problems and attempt to solve potential problems much before they occur. This should be a feature of risk management and the goal of the presented study.

In order to better illustrate the results of the research it is necessary to confirm a significant fitment of organizations in present day. To delivers the end user value and as well enhance their organizational performance by means of efficient, effective approach to situations and flexible adaptation to rapid industry organizations need has to become accustomed. Presenting these research results, an analysis of the basic research characteristics of the items was used. Such a characteristic are set of methods that gives a description of the results and aims at grouping, arranging and displaying results, as well as determining the basic indicators of model applying possibilities. The model network is further incorporated into a modified matrix network approach in order to facilitate a quantitative and more accurate risk-based conditional probabilities of the project assessment. The quantitative model matrix is further used to identify the significance of the given variables, while factor risk analysis was used in establishing which of the variables could be measuring the same effect.

The model application of using quantitative systems is applicable to the existing and new methods. The model applicability represents a good understanding of the objective, recognition of all relevant variables, their relationships and ability to take and undertake the risk analysis. The model has possibility to be integrated and applied based on the schematic, analogue, mathematical numerical parameters. The emphasis is given on the collection and integration of the numerical data, summary of it and final mitigated drawn conclusions. Nevertheless, the next charts are showing that the usage of the final data results from the model, are easily integrated into the MS Project Office tool. Easy model MS project integration comes from the initial work breakdown structure data, then initial schedule, where upon the model mitigation strategy is completed the new schedule results are obtained. Such a data can be easily used within any scheduling tool for the purposes of the time deviation presentation in days/percentages or the even the financial presentation including the PERT analysis probability cases through the Monte Carlo [55].

7.1 Testing the reliability of the model elements

The probabilistic reliability of model techniques and a deeper understanding of model failure are given through the likelihood of usefulness of the testing techniques. The testing draws our attention to the consequences of failure at early project stage related to the risk management process. However, to achieve such a possibility, a well-defined model and the systematic structure together with a robust reliability technique is needed. The systematic method element provides an implicit limitation that is far more accurate than other approaches. Thus, such an approach from one point of view will have the full advantage of the probabilistic possibilities and from another view of it needs will have both an advanced systematic model and supporting reliability technique. The assessment and absence of systematic modeling methodology approach of solving errors, includes fact that its error analysis is well-understood. This bring to the conclusion that many challenging methods do lack in this manner [15, 69]. A weakness of such a method is the often-large number of runs needed per the given gates, particularly in complex models, where each of the run may require a set of elements, analysis or other elements that are time-consuming for process.

The stage gate controls reliability and analysis of systematic structures with variety of key known set points. This is considered to be the most robust and most generally test applicable. The return functions of variables between the steps, further reduce possible faults and give methods more reliability elements. With such a treatment there are no possibilities of missing or skipping of steps, there are no possibilities of adding any other file that is not designated for the certain step of the predefined task. Further down in the dissertation chapters it will be described how the testing from the information technology (IT) prospective is setup. The systemic model describes the way of reduced replication through the stage gate tests even further then other models, while retaining the accuracy and taking into account present limitation of given information. The weight of the model lies in the difficulties where it is necessary to make highly accurate mitigation of risk reduction. The recognized authors such as Word and Chapman suggested that is usefulness of minor risk formalization is eminent with decision to be eliminated from the further consideration [27]. The emphasis is that such a group of risks should be collected together, where leaves a relatively small residual of the major or highly need risks. In this way, various risks can be constantly checked and monitored. Such a decision-making process presents a framework for risk management where each step of stage gates is a sequential decision for its self’s.

7.2 Model compatibility with the existing risk management tools

Dissertation describes a framework of collaborative risk management tools based on the model of multidimensional coordination that includes [39]:

- ✓ documentation reviews,
- ✓ information gathering techniques,
- ✓ brainstorming,
- ✓ delphi technique,
- ✓ root cause analysis,
- ✓ checklist analysis,
- ✓ risk registers,
- ✓ risk data quality assessment,
- ✓ determination of quantitative probability and impact,
- ✓ partially monetary analysis,

- ✓ and the decision tree analysis.

Such a model collaboration structure allows run time expansion, making mitigation a continuous process with the variable risk structure depth. This allows risk management to apply different hierarchical decisions. The developed method has an ability to be used from and for any other existing method. In certain stages of the risks mitigation we can associate the action or the even tools with the existing traditional risk management processes [31, 33, 36]:

- ✓ (RWBS) Risk Work Break Down Structure,
- ✓ (PERT) Project Evaluation and Review Technique,
- ✓ (FTA) Fault Tree Analysis,
- ✓ (HAZOP) Hazard and Operability Analysis,
- ✓ (HAZID) Hazard Identification Study,
- ✓ (ETA) Event Tree Analysis,
- ✓ (AHP) Analytic Hierarchy Process.

Dissertation develops fully integrated risk assessment with more details and more steps that are necessary to bridge the existing gaps. The model is also using a quality check list and it is superior to the other traditional risks check list, such as risk work break down structure and the works shops. Within the usage of the existing traditional risk management tools the model also quantifies the risks in the systematic manner, such as causal relationship between the model steps and the stage gates.

7.3 Model compatibility with the existing planning and scheduling tools

The one of the most achievable tasks in the presented model is collaboration with the existing scheduling tools (MS project, Primavera or any other similar scheduling tool). The possibilities of integration is widely applicable. From the upfront work breakdown selection and the early schedule estimation, through the final selection of main risks impacted by the schedule activities, collaboration of effects resulting with the final mitigations. The possibilities and impact on the schedule tools to exclude the faults are usually mitigation faults scenarios that includes [25]:

- ✓ being early/late for a milestone,
- ✓ increased/decreased cost,
- ✓ exceeding the authorized budget/being on budget,
- ✓ failing to meet any contractual agreed targets etc.

The effects of the above-mentioned faults are the part of the contingent events. From the schedule point of view the contingency has to be upfront planned with the unplanned potential future variations, which will not occur unless risks happen. The main mitigation aim of the faults will be up-front estimate of the known risk. The next step is not to have any faults with impact in this case on the time duration, which on the end will reflect on cost with buildup contingency to the level of overestimated but risky secured project. In the schedule such a criterion is established from the purposes of the scheduling but with the reflection of establishing kind of systematic structure criteria. Not considering such an approach in the early project definition level, reviewing those processes often assume an unrealistic degree of certainty about the project objectives and therefore, it usually reaches conservative approach of the time estimation and the contingency [25].

Based on the selected approach, model will for illustration use the risk model methodology shown through the project scheduling, including given risk provided dates with critical paths based on activity durations and resource risk management availability, with assumption that all risks are recognized with certainty. The quantitative risk analysis used in the proposed methodology explores quantitative measurements and contrasting to the given risk numbers in the early project phase [22]. Such an analysis allows the future development in project phasing to use and consider results of risk analysis and prepare the team-awareness in relation to correspondence: risks are being recognized and evaluated [25].

For the purpose of meaningful results, it is imperative to have life cycle risks identification recognition in the earliest project phase, with outcome that more realistic project plans and expectations of results are expected. An early methodical identification of risks allows us to minimize and reduce the negative effect (faults) that have impact on achieving the initially set of objectives [25]. Based on the previous, one of the stage gate model aims is to usefully repeat the steps at some major levels. Such a repetition will be done only in case that results are not in line with the given targets. Additionally, correction of the faults can be made by systematic risk assessment approach, with conveying better results.

Based on the final results the schedule will have already assessed and recognized major risk events that have impact on the schedule. Such an approach will give the project managers and the schedulers much better upfront knowledge and allowed them to react accordingly. Also, let's not forget that in the RIO model whoever is the owner of the risks will decide on the mitigation method and the risk priorities. With the structure of the model criteria, it will be presented formation of the backup checking to reduce the negative effect of the risks. One more field is important when we are talking about the early identification of the risks, which are the unknown risk values, which produce uncertain risk probability and impact on schedule. Through the model it will be identified most of the unknown risks with the high predictability [25]. By unknown predictability it will be estimated the range of risks impact, and selected risk group of low manageability. At definition risk management stage some of the results can show as risks with high or low risk potential therefore decision can be made of transferring possibility of unknown manageable risks to another (third) party. Not all unknown risk can be mitigated since unknown sources but at least it can be measured and recognized for the purpose of alert in preparation and detailed schedule implementation. The final risk data is early transferable trough the model and can be used as shown in the reports at RIO stage gates IV through VI.

V. RIO web model connections

This section presents an analysis of the research results with emphasis on testing the hypothesis and answers to major research questions. In addition, a comparison of the obtained research results between the presented dissertation (theoretical background), as well as the practical implications arising from the two project examples results has been presented.

8. Analysis of model connections

8.1 Model pattern demonstration

As per the **Chapter III** and the paragraph 6.9 the RIO model covariance primary use matrix link associations between the groups: control flow items (*), stage steps (**) and documents (***). Based for the model creation and test homogeneity for accessing and managing the data are used Microsoft and core web technologies. In general, the HTML5 (markup language), CSS3 (Cascading Style Sheets), JavaScript (interpreted programming language) are used for creating frontend interfaces and visual state display. The language C Sharp (C #, Programming Language) is used for creating a back-end data management interface with the document variable relation. The SQL (Structured Query Language) was used to create a database queries. The Microsoft Access tools was used an overall covariance to save and manage the state of the project and their steps.

Chart IV-1. RIO web model of Stage Gate No.1 (*Enclosure No.7*)

Chart IV-1 shows the stage gate No. 1, based on the described process in section III, paragraph 6.9, **Chart III-2.** The foundation for design of the web tool and creating a RIO model was a matrix model flow chart. The code of the provided languages is (paragraph 6.9) giving the basis for a visual representation of the workflow. After workflow analysis is created, parameters are created and set to be used in the database. The parameters are defined so that current status of each data sets and steps within the sets can be monitored. The supervision was established through the tables. The tables are created, and baseline standardization was done in the process. The process of the same data organization gains flexibility and efficiency when drawing logical matrices and data sequences. In the background model uses (hard-coded) a tightly keyed way of checking data parameters from an excel document and verifying their availability.

Chart IV-2. RIO web model of Stage Gate No.2 (*Enclosure No.8*)

Chart IV-2 shows the stage gate No. 1, based on the described process in section III, paragraph 6.9, **Chart III-3.**

Chart IV-3. RIO web model of Stage Gate No.3 (*Enclosure No.9*)

Chart IV-3 shows the stage gate No. 1, based on the described process in section III, paragraph 6.9, **Chart III-4.**

Chart IV-4. RIO web model of Stage Gate No.4 (*Enclosure No.10*)

Chart IV-4 shows the stage gate No. 1, based on the described process in section III, paragraph 6.9, **Chart III-5.**

Chart IV-5. RIO web model of Stage Gate No.5 (*Enclosure No.11*)

Chart IV-5 shows the stage gate No. 1, based on the described process in section III, paragraph 6.9, **Chart III-6.**

Chart IV-6. RIO web model of Stage Gate No.6 (*Enclosure No.12*)

Chart IV-6 shows the stage gate No. 1, based on the described process in section III, paragraph 6.9, **Chart III-7.**

For each and every step, the coded functions and methodology that are executing the forms are programmed to find exact defined templates with exactly defined parameters. The program code is using special classes from (library) before checking each and every step. The programmed code checks the file without loading the file into the model until all the conditions in the file are met. Depending on the defined parameters, the functions for each and every step are separately controlled and administrated during the process operation.

By using the below described roles the multiple parameters are checked using the functions:

- ✓ Data about the state of a particular step in the database (a query is created based on a database flow chart that use the return function true or false to the certain attributes) through the Structured Query Language. This is coded through the defined document and purposes, scope, definitions and revision history (***).
- ✓ Data on the state of the previous step define the actual steps of the current step (checking that there is a file from the previous step, and querying the database to get information that the previous step is completed) through the Structured Query Language, C Sharp
- ✓ Data from the excel templates (***) that is requested at a particular step (upload a class excel document (***) to load the parameters based on which the application responds to error messages or goes further through the process) is controlled by C Sharp
- ✓ In the certain steps the return function of the connection in the flow chart has a function with manually defined workflow, where and when the project risk owner considers it is necessary to make changes within the defined templates. Function described as (Yes / No). Additional sub-functions and codes are used to perform such actions. Example of such a control is seen in step 2.17 with return function in stem 2.1 **of Chart IV-2.** Web Model of Risk Management Stage Gate No.2.

Depending on the function described as (Yes / No) in steps of the stage gates, defined by the matrix query and stored files, in such a case that return function yes or no is selected, database is managing such as step by deleting stored files from the system. Therefore, the parts of the functions that querying towards or in established base perform a change of state to exactly defined matrix subtopic steps. In another word returns the process to the predefined flow map tree step. This is controlled by Structured Query Language and, C Sharp.

8.2 Testing of the measurement model parameters

The RIO model uses accurately defined excel documentation templates (***) where the parameters are and can be monitored with presented application. Various methods for checking those parameters are used. The method, "Check Excel File" checks restrictions at each particular step, depending on the accepted parameter. If the parameters are precise, file is authenticated and proceeds with variables 1 or 0 as a result. If any of the required parameters within the template is incorrect, the application outputs are shown as error depending on which parameter is incorrect [.net library]. The message is shown as an incorrect document template or parameter document validation within the "Approve" worksheet.

```
private int CheckExcelFile(string DocName, FileUpload UploadForm)
  {
      try
      {
          ExcelPackage package = new ExcelPackage(UploadForm.FileContent);

          var ws = package.Workbook.Worksheets["Approve"];

          if (ws.Cells[3, 2].Value.ToString() == DocName && ws.Cells[6, 2].Value.ToString() == "Yes")
          {
              return 1;
          }

          return 0;
      }
      catch
      {
          return 0;
      }

  }
```

Chart V-1. Coding of data excel documents (MS Excel)

Chart V-2. Approved coding of data excels document, protection (MS Excel) (*Enclosure No.13*)

Criteria for each step in RIO model are firmly typed functions using methodology that must re-examine each condition that is defined per each row. Such an approach will make successful model. For the purpose of the non-breach security it is used template with extension *.xlsx for encryption and document protection at a higher level. Such a higher level of protection was not possible in earlier versions of the Microsoft office document (Excel 97-2003) [ADO.NET data controls]. Thus, from Microsoft office document Excel version 2007, it has been used more advance algorithms protection. Also, within the Microsoft office document Excel version 2007 standard itself its reduced ability to break protection and change the limits which we want to protect against unauthorized modifications. Each document is and can be protected at multiple levels to allow user to work on a specific project and reduce the ability to modify parameters that affecting the accuracy of the document. The easiest rechecking of model can be tested by trying to change a parameter within a particular template for which we do not have certain rights and we try to attach that same document within a certain step. The model will alert the fault. Example of such a control can be seen in all steps of the RIO Stage Gate Web Model. *Annotation (2). Enclosure No.17 – RIO – Risk Process Map Web Model is showing web tool and detailed RIO model code.*

Chart V-3. Fault alert of coding, data excel documents, protection (MS Excel) (*Enclosure No.14*)

The outcome of the multi-level protection results that unapproved document cannot be attached to defined step. If this is the case, the application will eject the following message using built-in functions and methods for checking the parameters.

Chart V-4. Message of the unapproved excel documents (MS Excel) (*Enclosure No.15*)

This means that the model is protected against two levels by preventing and reducing the likelihood of errors occurring.

8.3 Testing of individual connections in the model

The RIO model individual connection of the documents (***) are very important. Each document of a particular project is related to a previous document or multiple documents. The relative link to the folder in which the documents of a specific project are saved and protected doesn't have to change connection. In a way that such as step is needed change of any connections is possible by binding documents manually if necessary. By this systematic approach RIO model allows documents of a particular project to be subsequently collated through file sharing technology and management control. Such an example is SharePoint, or some special collaboration system tool.

The root cause of the chosen methodology and the verification of each step after it is confirmed within the document it is saved it in the folder within the application called by the project name. The verified and stored documents are physically available for reprocess if turn out to be necessity. Such, a document can be subject to changes. The program code checks separately gate and steps each time the application is loaded [.net library]. Therefore, step is validated only based on the parameter confirmation and the presence of the file as a physical confirmation. If any of the conditions are not met all further steps and the gates are not visible. The parameter function performs checks each and every time of the current or preceding steps to make unquestionable that parameters are visible or hidden. The format of parameter functions is setup in such a way that allows users to easily monitor the project process status.

For the purpose of gates and steps control, special methods have been programmed for checking and allowing the specific action. The special technique of double step verification is performed. Firstly, verification is done through the file or files by authentication method and special additional function. The additional function, besides examining the presence of the file, requires that particular step to be further manually verified for the validity.

```
protected void btnEnsuredYes_Click(object sender, EventArgs e)
  {
    using (OleDbConnection con = new OleDbConnection(konekcija))
    {
      string upit = "UPDATE t_project SET ensured = 1 WHERE id = @id";

      using (OleDbCommand cmd = new OleDbCommand(upit))
      {
        DataView dv = (DataView)dsSelectProcject.Select(DataSourceSelectArguments.Empty);

        string ProjektID = dv.Table.Rows[ddlProject.SelectedIndex - 1][0].ToString();

        cmd.Connection = con;

        cmd.Parameters.AddWithValue("@id", ProjektID);

        con.Open();
        cmd.ExecuteNonQuery();
        con.Close();
      }

      Start();
      ShowMatrixGate1();
    }
  }
```

Chart V-5. Authentication functions for data excel documents (MS Excel)

```
protected void btnEnsuredNo_Click(object sender, EventArgs e)
  {
    using (OleDbConnection con = new OleDbConnection(konekcija))
    {
      string upit = "UPDATE t_project SET started = 0, ensured=0 WHERE id = @id";

      using (OleDbCommand cmd = new OleDbCommand(upit))
      {
        DataView dv = (DataView)dsSelectProcject.Select(DataSourceSelectArguments.Empty);

        string ProjektID = dv.Table.Rows[ddlProject.SelectedIndex - 1][0].ToString();

        cmd.Connection = con;

        cmd.Parameters.AddWithValue("@id", ProjektID);

        con.Open();
        cmd.ExecuteNonQuery();
        con.Close();

      }

      pnlStart.Visible = true;
      btnStart.Visible = true;

      Start();
      ShowMatrixGate1();
    }
               }
```

Chart V-6. Authentication validity functions for data excel documents (MS Excel)

In certain phases, this means going back to the previous step depending on the certain given conditions, through the more pre-setup functions and ways. The one of the functions is written for base query. By that function it can changed the state of the certain steps. The second purpose is to delete the files up to the steps that is defined by flow chart condition with given return back option to the certain step. For the deletion task it is defined special function within the tasks to delete selected documents which are defined in the model.

```
protected void btn_step1_3_no_Click(object sender, EventArgs e)
  {

    DeleteFile("1. Risk Assesment Document.xlsx");
    DeleteFile("1.a Risk Assesment Document.xlsx");
    DeleteFile("1.b Risk Assesment Document.xlsx");

    hlStep1_2.Enabled = false;
    hlStep1_3_1.Enabled = false;
    hlStep1_3_2.Enabled = false;

    BackToStart(4);
    BackToStep(3,2);
  }
```

Chart V-7. Validity functions of steps changes for data excel documents (MS Excel)

Alternatively, the written functions for the parameters of reset is used for resetting, and the status changes per the given definition in the flow chart.

```
protected void BackToStep(int less, int more)
  {
```

```
        using (OleDbConnection con = new OleDbConnection(konekcija))
        {
            string upit = "UPDATE t_criteria SET finished = 0 WHERE project_id = @project_id AND step_id <= "
+ less + "AND step_id >= " + more + "";

            using (OleDbCommand cmd = new OleDbCommand(upit))
            {
                DataView dv = (DataView)dsSelectProcject.Select(DataSourceSelectArguments.Empty);

                string ProjektID = dv.Table.Rows[ddlProject.SelectedIndex - 1][0].ToString();

                cmd.Connection = con;

                cmd.Parameters.AddWithValue("@project_id", ProjektID);

                con.Open();
                cmd.ExecuteNonQuery();
                con.Close();

            }
        }

        Start();

        ShowMatrixGate1();
    }
```

Chart V-8. Validity special functions of selected document erasing (MS Excel)

In each particular template document (***), depending on the step and the stage gate, the columns are locked and cannot be modified/changed. For the purpose of the systematic document control it is used function for protection (locked), modified only for the arrays that are not needed per the option steps in particular excel document. The protected documents only point certain possibilities of visualization for some formulas and background function if it's necessary. In order its functionality workbook or the sheet must be password protected.

Chart V-9. Locked special functions of all document (MS Excel) (*Enclosure No.16*)

The link between any documents, with emphasis on related documents to the scheduling activities is achieved by using the built-in excel functionality. Built-in formula automatically searches source of needed data and usage through the current working step. By each time the document is used or open, it will request the update function. This have been achieved by “FORMULAS> Edit links" described in the dissertation under paragraph 6.9 by formula (1).

The scheduling connection of the initial work breakdown structure (WBS) and the all further related link documents to the scheduling files follows the similar logic. All data is analyzed with emphasis only on schedule timeline impacts. The comparison has been withdrawn from the initial data file and treated through matrix flow steps of changes. The changes are shown using the embedded excel formula and pivot analysis of data on certain tasks in which changes are occurred. Such a connection drives the proceeding data, to obtain the final excel graph views.

In general, the rule of the links between the documents is viable if the data source that is used is unified. This means that the path to the source document from which data is used, always pointing to the absolute path instead of the relative. The absolute path allows the user to work without modifying the link to the document from which we retrieve the data.

For such a type of document management, it is best to use "mapping" which in this case is RIO model systematic setup. By this, each user or computer location that performs file Excel data handling, allowing end user to exercise the accurate data source for the particular needed document. This is not necessarily limited to case of source such as excel document, on contrary source can be a database or some other file source from which we want to modify the existing data.

8.4 Practical model implications

For the capacity of the fully RIO model functionality, the application requires the presence of a Microsoft Office suite as a predefined template of management tool and Microsoft web server (IIS, Internet Information Services) [Programming C#, 4th Edition 2005]. The application itself is independent and can be distributed through any location and it can be accessed locally or through the network. For the application stability the minimum software requirements of the broadly standard application is needed. Such a minimum is achieved through the Microsoft OS WIN7, Server 2008 R2 or later, Microsoft NET. Framework 4.6.1 and the Access Database Engine [Programming C#, 4th Edition 2005, ADO.NET data controls, OLE DB provider].

The implications that may arise using the application can be of applicative nature or may be caused by a human factor.

<u>The implications of the applicative nature:</u>

- ✓ incorrectly configured server configuration on which the application is distributed,
- ✓ incompatibility (due to non-compliance with minimum software requirements),
- ✓ due to code errors and unforeseen situations that are not defined in the exceptions.

<u>Implications caused by a human factor:</u>

- ✓ social engineering (a template change password that allows users to modify the document structure and modify parameters for regular work),
- ✓ save templates to formats that are not supported by the application.

All above implications are mitigated through the process. One of the mitigation factors is taking into account the human errors. Inability to influence on human factor, the application through the model implements the exceptions. Such an exception attempting to load the parameters while tracking the database status with continuously controlling the correct operation in the RIO model. In case of <u>applicative nature</u> errors in application or error occurred by human-induced faults, the application allows easy and quick modification of steps refinement of functions, and control methods. The modification is possible because of the programming technique (object-oriented access). Such a technique has been used with the main aim of avoiding data structures by enabling communication between the objects, for easier monitoring of status and changes. From the RIO model application point of view, the flexibility of the model is defined by the workflow and the controlled matrix flow chart that has possibility of:

- ✓ changes,
- ✓ adjustments,
- ✓ and improvements if it is needed.

Usually this flexibility is proposed for the purpose of:

- ✓ risk ownership changes,
- ✓ prioritization of other disciplines,

- ✓ or the introducing different nature of the project objective.

For the purpose of easier application distribution and the RIO model management, the Access database from office packets was used during development phase. For the future guidelines of the research in a corporate world surroundings for this type of practice, with larger database file and data volume requirements solution such as Oracle Database or MSSQL type enterprise would allow an even more flexible measure [Programming C#, 4th Edition 2005]. *Annotation (2).*

VI. Discussion of the results

9. Analysis of research results

9.1 Model results comparison based on presented project No.1 & project No.2

For the purpose of dissertation, the RIO model will make the comparison between actual projects (Project No.1 and Project No.2) and expected results with the possible known deviation analysis. Both projects (Project No.1 and Project No.2) are defined, prepared, and executed from the same team members. The Project No.1 has been applied through the model in a way that analysis is done upon project completion. The objective risk comparisons have been taken into consideration. The approach and the process focus were only on the risk associated tasks that where familiar in the project definition phase. Such a method is used to have correct and precise comparisons. None of the risk was taken into account that had corrective action during the implementation phase. The results and the knowledge of the analysis is considered in the future planning process in order to avoid other plan deviations. Few steps in this risk project analysis has been conducted:

- ✓ first, the completed actual values are compared with the planned values,
- ✓ then with the help of the systematic risk RIO model analysis the correct decisions and measures are recommended.

The Project No.1 is a reconstruction project of a jack up platform in energy sector. The project is grounded on one hundred six technical specification, with the purpose of the ten years recertification of the jack up unit which includes major reconstruction activities covering all engineering disciplines. For the purpose of the risk identification, assessment, mitigation, contingency and analysis the main tools as RWBS, RR, PI, AHP, and FTA are used [23, 42, 50]. All mentioned tools are integrated into the early systematic process called RIO. At the initial phase of the risk identification, it has been identified in total three hundred two (302) risks [37]. The existing history database is used and compared with the identified total three hundred two (302) risks. Upon all stage gates iterations and applied mitigation strategies it has been selected only fifty-one (51) major risks. The final (51) fifty-one risks uses the form of work breakdown structure (WBS) with addition of scheduling timeline impacts. The final risks are analyzed are process through sets of predefined formulas, using the Microsoft excel as base for the data analysis. Using the RIO model and going through the defined steps leads to the Table V-1. Result differences. It has been shown that considerable gaps regarding timelines are detected [37]. Full report results can be seen under the *X. Results, (Report results - Model results of the Stage Gate I - Project No.1).*

Table V-1. Major risks for the Project No.1 [37]

Task ID	Task	Baseline Duration tasks	Estimated Duration tasks	Differences in days per tasks ID
1	STSI - painting specialist consultant	216	210	-6
2	Painting specialist consulting in work breakdown - ongoing activity with intermetent meetings and consulting - Phase1	62	57	-5
3	Painting specialist consulting in work breakdown - ongoing activity with intermetent meetings and consulting - Phase 2	62	50	-12
4	Painting specialist consulting in work breakdown - ongoing activity with intermetent meetings and consulting - Phase 3	62	56	-6
5	**Procurement LLI**	272	335	63
6	**Procurement Other**	142	343	201
7	Project Team - mobilization	13	15	2
8	**LEGS SCOPES OF WORK (Detailed Schedule)**	171	170	-1
9	**Leg #3**	171	170	-1
10	**Leg #2**	144	159	15
11	**Leg #1**	144	142	-2
12	**LAB-HSO-004 Main Deck - steel renewal**	129	149	20
13	**Removal of wasted areas and welding of new steel as per refurbishment plan**	89	80	-9
14	Removal of wasted areas and welding of new steel as per refurbishment plan PHASE 1	27	15	-12
15	Removal of wasted areas and welding of new steel as per refurbishment plan PHASE 2	29	21	-8
16	Removal of wasted areas and welding of new steel as per refurbishment plan PHASE 3	31	22	-9
17	**LAB-HSO-002/003 PRELOAD TANKS**	98	143	45
18	**BOW**	70	86	16
19	**TANK #1**	54	82	28
20	**TANK #2**	58	83	25
21	**TANK #3**	64	86	22
22	**STBD**	71	90	19
23	**TANK #13**	64	86	22
24	**TANK #17**	69	93	24
25	**TANK #12**	72	72	0
26	**TANK #14**	74	63	-11
27	**LAB-HSO-023 Cable Trays & Supports - renewal**	93	85	-8
28	Refurbishment of cable trays and supports - phase 2	32	24	-8
29	Refurbishment of cable trays and supports - phase 3	23	15	-8
30	**Helideck installation**	77	36	-41
31	**MARINE EQUIPMENT & SYSTEMS**	123	129	6
32	LAB-MES-002 Jacking system	14	20	6
33	**LAB-MES-008 Preload System - piping & dump vaves repair/replacement**	98	139	41
34	Preload System - piping & dump vaves repair/replacement - PHASE 1	48	94	46
35	Preload System - piping & dump vaves repair/replacement - PHASE 2	49	40	-9
36	**DRILLING EQUIPMENT & SYSTEMS**	114	151	37
37	**LAB-DES-004 Top Drive - overhaul**	85	72	-13
38	LAB-DES-003 Top Drive Trolley Beams - guide track alignement/replacement	55	44	-11
39	LAB-DES-008 Well Testing Lines - repair / replacement	18	11	-7
40	LAB-DES-013 Mud Pumps - overhaul	60	40	-20
41	**SAFETY EQUIPMENT & SYSTEMS**	124	106	-18
42	LAB-SES-004 Fast Rescue Boat - refurbishment	35	28	-7
43	LAB-SES-003 Installation of new davits and life boat stations 3 & 4	50	35	-15
44	LAB-SES-006/007 Fire Alarm System (AUTRONICA) - upgrade	55	45	-10
45	**LAB-LAG-002 Deck Cranes**	125	65	-60
46	STBD CRANE	41	31	-10
47	AFT CRANE	41	37	-4
48	PORT CRANE	41	37	-4
49	**LAB-EPS-001 MCC - upgrade**	112	100	-12
50	**COMMUNICATIONS & DATA PROCESSING**	86	167	81
51	LAB-CDP-004 TV system - recievers replacment	14	12	-2

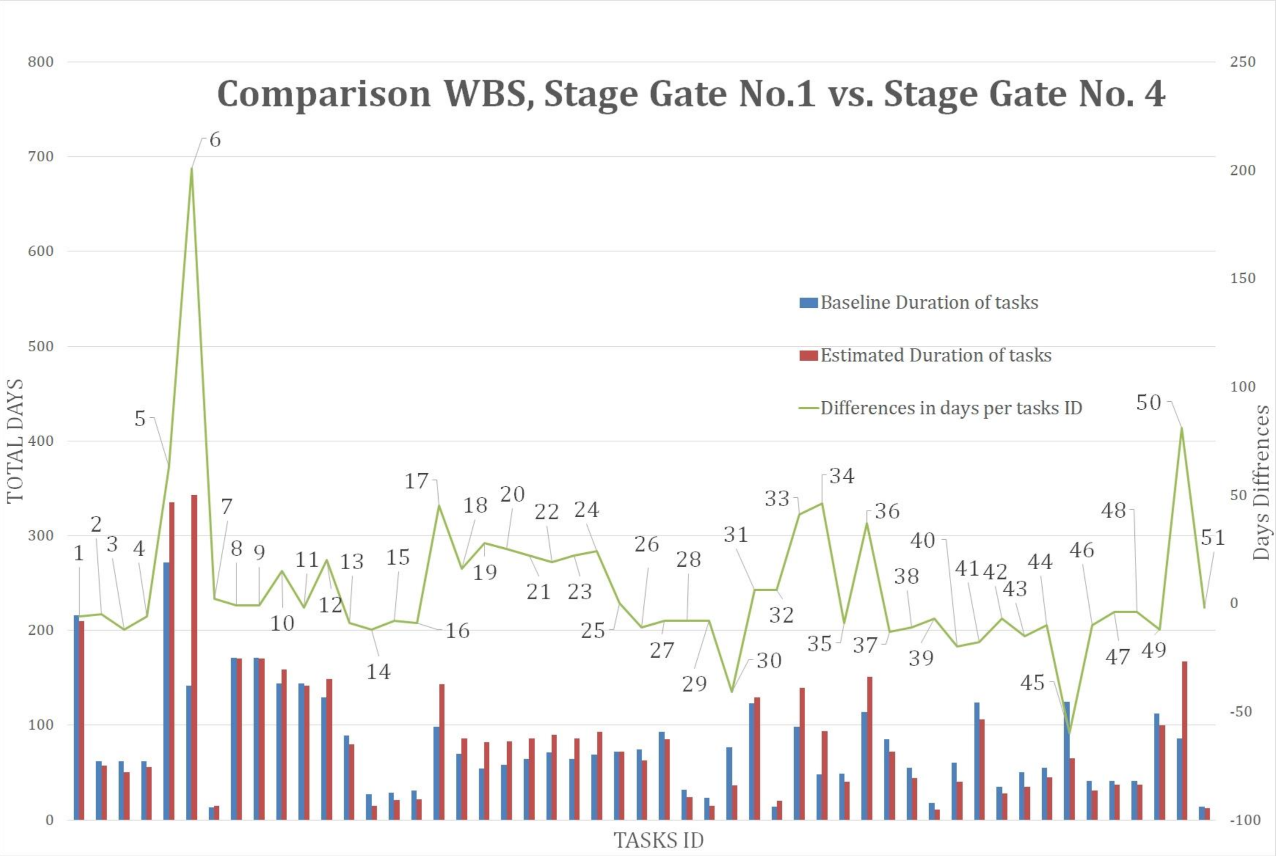


Chart V-10. Major risk deviations Project No.1

Chart V-10 is showing the main deviation from the estimated, planned and actual in days. Only major risk is taken into account. Chart V-10 shows the graph and the amplitudes of the deviations [37]:

- ✓ Baseline duration presents tasks timeline, including all stage gates in RIO process,
- ✓ Estimated durations presents timelines based on initial WBS and schedule,
- ✓ Differences in days presents tasks after the RIO systematic risk process is used.

Therefore, it is obvious that from the initial estimates towards the final durations, applied systematic risk management model approach added significant value. In addition, the development of a new risk in RIO model tool aimed to assist the planners and planning process stakeholders in the evaluation of risk development trends and the future project risk implementation. The risk model tool will allow a more efficient and effective monitoring of the future implementation per the project objectives, while it will enable decision makers to evaluate the early risk mitigation result suggestions for plan revision with concrete criteria, based on solidly documented facts.

The Project No.2 has been applied through the model in a way that it has been analyzed the project from the beginning, definition then after, preparation until its completion. The risk comparisons objective has been taken into consideration. Focus and the approach was only on the risks that where familiar in the project definition phase where we could apply the corrective actions. The Project No.02 is a modernization project of a mobile drilling rig in energy sector. The project is grounded on forty-seven technical specifications with the purpose of upgrade and modernization. Project consist of all relevant engineering disciplines. For the purpose of the risk identification, assessment, mitigation, contingency and analysis exact set of tools and documents are used as in Project No. 1 [23, 37, 42, 50]. All mentioned tools are integrated into the early systematic process called RIO. At the initial phase of the risk identification, it has been identified in total two hundred fifty-two (252) risks [37]. The existing history database is used and compared with the identified total two hundred fifty-two (252) risks. Upon all stage gates iterations and applied mitigation strategies it has been selected only thirty (30) major risks. The final thirty (30) risks uses the form of work breakdown structure (WBS) with addition of scheduling timeline impacts. The final risks are analyzed are process through sets of predefined formulas, using the Microsoft excel as base for the data analysis. Using the RIO model and going through the defined steps leads to the Table V-2 result differences. It has been shown that considerable gaps regarding timelines are detected [37]. Each phase of the project domestic or international requires a unique decision-making process to accommodate unique risk factors [71, 72]. For this reason, authors Tah and Carr highlighted the importance of establishing a systematic risk management process for each decision phase in any construction project [73]. *Full report results can be seen under the X. Results, (Report results - Model results of the Stage Gate I - Project No.2).*

Table V-2. Major risks for the Project No.1

Task ID	Task	Baseline Duration tasks	Estimated Duration tasks	Differences in days per tasks ID
1	Project preparation phase	228	207	-21
2	Wind-wall	60	62	2
3	Triplex pumps	126	86	-40
4	Third party inspections, acceptances	11	18	7
5	**Substructure**	61	55	-6
6	**R/U electrical power supply. (as per electrical power plan)**	167	76	-91
7	Procurement of ZJ40 rig and main aux.equipment	350	241	-109
8	**Procurement of Solids Control Equipments**	160	118	-42
9	**Procurement of BOP control unit**	276	193	-83
10	**Procurement of BHA elements**	226	226	0
11	**Outdoor high voltage and lighting system execution works**	165	154	-11
12	**Nested water tank manufacturing**	140	98	-42
13	**MCC container manufacturing**	144	111	-33
14	Mast and substructure finalizing jobs	120	85	-35
15	Manufacturing of mudtank system	197	132	-65
16	Low Pressure mud system	18	35	17
17	**Instrumentation system**	95	72	-23
18	**Instrumentation and data system**	130	121	-9
19	**Install the HP lines & H.mannifold.**	13	13	0
20	**Hydraulic system modification**	125	50	-75
21	**High Pressure mud system manufacturing**	197	209	12
22	**Fuel tank system manufacturing**	258	117	-141
23	**Foldable mobile hause manufacturing**	114	103	-11
24	**Finalize Social & office containers.**	81	74	-7
25	**Diesel supply system**	114	60	-54
26	**Caravan manufacturing**	183	123	-60
27	**BOP transport and testing skid**	32	34	2
28	Air supply unit manufacturing	140	113	-27
29	Works prior to mast erection	13	15	2
30	**Mast erection partial jobs**	20	22	2

Chart V-11 show the graph and the amplitudes of the deviations with the exact same references as per the given breakdowns in Chart V-10.

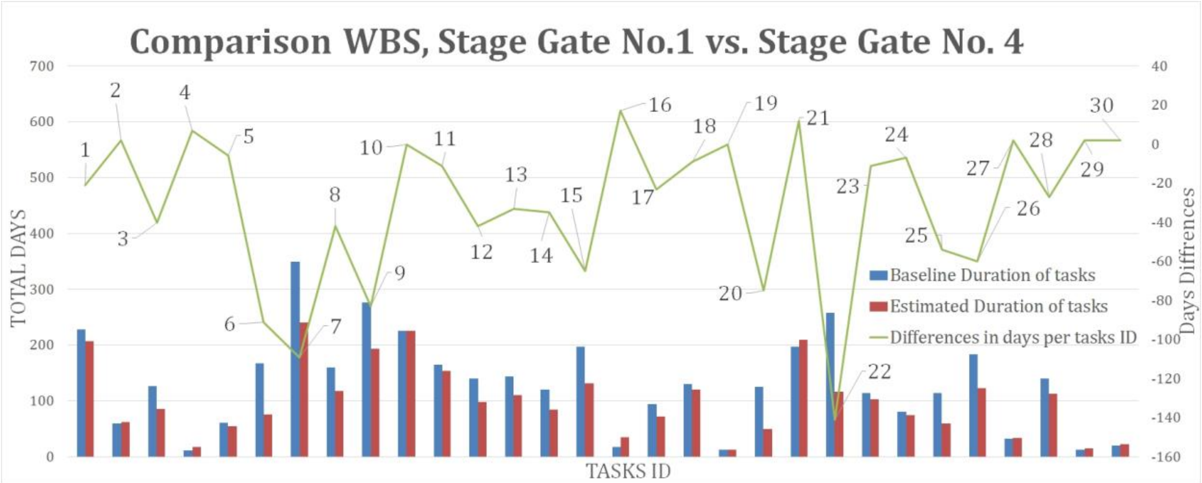


Chart V-11. Major risk deviations Project No.2

Absence of accuracy leads to the wrong findings. The presented RIO model process eliminates the possibility of faults. The sensitivity of the model process and the finals selected risk findings are shown in *Chart V-10 through the Chart V-13*. *Chart V-10 and Chart V-12* are showing the scales of the deviations for Project No. 1 and Project No. 2. *Charts V-11 and Chart V-13* are associated with Table No. 1 & Table No. 2 - Major risks for Project No. 1 & 2. *Chart V-10 and Chart V-12* evidently shows the desirable and undesirable deviations with direct effect on the timeline durations of the project. Based on the results, it is evidently that methodology of early risk identification including all possible risk management tools through the RIO model has a remarkable improvement effects.

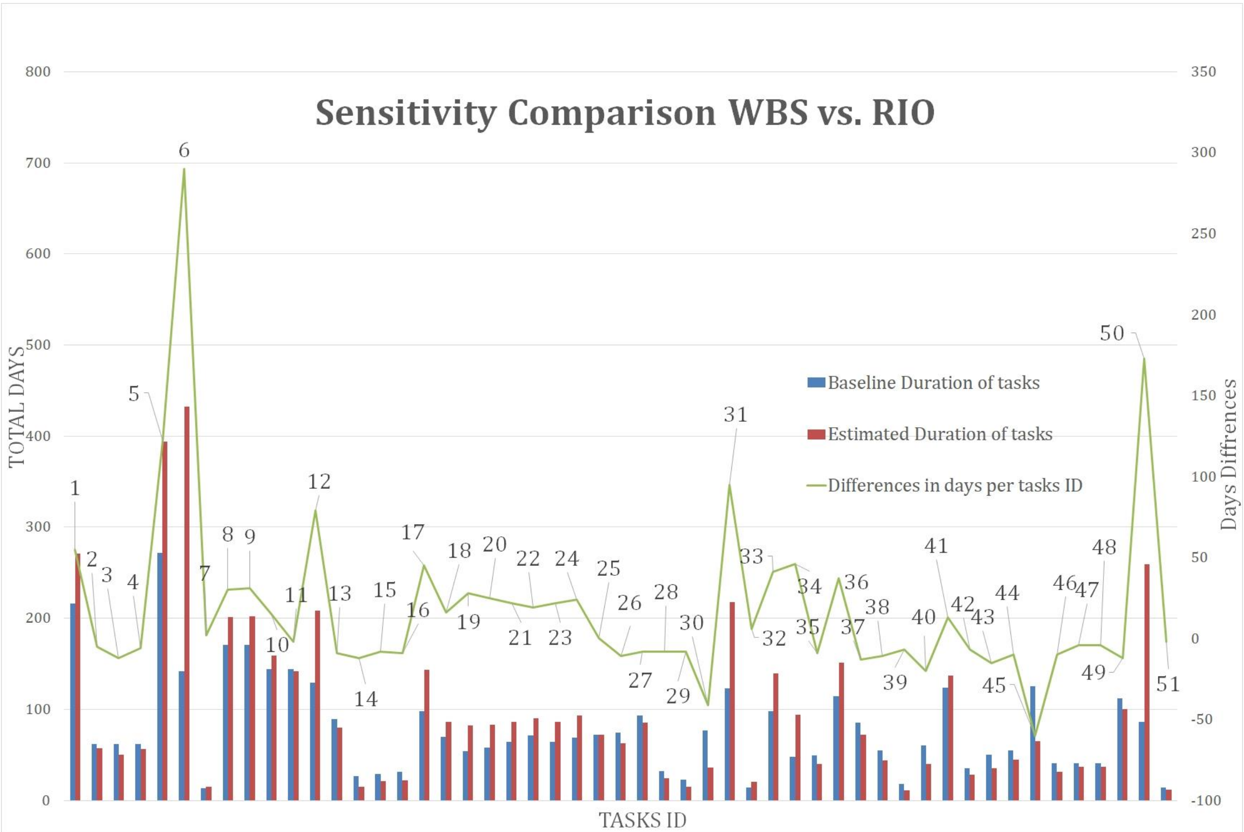


Chart V-12. Sensitivity of major risk deviations Project No. 1

Regarding the mentioned sensitivity and its applicability through the RIO systematic risk management model*, Charts V-11 and Chart V-13* are showing the sensitivity amplitudes. Through the RIO model few of the predefined steps in flow decision tree is skipped and ignored. Both of the graphs are showing major deviations within a negative outcome to the given project objectives [74]. That is on more evidence that RIO model with the early systematic risk treatments can bridge possible gaps or faults by predefined flow tree steps. Therefore, if the risk assessment and treatments is taken in an inconsequential way, and not using all defined steps it is not possible to treat the risk through the RIO model process [15, 37]. This suggests that necessity for early risk systematic model is evident [93].

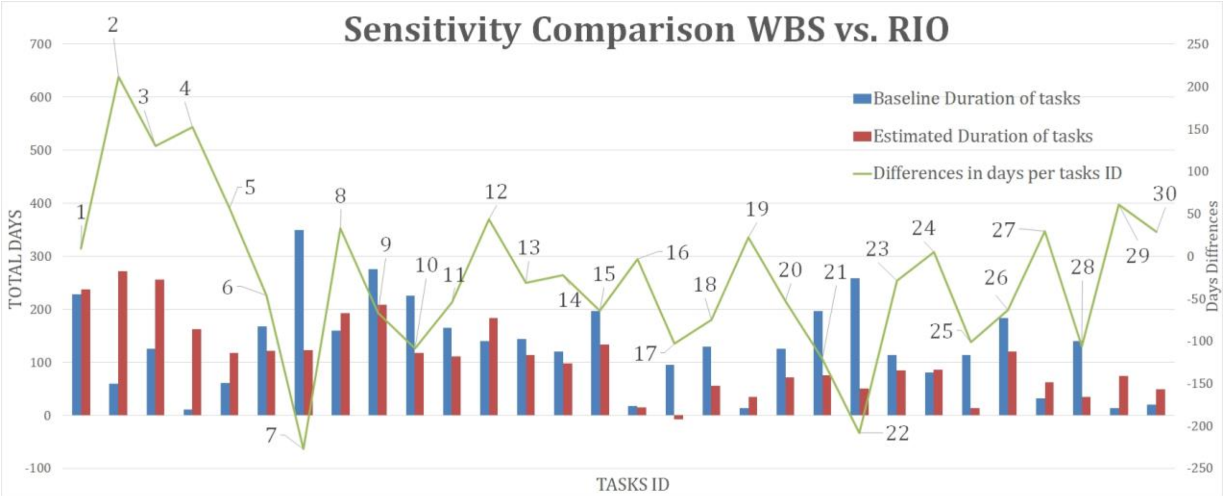


Chart V-13. Sensitivity of major risk deviations Project No. 2

Therefore, the presented charts have the following results. With the systematic approach in the early initiation phase of the project and their applied mitigation criteria's it will be shown the following:

1. *Number of total risks for each project before and after risk mitigation process (known and unknowns) where significant reduction has been done after the first mitigation action. Percentage reduction in per all risk categories (known and unknowns):*

Table V-3. Known risk reduction Stage Gate 1 vs. 3, Project No.1

CATEGORY	FAMS	KNOWN	KNOWN After SC	Total	After SC	Mitigation %
PO - Owner of the project	PO	14	14	184	116	-37,0%
GM - General / Management	GM	9	9	120	72	-40,0%
TM - Technology / Methods	TM	2	2	30	16	-46,7%
MO - Monetary	MO	4	4	46	24	-47,8%
EN - Engineering	EN	9	9	118	70	-40,7%
PV - Procurement - Vendors	PV	9	9	100	62	-38,0%
OP - Operational	OP	7	7	80	34	-57,5%
EX - Execution	EX	5	5	54	32	-40,7%
HR - Human Recourse	HR	1	1	10	6	-40,0%
LE - Legal	LE	2	2	28	20	-28,6%
PC - Project Controls	PC	2	2	26	12	-53,8%
BD - Business Development	BD	1	1	12	10	-16,7%
	Total	65	65			

Constants		
1 =	2 =	12,5%
2 =	4 =	25,0%
3 =	6 =	37,5%
4 =	8 =	50,0%
5 =	10 =	62,5%
6 =	12 =	75,0%
7 =	14 =	87,5%
8 =	16 =	100,0%

<u>A brief explanation of the Table V-3 and Chart V-14:</u> Table is showing the significant reduction from the initial established number of (65) knowns, which includes the known history from the main data base. First run of the mitigation reduced known risk per the functional areas pressed in percentages. Thus, the applied mitigation results per the below chart, where the dark blue line shows the initial knowns including the history, and the light blue line below it shows the numbers after mitigation is applied. Annotation (1): Explanation of the FAMs is given per the category and the ratio/value of the High – High = 16, High = 14, High-Medium = 12, Medium – Medium = 10, Medium = 8, Medium – Low = 6, Low = 4, Low – Low = 2.

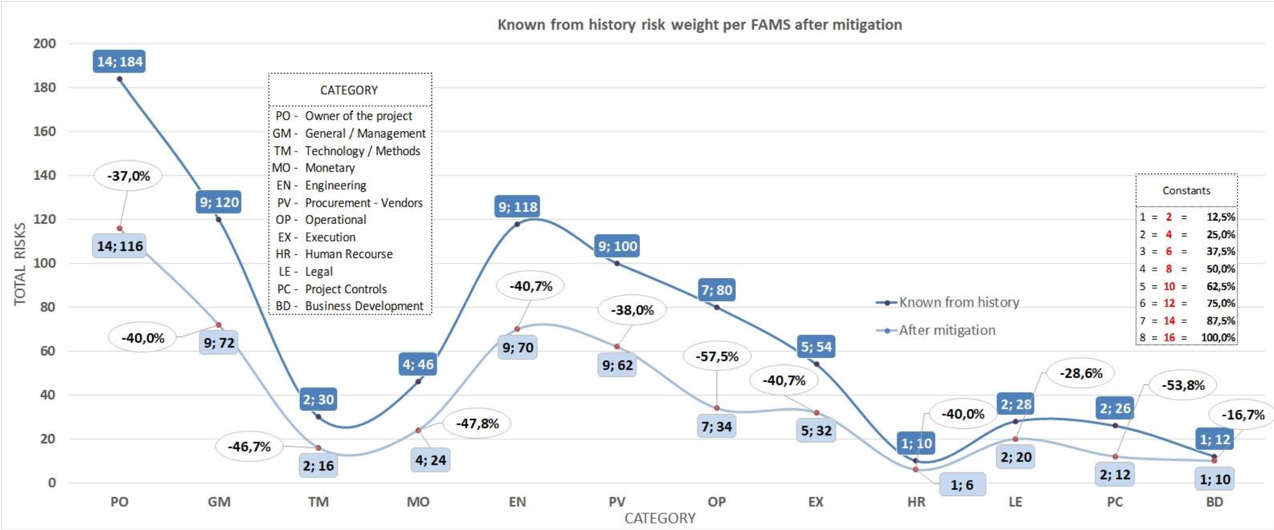


Chart V-14. Major risk graph reduction (knowns) Project No.1

Table V-4. Unknown risk reduction Stage Gate 1 v. 3, Project No.1

CATEGORY
PO - Owner of the project
GM - General / Management
TM - Technology / Methods
MO - Monetary
EN - Engineering
PV - Procurement - Vendors
OP - Operational
EX - Execution
HR - Human Recourse
LE - Legal
PC - Project Controls
BD - Business Development

FAMS	UNKNOWN	UNKNOWN After SC	Total	After SC	Mitigation %
PO	10	10	136	108	-20,6%
GM	5	5	52	38	-26,9%
TM	0	0	0	0	0,0%
MO	4	4	48	34	-29,2%
EN	10	10	132	106	-19,7%
PV	8	8	102	78	-23,5%
OP	15	15	196	138	-29,6%
EX	9	9	102	62	-39,2%
HR	1	1	14	10	-28,6%
LE	1	1	14	10	-28,6%
PC	1	1	10	8	-20,0%
BD	2	2	32	22	-31,3%
Total	66	66			

Constants	
1 = 2 =	12,5%
2 = 4 =	25,0%
3 = 6 =	37,5%
4 = 8 =	50,0%
5 = 10 =	62,5%
6 = 12 =	75,0%
7 = 14 =	87,5%
8 = 16 =	100,0%

<u>A brief explanation of the Table V-4 and Chart V-15:</u> Table is showing the significant reduction from the initial established number of (66) unknowns, which includes the unknown history from the main data base. First run of the mitigation reduced unknown risk per the functional areas pressed in percentages. Thus, applied mitigation result per the below chart, where the dark red line shows the initial unknowns including the history, and the light red line below it shows the numbers after mitigation is applied. Annotation (1).

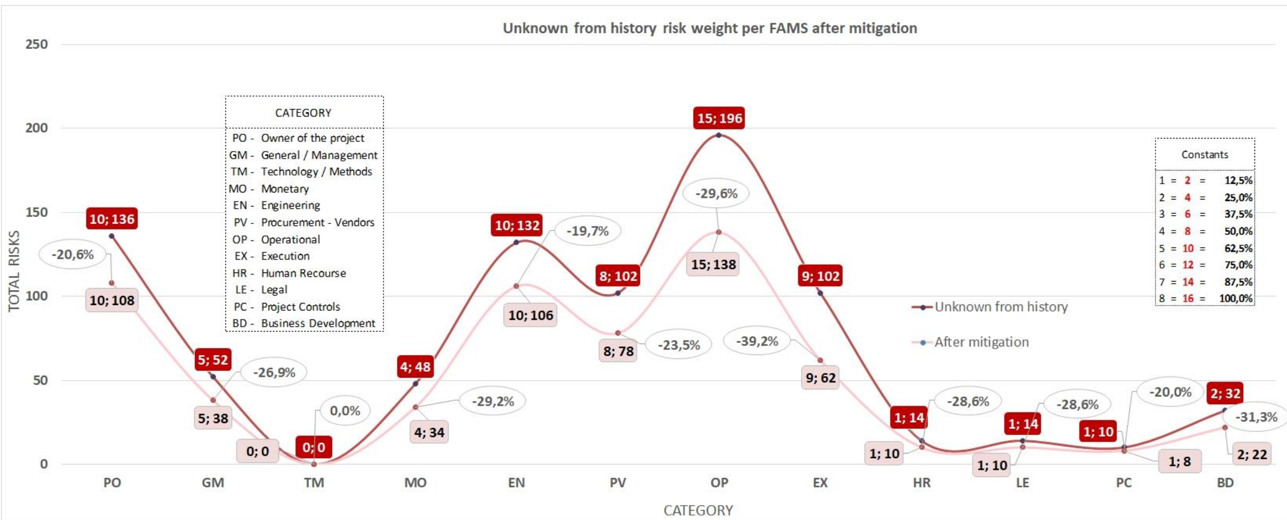


Chart V-15. Major risk graph reduction (unknowns) Project No.1

Table V-5. Known risk reduction Stage Gate 1 v. 3, Project No.2

CATEGORY	
PO -	Owner of the project
GM -	General / Management
TM -	Technology / Methods
MO -	Monetary
EN -	Engineering
PV -	Procurement - Vendors
OP -	Operational
EX -	Execution
HR -	Human Recourse
LE -	Legal
PC -	Project Controls
BD -	Business Development

FAMS	KNOWN	KNOWN After SC	Total	After SC	Mitigation %
PO	13	13	174	174	0,0%
GM	9	9	120	120	0,0%
TM	2	2	30	30	0,0%
MO	4	4	46	46	0,0%
EN	9	9	118	118	0,0%
PV	9	9	100	100	0,0%
OP	7	7	80	70	-12,5%
EX	5	5	54	20	-63,0%
HR	1	1	10	10	0,0%
LE	2	2	28	28	0,0%
PC	2	2	26	20	-23,1%
BD	1	1	12	12	0,0%
Total	64	64			

Constants				
1	=	2	=	12,5%
2	=	4	=	25,0%
3	=	6	=	37,5%
4	=	8	=	50,0%
5	=	10	=	62,5%
6	=	12	=	75,0%
7	=	14	=	87,5%
8	=	16	=	100,0%

<u>A brief explanation of the Table V-5 and Chart V-16:</u> Table is showing the significant reduction from the initial established number of (64) knowns, which includes the known history from the main data base. First run of the mitigation reduced known risk per the functional areas pressed in percentages. Thus, applied mitigation result per the below chart, where the dark blue line shows the initial knowns including the history, and the light blue line below it shows the numbers after mitigation is applied. Annotation (1). Full report results can be seen under the X. Results, (Report results - Model results of the Stage Gate II - Project No.1 & Model results of the Stage Gate III - Project No.1).

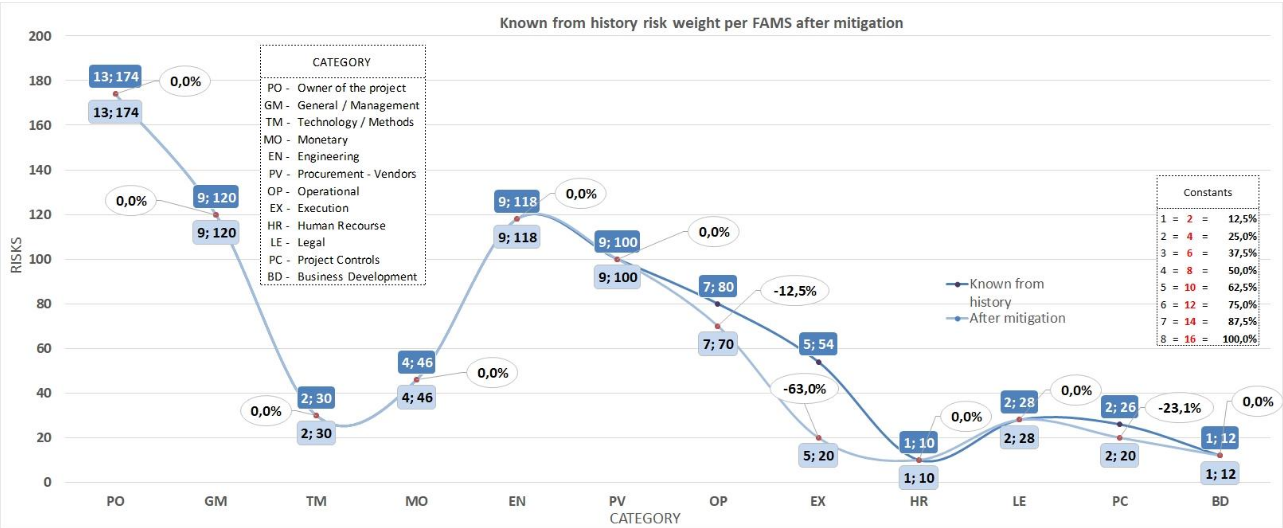


Chart V-16. Major risk graph reduction (knowns) Project No.2

Table V-6. Unknown risk reduction Stage Gate 1 v. 3, Project No.2

CATEGORY	
PO -	Owner of the project
GM -	General / Management
TM -	Technology / Methods
MO -	Monetary
EN -	Engineering
PV -	Procurement - Vendors
OP -	Operational
EX -	Execution
HR -	Human Recourse
LE -	Legal
PC -	Project Controls
BD -	Business Development

FAMS	UNKNOWN	UNKNOWN After SC	Total	After SC	Mitigation %
PO	9	9	122	122	0,0%
GM	5	5	52	52	0,0%
TM	0	0	0	0	0,0%
MO	4	4	48	48	0,0%
EN	10	10	132	132	0,0%
PV	8	8	102	102	0,0%
OP	15	15	196	196	0,0%
EX	9	0	102	0	-100,0%
HR	1	1	14	14	0,0%
LE	1	1	14	14	0,0%
PC	1	1	10	10	0,0%
BD	2	2	32	32	0,0%
Total	65	56			

Constants				
1	=	2	=	12,5%
2	=	4	=	25,0%
3	=	6	=	37,5%
4	=	8	=	50,0%
5	=	10	=	62,5%
6	=	12	=	75,0%
7	=	14	=	87,5%
8	=	16	=	100,0%

<u>A brief explanation of the Table V-6 and Chart V-17:</u> Table is showing the significant reduction from the initial established number of (65) unknowns, which includes the unknown history from the main data base. First run of the mitigation reduced known risk per the functional areas pressed in percentages. Thus, applied mitigation result per the below chart, where the dark red line shows the initial unknowns including the history, and the light red line below it shows the numbers after mitigation is applied. Annotation (1). Full report results can be seen under the X. Results, (Report results - Model results of the Stage Gate II - Project No.2 & Model results of the Stage Gate III - Project No.2).

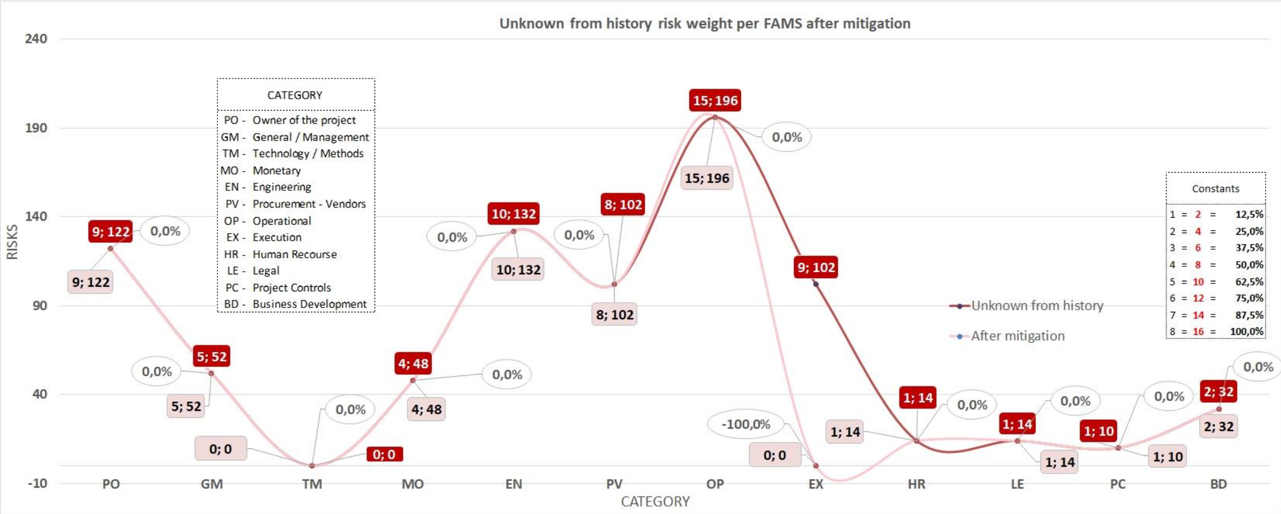


Chart V-17. Major risk graph reduction (unknowns) Project No.2

2. *<u>Number of the identified high-high</u> (known and unknowns) risk as an alert to the future project implementation. Full report results can be seen under the X. Results, (Report results - Model results of the Stage Gate IV - Project No.1 & Model results of the Stage Gate V - Project No.1) and (Report results - Model results of the Stage Gate IV - Project No.2 & Model results of the Stage Gate V - Project No.2).*

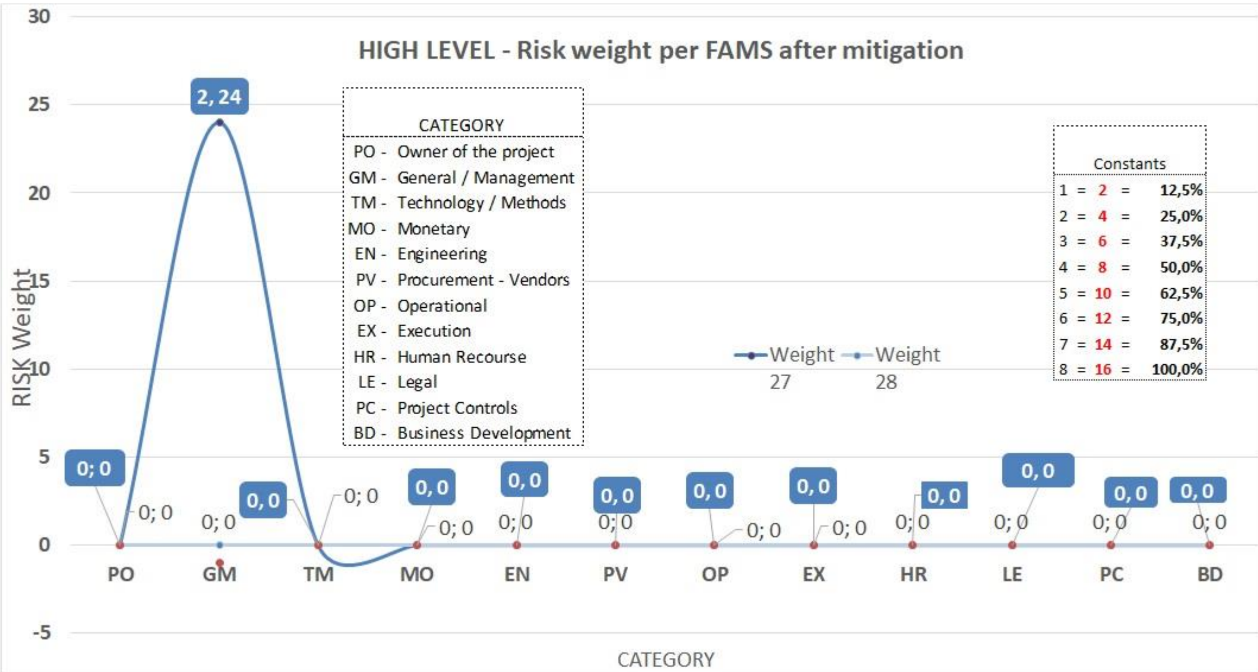


Chart V-18. High-High (knowns) risk reduction Stage Gate 1 v. 5, Project No.1

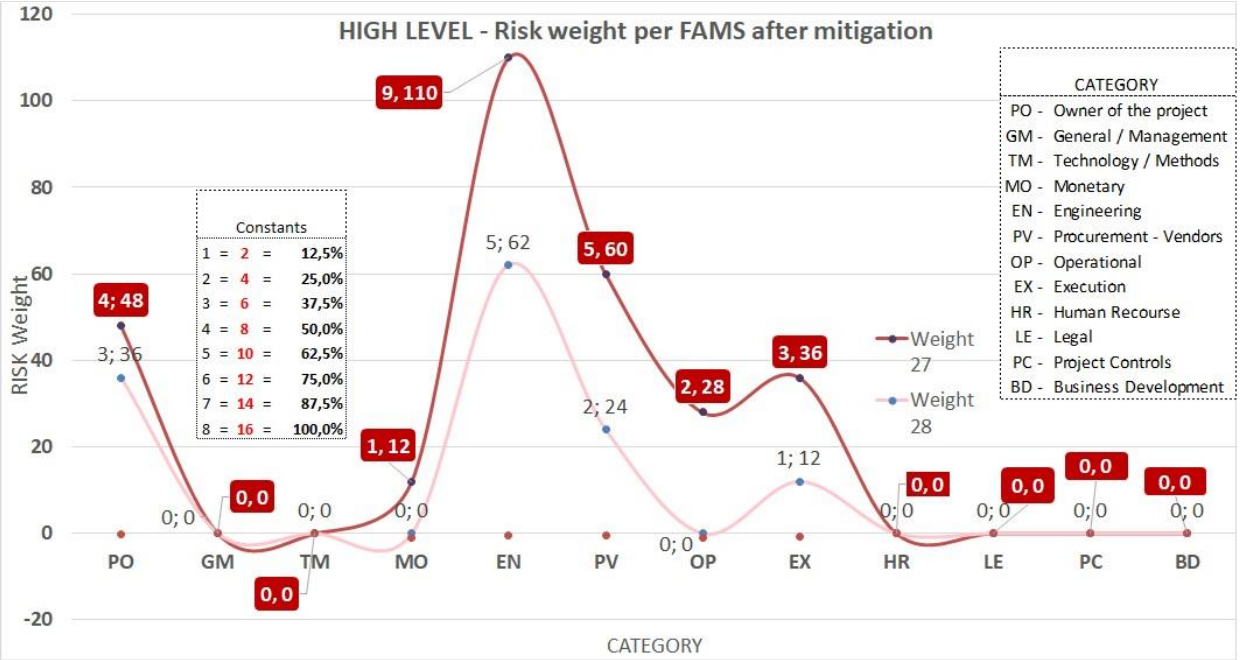


Chart V-19. High-High (unknowns) risk reduction Stage Gate 1 v. 5, Project No.1

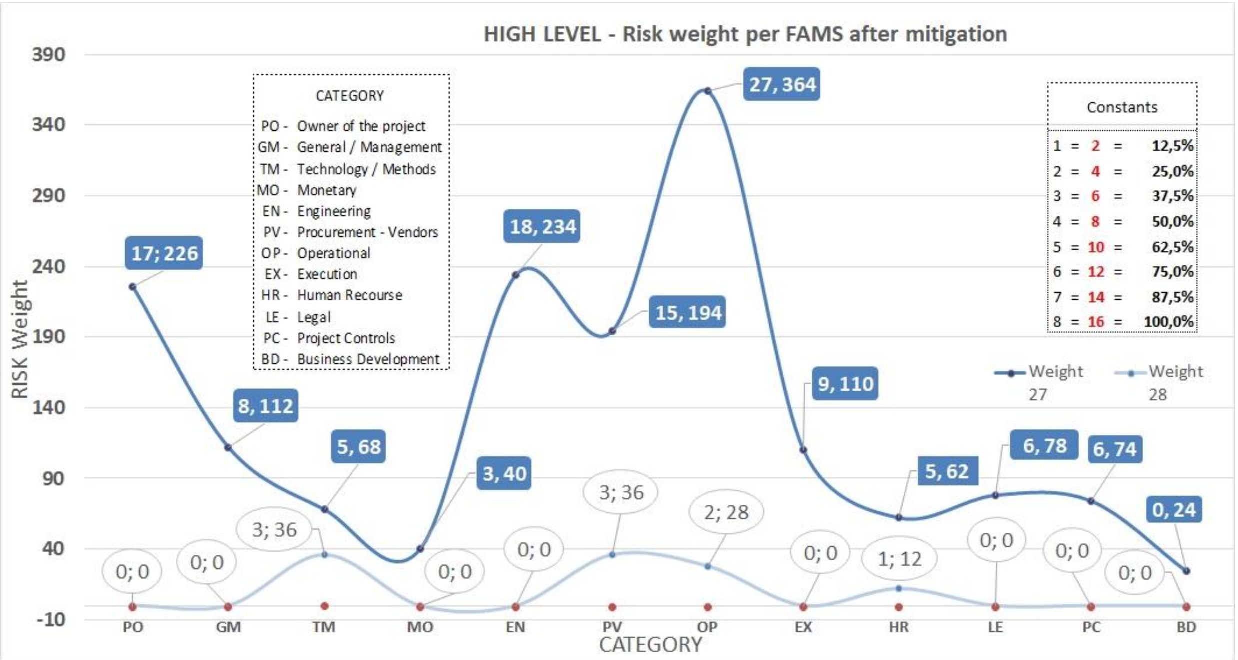


Chart V-20. High-High (knowns) risk reduction Stage Gate 1 v. 5, Project No.2

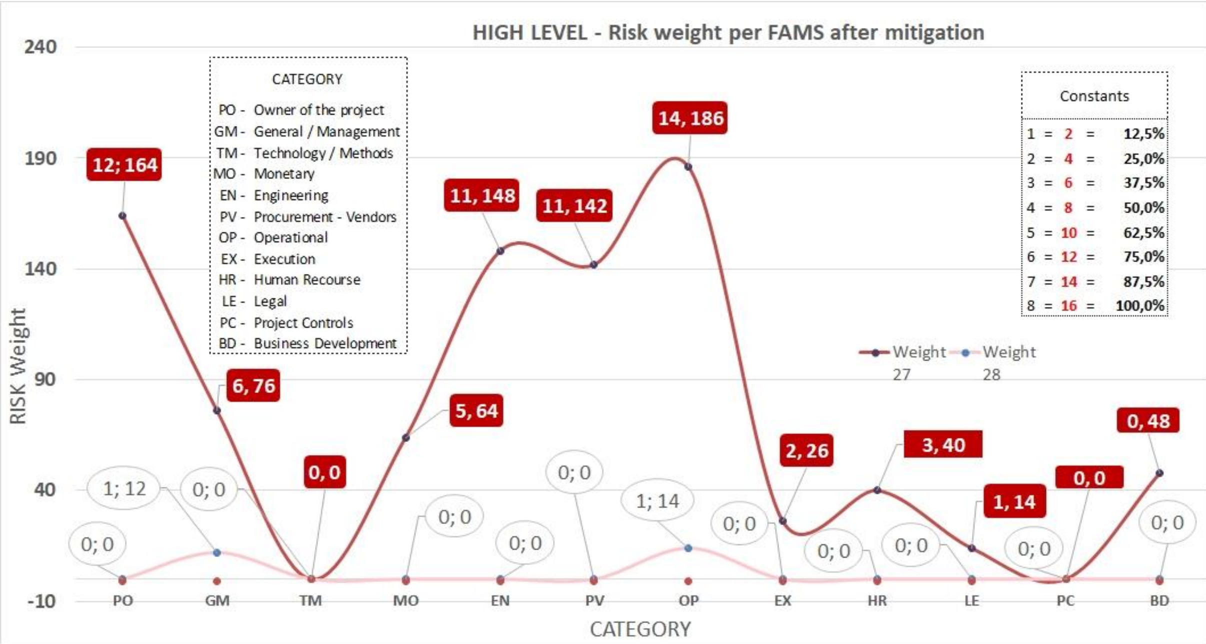


Chart V-21. High-High (unknowns) risk reduction Stage Gate 1 v. 5, Project No.2

3. *Schedule chart reduction with the comparison of the planned, actual and realized. Full report results can be seen under the X. Results, (Report results - Model results of the Stage Gate VI - Project No.1).*

Starting Year	2013	Actual Year	2015	Chart Start Year	2013	Chart End Year	2015
Starting Month	6	Actual Month	3	Chart Start Month	1	Chart End Month	12

Actual delay in days from plann	12	Forecasted delay in days	14

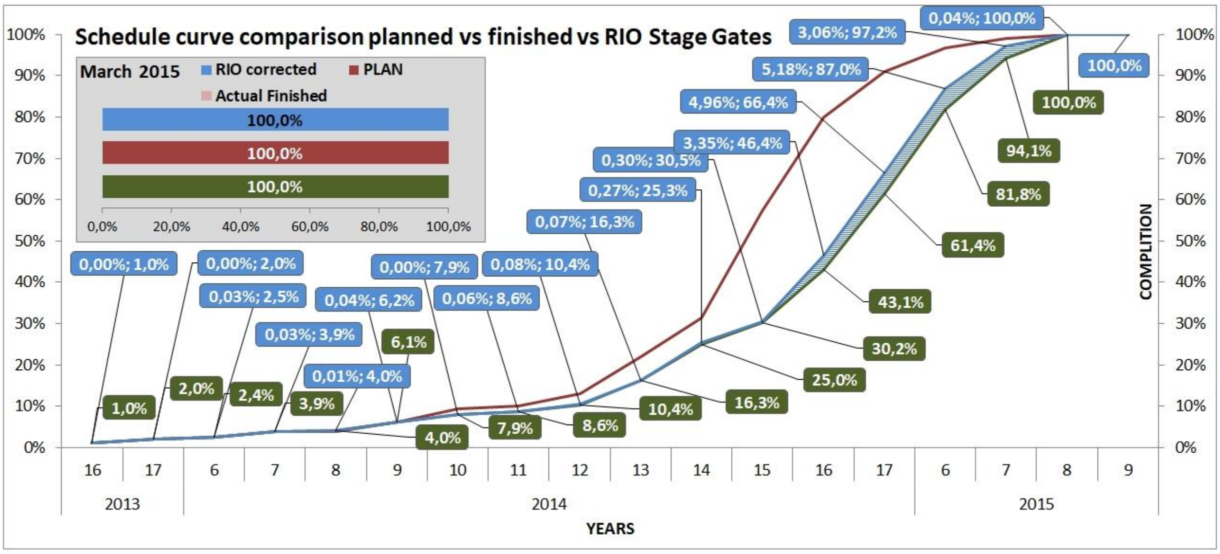
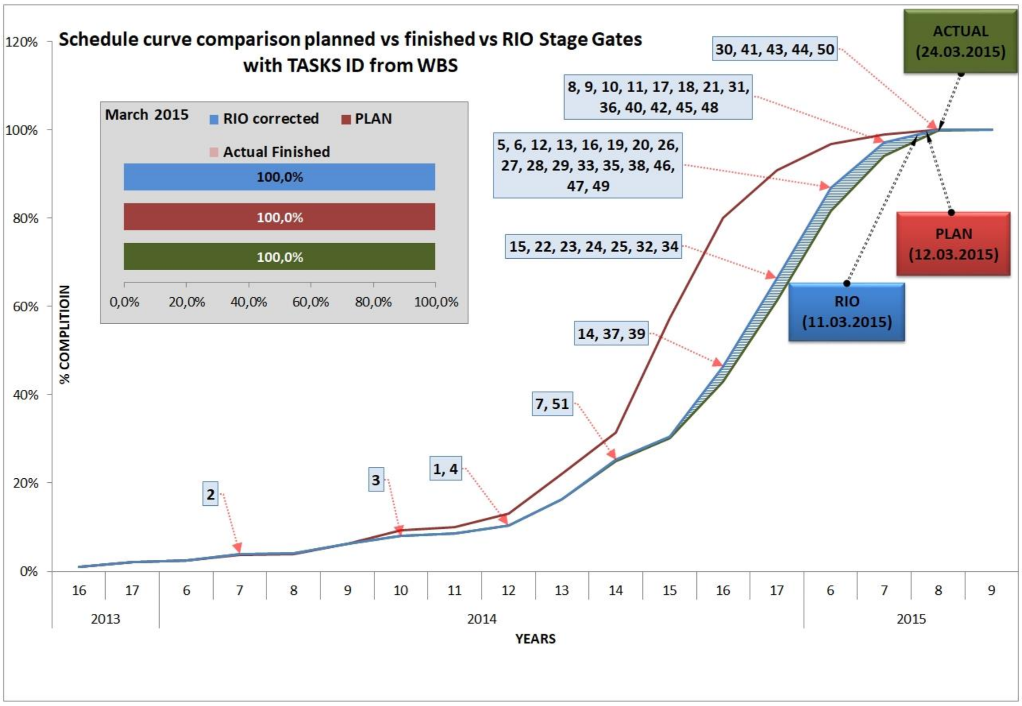


Chart V-22. Schedule comparisons planned, actual, RIO realized Project No.1

A brief explanation of the Charts V-23 and V-24: Charts are showing schedule data comparison where we have the planned curve in red, the actual curve with green and the blue curve with the applied RIO model process. Therefore, it has been shown that planning was unrealistic, that realization was below the plan and that realistic projection of the project is based on the mitigated and applied risk model factors. Based on the initial established number of (51) main risks which includes all risks unknown and known, from the main data base the mitigation factors have reduced the planned project by the (23) twenty-three days. Not only that project has completed before the planned finish date, the activities on the project curve projection had the better distribution of the activities during the project execution.



WBS LINKS TO SCHEDULE TASKS	
1	35
2	36
3	37
4	38
5	39
6	40
7	41
8	42
9	43
10	44
11	45
12	46
13	47
14	48
15	49
16	50
17	51
18	
19	
20	
21	
22	
23	
24	
25	
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30	
31	
32	
33	
34	

Chart V-23. Main risk comparisons planned, actual, RIO realized Project No.1

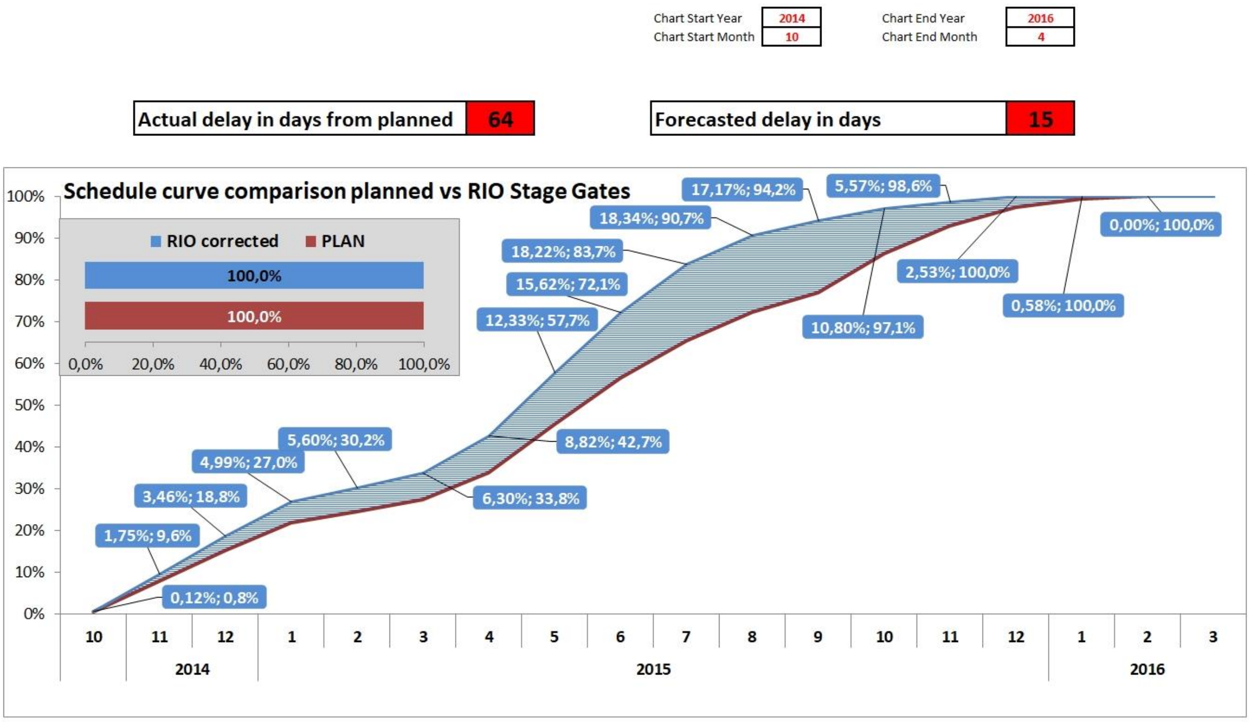
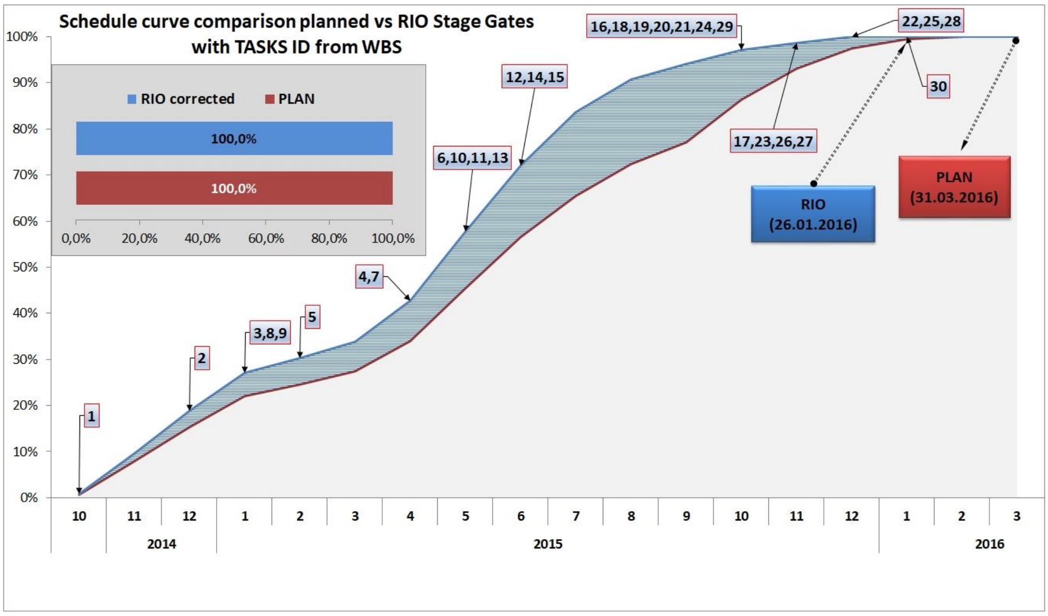


Chart V-24. Schedule comparisons planned, actual, realized Project No.2

__A brief explanation of the Charts V-22 and V-23:__ Charts are showing schedule data comparison where we have the planned curve in red and the blue curve with the applied RIO model process. Therefore, it has been shown that planning was optimistic, that realization was below the plan and that realistic projection of the project is based on the mitigated and applied risk model factors. Based on the initial established number of (30) main risks which includes all risks unknown and known, from the main data base the mitigation factors have reduced the planned project by the (31) thirty-one days. Not only that project has completed before the planned finish date, the activities on the project curve projection had the better distribution of the activities during the project execution. Full report results can be seen under the X. Results, (Report results - Model results of the Stage Gate VI - Project No.2).



WBS LINKS TO TASKS SCHEDULE	
1	16
2	17
3	18
4	19
5	20
6	21
7	22
8	23
9	24
10	25
11	26
12	27
13	28
14	29
15	30

Chart V-25. Main risk comparisons planned, actual, RIO realized Project No.2

4. *<u>Cost reduction</u>. In a nutshell how, much was the initial estimation of the contingency before and after the applied risk mitigation process. Full report results can be seen under the X. Results, (Report results - Model results of the Stage Gate V - Project No.1 & Report results - Model results of the Stage Gate V - Project No.2).*

Table V-7. Unknown and known cost reduction Stage Gate 1 v. 5, Project No.1

CATEGORY
- PO - Owner of the project
- GM - General / Management
- TM - Technology / Methods
- MO - Monetary
- EN - Engineering
- PV - Procurement - Vendors
- OP - Operational
- EX - Execution
- HR - Human Recourse
- LE - Legal
- PC - Project Controls
- BD - Business Development

FAMS	KNOWN COSTS 26	UNKNOWN COSTS 26	KNOWN COSTS 29	UNKNOWN COSTS 29	KNOWN Mitigation %	UNKNOWN Mitigation %
PO	313.956,3	1.958.500,0	271.287,5	1.783.300,0	-13,6%	-8,9%
GM	66.125,0	37.250,0	52.687,5	30.125,0	-20,3%	-19,1%
TM	51.250,0	30.000,0	37.187,5	20.000,0	-27,4%	-33,3%
MO	5.875,0	61.875,0	5.187,5	37.875,0	-11,7%	-38,8%
EN	41.400,0	673.625,0	36.275,0	647.375,0	-12,4%	-3,9%
PV	35.687,5	181.875,0	32.562,5	128.375,0	-8,8%	-29,4%
OP	772.125,0	203.125,0	710.625,0	151.750,0	-8,0%	-25,3%
EX	77.937,5	298.625,0	75.812,5	242.750,0	-2,7%	-18,7%
HR	9.625,0	22.375,0	8.437,5	13.000,0	-12,3%	-41,9%
LE	26.250,0	266.875,0	15.000,0	259.000,0	-42,9%	-3,0%
PC	9.187,5	25.000,0	9.187,5	25.000,0	0,0%	0,0%
BD	8.050,0	698.750,0	6.212,5	373.000,0	-22,8%	-46,6%
Total	1.417.468,8	4.457.875,0	1.260.462,5	3.711.550,0	-11,1%	-16,7%

<u>A brief explanation of the Table V-7 and Charts V-26 and V-27:</u> Table is showing the substantial reduction from the initial established cost which includes the all identified risk. Since dissertation will not focus on the financial aspect writer took a liberty to show the total reduced cost based on RIO model mitigation. The chart below is showing separated percentage reduction for the knowns and unknown with the category on the X axes the risk discipline category where on the Y axes shows the cost in local current. This has been applied for the both charts. Annotation (1).

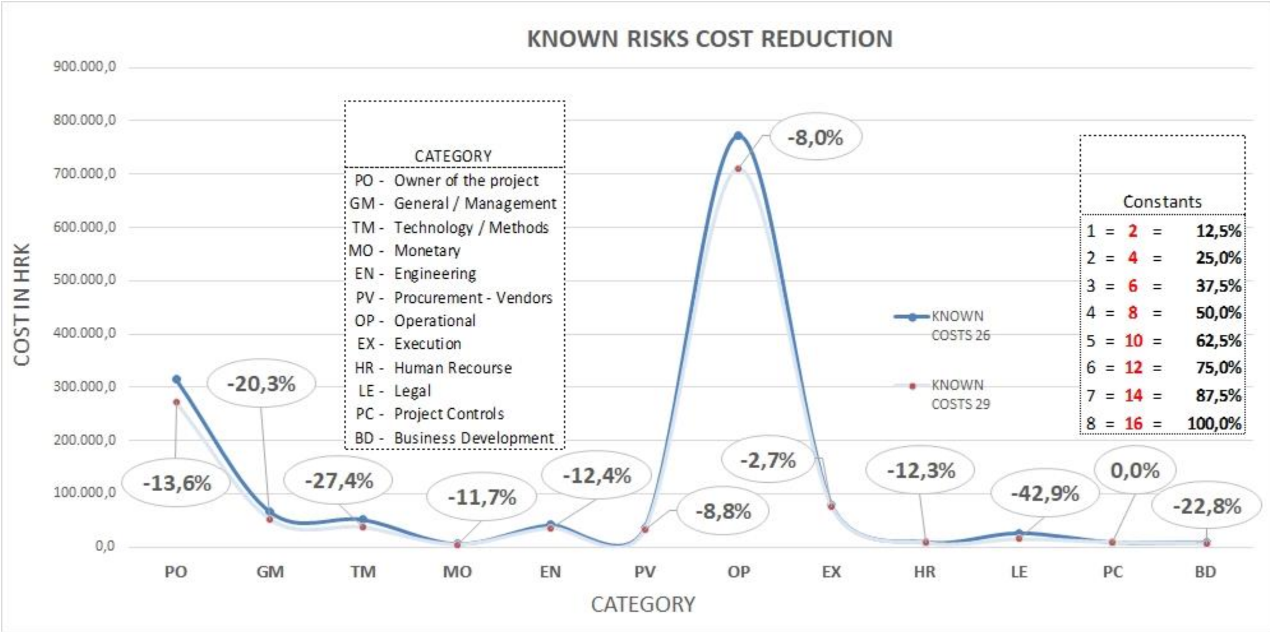


Chart V-26. Cost reduction knowns Project No.1

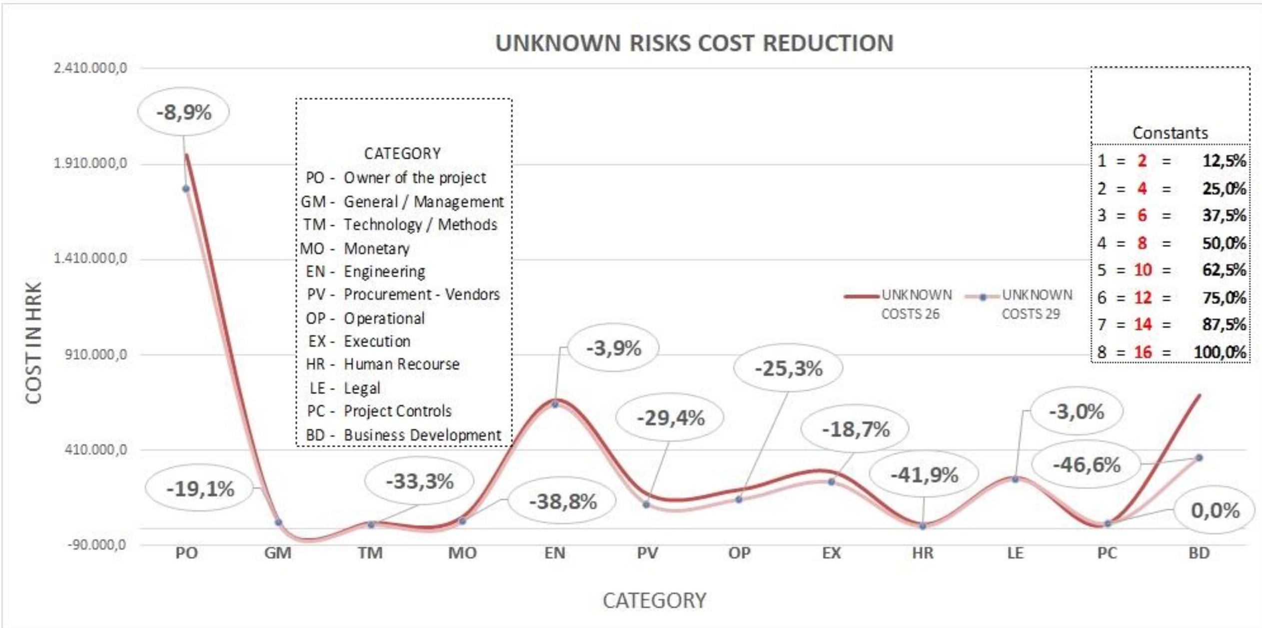


Chart V-27. Cost reduction unknowns Project No.1

Table V-8. Unknown and known cost reduction Stage Gate 1 v. 5, Project No.2

CATEGORY	FAMS	KNOWN COSTS 26	UNKNOWN COSTS 26	KNOWN COSTS 29	UNKNOWN COSTS 29	KNOWN Mitigation %	UNKNOWN Mitigation %
PO - Owner of the project	PO	216.606,3	1.743.375,0	75.581,3	715.400,0	-65,1%	-59,0%
GM - General / Management	GM	78.062,5	61.750,0	35.125,0	38.625,0	-55,0%	-37,4%
TM - Technology / Methods	TM	90.625,0	0,0	57.187,5	0,0	-36,9%	0,0%
MO - Monetary	MO	16.000,0	157.750,0	6.437,5	71.000,0	-59,8%	-55,0%
EN - Engineering	EN	67.075,0	797.875,0	39.737,5	359.250,0	-40,8%	-55,0%
PV - Procurement - Vendors	PV	57.687,5	120.250,0	41.687,5	72.750,0	-27,7%	-39,5%
OP - Operational	OP	432.350,0	221.250,0	281.737,5	150.875,0	-34,8%	-31,8%
EX - Execution	EX	108.562,5	137.500,0	72.812,5	80.000,0	-32,9%	-41,8%
HR - Human Recourse	HR	18.000,0	210.000,0	9.437,5	68.750,0	-47,6%	-67,3%
LE - Legal	LE	40.625,0	78.750,0	24.500,0	40.000,0	-39,7%	-49,2%
PC - Project Controls	PC	19.000,0	31.250,0	7.250,0	31.250,0	-61,8%	0,0%
BD - Business Development	BD	10.500,0	97.750,0	9.187,5	62.500,0	-12,5%	-36,1%
	Total	1.155.093,8	3.657.500,0	660.681,3	1.690.400,0	-42,8%	-53,8%

<u>A brief explanation of the table V-8 and Charts V-28 and V-29:</u> Table is showing the substantial reduction from the initial established cost which includes the all identified risk. Since dissertation will not focus on the financial aspect writer took a liberty to show the total reduced cost based on RIO model mitigation. The chart below is showing separated percentage reduction for the knowns and unknown with the category on the X axes the risk discipline category where on the Y axes shows the cost in local current. This has been applied for the both charts. Annotation (1).

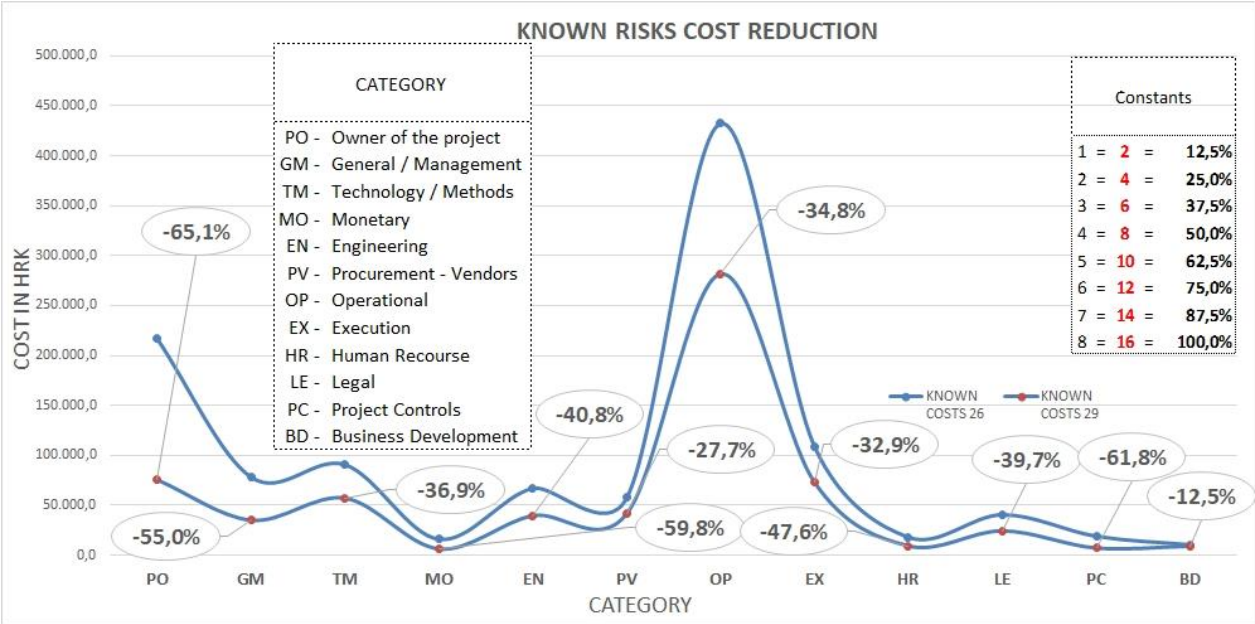


Chart V-28. Cost reduction knowns Project No.2

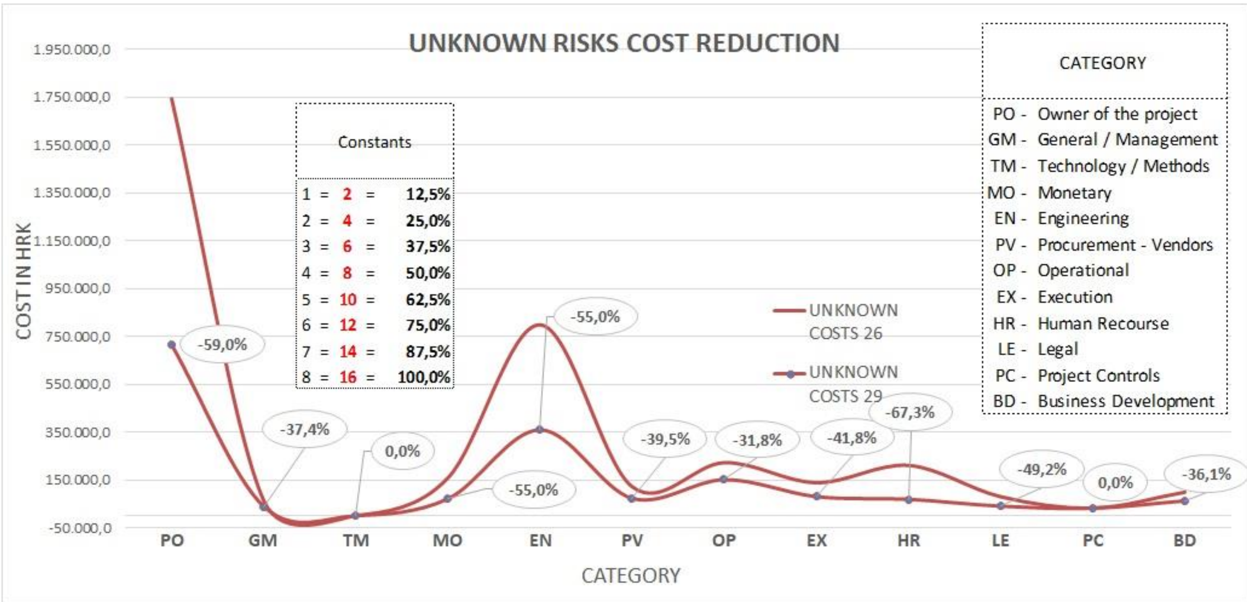


Chart V-29. Cost reduction unknowns Project No.2

VII. Conclusions and directions for further research

10. Conclusions of considerations

The main idea in the dissertation is to deliver an early systematic risk model, based on methodology of systematic stage gate approach, using best available tools, knowledge of the stakeholders. The narrow guideline has been given in engineering industry field by best engineering practices with aim to improve the outcome of risk mitigation results and disable any possible gap. The RIO model methodology will have ability to bring together improvements in risk analysis by detecting the faults and gaps through entire systematic risk assessment [41, 92]. The expected improvements reflect on early risk management awareness with focus on more detailed approach in early phase of the project. The corrective measures have been given through the leaner systematic risk identification and categorization. It has been shown that data model is integrated through the web application, using the final result possibility integration into MS excel and MS project schedule, with the main purpose to mitigate the timing (POP) and the possible cost budget contingency.

The next research effort is given in direction of methodical web-based application that can be used and accessed by companies through servers. In this way if there is a need for the further improvement of the web application, such an approach can be further developed. The dissertation represents, development of the systematic risk model with the references, collaboration quantitative tools system and the impact of the mentioned systematic system in resolving gaps and faults related to organizational performance that is based on the models of risk management system success. The dissertation clearly outlines industry needs regarding the risk project management companies to successfully measure the effects of risk treats in any engineering technologies in order to increase awareness, strategic project preparation/execution advantage and to gain or maintain the level of the risk stakeholder's involvement.

In addition, new effective improvements of the collaboration system are influenced by the quality of the system model, the friendly use, stakeholder's involvement and resulted with greater benefits. From a practical point of view, this dissertation proposes a new model of an early systematic risk process. The presented structure helps businesses to examine in the early project definition stage how effective awareness and risk perceptions is necessary to improve future project preparation and execution. The RIO model practice methodology of data history collection which reduce repetition of risk cases and improve better usage of the risk measures. In the presented model objective parameters definition with combination of subjective stakeholders' attitudes bring one more added value to the final results [25]. Based on the previous results of the research it is obviously that major gaps are mitigated. The success of risk model is based on the indicators from the operational improved results and the general empirically confirmed solutions. The research represents a valid and reliable step towards improving the measurement of the risk mitigation systems. The RIO model obtained, and selected approach used developed and validated tools with ability to be changes or access remotely. In most cases, the success of web information systems is conditioned by several factors that are interconnected. In all likelihood, the same elements of success can be applied to different information systems and their use can contribute to increasing the effectiveness of the system and reducing the simple spread sheets paradoxes.

The results achieved in this dissertation contribute to a better understanding of how to measure or evaluate the risk effectiveness, and to understand them prior the preparation project startup.

The contributions that arise from this dissertation are:

- ✓ the dissertation modifies and complements existing models of systematic risk success assessment - effectiveness in the context of the structured systematic system and provides information regarding relations between the stakeholders,
- ✓ the achieved results of the dissertation are in accordance with previous research and are additionally confirmed,
- ✓ a data collection approach using two different type of the projects completed vs. monitored, represents a led to the development of a new measure in the research, and to indicate the shortcomings of the model's success that are present in the literature,
- ✓ the new early systematic instrument for measuring the risk collaborative developed in the research can become a practical tool for risk management systems that evaluates the performance of risk information implementations, by enabling a more accurate measurement of the risks input and output sizes and reduce possible faults, additional long learning and huge correction processes,
- ✓ the sensitivity of the RIO model clearly shows how systematic approach is needed, and evidently presents misguidance of the data,
- ✓ the results of this dissertation open a new dimension of research, but also delivers sufficient knowledge for future study by addressing awareness of early project definition by better startup, with achieved successful and effective project objectives.

The modern technology of risk management achievements, such as systematic approaches and knowledge sharing tools, can contribute to the accomplishment rate of early risk awareness and understanding. Given that the presented model enhanced the multiple awareness of the existing risk management rate, the awareness of the project management system is related to:

- ✓ the processes of an early risk contribution in the definition phase,
- ✓ then the preparation phase awareness,
- ✓ and on the end, it gives character which on results leaves a relevant new values:
    - I. knowledge,
    - II. experience,
    - III. innovation,
    - IV. skills,
    - V. responsibility and risk behavior.

The knowledge is everywhere around us and early systematic risk model approach allows it to be structured into early assessment. Such a structure is favorable contribution to the implementation phase. Based on the all captured facts and the made improvements organizational learning can positively influence on systematic risk management practice. Such a systematic and controlled learning practices can improve construction organizations', project management risk maturity and improve the overall organizational project risk management performance.

10.1 Guidelines for future research

The research has few limitations that lead to guidelines of future research. First of all, some of the expected model connections regarding the financial portion of the analysis have not been confirmed. The previous section presents possible explanations for such results, however, the data used in this dissertation did not allow additional testing of such explanations. The future research is needed to further prove and confirm the findings of dissertation based on the software standpoint. The model is protected as a database collection method, which is especially valuable for continuing further research.

The usage of the model is limited to the project management industries. Therefore, the scope of research is directed only to medium or large-scale energy project. Data from a large number of companies would increase the validity of research results. There is space in the aspects of international project risks leaving room for further research designed to develop systematic risk management processes that cover all the stages of a project's life cycle. Also, data collected from companies operating in different markets and activities would increase the validity of research results of this doctoral dissertation. In addition, the model of the systematic risk management system can also be tested in different recognized disciplines, including any risk-oriented discipline.

The research is further limited by the aspect of the software developments. Given the type of information in the model the context of the availability of the code, by this research can only viewed by software solutions whose source code was published under a license allowing users to study, to modify and improve the model into the software, and to distribute it in a modified or unmodified form. The observation and software solutions, whose source codes are protected and not accessible for change, would increase the degree of universality, that is, the applicability of the results. The model outlook from the software solutions point has a source code protected. An open source software might upgrade the results of this dissertation and provide a deeper understanding of the interconnection and interrelationships between the recognized risk, given variables and the collaboration of the software system models.

The research did not deal with financial performance due to limited access to business results prior to the application of this system and estimation after its implementation. A number of items that measure the performance of the project objective and the contingency estimation would further examine the validity of the proposed solution in the implementation phase. Future research should focus on the analysis of financial results before and after the implementation of the projects.

VIII. Literature

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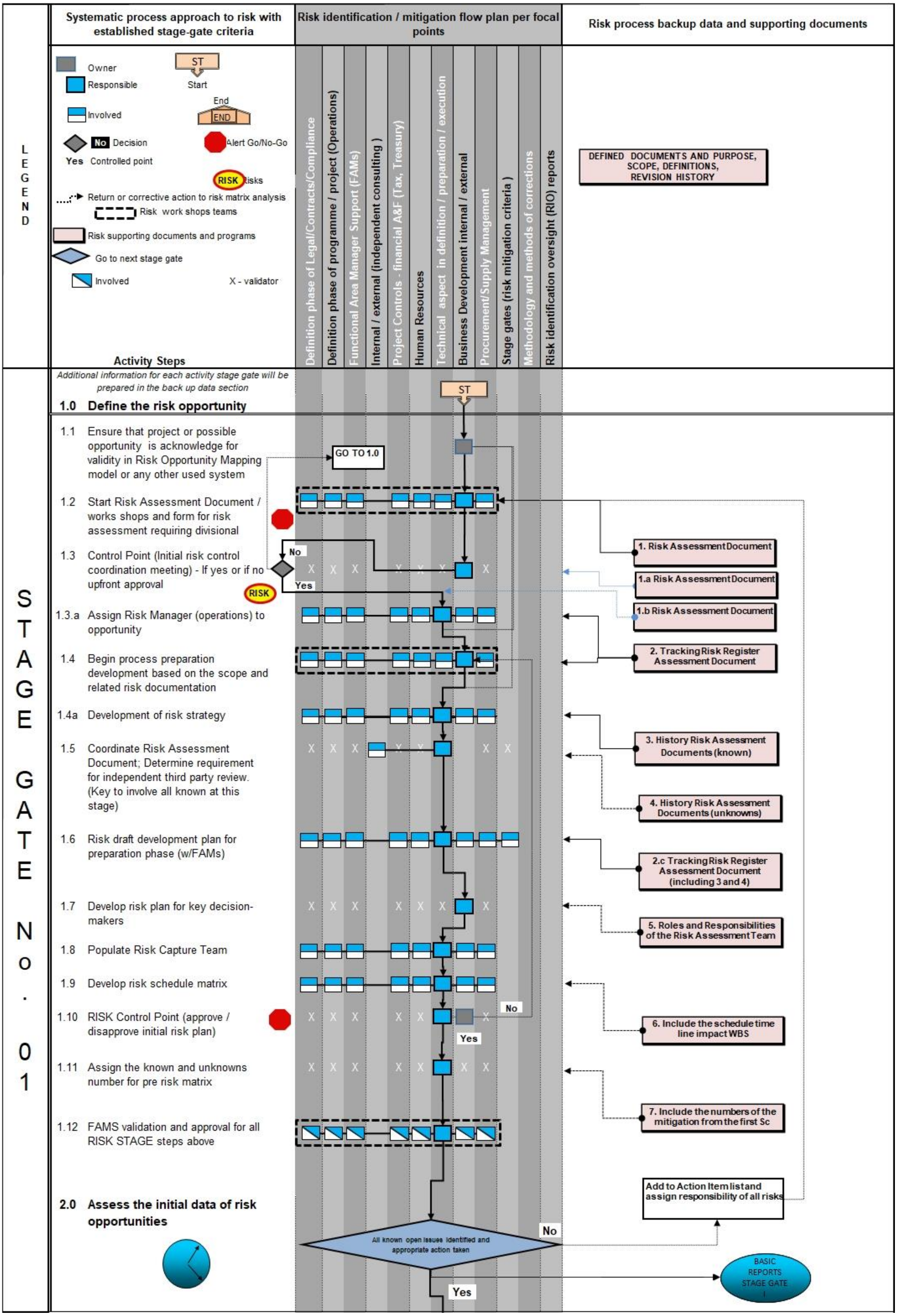
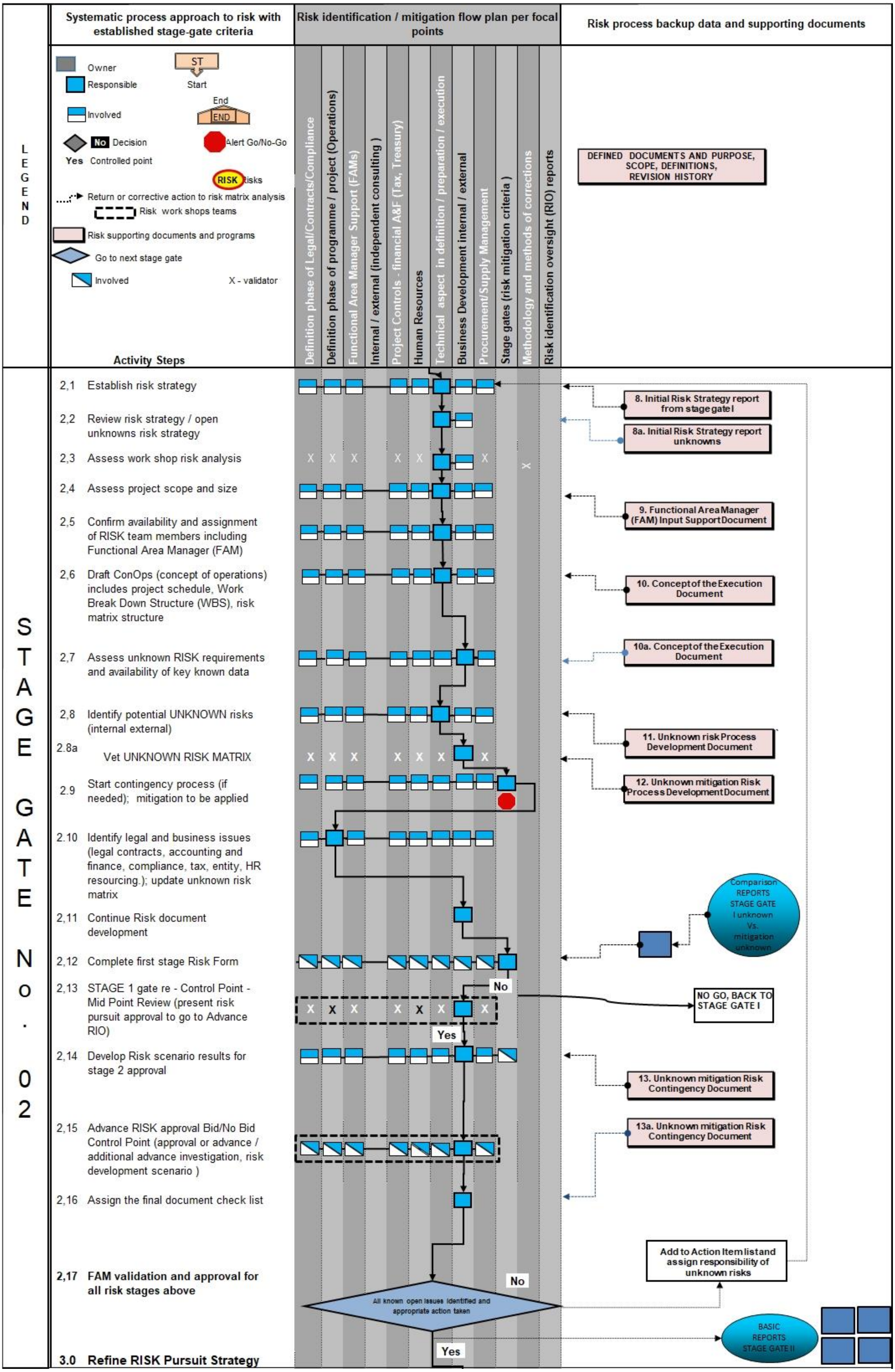
IX. Enclosures

- Enclosure No.1 - **Chart III-2**. Stage Gate Matrix No.1
- Enclosure No.2 - **Chart III-3.** Stage Gate Matrix No.2
- Enclosure No.3 - **Chart III-4.** Stage Gate Matrix No.3
- Enclosure No.4 - **Chart III-5.** Stage Gate Matrix No.4
- Enclosure No.5 - **Chart III-6.** Stage Gate Matrix No.5
- Enclosure No.6 - **Chart III-7.** Stage Gate Matrix No.6 – reports
- Enclosure No.7 - **Chart IV-1**. Web Model of Risk Management Stage Gate No.1
- Enclosure No.8 - **Chart IV-2.** Web Model of Risk Management Stage Gate No.2
- Enclosure No.9 - **Chart IV-3.** Web Model of Risk Management Stage Gate No.3
- Enclosure No.10 - **Chart IV-4**. Web Model of Risk Management Stage Gate No.4
- Enclosure No.11 - **Chart IV-5.** Web Model of Risk Management Stage Gate No.5
- Enclosure No.12 - **Chart IV-6.** Web Model of Risk Management Stage Gate No.6
- Enclosure No.13 - **Chart V-2.** Approved coding of the data excel documents, protection (MS Excel)
- Enclosure No.14 - **Chart V-3.** Fault alert of coding of the data excel documents, protection (MS Excel)
- Enclosure No.15 - **Chart V-4.** Message of the unapproved excel documents (MS Excel)
- Enclosure No.16 – **Chart V-9.** Locked special functions of all document (MS Excel)
- Enclosure No.17 – **RIO –** Risk Process Map Web Model

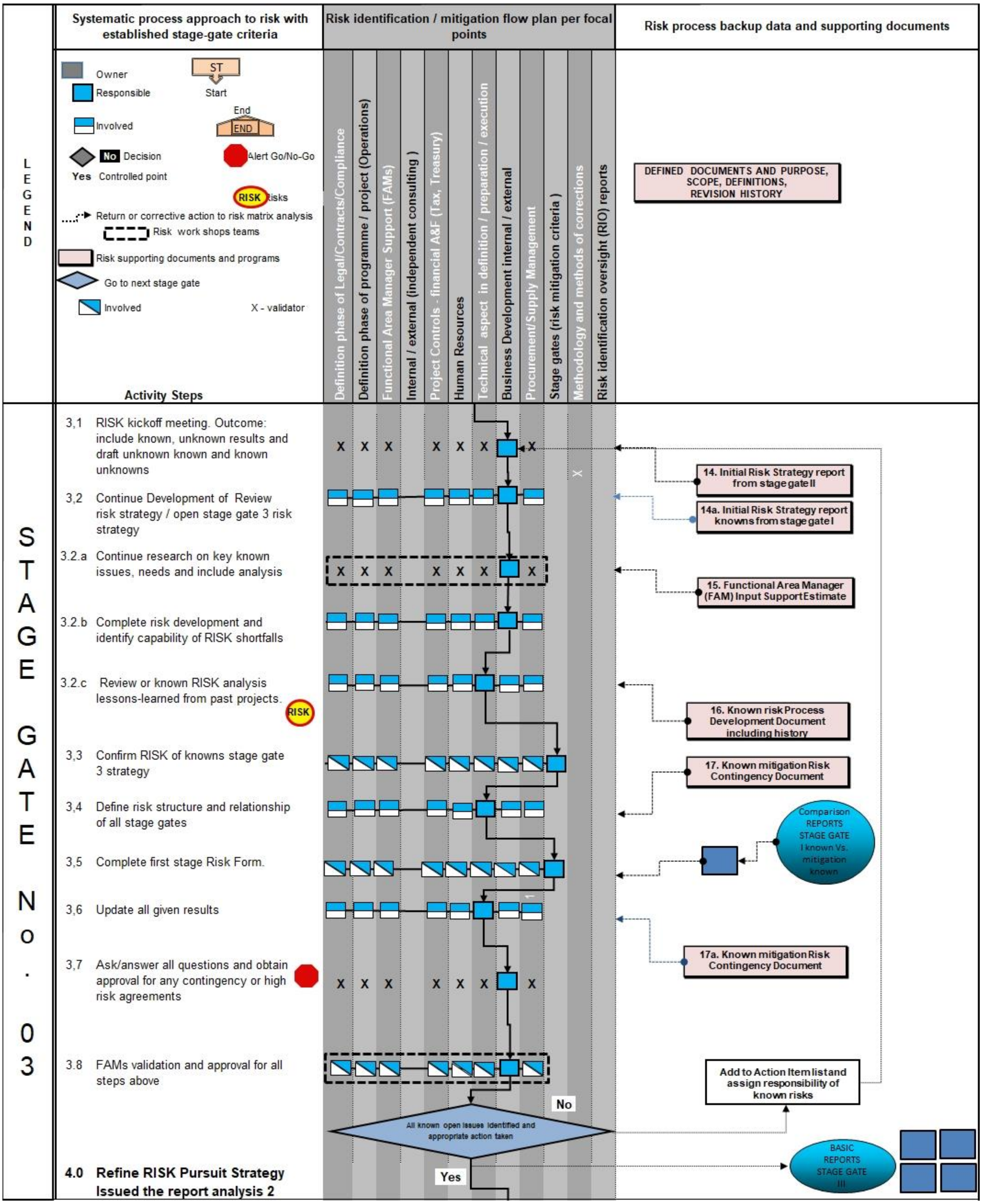
Enclosure No.1 - Chart III-2. Stage Gate Matrix No.1


Systematic process approach to risk with established stage-gate criteria
Risk identification / mitigation flow plan per focal points
Risk process backup data and supporting documents
LEGEND
Owner
ST
Start
Responsible
End
END
Involved
No Decision
Alert Go/No-Go
Yes Controlled point
RISK Risks
Return or corrective action to risk matrix analysis
Risk work shops teams
Risk supporting documents and programs
Go to next stage gate
Involved
X - validator
Activity Steps
Definition phase of Legal/Contracts/Compliance
Definition phase of programme / project (Operations)
Functional Area Manager Support (FAMs)
Internal / external (independent consulting)
Project Controls - financial A&F (Tax, Treasury)
Human Resources
Technical aspect in definition / preparation / execution
Business Development internal / external
Procurement/Supply Management
Stage gates (risk mitigation criteria)
Methodology and methods of corrections
Risk identification oversight (RIO) reports
DEFINED DOCUMENTS AND PURPOSE, SCOPE, DEFINITIONS, REVISION HISTORY
STAGE GATE No. 01
Additional information for each activity stage gate will be prepared in the back up data section
1.0 Define the risk opportunity
1.1 Ensure that project or possible opportunity is acknowledge for validity in Risk Opportunity Mapping model or any other used system
GO TO 1.0
1.2 Start Risk Assessment Document / works shops and form for risk assessment requiring divisional
1.3 Control Point (Initial risk control coordination meeting) - If yes or if no upfront approval
No
Yes
RISK
1.3.a Assign Risk Manager (operations) to opportunity
1.4 Begin process preparation development based on the scope and related risk documentation
1.4a Development of risk strategy
1.5 Coordinate Risk Assessment Document; Determine requirement for independent third party review. (Key to involve all known at this stage)
1.6 Risk draft development plan for preparation phase (w/FAMs)
1.7 Develop risk plan for key decision-makers
1.8 Populate Risk Capture Team
1.9 Develop risk schedule matrix
1.10 RISK Control Point (approve / disapprove initial risk plan)
No
Yes
1.11 Assign the known and unknowns number for pre risk matrix
1.12 FAMS validation and approval for all RISK STAGE steps above
2.0 Assess the initial data of risk opportunities
1. Risk Assessment Document
1.a Risk Assessment Document
1.b Risk Assessment Document
2. Tracking Risk Register Assessment Document
3. History Risk Assessment Documents (known)
4. History Risk Assessment Documents (unknowns)
2.c Tracking Risk Register Assessment Document (including 3 and 4)
5. Roles and Responsibilities of the Risk Assessment Team
6. Include the schedule time line impact WBS
7. Include the numbers of the mitigation from the first Sc
Add to Action Item list and assign responsibility of all risks
All known open issues identified and appropriate action taken
No
Yes
BASIC REPORTS STAGE GATE I

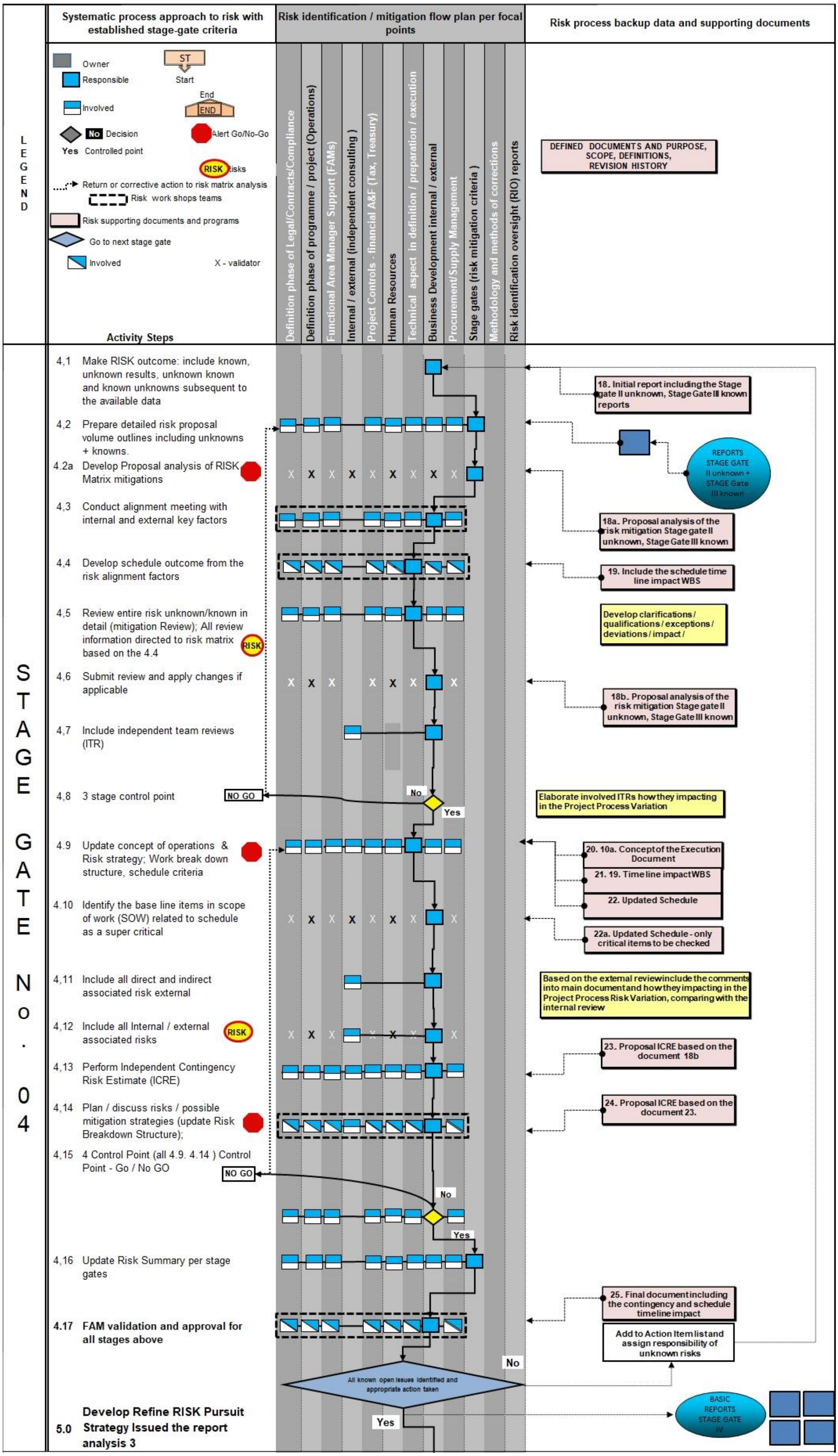
Enclosure No.2 - Chart III-3. Stage Gate Matrix No.2


Systematic process approach to risk with established stage-gate criteria
Risk identification / mitigation flow plan per focal points
Risk process backup data and supporting documents
LEGEND
Owner
Responsible
Involved
ST
Start
End
END
No Decision
Yes Controlled point
Alert Go/No-Go
RISK Risks
Return or corrective action to risk matrix analysis
Risk work shops teams
Risk supporting documents and programs
Go to next stage gate
Involved
X - validator
Activity Steps
Definition phase of Legal/Contracts/Compliance
Definition phase of programme / project (Operations)
Functional Area Manager Support (FAMs)
Internal / external (independent consulting)
Project Controls - financial A&F (Tax, Treasury)
Human Resources
Technical aspect in definition / preparation / execution
Business Development internal / external
Procurement/Supply Management
Stage gates (risk mitigation criteria)
Methodology and methods of corrections
Risk identification oversight (RIO) reports
DEFINED DOCUMENTS AND PURPOSE, SCOPE, DEFINITIONS, REVISION HISTORY
STAGE GATE No. 02
2,1 Establish risk strategy
2,2 Review risk strategy / open unknowns risk strategy
2,3 Assess work shop risk analysis
2,4 Assess project scope and size
2,5 Confirm availability and assignment of RISK team members including Functional Area Manager (FAM)
2,6 Draft ConOps (concept of operations) includes project schedule, Work Break Down Structure (WBS), risk matrix structure
2,7 Assess unknown RISK requirements and availability of key known data
2,8 Identify potential UNKNOWN risks (internal external)
2.8a Vet UNKNOWN RISK MATRIX
2.9 Start contingency process (if needed); mitigation to be applied
2.10 Identify legal and business issues (legal contracts, accounting and finance, compliance, tax, entity, HR resourcing.); update unknown risk matrix
2,11 Continue Risk document development
2,12 Complete first stage Risk Form
2,13 STAGE 1 gate re - Control Point - Mid Point Review (present risk pursuit approval to go to Advance RIO)
2,14 Develop Risk scenario results for stage 2 approval
2,15 Advance RISK approval Bid/No Bid Control Point (approval or advance / additional advance investigation, risk development scenario)
2,16 Assign the final document check list
2,17 FAM validation and approval for all risk stages above
3.0 Refine RISK Pursuit Strategy
8. Initial Risk Strategy report from stage gate I
8a. Initial Risk Strategy report unknowns
9. Functional Area Manager (FAM) Input Support Document
10. Concept of the Execution Document
10a. Concept of the Execution Document
11. Unknown risk Process Development Document
12. Unknown mitigation Risk Process Development Document
Comparison REPORTS STAGE GATE I unknown Vs. mitigation unknown
No
NO GO, BACK TO STAGE GATE I
Yes
13. Unknown mitigation Risk Contingency Document
13a. Unknown mitigation Risk Contingency Document
Add to Action Item list and assign responsibility of unknown risks
No
All known open issues identified and appropriate action taken
Yes
BASIC REPORTS STAGE GATE II

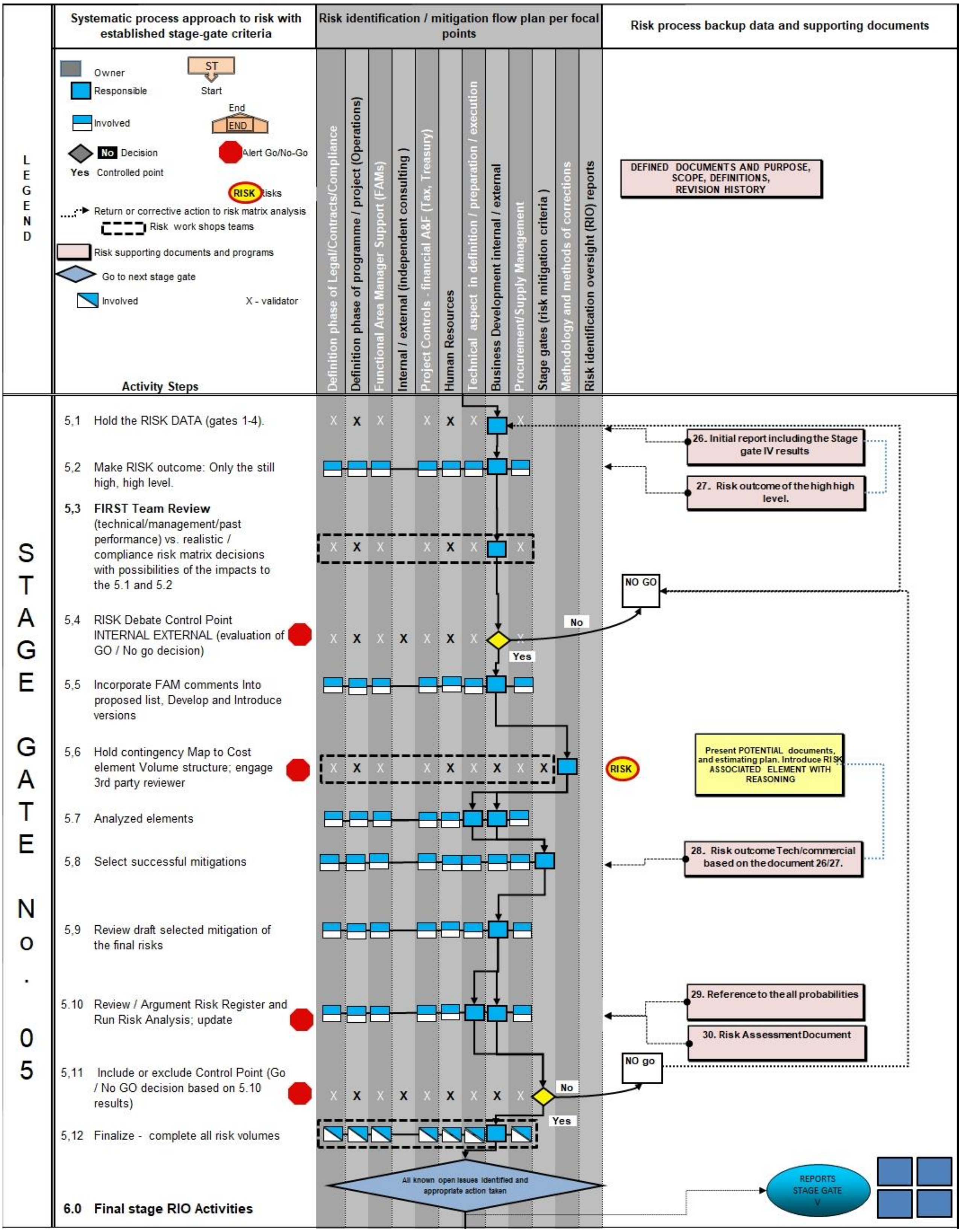
Enclosure No.3 - Chart III-4. Stage Gate Matrix No.3


Systematic process approach to risk with established stage-gate criteria
Risk identification / mitigation flow plan per focal points
Risk process backup data and supporting documents
LEGEND
Owner
ST
Start
Responsible
End
END
Involved
No
Decision
Alert Go/No-Go
Yes
Controlled point
RISK
Risks
Return or corrective action to risk matrix analysis
Risk work shops teams
Risk supporting documents and programs
Go to next stage gate
Involved
X - validator
Activity Steps
Definition phase of Legal/Contracts/Compliance
Definition phase of programme / project (Operations)
Functional Area Manager Support (FAMs)
Internal / external (independent consulting)
Project Controls - financial A&F (Tax, Treasury)
Human Resources
Technical aspect in definition / preparation / execution
Business Development internal / external
Procurement/Supply Management
Stage gates (risk mitigation criteria)
Methodology and methods of corrections
Risk identification oversight (RIO) reports
DEFINED DOCUMENTS AND PURPOSE, SCOPE, DEFINITIONS, REVISION HISTORY
STAGE GATE No. 03
3,1 RISK kickoff meeting. Outcome: include known, unknown results and draft unknown known and known unknowns
3,2 Continue Development of Review risk strategy / open stage gate 3 risk strategy
3.2.a Continue research on key known issues, needs and include analysis
3.2.b Complete risk development and identify capability of RISK shortfalls
3.2.c Review or known RISK analysis lessons-learned from past projects.
3,3 Confirm RISK of knowns stage gate 3 strategy
3,4 Define risk structure and relationship of all stage gates
3,5 Complete first stage Risk Form.
3,6 Update all given results
3,7 Ask/answer all questions and obtain approval for any contingency or high risk agreements
3.8 FAMs validation and approval for all steps above
4.0 Refine RISK Pursuit Strategy Issued the report analysis 2
14. Initial Risk Strategy report from stage gate II
14a. Initial Risk Strategy report knowns from stage gate I
15. Functional Area Manager (FAM) Input Support Estimate
16. Known risk Process Development Document including history
17. Known mitigation Risk Contingency Document
Comparison REPORTS STAGE GATE I known Vs. mitigation known
17a. Known mitigation Risk Contingency Document
Add to Action Item list and assign responsibility of known risks
No
All known open issues identified and appropriate action taken
Yes
BASIC REPORTS STAGE GATE III

Enclosure No. 4 - Chart III-5. Stage Gate Matrix No.4

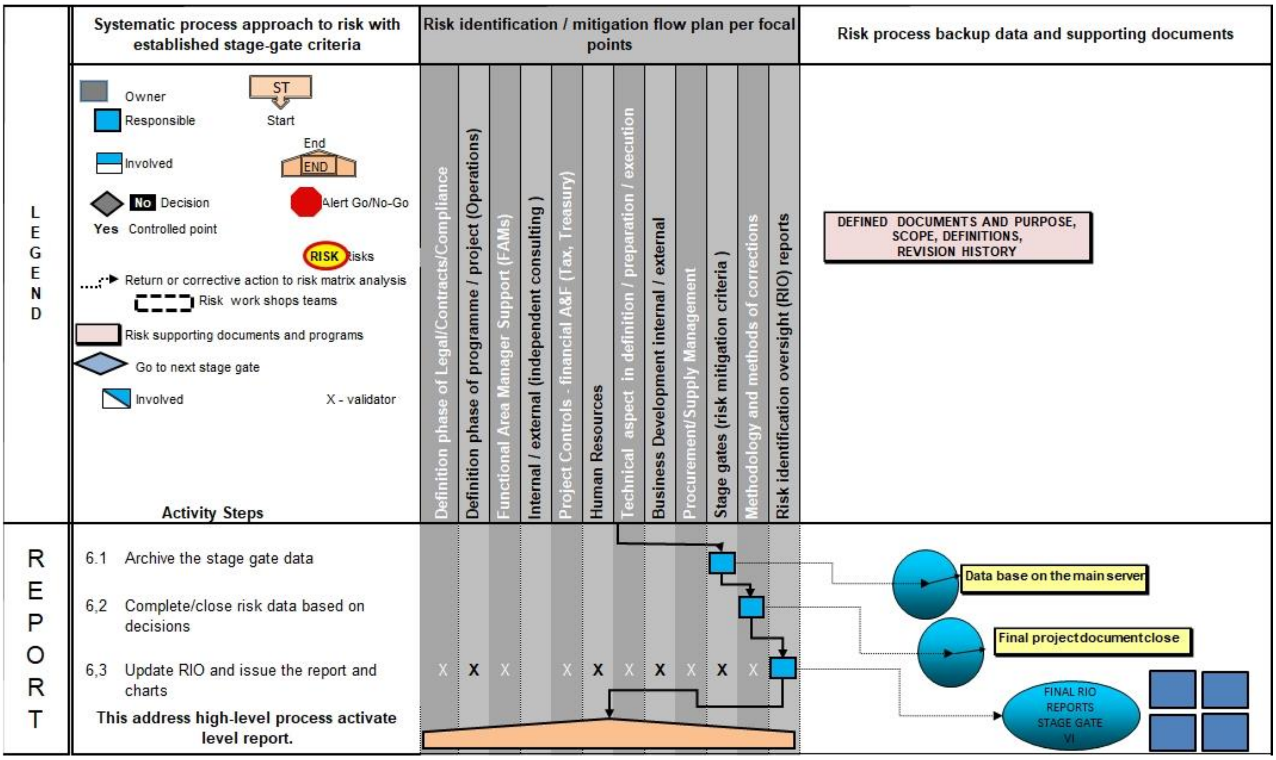

Systematic process approach to risk with established stage-gate criteria
Risk identification / mitigation flow plan per focal points
Risk process backup data and supporting documents
LEGEND
Owner
Responsible
Involved
ST
Start
End
END
No
Decision
Yes
Controlled point
Alert Go/No-Go
RISK
Risks
Return or corrective action to risk matrix analysis
Risk work shops teams
Risk supporting documents and programs
Go to next stage gate
Involved
X - validator
Activity Steps
Definition phase of Legal/Contracts/Compliance
Definition phase of programme / project (Operations)
Functional Area Manager Support (FAMs)
Internal / external (independent consulting)
Project Controls - financial A&F (Tax, Treasury)
Human Resources
Technical aspect in definition / preparation / execution
Business Development internal / external
Procurement/Supply Management
Stage gates (risk mitigation criteria)
Methodology and methods of corrections
Risk identification oversight (RIO) reports
DEFINED DOCUMENTS AND PURPOSE, SCOPE, DEFINITIONS, REVISION HISTORY
STAGE GATE No. 04
4,1 Make RISK outcome: include known, unknown results, unknown known and known unknowns subsequent to the available data
4,2 Prepare detailed risk proposal volume outlines including unknowns + knowns.
4.2a Develop Proposal analysis of RISK Matrix mitigations
4,3 Conduct alignment meeting with internal and external key factors
4,4 Develop schedule outcome from the risk alignment factors
4,5 Review entire risk unknown/known in detail (mitigation Review); All review information directed to risk matrix based on the 4.4
4,6 Submit review and apply changes if applicable
4,7 Include independent team reviews (ITR)
4,8 3 stage control point
NO GO
No
Yes
4.9 Update concept of operations & Risk strategy; Work break down structure, schedule criteria
4.10 Identify the base line items in scope of work (SOW) related to schedule as a super critical
4,11 Include all direct and indirect associated risk external
4,12 Include all Internal / external associated risks
4,13 Perform Independent Contingency Risk Estimate (ICRE)
4,14 Plan / discuss risks / possible mitigation strategies (update Risk Breakdown Structure);
4,15 4 Control Point (all 4.9. 4.14) Control Point - Go / No GO
NO GO
No
Yes
4,16 Update Risk Summary per stage gates
4.17 FAM validation and approval for all stages above
All known open issues identified and appropriate action taken
No
Yes
5.0 Develop Refine RISK Pursuit Strategy Issued the report analysis 3
18. Initial report including the Stage gate II unknown, Stage Gate III known reports
REPORTS STAGE GATE II unknown + STAGE Gate III known
18a. Proposal analysis of the risk mitigation Stage gate II unknown, Stage Gate III known
19. Include the schedule time line impact WBS
Develop clarifications / qualifications / exceptions / deviations / impact /
18b. Proposal analysis of the risk mitigation Stage gate II unknown, Stage Gate III known
Elaborate involved ITRs how they impacting in the Project Process Variation
20. 10a. Concept of the Execution Document
21. 19. Time line impact WBS
22. Updated Schedule
22a. Updated Schedule - only critical items to be checked
Based on the external review include the comments into main document and how they impacting in the Project Process Risk Variation, comparing with the internal review
23. Proposal ICRE based on the document 18b
24. Proposal ICRE based on the document 23.
25. Final document including the contingency and schedule timeline impact
Add to Action Item list and assign responsibility of unknown risks
BASIC REPORTS STAGE GATE IV

Enclosure No. 5 - Chart III-6. Stage Gate Matrix No.5

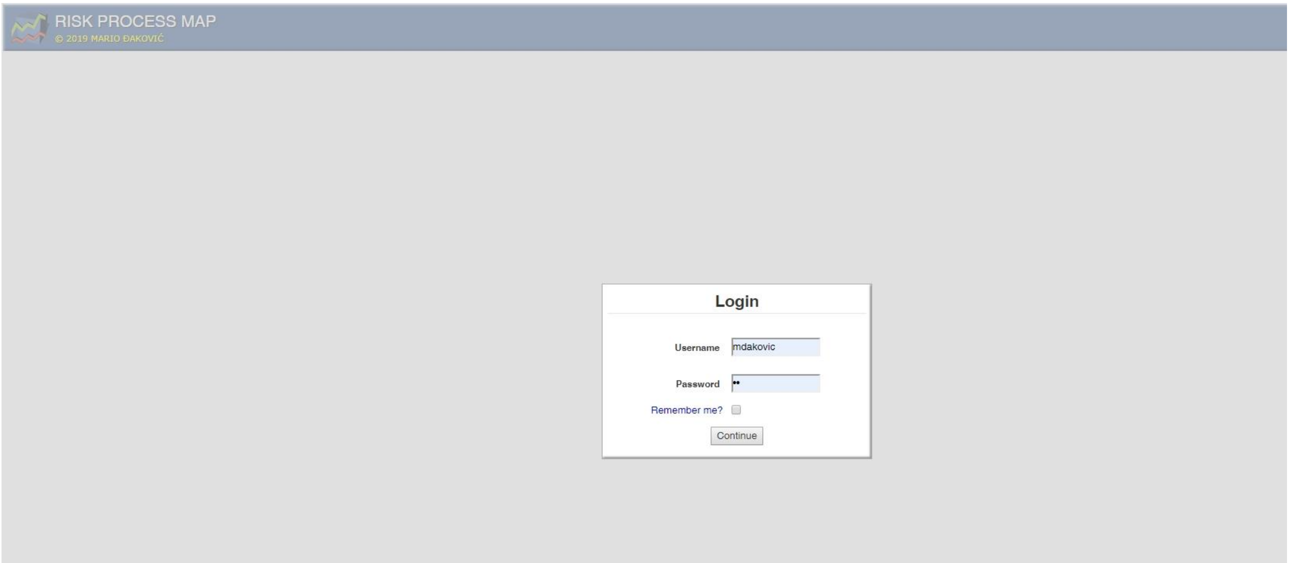


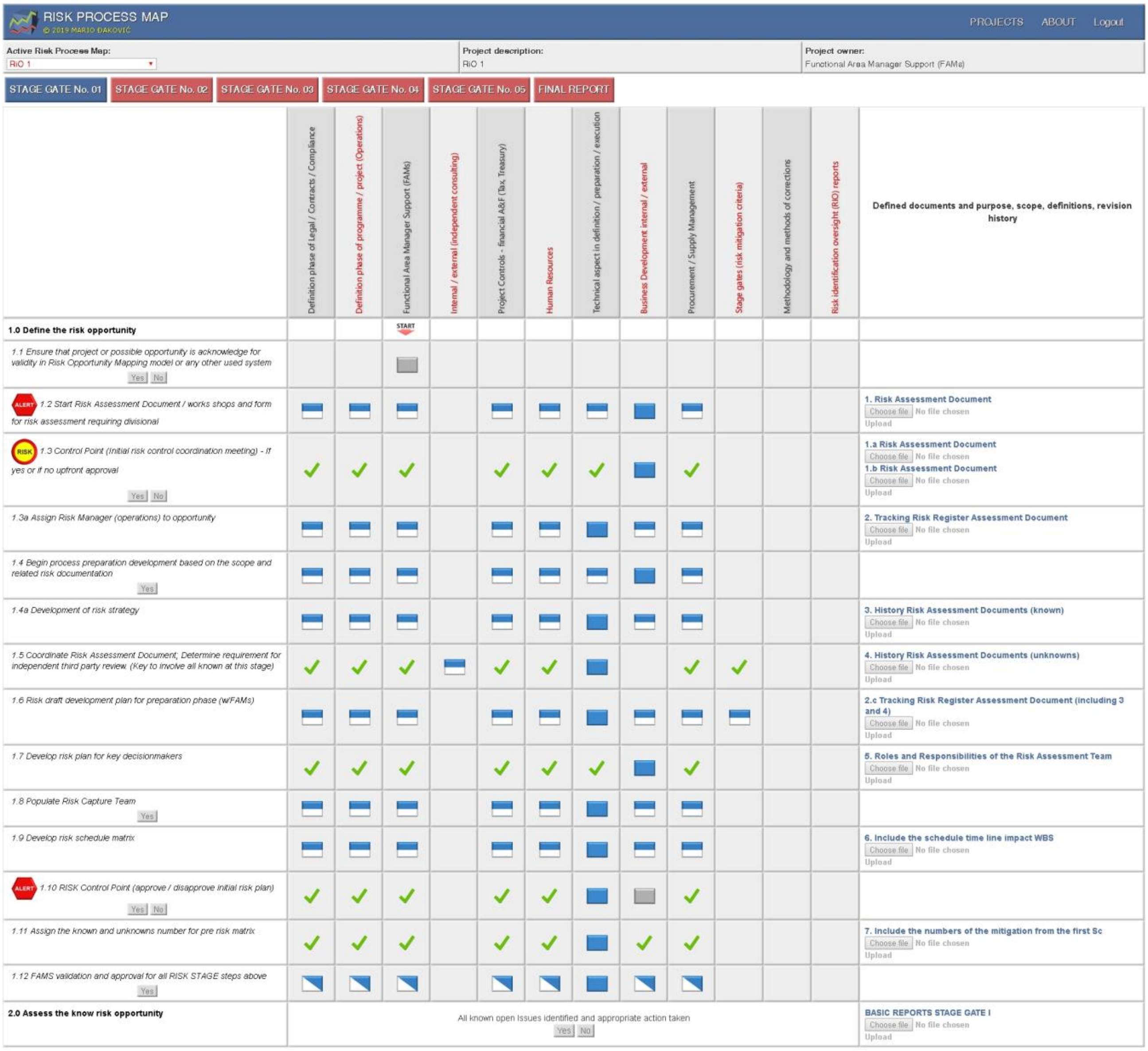
Systematic process approach to risk with established stage-gate criteria
Risk identification / mitigation flow plan per focal points
Risk process backup data and supporting documents
LEGEND
Owner
Responsible
Involved
No Decision
Yes Controlled point
ST
Start
End
END
Alert Go/No-Go
RISK Risks
Return or corrective action to risk matrix analysis
Risk work shops teams
Risk supporting documents and programs
Go to next stage gate
Involved
X - validator
Activity Steps
Definition phase of Legal/Contracts/Compliance
Definition phase of programme / project (Operations)
Functional Area Manager Support (FAMs)
Internal / external (independent consulting)
Project Controls - financial A&F (Tax, Treasury)
Human Resources
Technical aspect in definition / preparation / execution
Business Development internal / external
Procurement/Supply Management
Stage gates (risk mitigation criteria)
Methodology and methods of corrections
Risk identification oversight (RIO) reports
DEFINED DOCUMENTS AND PURPOSE, SCOPE, DEFINITIONS, REVISION HISTORY
STAGE GATE No. 05
5,1 Hold the RISK DATA (gates 1-4).
5,2 Make RISK outcome: Only the still high, high level.
5,3 FIRST Team Review (technical/management/past performance) vs. realistic / compliance risk matrix decisions with possibilities of the impacts to the 5.1 and 5.2
5,4 RISK Debate Control Point INTERNAL EXTERNAL (evaluation of GO / No go decision)
5,5 Incorporate FAM comments Into proposed list, Develop and Introduce versions
5,6 Hold contingency Map to Cost element Volume structure; engage 3rd party reviewer
5.7 Analyzed elements
5,8 Select successful mitigations
5,9 Review draft selected mitigation of the final risks
5.10 Review / Argument Risk Register and Run Risk Analysis; update
5,11 Include or exclude Control Point (Go / No GO decision based on 5.10 results)
5,12 Finalize - complete all risk volumes
6.0 Final stage RIO Activities
26. Initial report including the Stage gate IV results
27. Risk outcome of the high high level.
NO GO
No
Yes
RISK
Present POTENTIAL documents, and estimating plan. Introduce RISK ASSOCIATED ELEMENT WITH REASONING
28. Risk outcome Tech/commercial based on the document 26/27.
29. Reference to the all probabilities
30. Risk Assessment Document
NO go
All known open issues identified and appropriate action taken
REPORTS STAGE GATE V

Enclosure No. 6 - Chart III-7. Stage Gate Matrix No.6 – reports

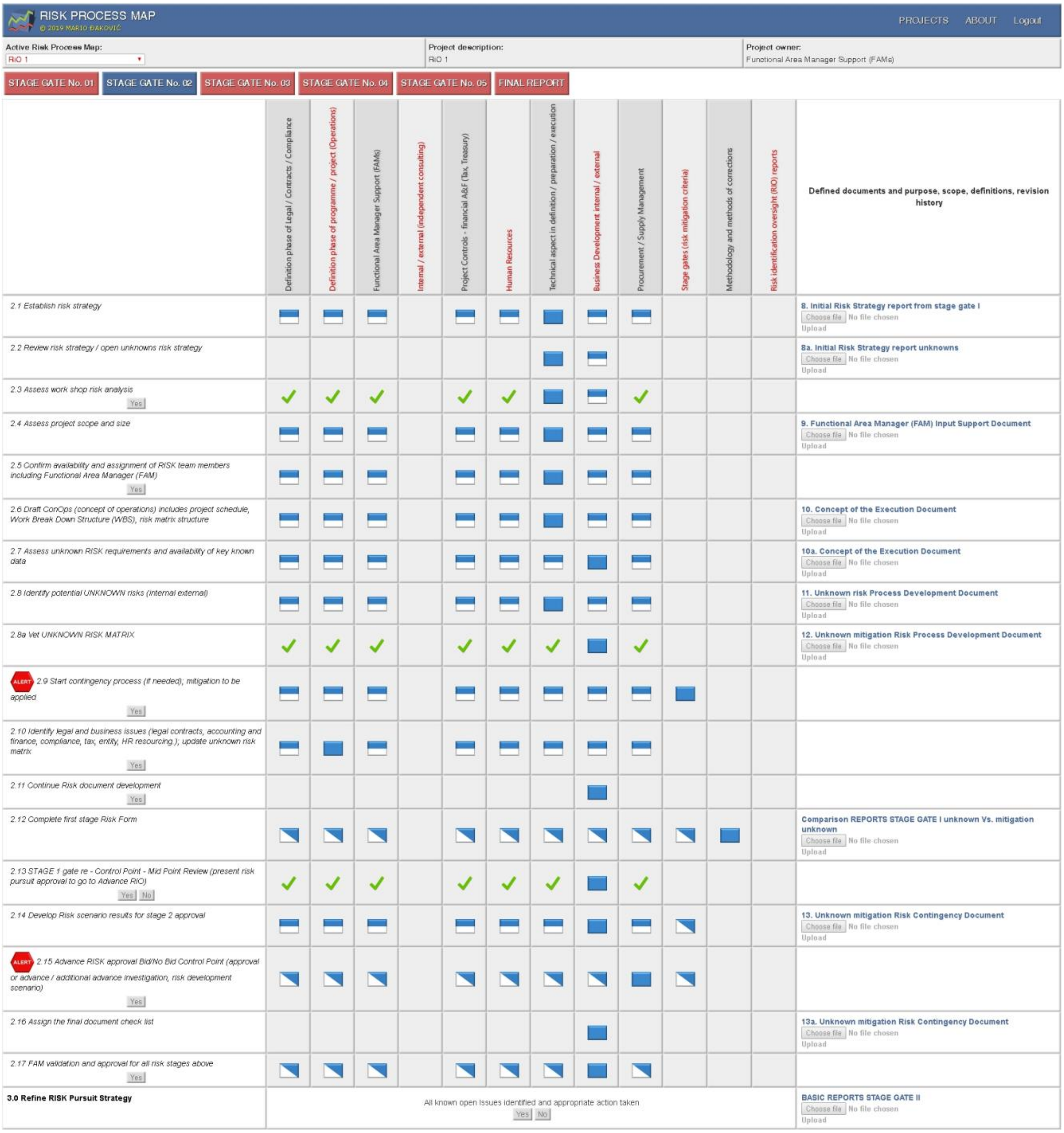

Systematic process approach to risk with established stage-gate criteria
Risk identification / mitigation flow plan per focal points
Risk process backup data and supporting documents
LEGEND
Owner
Responsible
Involved
ST
Start
End
END
No Decision
Yes Controlled point
Alert Go/No-Go
RISK Risks
Return or corrective action to risk matrix analysis
Risk work shops teams
Risk supporting documents and programs
Go to next stage gate
Involved
X - validator
Activity Steps
Definition phase of Legal/Contracts/Compliance
Definition phase of programme / project (Operations)
Functional Area Manager Support (FAMs)
Internal / external (independent consulting)
Project Controls - financial A&F (Tax, Treasury)
Human Resources
Technical aspect in definition / preparation / execution
Business Development internal / external
Procurement/ Supply Management
Stage gates (risk mitigation criteria)
Methodology and methods of corrections
Risk identification oversight (RIO) reports
DEFINED DOCUMENTS AND PURPOSE, SCOPE, DEFINITIONS, REVISION HISTORY
REPORT
6.1 Archive the stage gate data
6,2 Complete/close risk data based on decisions
6,3 Update RIO and issue the report and charts
This address high-level process activate level report.
X X X X X X X X X X
Data base on the main server
Final project document close
FINAL RIO REPORTS STAGE GATE VI

Enclosure No. 7 - Chart IV-1. Web Model of Risk Management Stage Gate No.1


RISK PROCESS MAP
© 2019 MARIO ĐAKOVIĆ
Login
Username
mdakovic
Password
Remember me?
Continue


RISK PROCESS MAP
© 2019 MARIO ĐAKOVIĆ
PROJECTS
ABOUT
Logout
Active Risk Process Map:
RiO 1
Project description:
RiO 1
Project owner:
Functional Area Manager Support (FAMs)
STAGE GATE No. 01
STAGE GATE No. 02
STAGE GATE No. 03
STAGE GATE No. 04
STAGE GATE No. 05
FINAL REPORT
Definition phase of Legal / Contracts / Compliance
Definition phase of programme / project (Operations)
Functional Area Manager Support (FAMs)
Internal / external (independent consulting)
Project Controls - financial A&F (Tax, Treasury)
Human Resources
Technical aspect in definition / preparation / execution
Business Development internal / external
Procurement / Supply Management
Stage gates (risk mitigation criteria)
Methodology and methods of corrections
Risk identification oversight (RIO) reports
Defined documents and purpose, scope, definitions, revision history
1.0 Define the risk opportunity
START
1.1 Ensure that project or possible opportunity is acknowledge for validity in Risk Opportunity Mapping model or any other used system
Yes No
ALERT
1.2 Start Risk Assessment Document / works shops and form for risk assessment requiring divisional
1. Risk Assessment Document
Choose file No file chosen
Upload
RISK
1.3 Control Point (Initial risk control coordination meeting) - If yes or if no upfront approval
Yes No
1.a Risk Assessment Document
Choose file No file chosen
1.b Risk Assessment Document
Choose file No file chosen
Upload
1.3a Assign Risk Manager (operations) to opportunity
2. Tracking Risk Register Assessment Document
Choose file No file chosen
Upload
1.4 Begin process preparation development based on the scope and related risk documentation
Yes
1.4a Development of risk strategy
3. History Risk Assessment Documents (known)
Choose file No file chosen
Upload
1.5 Coordinate Risk Assessment Document; Determine requirement for independent third party review. (Key to involve all known at this stage)
4. History Risk Assessment Documents (unknowns)
Choose file No file chosen
Upload
1.6 Risk draft development plan for preparation phase (w/FAMs)
2.c Tracking Risk Register Assessment Document (including 3 and 4)
Choose file No file chosen
Upload
1.7 Develop risk plan for key decisionmakers
5. Roles and Responsibilities of the Risk Assessment Team
Choose file No file chosen
Upload
1.8 Populate Risk Capture Team
Yes
1.9 Develop risk schedule matrix
6. Include the schedule time line impact WBS
Choose file No file chosen
Upload
ALERT
1.10 RISK Control Point (approve / disapprove initial risk plan)
Yes No
1.11 Assign the known and unknowns number for pre risk matrix
7. Include the numbers of the mitigation from the first Sc
Choose file No file chosen
Upload
1.12 FAMS validation and approval for all RISK STAGE steps above
Yes
2.0 Assess the know risk opportunity
All known open Issues identified and appropriate action taken
Yes No
BASIC REPORTS STAGE GATE I
Choose file No file chosen
Upload

Enclosure No. 8 - Chart IV-2. Web Model of Risk Management Stage Gate No.2


RISK PROCESS MAP
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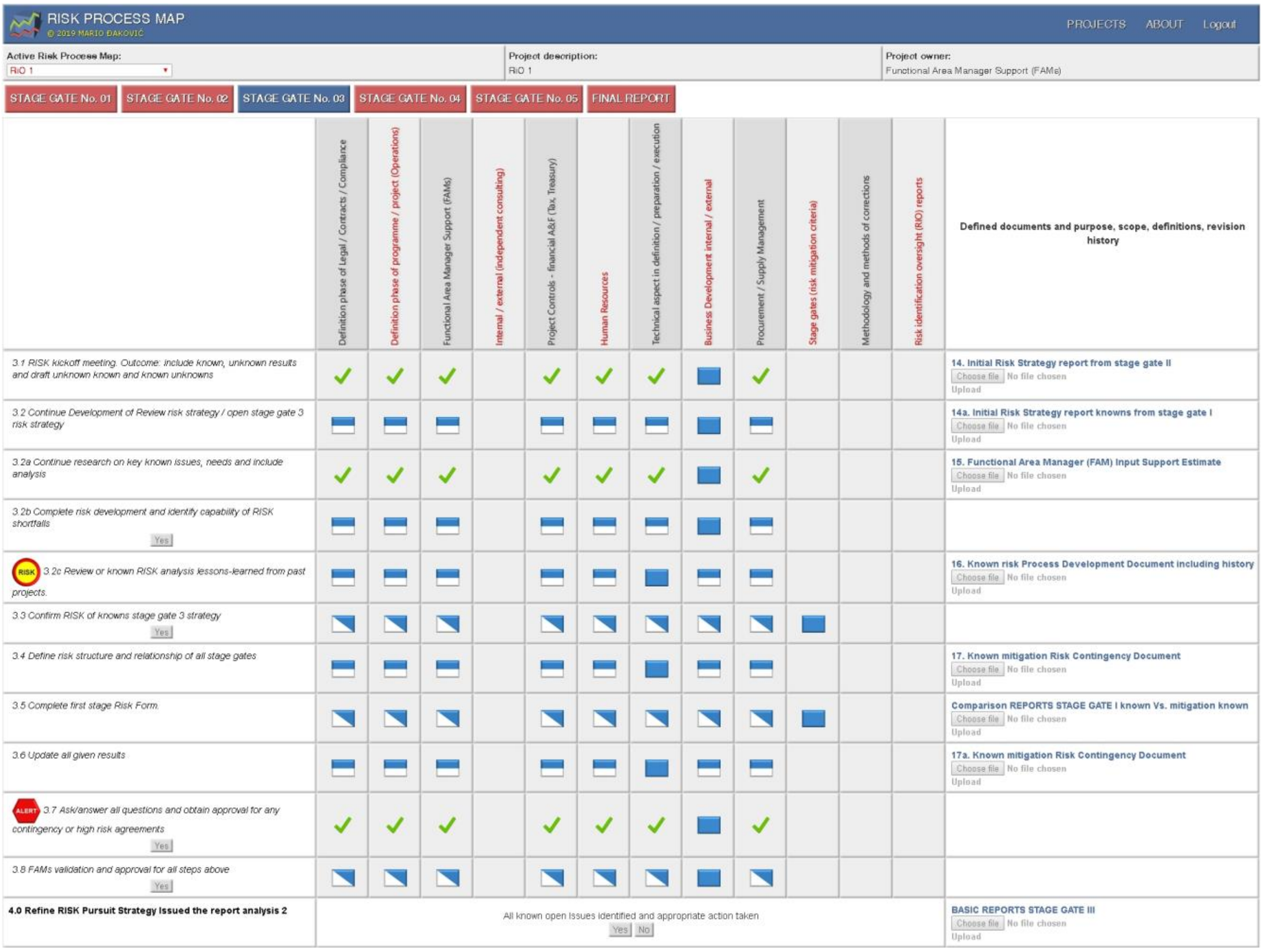
PROJECTS
ABOUT
Logout
Active Risk Process Map:
RiO 1
Project description:
RiO 1
Project owner:
Functional Area Manager Support (FAMs)
STAGE GATE No. 01
STAGE GATE No. 02
STAGE GATE No. 03
STAGE GATE No. 04
STAGE GATE No. 05
FINAL REPORT
Definition phase of Legal / Contracts / Compliance
Definition phase of programme / project (Operations)
Functional Area Manager Support (FAMs)
Internal / external (independent consulting)
Project Controls - financial A&F (Tax, Treasury)
Human Resources
Technical aspect in definition / preparation / execution
Business Development internal / external
Procurement / Supply Management
Stage gates (risk mitigation criteria)
Methodology and methods of corrections
Risk identification oversight (RIO) reports
Defined documents and purpose, scope, definitions, revision history
2.1 Establish risk strategy
8. Initial Risk Strategy report from stage gate I
2.2 Review risk strategy / open unknowns risk strategy
8a. Initial Risk Strategy report unknowns
2.3 Assess work shop risk analysis
2.4 Assess project scope and size
9. Functional Area Manager (FAM) Input Support Document
2.5 Confirm availability and assignment of RISK team members including Functional Area Manager (FAM)
2.6 Draft ConOps (concept of operations) includes project schedule, Work Break Down Structure (WBS), risk matrix structure
10. Concept of the Execution Document
2.7 Assess unknown RISK requirements and availability of key known data
10a. Concept of the Execution Document
2.8 Identify potential UNKNOWN risks (internal external)
11. Unknown risk Process Development Document
2.8a Vet UNKNOWN RISK MATRIX
12. Unknown mitigation Risk Process Development Document
ALERT
2.9 Start contingency process (if needed); mitigation to be applied
2.10 Identify legal and business issues (legal contracts, accounting and finance, compliance, tax, entity, HR resourcing); update unknown risk matrix
2.11 Continue Risk document development
2.12 Complete first stage Risk Form
Comparison REPORTS STAGE GATE I unknown Vs. mitigation unknown
2.13 STAGE 1 gate re - Control Point - Mid Point Review (present risk pursuit approval to go to Advance RIO)
2.14 Develop Risk scenario results for stage 2 approval
13. Unknown mitigation Risk Contingency Document
ALERT
2.15 Advance RISK approval Bid/No Bid Control Point (approval or advance / additional advance investigation, risk development scenario)
2.16 Assign the final document check list
13a. Unknown mitigation Risk Contingency Document
2.17 FAM validation and approval for all risk stages above
3.0 Refine RISK Pursuit Strategy
All known open issues identified and appropriate action taken
BASIC REPORTS STAGE GATE II
Choose file
No file chosen
Upload
Yes
No

Enclosure No.9 - Chart IV-3. Web Model of Risk Management Stage Gate No.3


RISK PROCESS MAP
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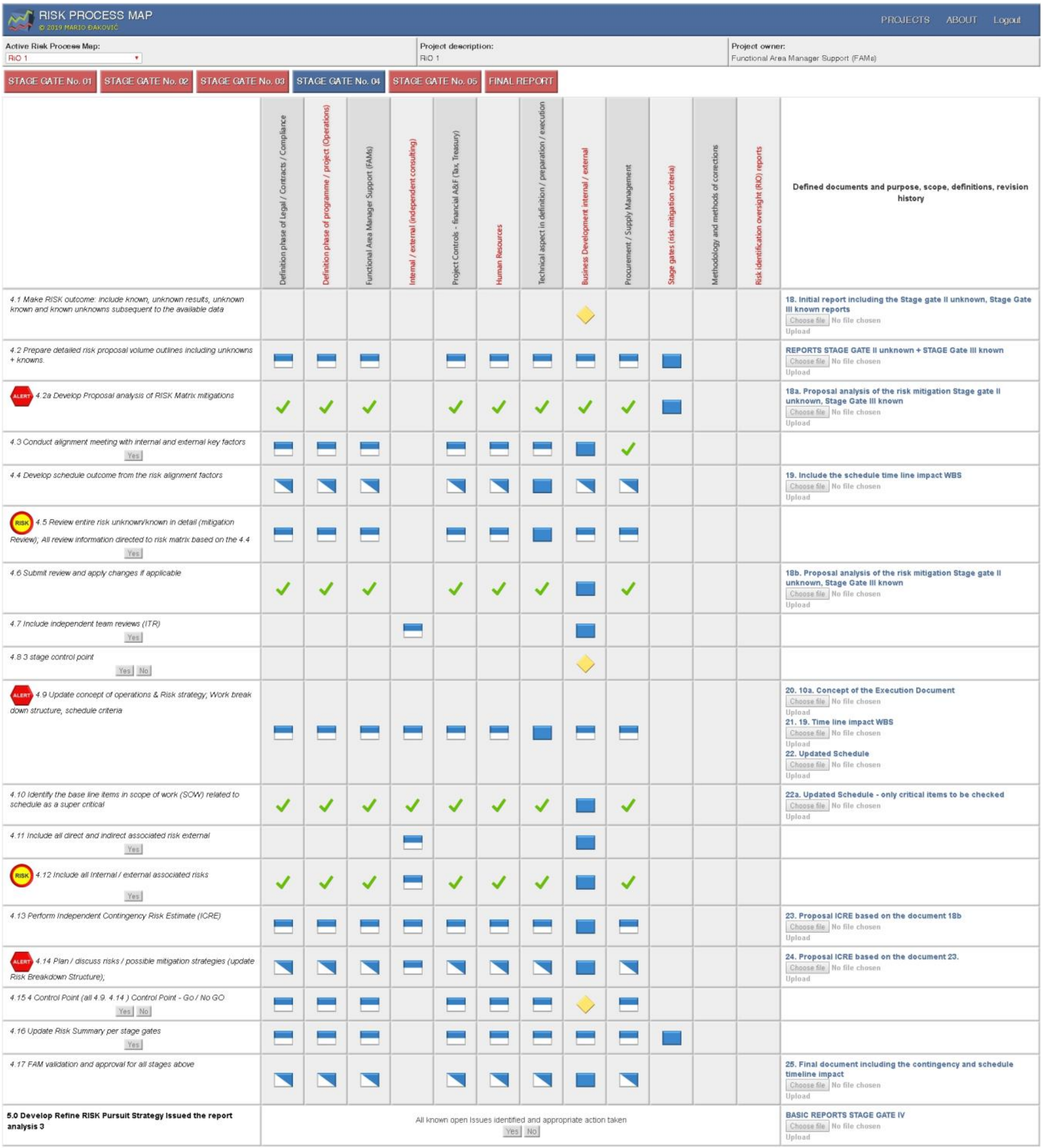
PROJECTS
ABOUT
Logout
Active Risk Process Map:
RiO 1
Project description:
RiO 1
Project owner:
Functional Area Manager Support (FAMs)
STAGE GATE No. 01
STAGE GATE No. 02
STAGE GATE No. 03
STAGE GATE No. 04
STAGE GATE No. 05
FINAL REPORT
Definition phase of Legal / Contracts / Compliance
Definition phase of programme / project (Operations)
Functional Area Manager Support (FAMs)
Internal / external (independent consulting)
Project Controls - financial A&F (Tax, Treasury)
Human Resources
Technical aspect in definition / preparation / execution
Business Development internal / external
Procurement / Supply Management
Stage gates (risk mitigation criteria)
Methodology and methods of corrections
Risk identification oversight (RIO) reports
Defined documents and purpose, scope, definitions, revision history
3.1 RISK kickoff meeting. Outcome: include known, unknown results and draft unknown known and known unknowns
3.2 Continue Development of Review risk strategy / open stage gate 3 risk strategy
3.2a Continue research on key known issues, needs and include analysis
3.2b Complete risk development and identify capability of RISK shortfalls
RISK
3.2c Review or known RISK analysis lessons-learned from past projects.
3.3 Confirm RISK of knowns stage gate 3 strategy
3.4 Define risk structure and relationship of all stage gates
3.5 Complete first stage Risk Form.
3.6 Update all given results
ALERT
3.7 Ask/answer all questions and obtain approval for any contingency or high risk agreements
3.8 FAMs validation and approval for all steps above
4.0 Refine RISK Pursuit Strategy Issued the report analysis 2
All known open Issues identified and appropriate action taken
Yes
No
14. Initial Risk Strategy report from stage gate II
14a. Initial Risk Strategy report knowns from stage gate I
15. Functional Area Manager (FAM) Input Support Estimate
16. Known risk Process Development Document including history
17. Known mitigation Risk Contingency Document
Comparison REPORTS STAGE GATE I known Vs. mitigation known
17a. Known mitigation Risk Contingency Document
BASIC REPORTS STAGE GATE III
Choose file
No file chosen
Upload

Enclosure No. 10 - Chart IV-4. Web Model of Risk Management Stage Gate No.4



RISK PROCESS MAP
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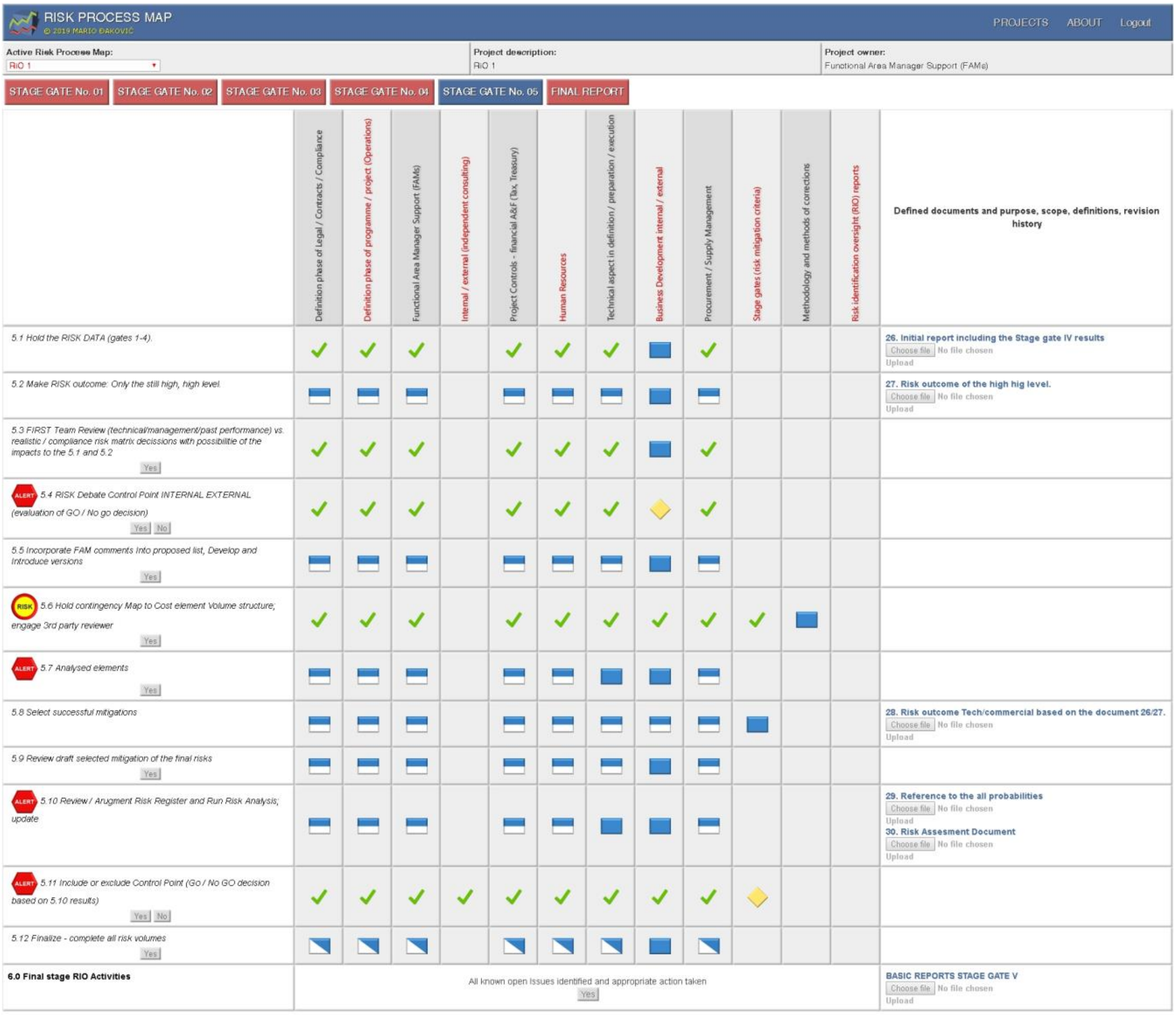
PROJECTS ABOUT Logout

Active Risk Process Map: RiO 1 | Project description: RiO 1 | Project owner: Functional Area Manager Support (FAMs)

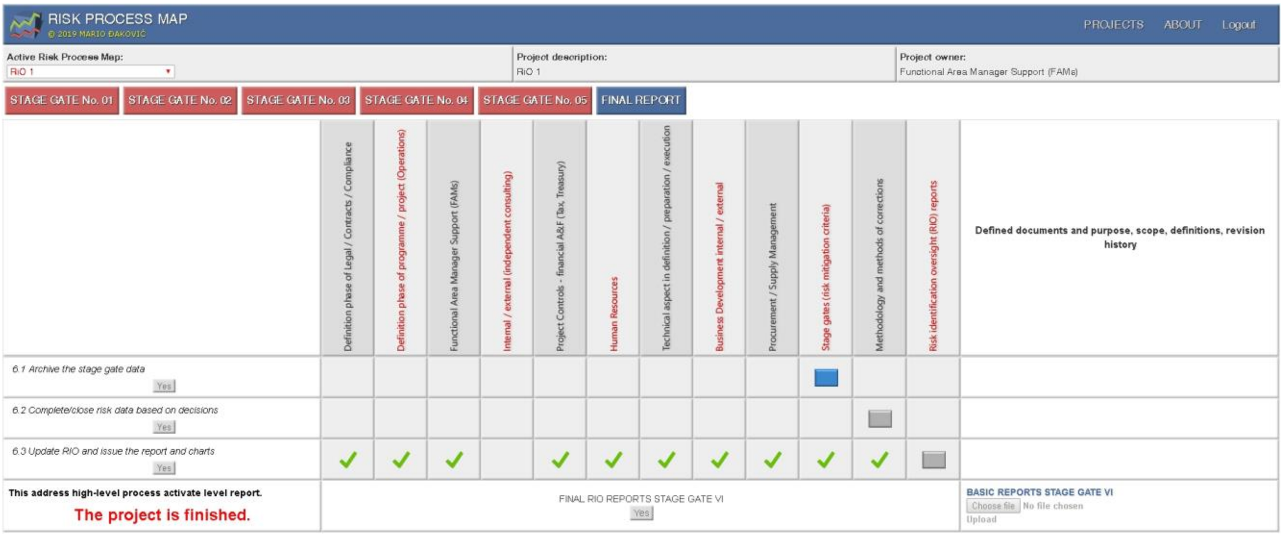
STAGE GATE No. 01 | STAGE GATE No. 02 | STAGE GATE No. 03 | STAGE GATE No. 04 | STAGE GATE No. 05 | FINAL REPORT

	Definition phase of Legal / Contracts / Compliance	Definition phase of programme / project (Operations)	Functional Area Manager Support (FAMs)	Internal / external (independent consulting)	Project Controls - financial A&F (Tax, Treasury)	Human Resources	Technical aspect in definition / preparation / execution	Business Development internal / external	Procurement / Supply Management	Stage gates (risk mitigation criteria)	Methodology and methods of corrections	Risk identification oversight (RIO) reports	Defined documents and purpose, scope, definitions, revision history
4.1 Make RISK outcome: include known, unknown results, unknown known and known unknowns subsequent to the available data								◆					18. Initial report including the Stage gate II unknown, Stage Gate III known reports Choose file No file chosen Upload
4.2 Prepare detailed risk proposal volume outlines including unknowns + knowns.	▭	▭	▭		▭	▭	▭	▭	▭	■			REPORTS STAGE GATE II unknown + STAGE Gate III known Choose file No file chosen Upload
ALERT 4.2a Develop Proposal analysis of RISK Matrix mitigations	✓	✓	✓		✓	✓	✓	✓	✓	■			18a. Proposal analysis of the risk mitigation Stage gate II unknown, Stage Gate III known Choose file No file chosen Upload
4.3 Conduct alignment meeting with internal and external key factors Yes	▭	▭	▭		▭	▭	▭	■	✓				
4.4 Develop schedule outcome from the risk alignment factors	◩	◩	◩		◩	◩	■	◩	◩				19. Include the schedule time line impact WBS Choose file No file chosen Upload
RISK 4.5 Review entire risk unknown/known in detail (mitigation Review); All review information directed to risk matrix based on the 4.4 Yes	▭	▭	▭		▭	▭	■	▭	▭				
4.6 Submit review and apply changes if applicable	✓	✓	✓		✓	✓	✓	■	✓				18b. Proposal analysis of the risk mitigation Stage gate II unknown, Stage Gate III known Choose file No file chosen Upload
4.7 Include independent team reviews (ITR) Yes				▭				■					
4.8 3 stage control point Yes No								◆					
ALERT 4.9 Update concept of operations & Risk strategy; Work break down structure, schedule criteria	▭	▭	▭	▭	▭	▭	■	▭	▭				20. 10a. Concept of the Execution Document Choose file No file chosen Upload 21. 19. Time line impact WBS Choose file No file chosen Upload 22. Updated Schedule Choose file No file chosen Upload
4.10 Identify the base line items in scope of work (SOW) related to schedule as a super critical	✓	✓	✓	✓	✓	✓	✓	■	✓				22a. Updated Schedule - only critical items to be checked Choose file No file chosen Upload
4.11 Include all direct and indirect associated risk external Yes				▭				■					
RISK 4.12 Include all Internal / external associated risks Yes	✓	✓	✓	▭	✓	✓	✓	■	✓				
4.13 Perform Independent Contingency Risk Estimate (ICRE)	▭	▭	▭	▭	▭	▭	▭	■	▭				23. Proposal ICRE based on the document 18b Choose file No file chosen Upload
ALERT 4.14 Plan / discuss risks / possible mitigation strategies (update Risk Breakdown Structure);	◩	◩	◩	▭	◩	◩	◩	■	◩				24. Proposal ICRE based on the document 23. Choose file No file chosen Upload
4.15 4 Control Point (all 4.9. 4.14) Control Point - Go / No GO Yes No	▭	▭	▭		▭	▭	▭	◆	▭				
4.16 Update Risk Summary per stage gates Yes	▭	▭	▭		▭	▭	▭	▭	▭	■			
4.17 FAM validation and approval for all stages above	◩	◩	◩		◩	◩	◩	■	◩				25. Final document including the contingency and schedule timeline impact Choose file No file chosen Upload
5.0 Develop Refine RISK Pursuit Strategy Issued the report analysis 3	All known open Issues identified and appropriate action taken Yes No												BASIC REPORTS STAGE GATE IV Choose file No file chosen Upload

Enclosure No. 11 - Chart IV-5. Web Model of Risk Management Stage Gate No.5


RISK PROCESS MAP
© 2019 MARIO DAKOVIĆ
PROJECTS
ABOUT
Logout
Active Risk Process Map:
RiO 1
Project description:
RiO 1
Project owner:
Functional Area Manager Support (FAMs)
STAGE GATE No. 01
STAGE GATE No. 02
STAGE GATE No. 03
STAGE GATE No. 04
STAGE GATE No. 05
FINAL REPORT
Definition phase of Legal / Contracts / Compliance
Definition phase of programme / project (Operations)
Functional Area Manager Support (FAMs)
Internal / external (independent consulting)
Project Controls - financial A&F (Tax, Treasury)
Human Resources
Technical aspect in definition / preparation / execution
Business Development internal / external
Procurement / Supply Management
Stage gates (risk mitigation criteria)
Methodology and methods of corrections
Risk identification oversight (RiO) reports
Defined documents and purpose, scope, definitions, revision history
5.1 Hold the RISK DATA (gates 1-4).
26. Initial report including the Stage gate IV results
Choose file No file chosen
Upload
5.2 Make RISK outcome: Only the still high, high level.
27. Risk outcome of the high hig level.
Choose file No file chosen
Upload
5.3 FIRST Team Review (technical/management/past performance) vs. realistic / compliance risk matrix decissions with possibilitie of the impacts to the 5.1 and 5.2
Yes
ALERT
5.4 RISK Debate Control Point INTERNAL EXTERNAL (evaluation of GO / No go decision)
Yes No
5.5 Incorporate FAM comments into proposed list, Develop and introduce versions
Yes
RISK
5.6 Hold contingency Map to Cost element Volume structure; engage 3rd party reviewer
Yes
ALERT
5.7 Analysed elements
Yes
5.8 Select successful mitigations
28. Risk outcome Tech/commercial based on the document 26/27.
Choose file No file chosen
Upload
5.9 Review draft selected mitigation of the final risks
Yes
ALERT
5.10 Review / Arugment Risk Register and Run Risk Analysis; update
29. Reference to the all probabilities
Choose file No file chosen
Upload
30. Risk Assesment Document
Choose file No file chosen
Upload
ALERT
5.11 Include or exclude Control Point (Go / No GO decision based on 5.10 results)
Yes No
5.12 Finalize - complete all risk volumes
Yes
6.0 Final stage RIO Activities
All known open issues identified and appropriate action taken
Yes
BASIC REPORTS STAGE GATE V
Choose file No file chosen
Upload

Enclosure No.12 - Chart IV-6. Web Model of Risk Management Stage Gate No.6


RISK PROCESS MAP
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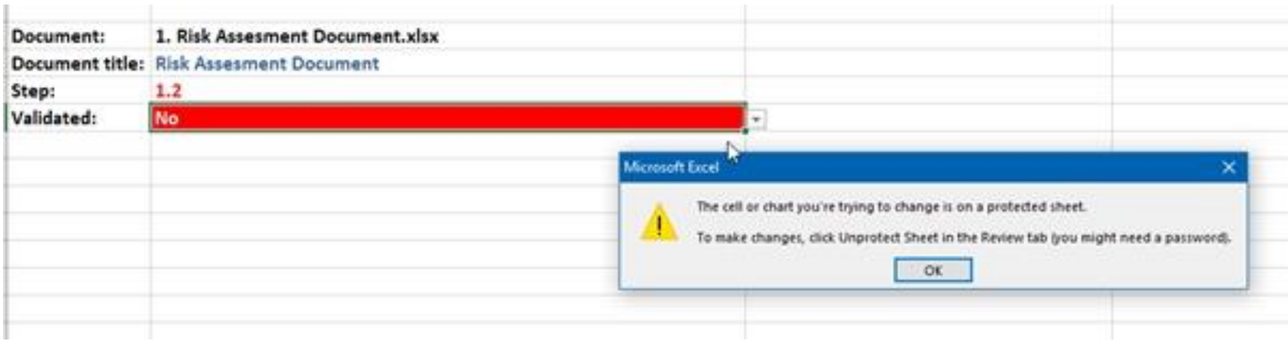
PROJECTS
ABOUT
Logout
Active Risk Process Map:
RiO 1
Project description:
RiO 1
Project owner:
Functional Area Manager Support (FAMs)
STAGE GATE No. 01
STAGE GATE No. 02
STAGE GATE No. 03
STAGE GATE No. 04
STAGE GATE No. 05
FINAL REPORT
Definition phase of Legal / Contracts / Compliance
Definition phase of programme / project (Operations)
Functional Area Manager Support (FAMs)
Internal / external (independent consulting)
Project Controls - financial A&F (Tax, Treasury)
Human Resources
Technical aspect in definition / preparation / execution
Business Development internal / external
Procurement / Supply Management
Stage gates (risk mitigation criteria)
Methodology and methods of corrections
Risk identification oversight (RIO) reports
Defined documents and purpose, scope, definitions, revision history
6.1 Archive the stage gate data
Yes
6.2 Complete/close risk data based on decisions
Yes
6.3 Update RIO and issue the report and charts
Yes
This address high-level process activate level report.
The project is finished.
FINAL RIO REPORTS STAGE GATE VI
Yes
BASIC REPORTS STAGE GATE VI
Choose file
No file chosen
Upload

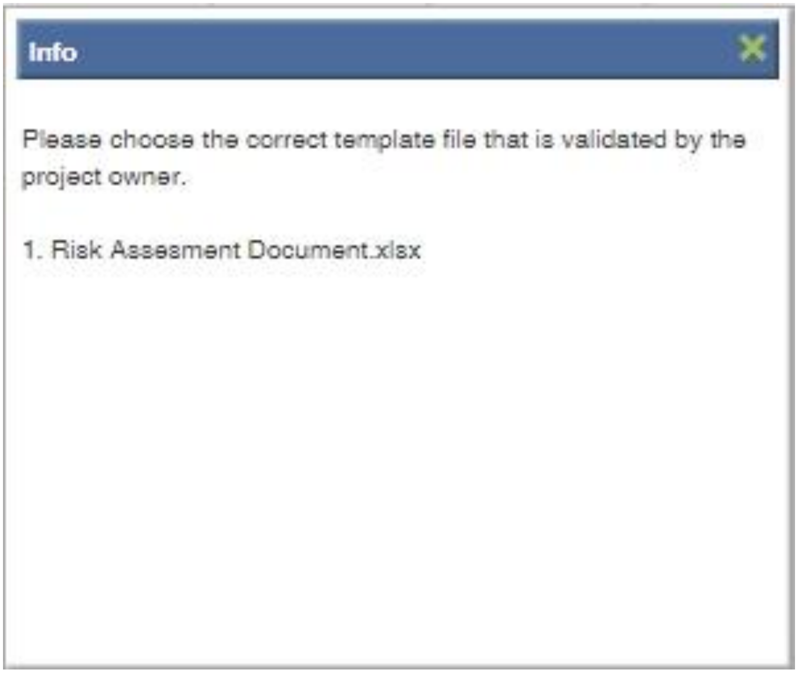
Enclosure No.13 - Chart V-2. Approved coding of the data excel documents, protection (MS Excel)

1			
2			
3	**Document:**	**Comparison REPORTS STAGE GATE I unknown Vs. mitigation unknown.xlsx**	
4	**Document title:**	**Comparison REPORTS STAGE GATE I unknown Vs. mitigation unknown.xlsx**	
5	**Step:**	**2.12**	
6	**Validated:**	**Yes**	
7			
8			
9			

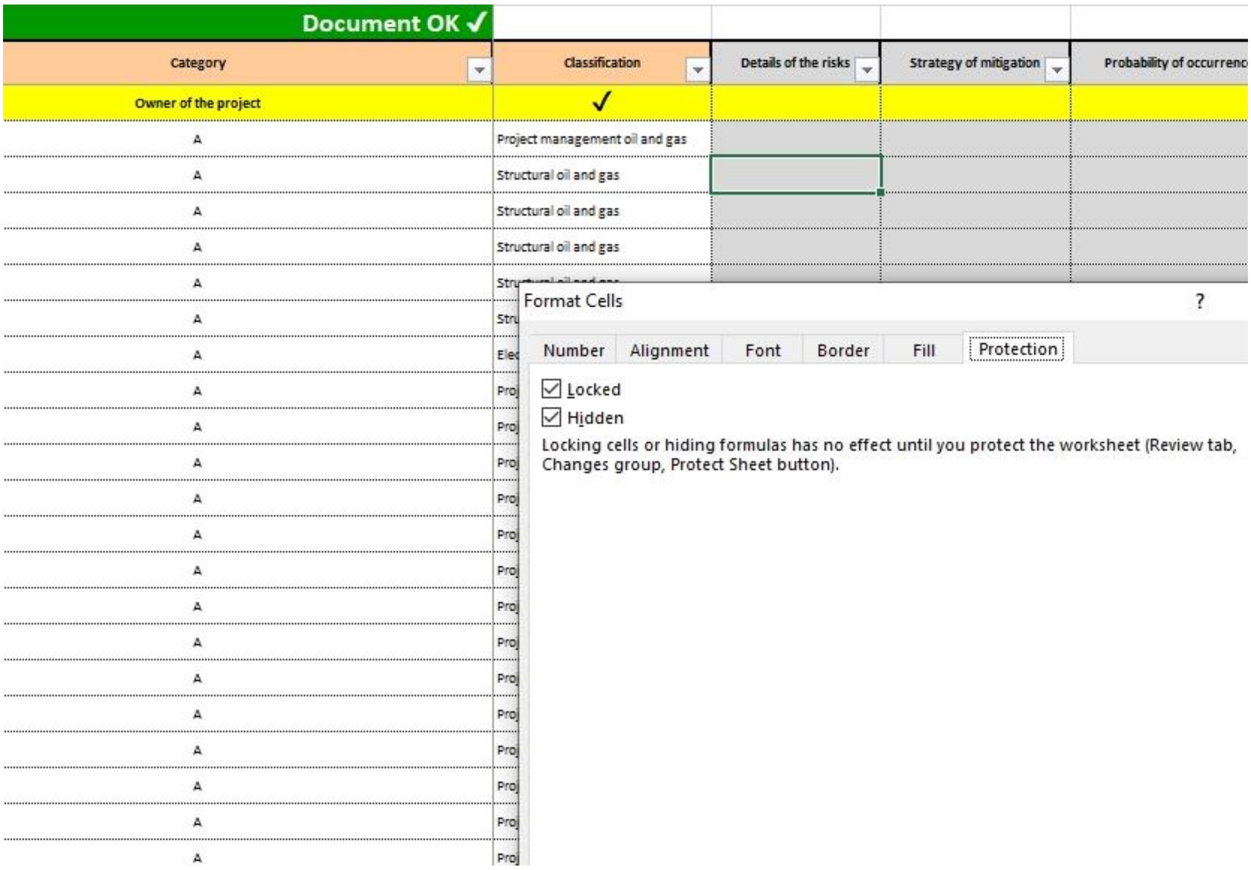
Enclosure No.14 - Chart V-3. Fault alert of coding of the data excel documents, (MS Excel)


Document:
1. Risk Assesment Document.xlsx
Document title:
Risk Assesment Document
Step:
1.2
Validated:
No
Microsoft Excel
The cell or chart you're trying to change is on a protected sheet.
To make changes, click Unprotect Sheet in the Review tab (you might need a password).
OK

Enclosure No. 15 - Chart V-4. Message of the unapproved excel documents (MS Excel)


Info
Please choose the correct template file that is validated by the project owner.
1. Risk Assesment Document.xlsx

Enclosure No. 16 - Chart V-9. Locked special functions of all document (MS Excel)


Document OK ✓
Category
Classification
Details of the risks
Strategy of mitigation
Probability of occurrenc
Owner of the project
✓
A
Project management oil and gas
Structural oil and gas
Structural oil and gas
Structural oil and gas
Format Cells
?
Number
Alignment
Font
Border
Fill
Protection
Locked
Hidden
Locking cells or hiding formulas has no effect until you protect the worksheet (Review tab, Changes group, Protect Sheet button).

Enclosure No.17 – RIO – Risk Process Map Web Model

Risk Process Map Web Model
RiskProcessMap_18.6.2019 – separate zip file attached

X.Reports

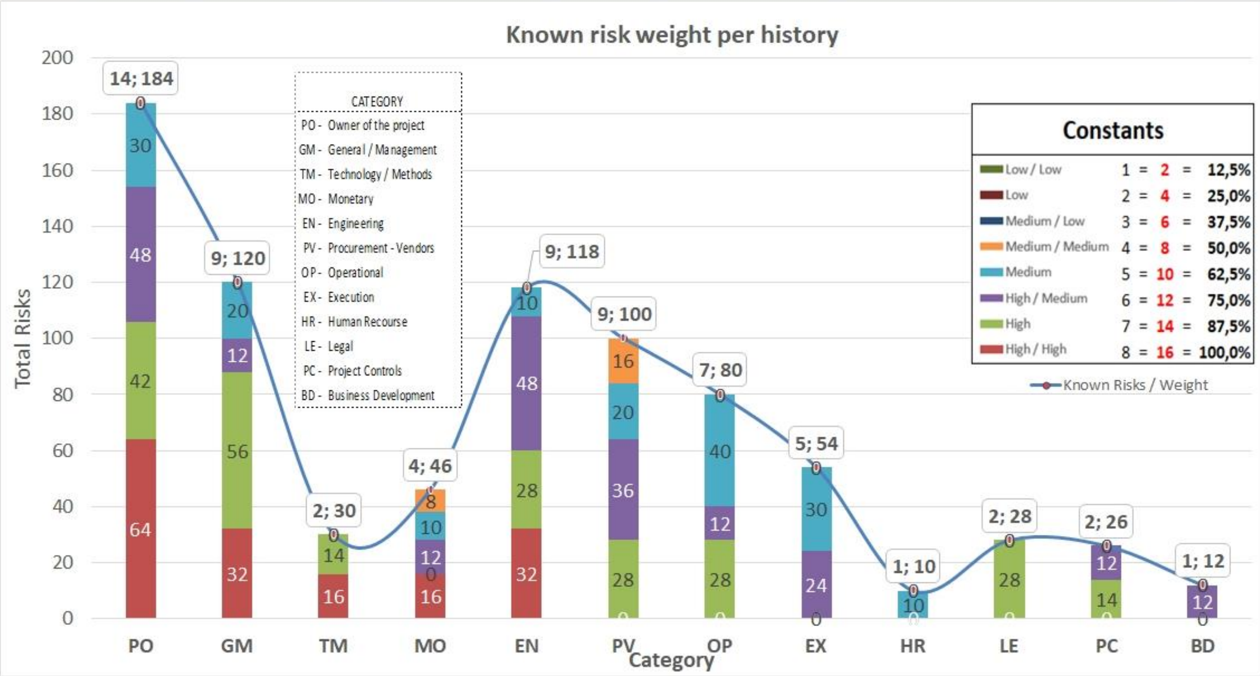
Report results

- **Model results of the Stage Gate I - Project No.1**
- **Model results of the Stage Gate I - Project No.2**
- **Model results of the Stage Gate II - Project No.1**
- **Model results of the Stage Gate II - Project No.2**
- **Model results of the Stage Gate III – Project No.1**
- **Model results of the Stage Gate III – Project No.2**
- **Model results of the Stage Gate IV – Project No.1**
- **Model results of the Stage Gate IV – Project No.2**
- **Model results of the Stage Gate V – Project No.1**
- **Model results of the Stage Gate V – Project No.2**
- **Model results of the Stage Gate VI – Project No.1**
- **Model results of the Stage Gate VI – Project No.2**
- **Model detailed notes Stage Gate I through VI**
- **Model list of the documents Stage Gate I through VI**

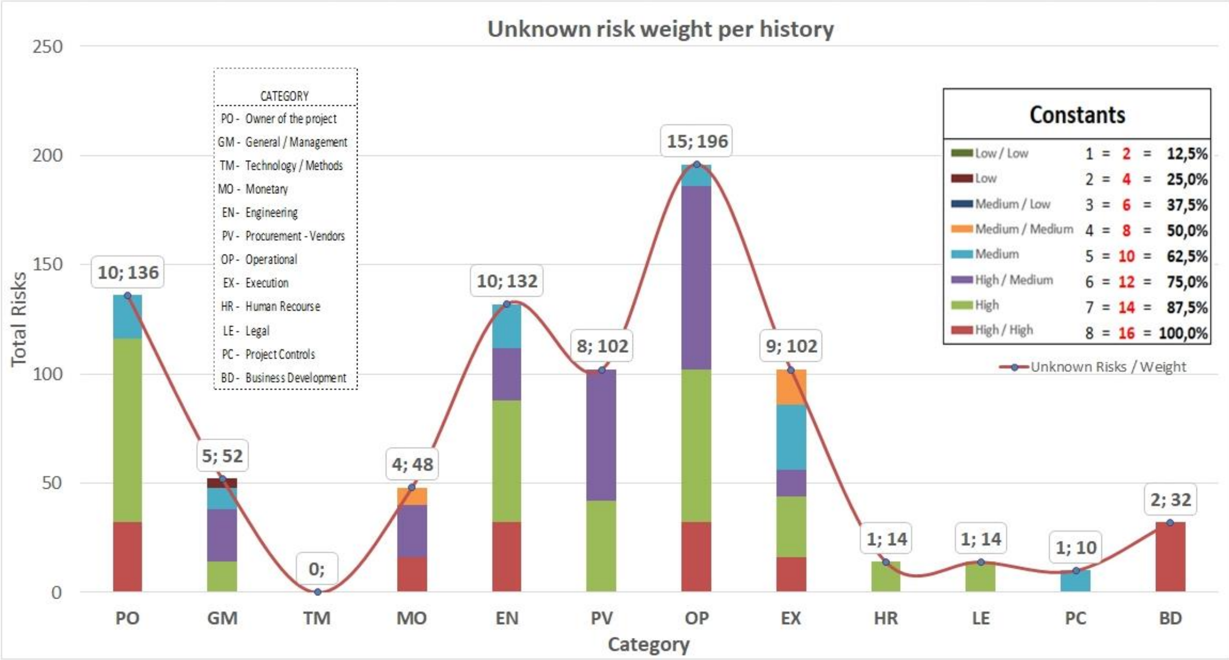
Model results of the Stage Gate I - Project No.1

Basis report stage gate I

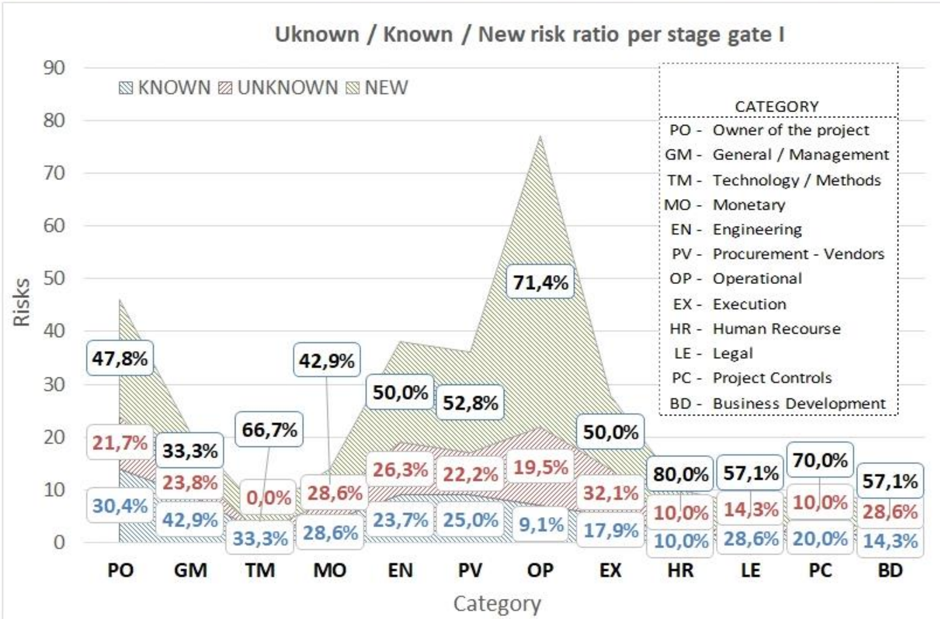
FAMS	KNOWN	High / High	High	High / Medium	Medium	Medium / Medium	Medium / Low	Low	Low / Low	Total
PO	14	64	42	48	30	0	0	0	0	184
GM	9	32	56	12	20	0	0	0	0	120
TM	2	16	14	0	0	0	0	0	0	30
MO	4	16	0	12	10	8	0	0	0	46
EN	9	32	28	48	10	0	0	0	0	118
PV	9	0	28	36	20	16	0	0	0	100
OP	7	0	28	12	40	0	0	0	0	80
EX	5	0	0	24	30	0	0	0	0	54
HR	1	0	0	0	10	0	0	0	0	10
LE	2	0	28	0	0	0	0	0	0	28
PC	2	0	14	12	0	0	0	0	0	26
BD	1	0	0	12	0	0	0	0	0	12
Total	65	160	238	216	170	24	0	0	0	

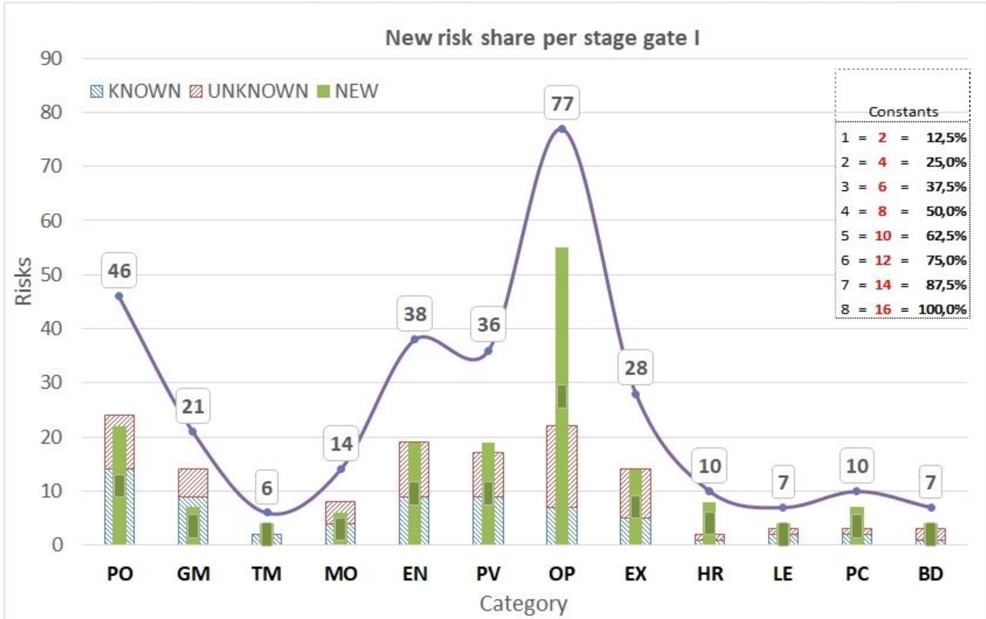


FAMS	UNKNOWN	High / High	High	High / Medium	Medium	Medium / Medium	Medium / Low	Low	Low / Low	Total
PO	10	32	84	0	20	0	0	0	0	136
GM	5	0	14	24	10	0	0	4	0	52
TM	0	0	0	0	0	0	0	0	0	0
MO	4	16	0	24	0	8	0	0	0	48
EN	10	32	56	24	20	0	0	0	0	132
PV	8	0	42	60	0	0	0	0	0	102
OP	15	32	70	84	10	0	0	0	0	196
EX	9	16	28	12	30	16	0	0	0	102
HR	1	0	14	0	0	0	0	0	0	14
LE	1	0	14	0	0	0	0	0	0	14
PC	1	0	0	0	10	0	0	0	0	10
BD	2	32	0	0	0	0	0	0	0	32
Total	66	160	322	228	100	24	0	4	0	

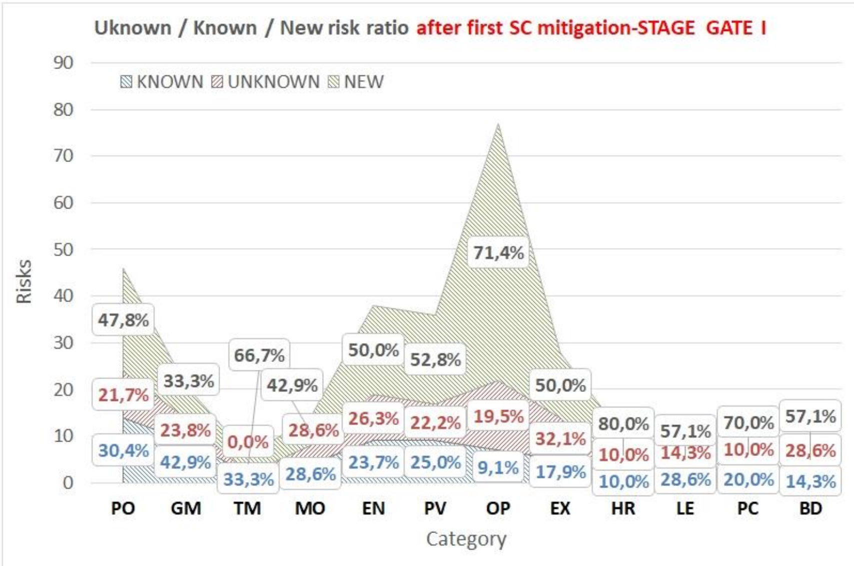


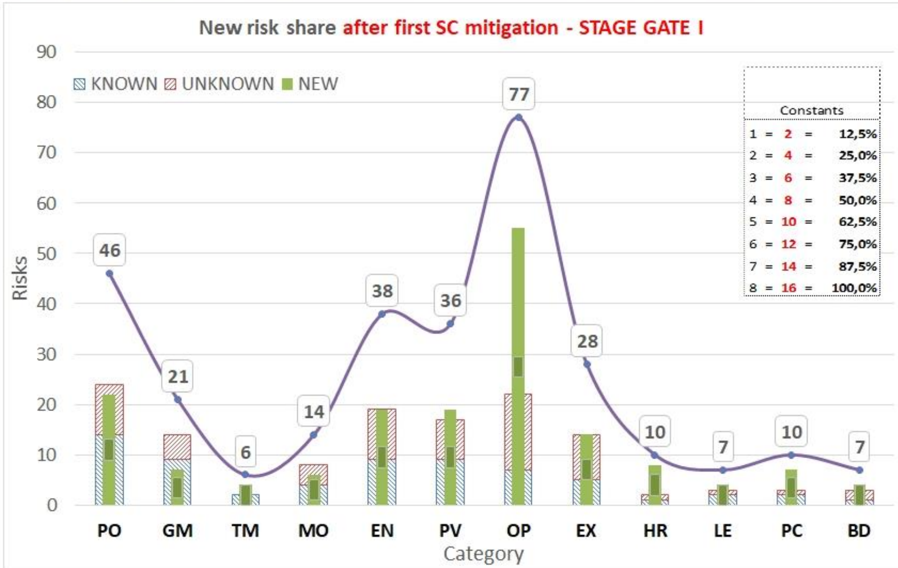
FAMS	RISKS	KNOWN	UNKNOWN	NEW	% Known	% Unknown	% New	High / High	High	High / Medium	Medium	Medium / Medium	Medium / Low	Low	Low / Low	Total
PO	46	14	10	22	30,4%	21,7%	47,8%	96	126	48	50	0	0	0	0	320
GM	21	9	5	7	42,9%	23,8%	33,3%	32	70	36	30	0	0	4	0	172
TM	6	2	0	4	33,3%	0,0%	66,7%	16	14	0	0	0	0	0	0	30
MO	14	4	4	6	28,6%	28,6%	42,9%	32	0	36	10	16	0	0	0	94
EN	38	9	10	19	23,7%	26,3%	50,0%	64	84	72	30	0	0	0	0	250
PV	36	9	8	19	25,0%	22,2%	52,8%	0	70	96	20	16	0	0	0	202
OP	77	7	15	55	9,1%	19,5%	71,4%	32	98	96	50	0	0	0	0	276
EX	28	5	9	14	17,9%	32,1%	50,0%	16	28	36	60	16	0	0	0	156
HR	10	1	1	8	10,0%	10,0%	80,0%	0	14	0	10	0	0	0	0	24
LE	7	2	1	4	28,6%	14,3%	57,1%	0	42	0	0	0	0	0	0	42
PC	10	2	1	7	20,0%	10,0%	70,0%	0	14	12	10	0	0	0	0	36
BD	7	1	2	4	14,3%	28,6%	57,1%	32	0	12	0	0	0	0	0	44
Total	300	65	66	169	21,7%	22,0%	56,3%	320	560	444	270	48	0	4	0	

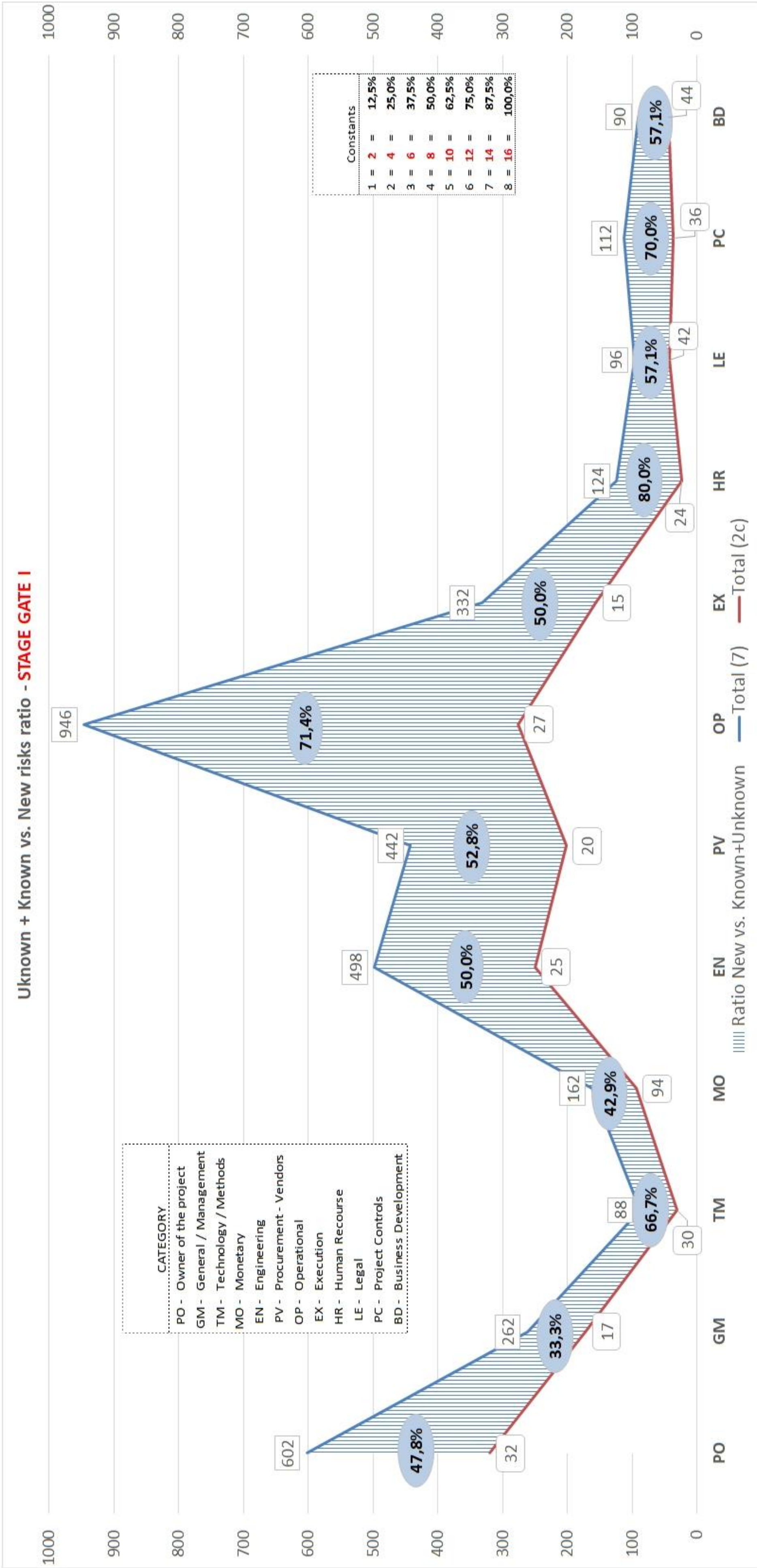




FAMS	RISKS	KNOWN	UNKNOWN	NEW	% Known	% Unknown	% New	High / High	High	High / Medium	Medium	Medium / Medium	Medium / Low	Low	Low / Low	Total (7)	Total (2c)	%
PO	46	14	10	22	30,4%	21,7%	47,8%	176	168	168	90	0	0	0	0	602	320	88,1%
GM	21	9	5	7	42,9%	23,8%	33,3%	32	112	84	30	0	0	4	0	262	172	52,3%
TM	6	2	0	4	33,3%	0,0%	66,7%	48	28	12	0	0	0	0	0	88	30	193,3%
MO	14	4	4	6	28,6%	28,6%	42,9%	32	14	60	40	16	0	0	0	162	94	72,3%
EN	38	9	10	19	23,7%	26,3%	50,0%	80	210	168	40	0	0	0	0	498	250	99,2%
PV	36	9	8	19	25,0%	22,2%	52,8%	32	168	168	50	24	0	0	0	442	202	118,8%
OP	77	7	15	55	9,1%	19,5%	71,4%	224	266	252	100	104	0	0	0	946	276	242,8%
EX	28	5	9	14	17,9%	32,1%	50,0%	32	112	72	100	16	0	0	0	332	156	112,8%
HR	10	1	1	8	10,0%	10,0%	80,0%	16	28	60	20	0	0	0	0	124	24	416,7%
LE	7	2	1	4	28,6%	14,3%	57,1%	0	84	12	0	0	0	0	0	96	42	128,6%
PC	10	2	1	7	20,0%	10,0%	70,0%	0	28	48	20	16	0	0	0	112	36	211,1%
BD	7	1	2	4	14,3%	28,6%	57,1%	32	14	24	20	0	0	0	0	90	44	104,5%
Total	300	65	66	169	21,7%	22,0%	56,3%	704	1232	1128	510	176	0	4	0			



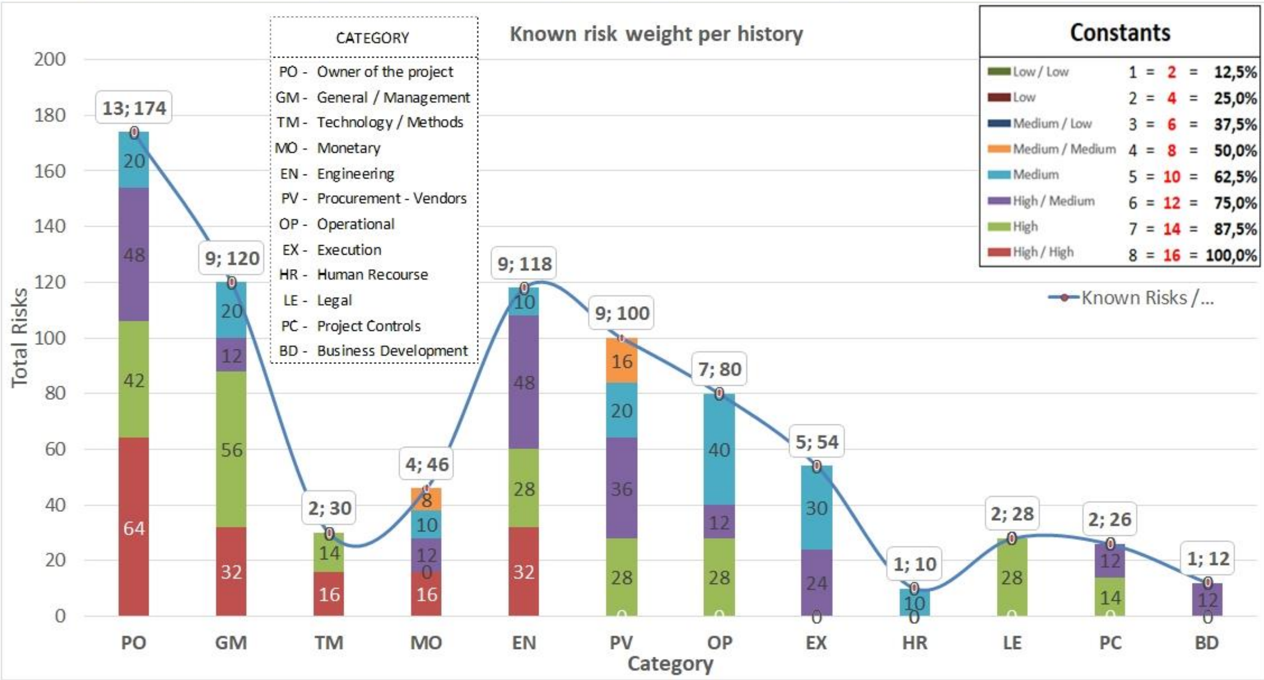



Uknown + Known vs. New risks ratio - STAGE GATE I
CATEGORY
PO - Owner of the project
GM - General / Management
TM - Technology / Methods
MO - Monetary
EN - Engineering
PV - Procurement - Vendors
OP - Operational
EX - Execution
HR - Human Recourse
LE - Legal
PC - Project Controls
BD - Business Development
Constants
1 = 2 = 12,5%
2 = 4 = 25,0%
3 = 6 = 37,5%
4 = 8 = 50,0%
5 = 10 = 62,5%
6 = 12 = 75,0%
7 = 14 = 87,5%
8 = 16 = 100,0%
PO GM TM MO EN PV OP EX HR LE PC BD
602 262 88 162 498 442 946 332 124 96 112 90
32 17 30 94 25 20 27 15 24 42 36 44
47,8% 33,3% 66,7% 42,9% 50,0% 52,8% 71,4% 50,0% 80,0% 57,1% 70,0% 57,1%
Ratio New vs. Known+Unknown
Total (7)
Total (2c)

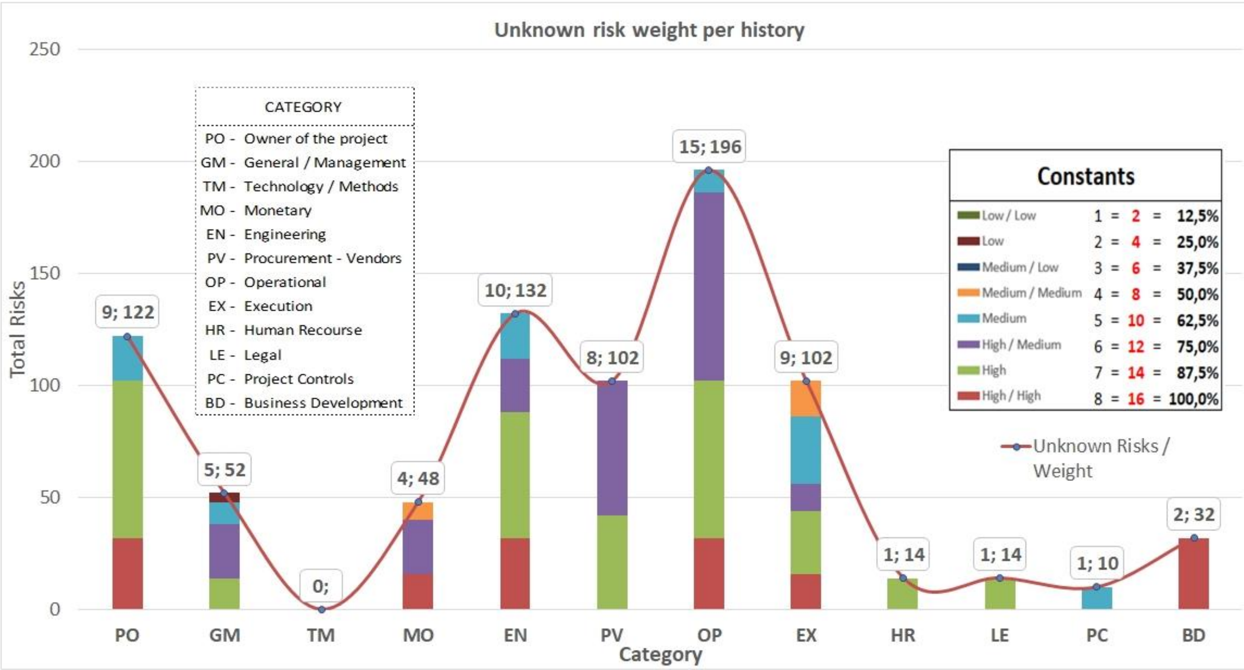
Model results of the Stage Gate I - Project No.2

Basis report stage gate I

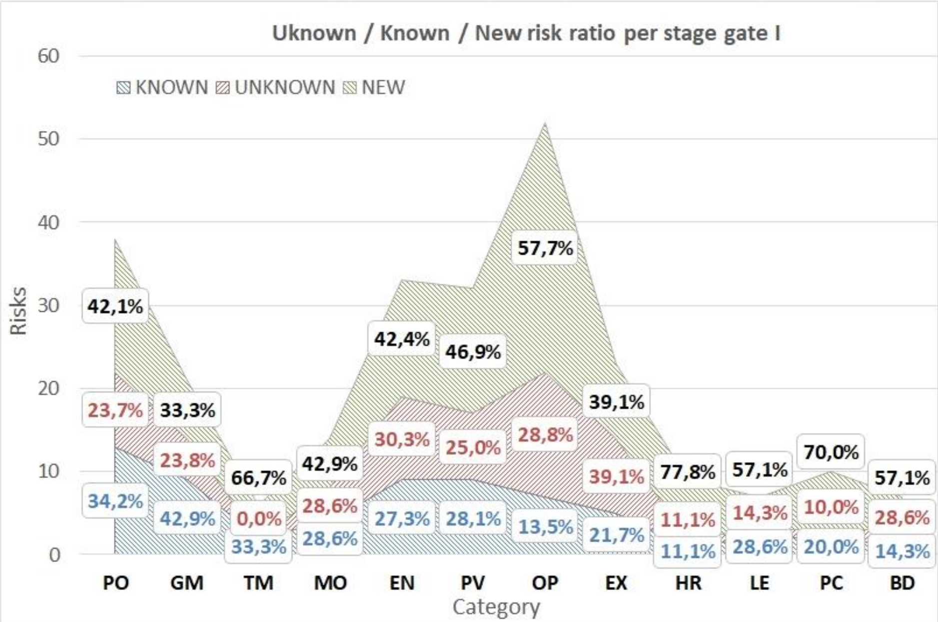
FAMS	KNOWN	High / High	High	High / Medium	Medium	Medium / Medium	Medium / Low	Low	Low / Low	Total
PO	13	64	42	48	20	0	0	0	0	174
GM	9	32	56	12	20	0	0	0	0	120
TM	2	16	14	0	0	0	0	0	0	30
MO	4	16	0	12	10	8	0	0	0	46
EN	9	32	28	48	10	0	0	0	0	118
PV	9	0	28	36	20	16	0	0	0	100
OP	7	0	28	12	40	0	0	0	0	80
EX	5	0	0	24	30	0	0	0	0	54
HR	1	0	0	0	10	0	0	0	0	10
LE	2	0	28	0	0	0	0	0	0	28
PC	2	0	14	12	0	0	0	0	0	26
BD	1	0	0	12	0	0	0	0	0	12
Total	64	160	238	216	160	24	0	0	0	

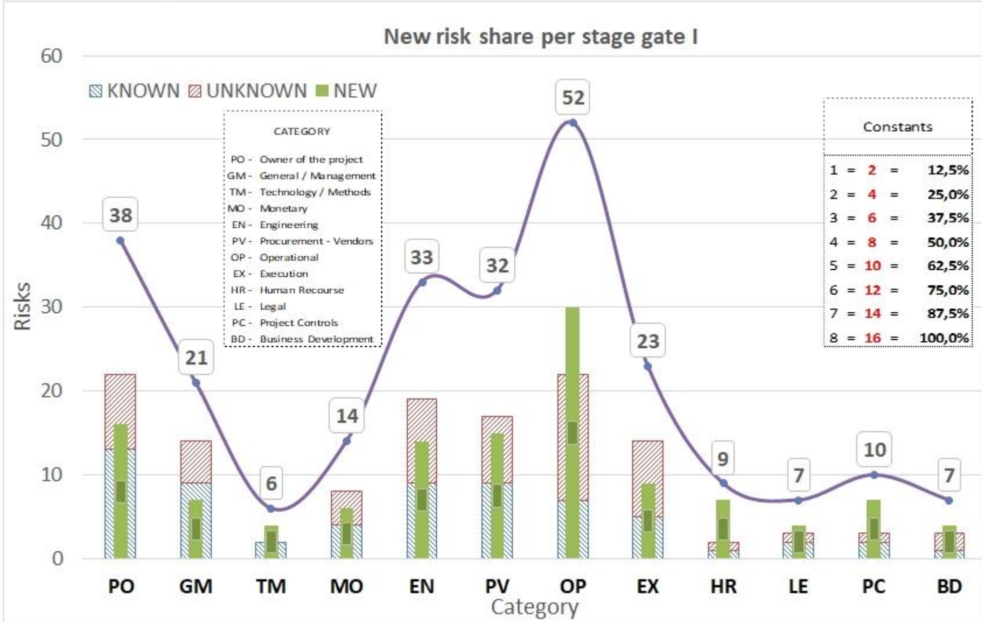


FAMS	UNKNOWN	High / High	High	High / Medium	Medium	Medium / Medium	Medium / Low	Low	Low / Low	Total
PO	9	32	70	0	20	0	0	0	0	122
GM	5	0	14	24	10	0	0	4	0	52
TM	0	0	0	0	0	0	0	0	0	0
MO	4	16	0	24	0	8	0	0	0	48
EN	10	32	56	24	20	0	0	0	0	132
PV	8	0	42	60	0	0	0	0	0	102
OP	15	32	70	84	10	0	0	0	0	196
EX	9	16	28	12	30	16	0	0	0	102
HR	1	0	14	0	0	0	0	0	0	14
LE	1	0	14	0	0	0	0	0	0	14
PC	1	0	0	0	10	0	0	0	0	10
BD	2	32	0	0	0	0	0	0	0	32
Total	65	160	308	228	100	24	0	4	0	

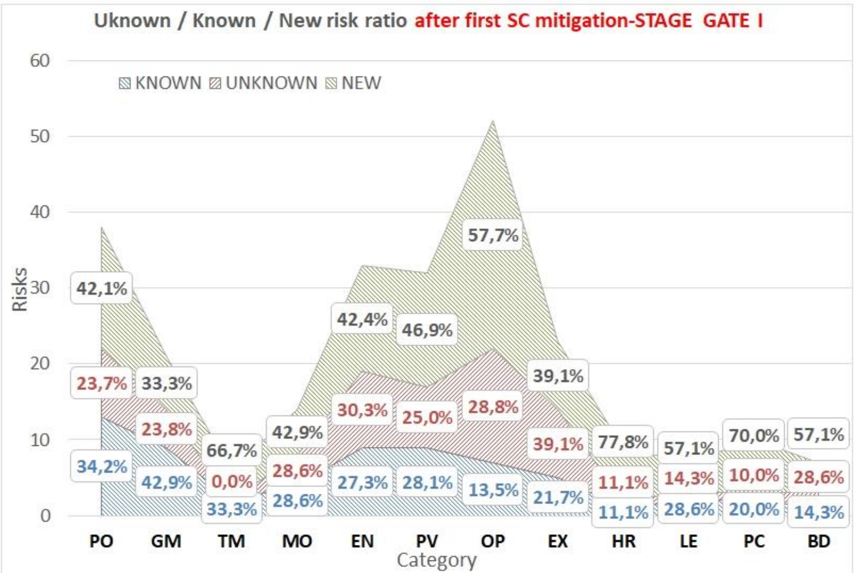


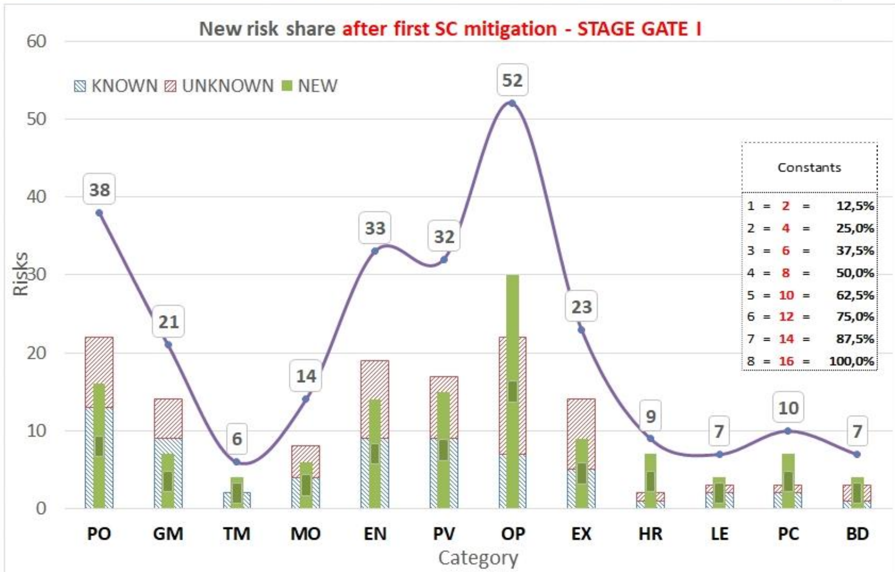
FAMS	RISKS	KNOWN	UNKNOWN	NEW	% Known	% Unknown	% New	High / High	High	High / Medium	Medium	Medium / Medium	Medium / Low	Low	Low / Low	Total
PO	38	13	9	16	34,2%	23,7%	42,1%	96	112	48	40	0	0	0	0	296
GM	21	9	5	7	42,9%	23,8%	33,3%	32	70	36	30	0	0	4	0	172
TM	6	2	0	4	33,3%	0,0%	66,7%	16	14	0	0	0	0	0	0	30
MO	14	4	4	6	28,6%	28,6%	42,9%	32	0	36	10	16	0	0	0	94
EN	33	9	10	14	27,3%	30,3%	42,4%	64	84	72	30	0	0	0	0	250
PV	32	9	8	15	28,1%	25,0%	46,9%	0	70	96	20	16	0	0	0	202
OP	52	7	15	30	13,5%	28,8%	57,7%	32	98	96	50	0	0	0	0	276
EX	23	5	9	9	21,7%	39,1%	39,1%	16	28	36	60	16	0	0	0	156
HR	9	1	1	7	11,1%	11,1%	77,8%	0	14	0	10	0	0	0	0	24
LE	7	2	1	4	28,6%	14,3%	57,1%	0	42	0	0	0	0	0	0	42
PC	10	2	1	7	20,0%	10,0%	70,0%	0	14	12	10	0	0	0	0	36
BD	7	1	2	4	14,3%	28,6%	57,1%	32	0	12	0	0	0	0	0	44
Total	252	64	65	123	25,4%	25,8%	48,8%	320	546	444	260	48	0	4	0	

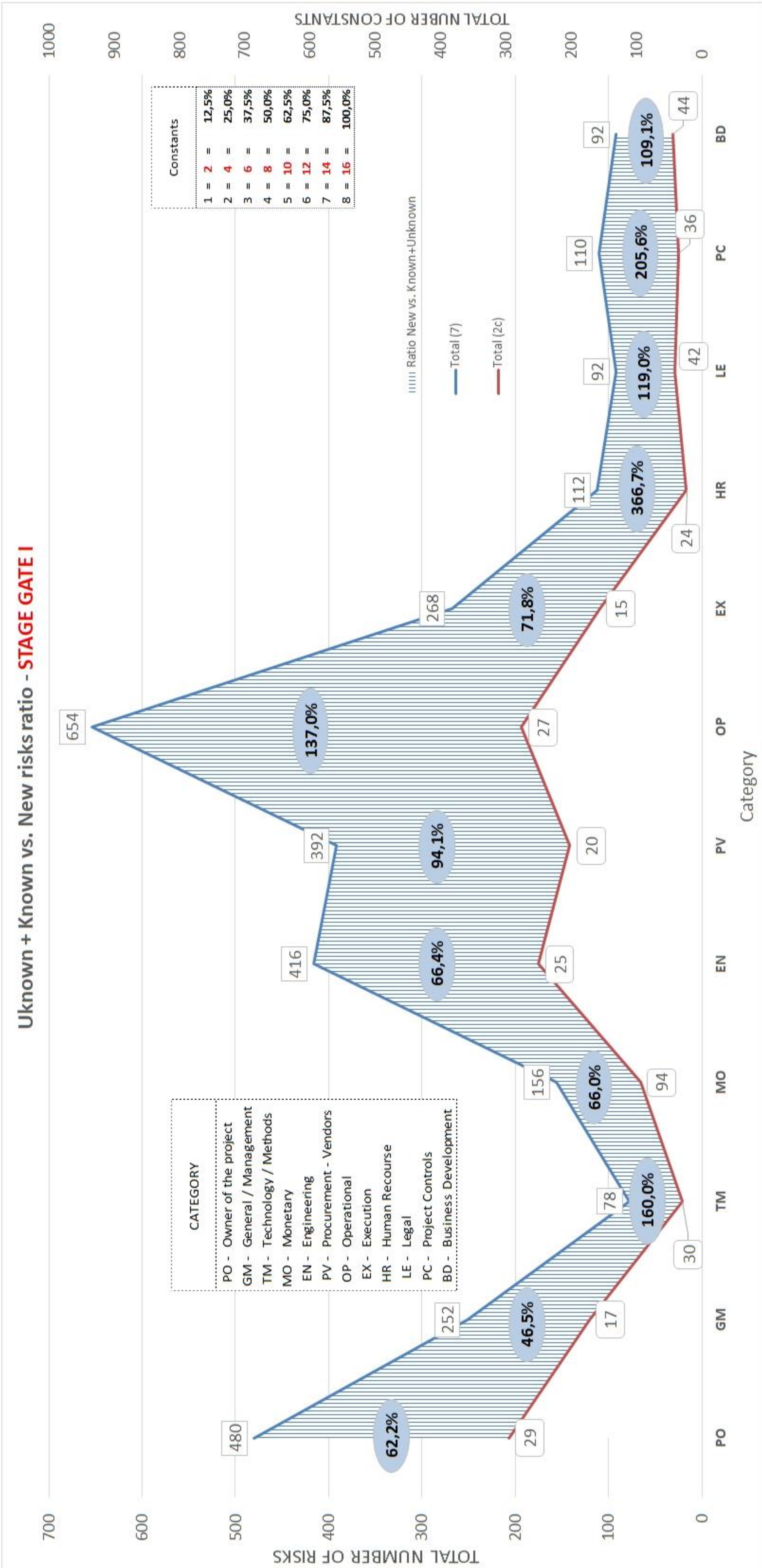




FAMS	RISKS	KNOWN	UNKNOWN	NEW	% Known	% Unknown	% New	High / High	High	High / Medium	Medium	Medium / Medium	Medium / Low	Low	Low / Low	Total (7)	Total (2c)	%
PO	38	13	9	16	34,2%	23,7%	42,1%	96	126	168	90	0	0	0	0	480	296	62,2%
GM	21	9	5	7	42,9%	23,8%	33,3%	32	84	72	60	0	0	4	0	252	172	46,5%
TM	6	2	0	4	33,3%	0,0%	66,7%	16	28	24	10	0	0	0	0	78	30	160,0%
MO	14	4	4	6	28,6%	28,6%	42,9%	32	0	72	20	32	0	0	0	156	94	66,0%
EN	33	9	10	14	27,3%	30,3%	42,4%	64	126	180	30	16	0	0	0	416	250	66,4%
PV	32	9	8	15	28,1%	25,0%	46,9%	0	168	168	40	16	0	0	0	392	202	94,1%
OP	52	7	15	30	13,5%	28,8%	57,7%	96	238	216	80	24	0	0	0	654	276	137,0%
EX	23	5	9	9	21,7%	39,1%	39,1%	16	56	120	60	16	0	0	0	268	156	71,8%
HR	9	1	1	7	11,1%	11,1%	77,8%	0	42	60	10	0	0	0	0	112	24	366,7%
LE	7	2	1	4	28,6%	14,3%	57,1%	0	56	36	0	0	0	0	0	92	42	119,0%
PC	10	2	1	7	20,0%	10,0%	70,0%	0	14	60	20	16	0	0	0	110	36	205,6%
BD	7	1	2	4	14,3%	28,6%	57,1%	48	0	24	20	0	0	0	0	92	44	109,1%
Total	252	64	65	123	25,4%	25,8%	48,8%	400	938	1200	440	120	0	4	0			





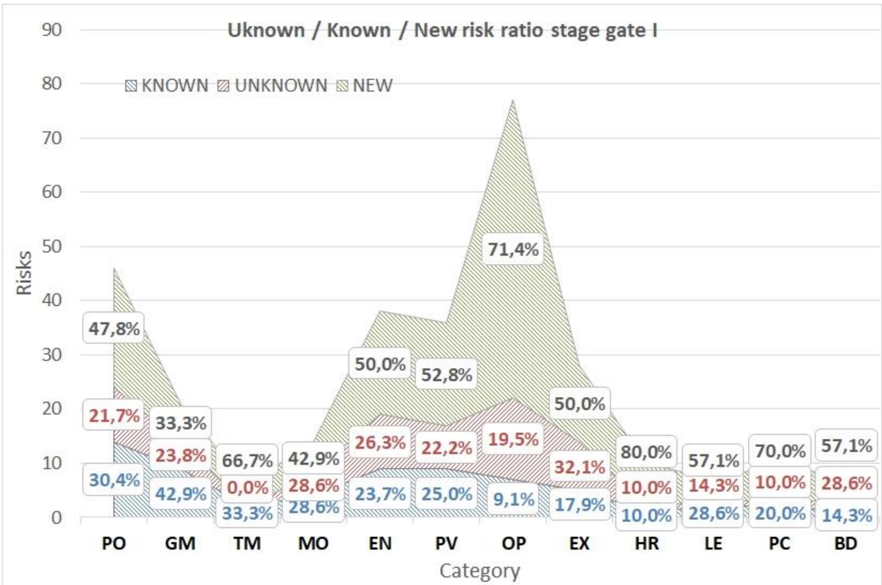


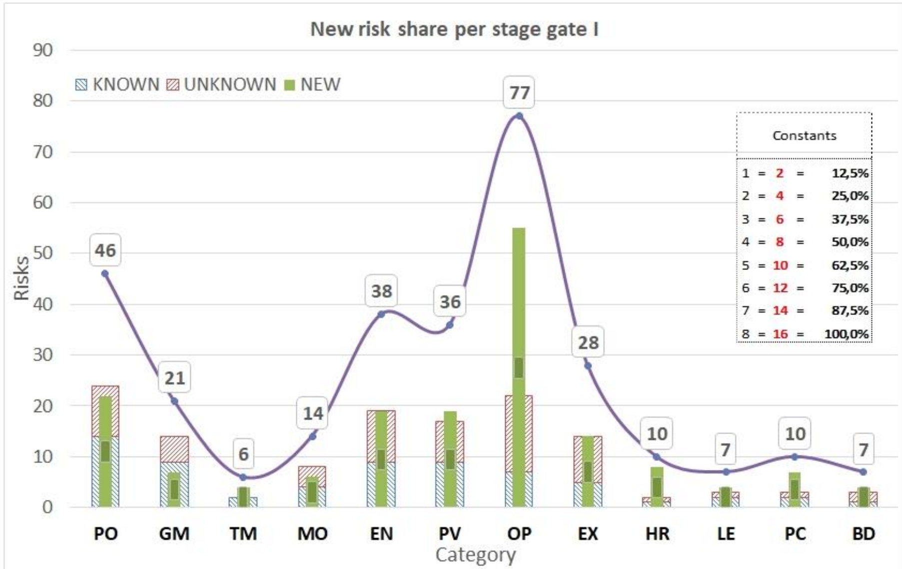
Uknown + Known vs. New risks ratio - STAGE GATE I
TOTAL NUMBER OF RISKS
TOTAL NUBER OF CONSTANTS
Category
PO GM TM MO EN PV OP EX HR LE PC BD
480 252 78 156 416 392 654 268 112 92 110 92
29 17 30 94 25 20 27 15 24 42 36 44
62,2% 46,5% 160,0% 66,0% 66,4% 94,1% 137,0% 71,8% 366,7% 119,0% 205,6% 109,1%
CATEGORY
PO - Owner of the project
GM - General / Management
TM - Technology / Methods
MO - Monetary
EN - Engineering
PV - Procurement - Vendors
OP - Operational
EX - Execution
HR - Human Recourse
LE - Legal
PC - Project Controls
BD - Business Development
Ratio New vs. Known+Unknown
Total (7)
Total (2c)
Constants
1 = 2 = 12,5%
2 = 4 = 25,0%
3 = 6 = 37,5%
4 = 8 = 50,0%
5 = 10 = 62,5%
6 = 12 = 75,0%
7 = 14 = 87,5%
8 = 16 = 100,0%

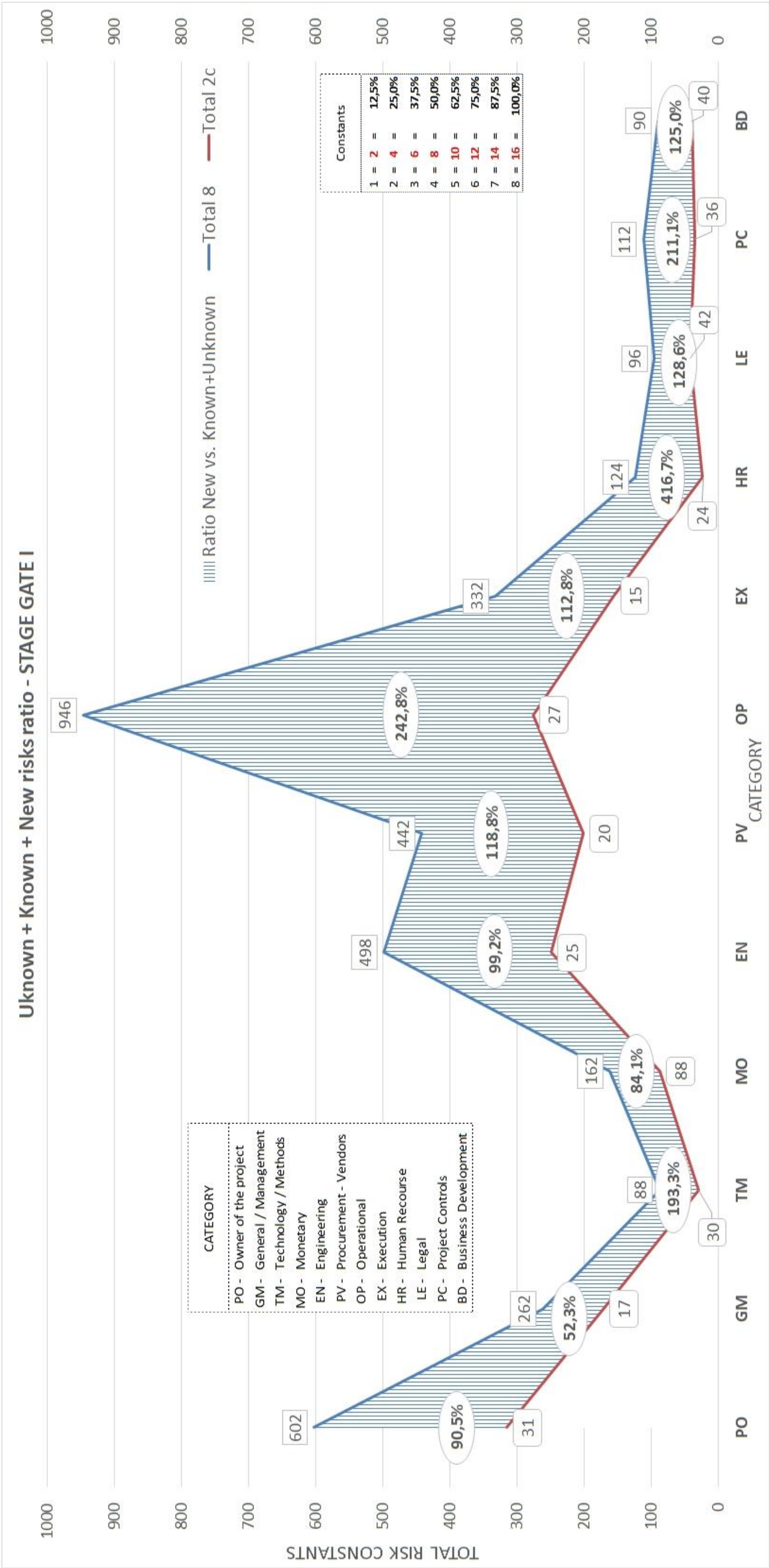
Model results of the Stage Gate II – Project No.1

Basis report stage gate II

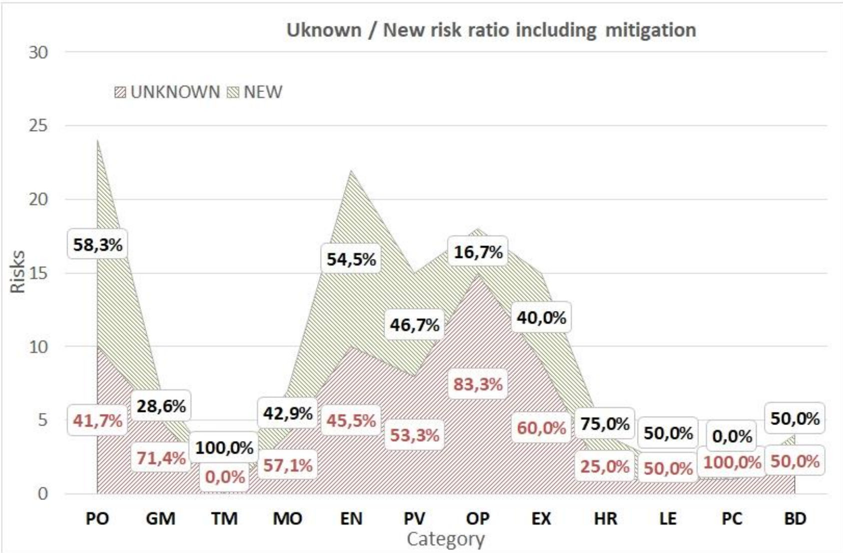
FAMS	RISKS	KNOWN	UNKNOWN	NEW	% Known	% Unknown	% New	High / High	High	High / Medium	Medium	Medium / Medium	Medium / Low	Low	Low / Low	Total 8	Total 2c	%
PO	46	14	10	22	30,4%	21,7%	47,8%	176	168	168	90	0	0	0	0	602	316	90,5%
GM	21	9	5	7	42,9%	23,8%	33,3%	32	112	84	30	0	0	4	0	262	172	52,3%
TM	6	2	0	4	33,3%	0,0%	66,7%	48	28	12	0	0	0	0	0	88	30	193,3%
MO	14	4	4	6	28,6%	28,6%	42,9%	32	14	60	40	16	0	0	0	162	88	84,1%
EN	38	9	10	19	23,7%	26,3%	50,0%	80	210	168	40	0	0	0	0	498	250	99,2%
PV	36	9	8	19	25,0%	22,2%	52,8%	32	168	168	50	24	0	0	0	442	202	118,8%
OP	77	7	15	55	9,1%	19,5%	71,4%	224	266	252	100	104	0	0	0	946	276	242,8%
EX	28	5	9	14	17,9%	32,1%	50,0%	32	112	72	100	16	0	0	0	332	156	112,8%
HR	10	1	1	8	10,0%	10,0%	80,0%	16	28	60	20	0	0	0	0	124	24	416,7%
LE	7	2	1	4	28,6%	14,3%	57,1%	0	84	12	0	0	0	0	0	96	42	128,6%
PC	10	2	1	7	20,0%	10,0%	70,0%	0	28	48	20	16	0	0	0	112	36	211,1%
BD	7	1	2	4	14,3%	28,6%	57,1%	32	14	24	20	0	0	0	0	90	40	125,0%
Total	300	65	66	169	21,7%	22,0%	56,3%	704	1232	1128	510	176	0	4	0			

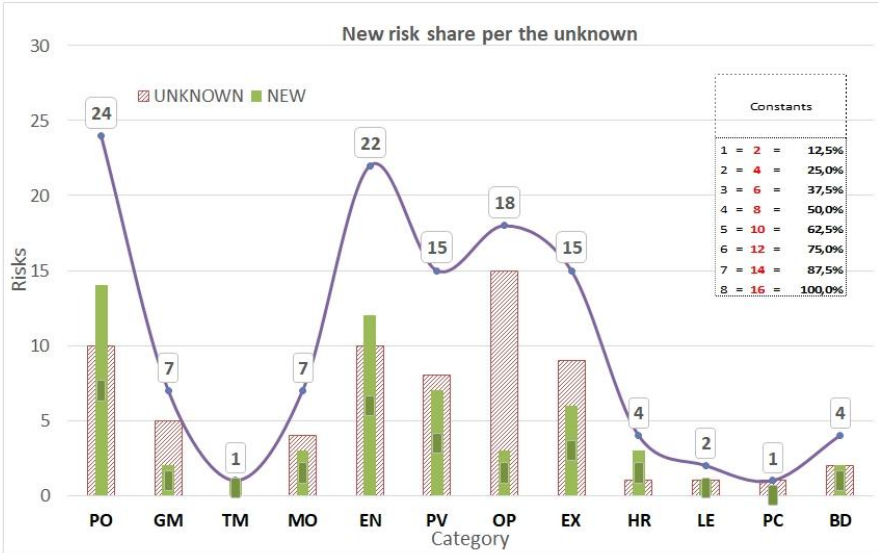


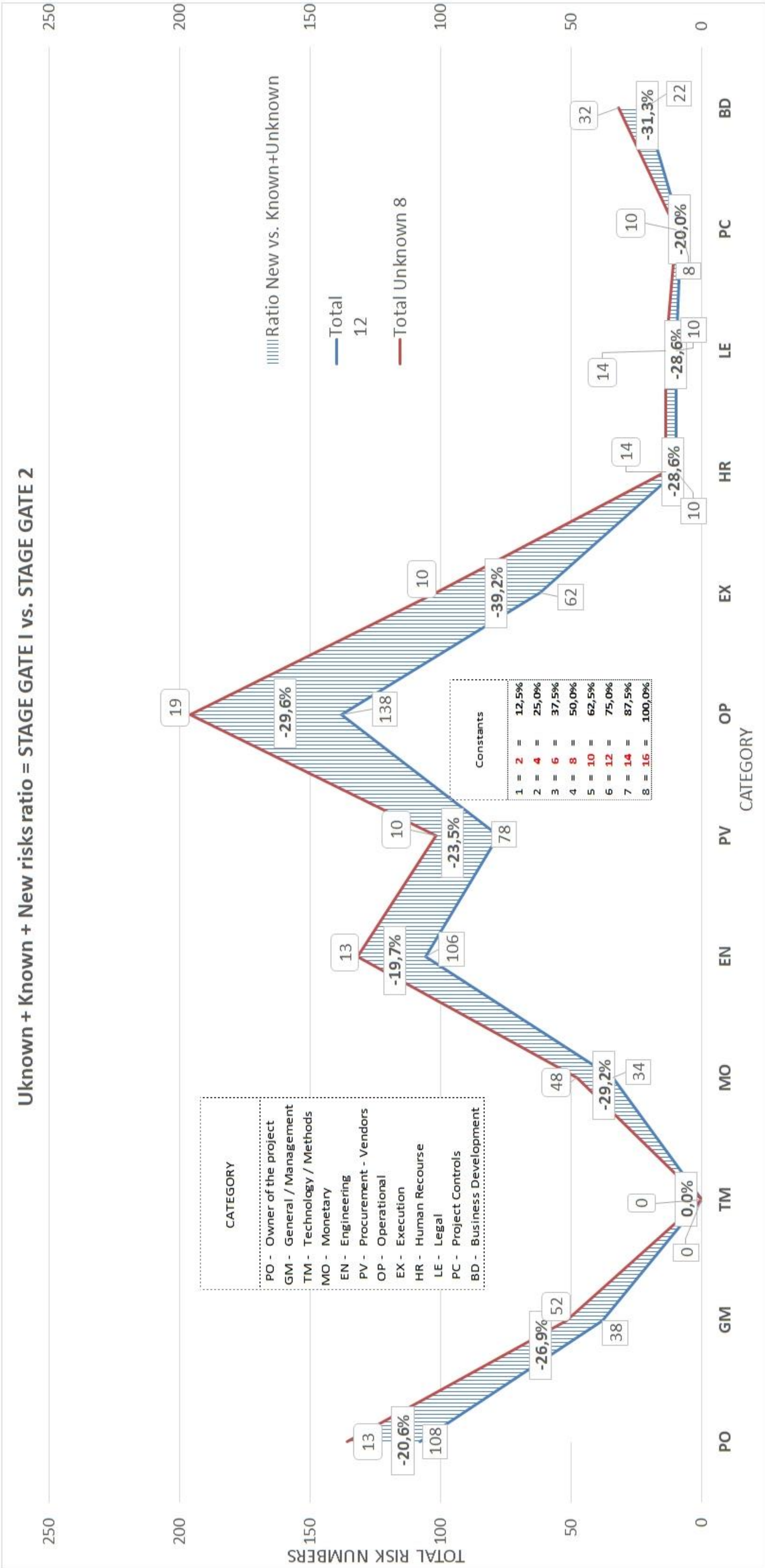



Uknown + Known + New risks ratio - STAGE GATE I
Ratio New vs. Known+Unknown
Total 8
Total 2c
TOTAL RISK CONSTANTS
CATEGORY
PO
GM
TM
MO
EN
PV
OP
EX
HR
LE
PC
BD
602
262
88
162
498
442
946
332
124
96
112
90
31
17
30
88
25
20
27
15
24
42
36
40
90,5%
52,3%
193,3%
84,1%
99,2%
118,8%
242,8%
112,8%
416,7%
128,6%
211,1%
125,0%
CATEGORY
PO - Owner of the project
GM - General / Management
TM - Technology / Methods
MO - Monetary
EN - Engineering
PV - Procurement - Vendors
OP - Operational
EX - Execution
HR - Human Recourse
LE - Legal
PC - Project Controls
BD - Business Development
Constants
1 = 2 = 12,5%
2 = 4 = 25,0%
3 = 6 = 37,5%
4 = 8 = 50,0%
5 = 10 = 62,5%
6 = 12 = 75,0%
7 = 14 = 87,5%
8 = 16 = 100,0%

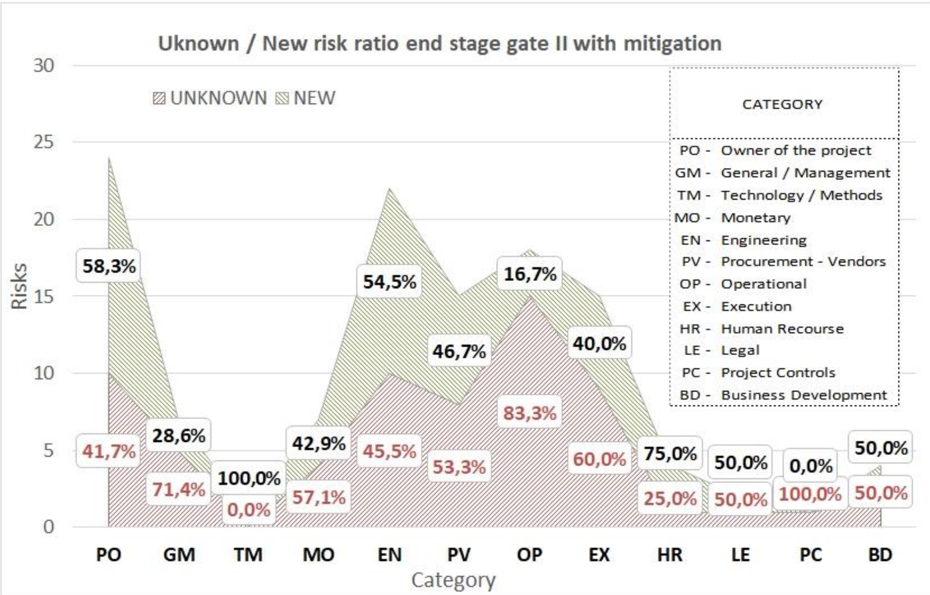
FAMS	UNKNOWN RISKS	KNOWN	UNKNOWN	NEW	% Known	% Unknown	% New	High / High	High	High / Medium	Medium	Medium / Medium	Medium / Low	Low	Low / Low	Total 12	Total Unknown 8	%
PO	24	0	10	14	0,0%	41,7%	58,3%	0	0	60	40	8	0	0	0	108	136	-20,6%
GM	7	0	5	2	0,0%	71,4%	28,6%	0	0	0	10	24	0	4	0	38	52	-26,9%
TM	1	0	0	1	0,0%	0,0%	100,0%	0	0	0	0	0	0	0	0	0	0	0,0%
MO	7	0	4	3	0,0%	57,1%	42,9%	0	0	12	0	16	6	0	0	34	48	-29,2%
EN	22	0	10	12	0,0%	45,5%	54,5%	0	14	48	30	8	6	0	0	106	132	-19,7%
PV	15	0	8	7	0,0%	53,3%	46,7%	0	0	0	70	8	0	0	0	78	102	-23,5%
OP	18	0	15	3	0,0%	83,3%	16,7%	0	14	12	50	56	6	0	0	138	196	-29,6%
EX	15	0	9	6	0,0%	60,0%	40,0%	0	0	0	30	8	12	12	0	62	102	-39,2%
HR	4	0	1	3	0,0%	25,0%	75,0%	0	0	0	10	0	0	0	0	10	14	-28,6%
LE	2	0	1	1	0,0%	50,0%	50,0%	0	0	0	10	0	0	0	0	10	14	-28,6%
PC	1	0	1	0	0,0%	100,0%	0,0%	0	0	0	0	8	0	0	0	8	10	-20,0%
BD	4	0	2	2	0,0%	50,0%	50,0%	0	0	12	10	0	0	0	0	22	32	-31,3%
Total	120	0	66	54	0,0%	55,0%	45,0%	0	28	144	260	136	30	16	0			

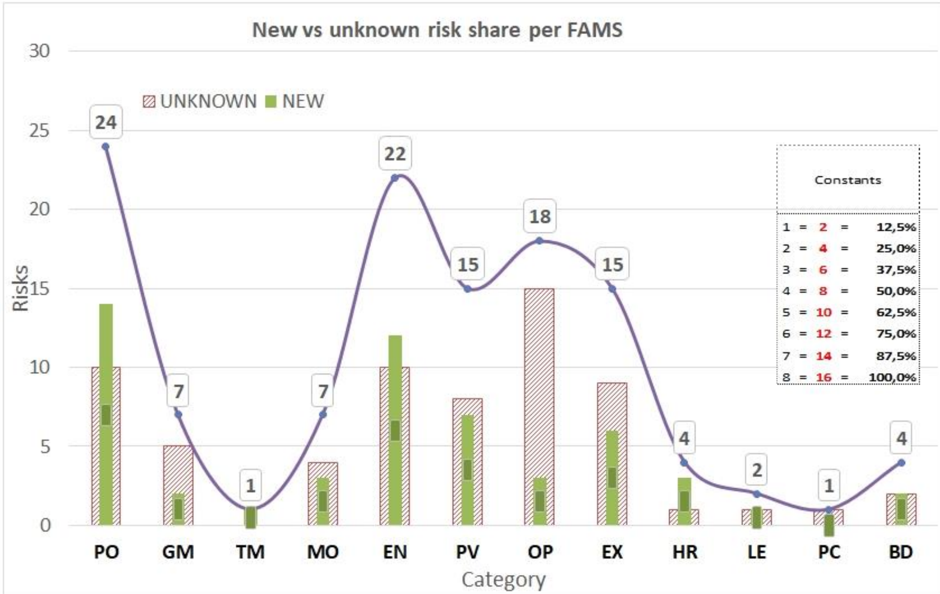




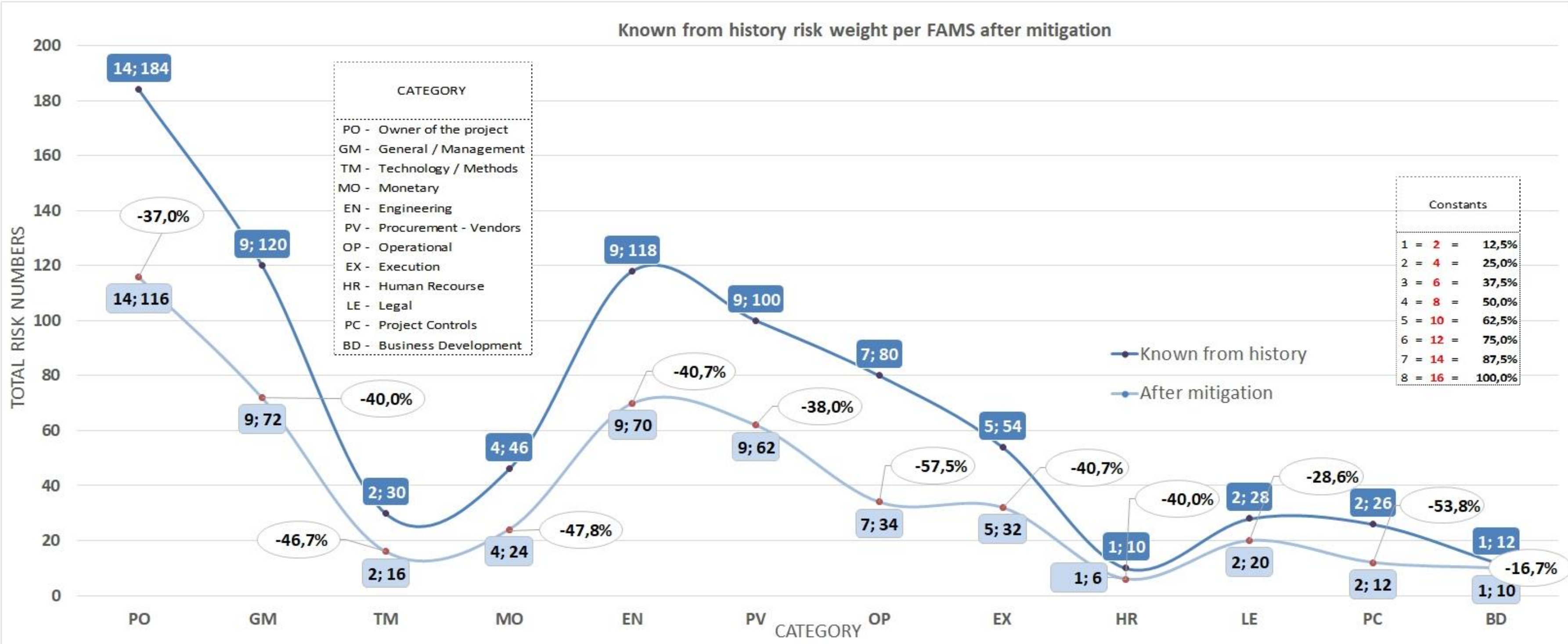

Uknown + Known + New risks ratio = STAGE GATE I vs. STAGE GATE 2
TOTAL RISK NUMBERS
CATEGORY
Ratio New vs. Known+Unknown
Total 12
Total Unknown 8
CATEGORY
PO - Owner of the project
GM - General / Management
TM - Technology / Methods
MO - Monetary
EN - Engineering
PV - Procurement - Vendors
OP - Operational
EX - Execution
HR - Human Recourse
LE - Legal
PC - Project Controls
BD - Business Development
Constants
1 = 2 = 12,5%
2 = 4 = 25,0%
3 = 6 = 37,5%
4 = 8 = 50,0%
5 = 10 = 62,5%
6 = 12 = 75,0%
7 = 14 = 87,5%
8 = 16 = 100,0%
PO GM TM MO EN PV OP EX HR LE PC BD
-20,6% -26,9% 0,0% -29,2% -19,7% -23,5% -29,6% -39,2% -28,6% -28,6% -20,0% -31,3%

FAMS	UNKNOWN RISKS	KNOWN	UNKNOWN	NEW	% Known	% Unknown	% New	High / High	High	High / Medium	Medium	Medium / Medium	Medium / Low	Low	Low / Low	Total
PO	24	0	10	14	0,0%	41,7%	58,3%	0	0	120	110	16	6	0	0	252
GM	7	0	5	2	0,0%	71,4%	28,6%	0	0	24	10	24	0	4	0	62
TM	1	0	0	1	0,0%	0,0%	100,0%	0	0	12	0	0	0	0	0	12
MO	7	0	4	3	0,0%	57,1%	42,9%	0	0	12	30	16	6	0	0	64
EN	22	0	10	12	0,0%	45,5%	54,5%	0	14	120	80	16	6	0	0	236
PV	15	0	8	7	0,0%	53,3%	46,7%	0	0	60	90	8	0	0	0	158
OP	18	0	15	3	0,0%	83,3%	16,7%	0	28	12	70	56	6	0	0	172
EX	15	0	9	6	0,0%	60,0%	40,0%	0	0	60	40	8	12	12	0	132
HR	4	0	1	3	0,0%	25,0%	75,0%	0	0	12	30	0	0	0	0	42
LE	2	0	1	1	0,0%	50,0%	50,0%	0	0	0	20	0	0	0	0	20
PC	1	0	1	0	0,0%	100,0%	0,0%	0	0	0	0	8	0	0	0	8
BD	4	0	2	2	0,0%	50,0%	50,0%	0	0	24	20	0	0	0	0	44
Total	120	0	66	54	0,0%	55,0%	45,0%	0	42	456	500	152	36	16	0	

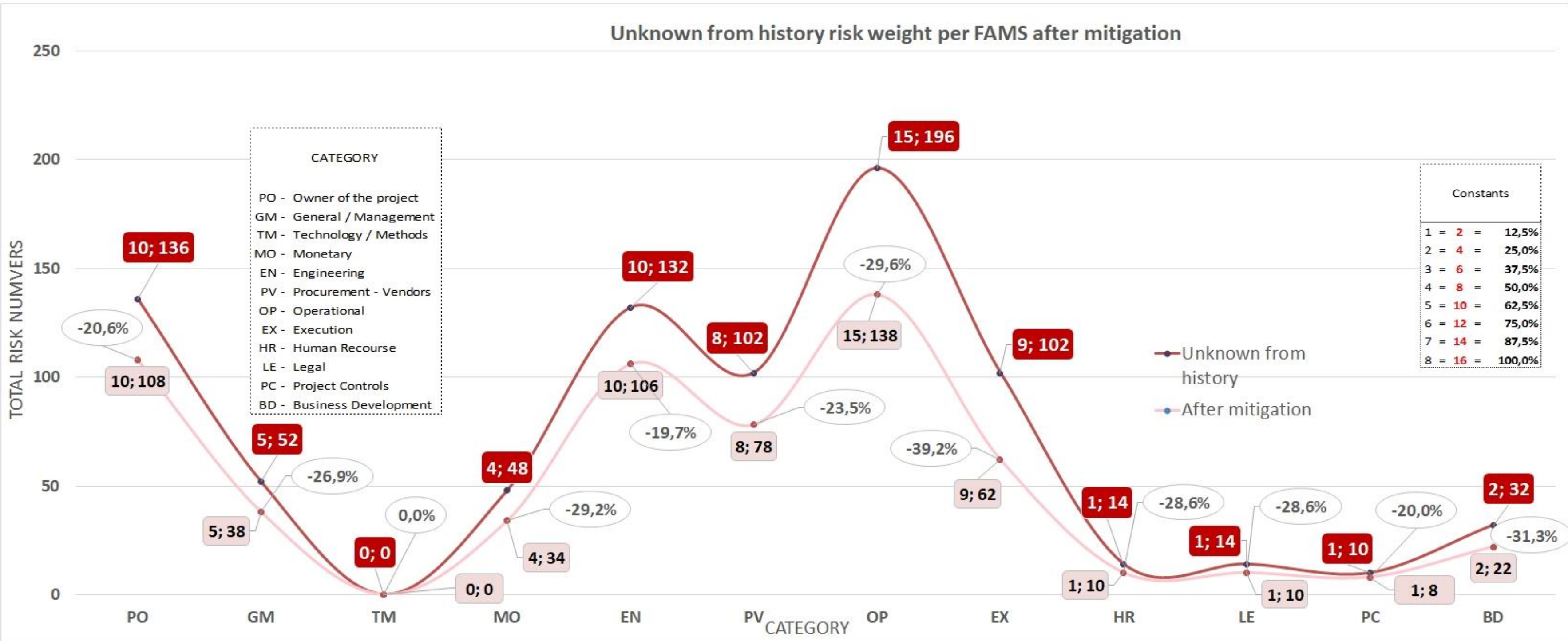




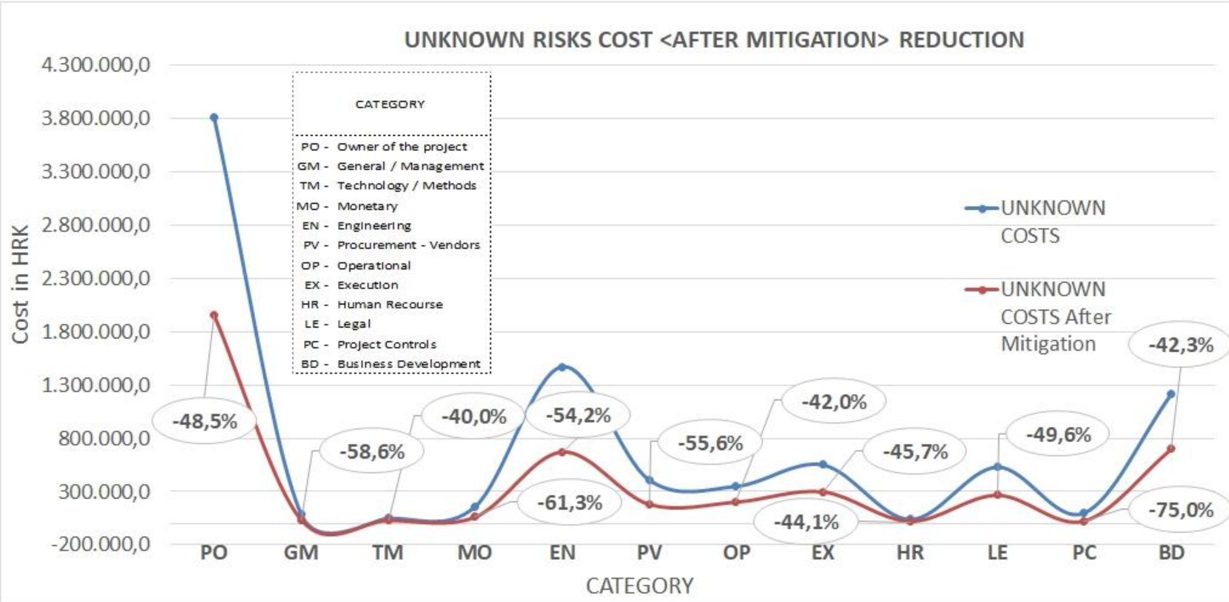
FAMS	KNOWN	KNOWN After SC	High / High	After SC	High	After SC	High / Medium	After SC	Medium	After SC	Medium / Medium	After SC	Medium / Low	After SC	Low	After SC	Low / Low	After SC	Total	After SC	Mitigation %
PO	14	14	64	0	42	0	48	0	30	50	0	48	0	18	0	0	0	0	184	116	-37,0%
GM	9	9	32	0	56	0	12	24	20	20	0	8	0	12	0	8	0	0	120	72	-40,0%
TM	2	2	16	0	14	0	0	0	0	0	0	16	0	0	0	0	0	0	30	16	-46,7%
MO	4	4	16	0	0	0	12	0	10	0	8	16	0	0	0	8	0	0	46	24	-47,8%
EN	9	9	32	0	28	0	48	12	10	10	0	24	0	24	0	0	0	0	118	70	-40,7%
PV	9	9	0	0	28	0	36	0	20	0	16	48	0	6	0	8	0	0	100	62	-38,0%
OP	7	7	0	0	28	0	12	0	40	10	0	0	0	0	0	24	0	0	80	34	-57,5%
EX	5	5	0	0	0	0	24	0	30	0	0	8	0	24	0	0	0	0	54	32	-40,7%
HR	1	1	0	0	0	0	0	0	10	0	0	0	0	6	0	0	0	0	10	6	-40,0%
LE	2	2	0	0	28	0	0	0	0	20	0	0	0	0	0	0	0	0	28	20	-28,6%
PC	2	2	0	0	14	0	12	0	0	0	0	0	0	12	0	0	0	0	26	12	-53,8%
BD	1	1	0	0	0	0	12	0	0	10	0	0	0	0	0	0	0	0	12	10	-16,7%
Total	65	65	160	0	238	0	216	36	170	120	24	168	0	102	0	48	0	0			



FAMS	UNKNOWN	UNKNOWN After SC	High / High	After SC	High	After SC	High / Medium	After SC	Medium	After SC	Medium / Medium	After SC	Medium / Low	After SC	Low	After SC	Low / Low	After SC	Total	After SC	Mitigation %
PO	10	10	32	0	84	0	0	60	20	40	0	8	0	0	0	0	0	0	136	108	-20,6%
GM	5	5	0	0	14	0	24	0	10	10	0	24	0	0	4	4	0	0	52	38	-26,9%
TM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0%
MO	4	4	16	0	0	0	24	12	0	0	8	16	0	6	0	0	0	0	48	34	-29,2%
EN	10	10	32	0	56	14	24	48	20	30	0	8	0	6	0	0	0	0	132	106	-19,7%
PV	8	8	0	0	42	0	60	0	0	70	0	8	0	0	0	0	0	0	102	78	-23,5%
OP	15	15	32	0	70	14	84	12	10	50	0	56	0	6	0	0	0	0	196	138	-29,6%
EX	9	9	16	0	28	0	12	0	30	30	16	8	0	12	0	12	0	0	102	62	-39,2%
HR	1	1	0	0	14	0	0	0	0	10	0	0	0	0	0	0	0	0	14	10	-28,6%
LE	1	1	0	0	14	0	0	0	0	10	0	0	0	0	0	0	0	0	14	10	-28,6%
PC	1	1	0	0	0	0	0	0	10	0	0	8	0	0	0	0	0	0	10	8	-20,0%
BD	2	2	32	0	0	0	0	12	0	10	0	0	0	0	0	0	0	0	32	22	-31,3%
Total	66	66	160	0	322	28	228	144	100	260	24	136	0	30	4	16	0	0			



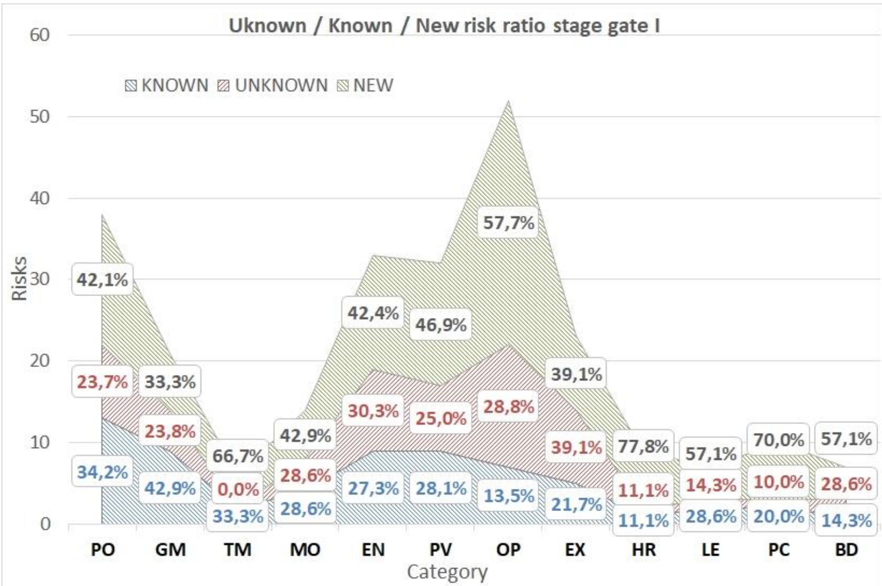
FAMS	UNKNOWN COSTS	UNKNOWN COSTS After Mitigation	Mitigation %
PO	3.806.000,0	1.958.500,0	-48,5%
GM	90.000,0	37.250,0	-58,6%
TM	50.000,0	30.000,0	-40,0%
MO	160.000,0	61.875,0	-61,3%
EN	1.470.000,0	673.625,0	-54,2%
PV	410.000,0	181.875,0	-55,6%
OP	350.000,0	203.125,0	-42,0%
EX	550.000,0	298.625,0	-45,7%
HR	40.000,0	22.375,0	-44,1%
LE	530.000,0	266.875,0	-49,6%
PC	100.000,0	25.000,0	-75,0%
BD	1.210.000,0	698.750,0	-42,3%
Total	**8.766.000,0**	**4.457.875,0**	**-49,1%**

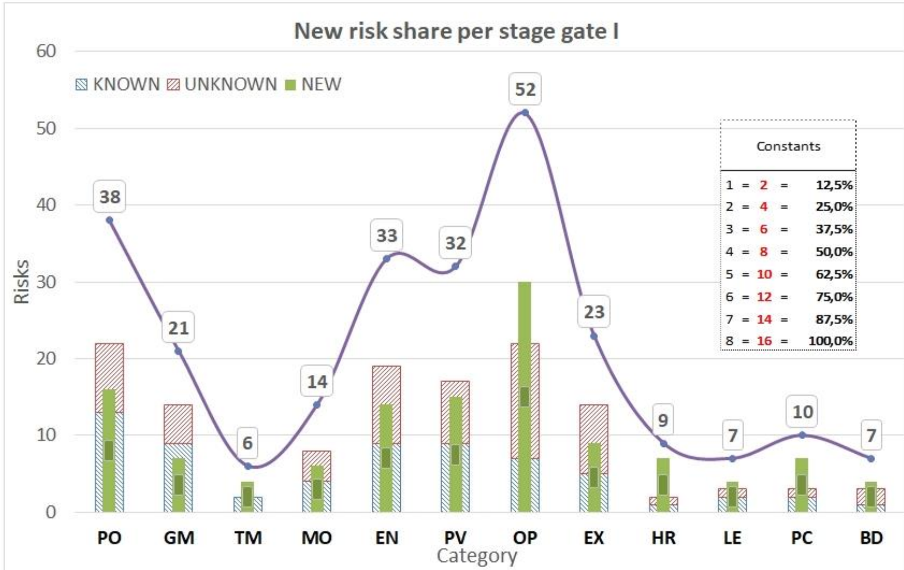


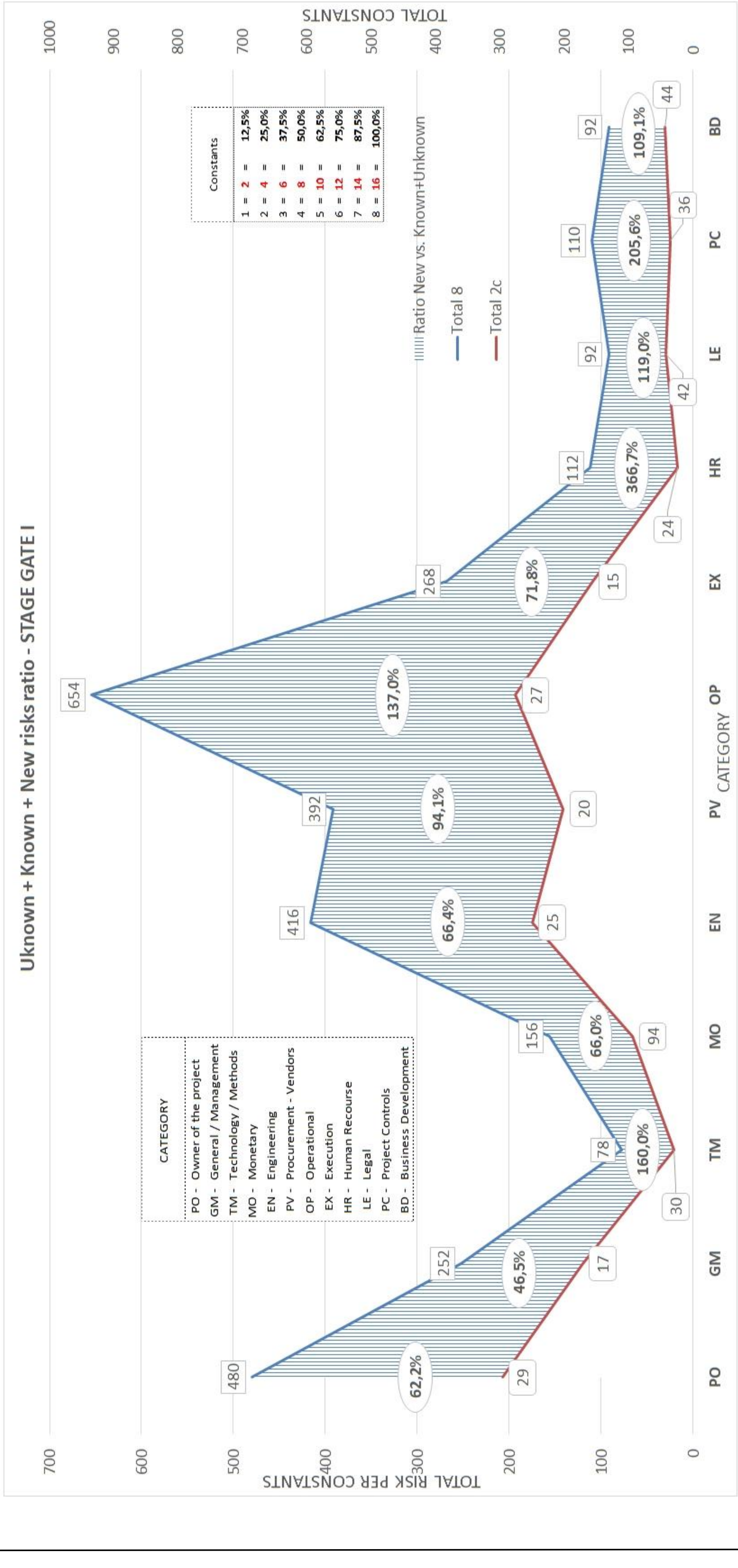
Model results of the Stage Gate III – Project No.2

Basis report stage gate II

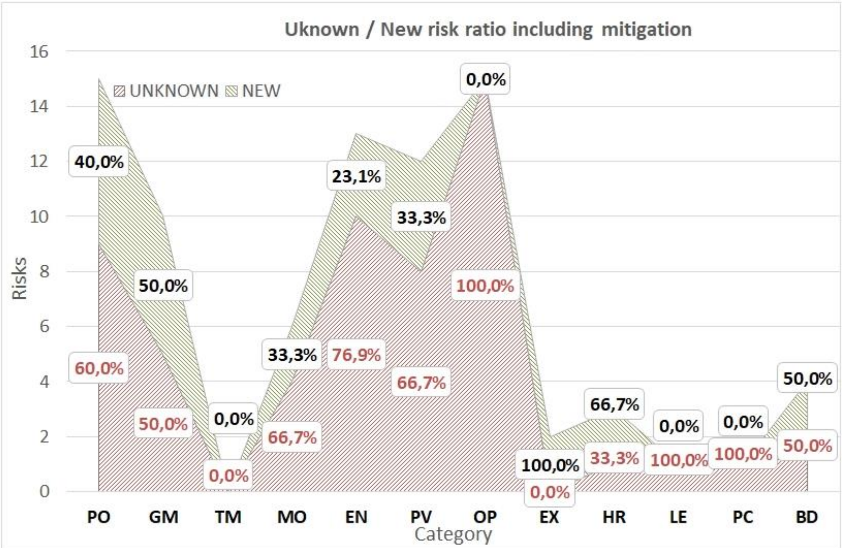
FAMS	RISKS	KNOWN	UNKNOWN	NEW	% Known	% Unknown	% New	High / High	High	High / Medium	Medium	Medium / Medium	Medium / Low	Low	Low / Low	Total 8	Total 2c	%
PO	38	13	9	16	34,2%	23,7%	42,1%	96	126	168	90	0	0	0	0	480	296	62,2%
GM	21	9	5	7	42,9%	23,8%	33,3%	32	84	72	60	0	0	4	0	252	172	46,5%
TM	6	2	0	4	33,3%	0,0%	66,7%	16	28	24	10	0	0	0	0	78	30	160,0%
MO	14	4	4	6	28,6%	28,6%	42,9%	32	0	72	20	32	0	0	0	156	94	66,0%
EN	33	9	10	14	27,3%	30,3%	42,4%	64	126	180	30	16	0	0	0	416	250	66,4%
PV	32	9	8	15	28,1%	25,0%	46,9%	0	168	168	40	16	0	0	0	392	202	94,1%
OP	52	7	15	30	13,5%	28,8%	57,7%	96	238	216	80	24	0	0	0	654	276	137,0%
EX	23	5	9	9	21,7%	39,1%	39,1%	16	56	120	60	16	0	0	0	268	156	71,8%
HR	9	1	1	7	11,1%	11,1%	77,8%	0	42	60	10	0	0	0	0	112	24	366,7%
LE	7	2	1	4	28,6%	14,3%	57,1%	0	56	36	0	0	0	0	0	92	42	119,0%
PC	10	2	1	7	20,0%	10,0%	70,0%	0	14	60	20	16	0	0	0	110	36	205,6%
BD	7	1	2	4	14,3%	28,6%	57,1%	48	0	24	20	0	0	0	0	92	44	109,1%
Total	252	64	65	123	25,4%	25,8%	48,8%	400	938	1200	440	120	0	4	0			

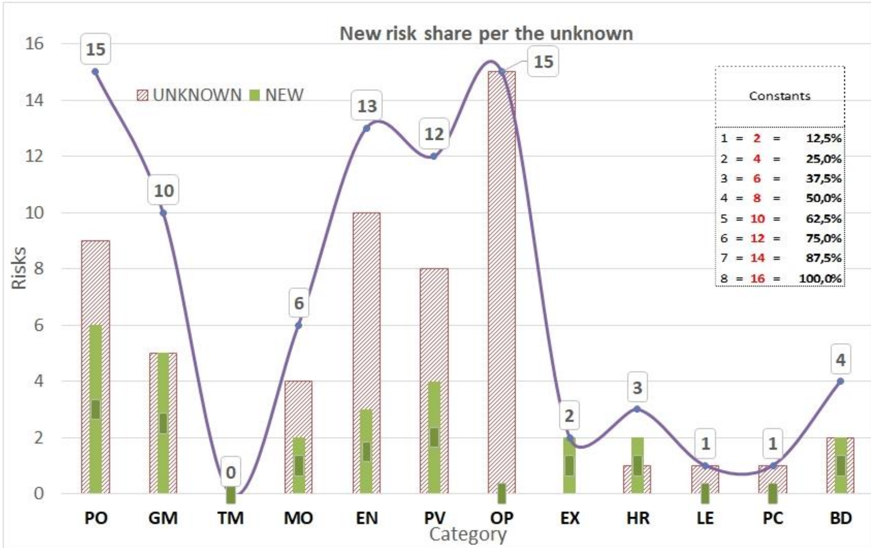


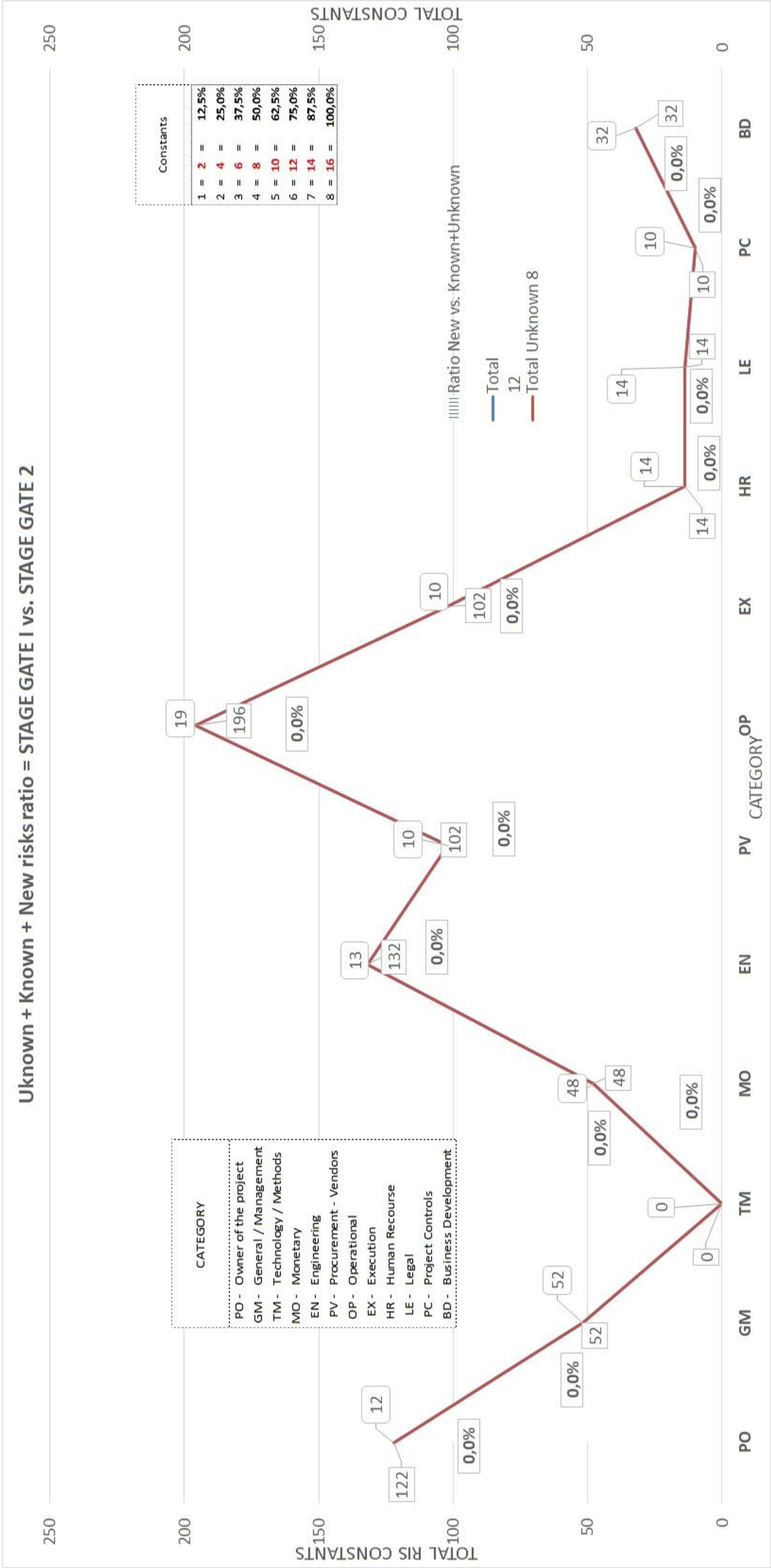



Uknown + Known + New risks ratio - STAGE GATE I
TOTAL RISK PER CONSTANTS
TOTAL CONSTANTS
CATEGORY
PO GM TM MO EN PV OP EX HR LE PC BD
480 252 78 156 416 392 654 268 112 92 110 92
29 17 30 94 25 20 27 15 24 42 36 44
62,2% 46,5% 160,0% 66,0% 66,4% 94,1% 137,0% 71,8% 366,7% 119,0% 205,6% 109,1%
CATEGORY
PO - Owner of the project
GM - General / Management
TM - Technology / Methods
MO - Monetary
EN - Engineering
PV - Procurement - Vendors
OP - Operational
EX - Execution
HR - Human Recourse
LE - Legal
PC - Project Controls
BD - Business Development
Ratio New vs. Known+Unknown
Total 8
Total 2c
Constants
1 = 2 = 12,5%
2 = 4 = 25,0%
3 = 6 = 37,5%
4 = 8 = 50,0%
5 = 10 = 62,5%
6 = 12 = 75,0%
7 = 14 = 87,5%
8 = 16 = 100,0%

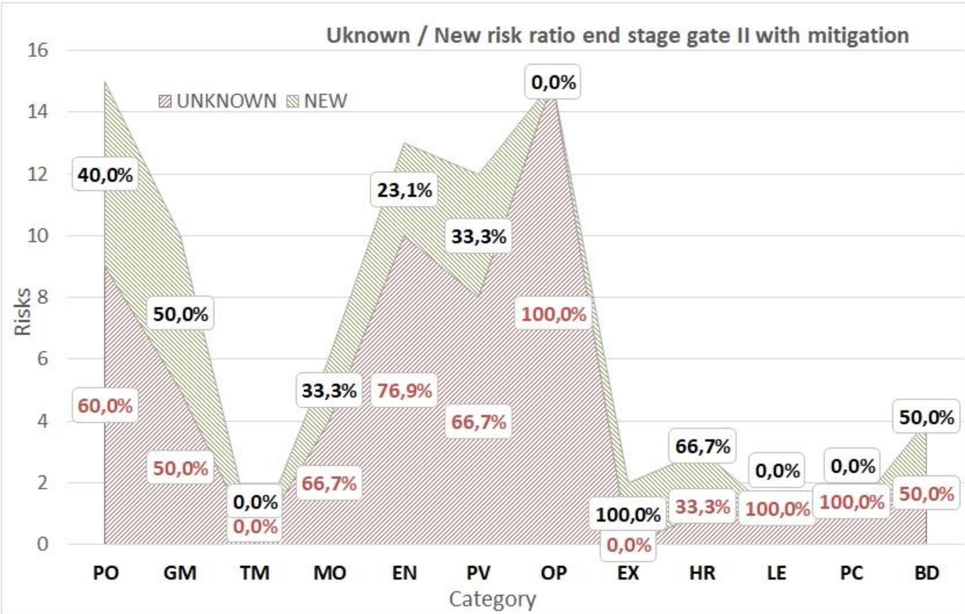
FAMS	UNKNOWN RISKS	KNOWN	UNKNOWN	NEW	% Known	% Unknown	% New	High / High	High	High / Medium	Medium	Medium / Medium	Medium / Low	Low	Low / Low	Total 12	Total Unknown 8	%
PO	15	0	9	6	0,0%	60,0%	40,0%	32	70	0	20	0	0	0	0	122	122	0,0%
GM	10	0	5	5	0,0%	50,0%	50,0%	0	14	24	10	0	0	4	0	52	52	0,0%
TM	0	0	0	0	0,0%	0,0%	0,0%	0	0	0	0	0	0	0	0	0	0	0,0%
MO	6	0	4	2	0,0%	66,7%	33,3%	16	0	24	0	8	0	0	0	48	48	0,0%
EN	13	0	10	3	0,0%	76,9%	23,1%	32	56	24	20	0	0	0	0	132	132	0,0%
PV	12	0	8	4	0,0%	66,7%	33,3%	0	42	60	0	0	0	0	0	102	102	0,0%
OP	15	0	15	0	0,0%	100,0%	0,0%	32	70	84	10	0	0	0	0	196	196	0,0%
EX	2	0	0	2	0,0%	0,0%	100,0%	16	28	12	30	16	0	0	0	102	102	0,0%
HR	3	0	1	2	0,0%	33,3%	66,7%	0	14	0	0	0	0	0	0	14	14	0,0%
LE	1	0	1	0	0,0%	100,0%	0,0%	0	14	0	0	0	0	0	0	14	14	0,0%
PC	1	0	1	0	0,0%	100,0%	0,0%	0	0	0	10	0	0	0	0	10	10	0,0%
BD	4	0	2	2	0,0%	50,0%	50,0%	32	0	0	0	0	0	0	0	32	32	0,0%
Total	82	0	56	26	0,0%	68,3%	31,7%	160	308	228	100	24	0	4	0			

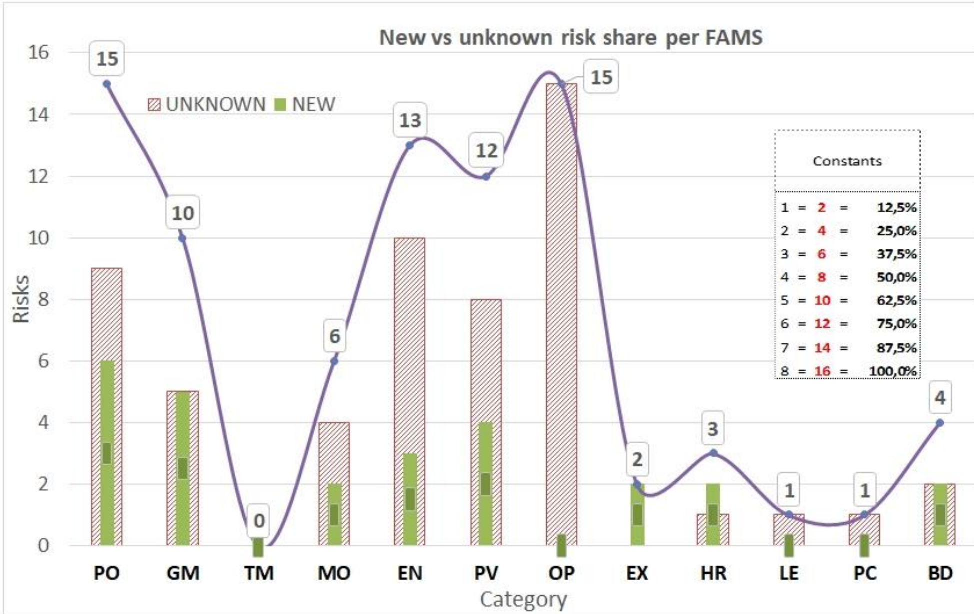




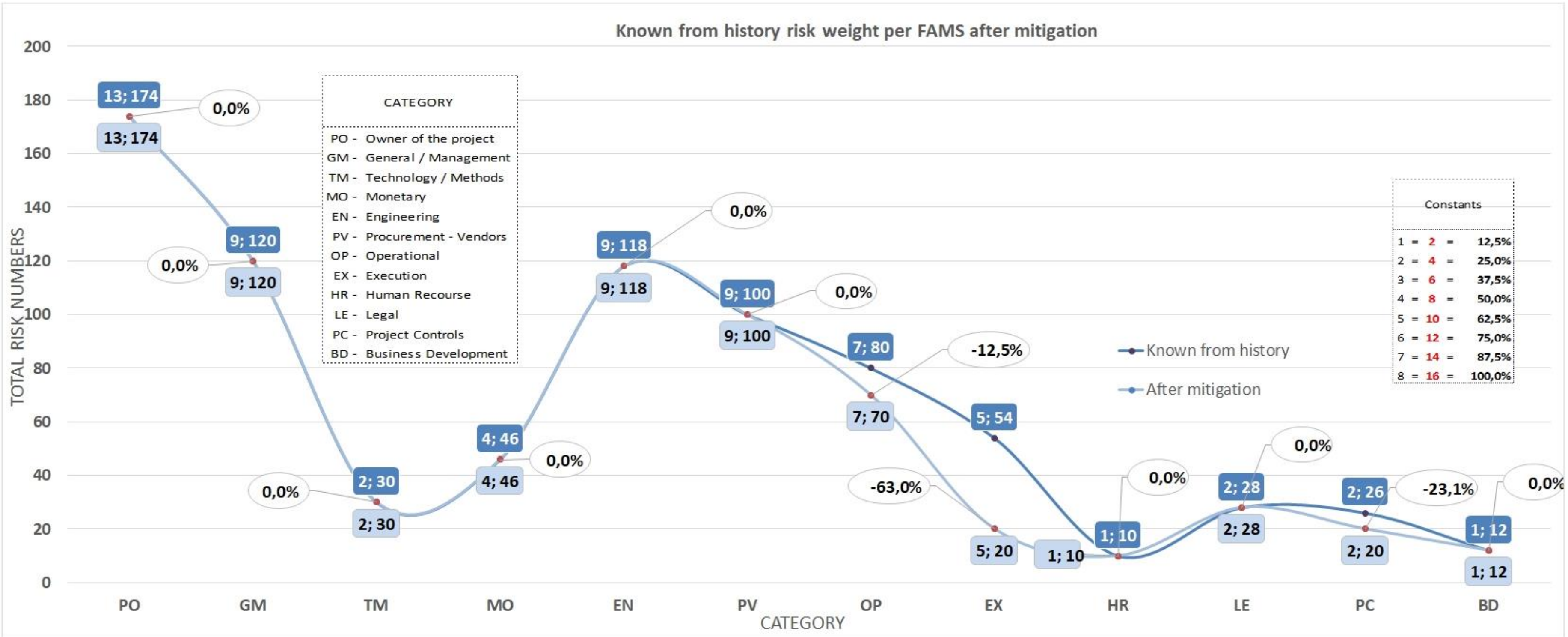

Uknown + Known + New risks ratio = STAGE GATE I vs. STAGE GATE 2
TOTAL RIS CONSTANTS
TOTAL CONSTANTS
CATEGORY
PO
GM
TM
MO
EN
PV
OP
EX
HR
LE
PC
BD
CATEGORY
PO - Owner of the project
GM - General / Management
TM - Technology / Methods
MO - Monetary
EN - Engineering
PV - Procurement - Vendors
OP - Operational
EX - Execution
HR - Human Recourse
LE - Legal
PC - Project Controls
BD - Business Development
Constants
1 = 2 = 12,5%
2 = 4 = 25,0%
3 = 6 = 37,5%
4 = 8 = 50,0%
5 = 10 = 62,5%
6 = 12 = 75,0%
7 = 14 = 87,5%
8 = 16 = 100,0%
Ratio New vs. Known+Unknown
Total 12
Total Unknown 8

FAMS	UNKNOWN RISKS	KNOWN	UNKNOWN	NEW	% Known	% Unknown	% New	High / High	High	High / Medium	Medium	Medium / Medium	Medium / Low	Low	Low / Low	Total
PO	15	0	9	6	0,0%	60,0%	40,0%	32	84	48	30	0	0	0	0	194
GM	10	0	5	5	0,0%	50,0%	50,0%	0	28	48	30	0	0	4	0	110
TM	0	0	0	0	0,0%	0,0%	0,0%	0	0	0	0	0	0	0	0	0
MO	6	0	4	2	0,0%	66,7%	33,3%	16	0	48	0	8	0	0	0	72
EN	13	0	10	3	0,0%	76,9%	23,1%	32	56	60	20	0	0	0	0	168
PV	12	0	8	4	0,0%	66,7%	33,3%	0	70	72	10	0	0	0	0	152
OP	15	0	15	0	0,0%	100,0%	0,0%	32	70	84	10	0	0	0	0	196
EX	2	0	0	2	0,0%	0,0%	100,0%	16	42	24	30	16	0	0	0	128
HR	3	0	1	2	0,0%	33,3%	66,7%	0	28	12	0	0	0	0	0	40
LE	1	0	1	0	0,0%	100,0%	0,0%	0	14	0	0	0	0	0	0	14
PC	1	0	1	0	0,0%	100,0%	0,0%	0	0	0	10	0	0	0	0	10
BD	4	0	2	2	0,0%	50,0%	50,0%	48	0	0	10	0	0	0	0	58
Total	82	0	56	26	0,0%	68,3%	31,7%	176	392	396	150	24	0	4	0	

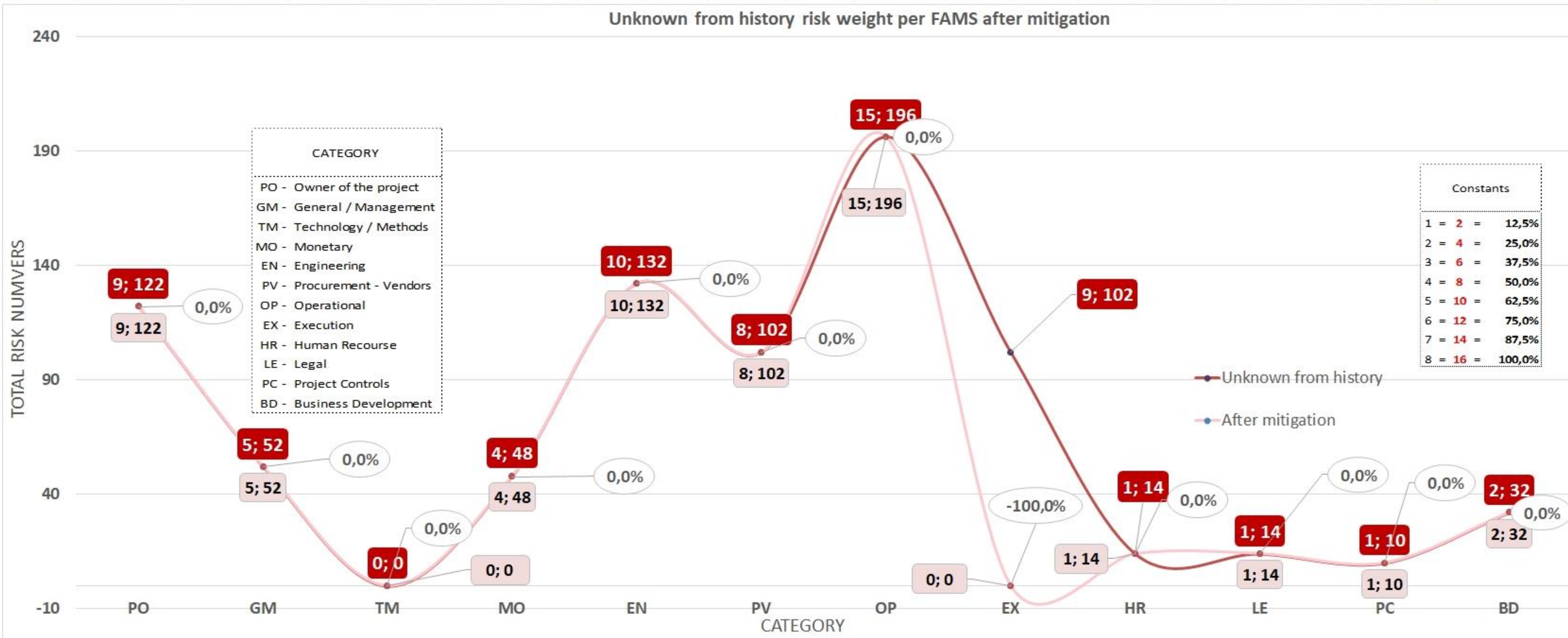




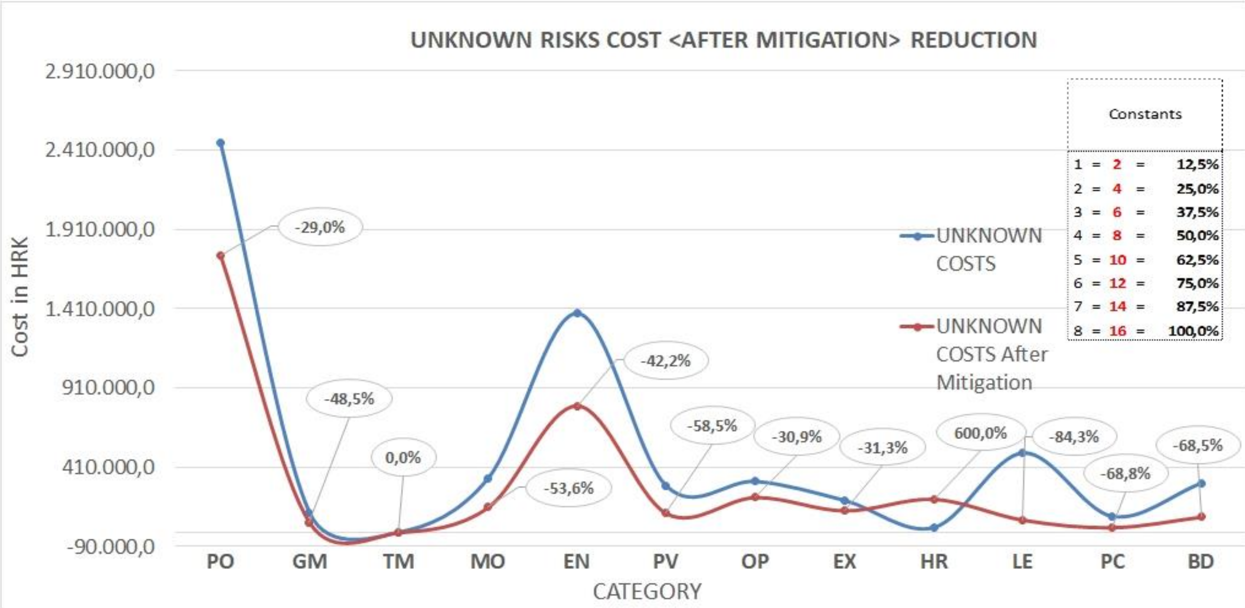
FAMS	KNOWN	KNOWN After SC	High / High	After SC	High	After SC	High / Medium	After SC	Medium	After SC	Medium / Medium	After SC	Medium / Low	After SC	Low	After SC	Low / Low	After SC	Total	After SC	Mitigation %
PO	13	13	64	64	42	42	48	48	20	20	0	0	0	0	0	0	0	0	174	174	0,0%
GM	9	9	32	32	56	56	12	12	20	20	0	0	0	0	0	0	0	0	120	120	0,0%
TM	2	2	16	16	14	14	0	0	0	0	0	0	0	0	0	0	0	0	30	30	0,0%
MO	4	4	16	16	0	0	12	12	10	10	8	8	0	0	0	0	0	0	46	46	0,0%
EN	9	9	32	32	28	28	48	48	10	10	0	0	0	0	0	0	0	0	118	118	0,0%
PV	9	9	0	0	28	28	36	36	20	20	16	16	0	0	0	0	0	0	100	100	0,0%
OP	7	7	0	0	28	0	12	0	40	70	0	0	0	0	0	0	0	0	80	70	-12,5%
EX	5	5	0	0	0	0	24	0	30	0	0	0	0	0	0	20	0	0	54	20	-63,0%
HR	1	1	0	0	0	0	0	0	10	10	0	0	0	0	0	0	0	0	10	10	0,0%
LE	2	2	0	0	28	28	0	0	0	0	0	0	0	0	0	0	0	0	28	28	0,0%
PC	2	2	0	0	14	0	12	0	0	20	0	0	0	0	0	0	0	0	26	20	-23,1%
BD	1	1	0	0	0	0	12	12	0	0	0	0	0	0	0	0	0	0	12	12	0,0%
Total	64	64	160	160	238	196	216	168	160	180	24	24	0	0	0	20	0	0			



FAMS	UNKNOWN	UNKNOWN After SC	High / High	After SC	High	After SC	High / Medium	After SC	Medium	After SC	Medium / Medium	After SC	Medium / Low	After SC	Low	After SC	Low / Low	After SC	Total	After SC	Mitigation %
PO	9	9	32	32	70	70	0	0	20	20	0	0	0	0	0	0	0	0	122	122	0,0%
GM	5	5	0	0	14	14	24	24	10	10	0	0	0	0	4	4	0	0	52	52	0,0%
TM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0%
MO	4	4	16	16	0	0	24	24	0	0	8	8	0	0	0	0	0	0	48	48	0,0%
EN	10	10	32	32	56	56	24	24	20	20	0	0	0	0	0	0	0	0	132	132	0,0%
PV	8	8	0	0	42	42	60	60	0	0	0	0	0	0	0	0	0	0	102	102	0,0%
OP	15	15	32	32	70	70	84	84	10	10	0	0	0	0	0	0	0	0	196	196	0,0%
EX	9	0	16	0	28	0	12	0	30	0	16	0	0	0	0	0	0	0	102	0	-100,0%
HR	1	1	0	0	14	14	0	0	0	0	0	0	0	0	0	0	0	0	14	14	0,0%
LE	1	1	0	0	14	14	0	0	0	0	0	0	0	0	0	0	0	0	14	14	0,0%
PC	1	1	0	0	0	0	0	0	10	10	0	0	0	0	0	0	0	0	10	10	0,0%
BD	2	2	32	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	32	0,0%
Total	65	56	160	144	308	280	228	216	100	70	24	8	0	0	4	4	0	0			



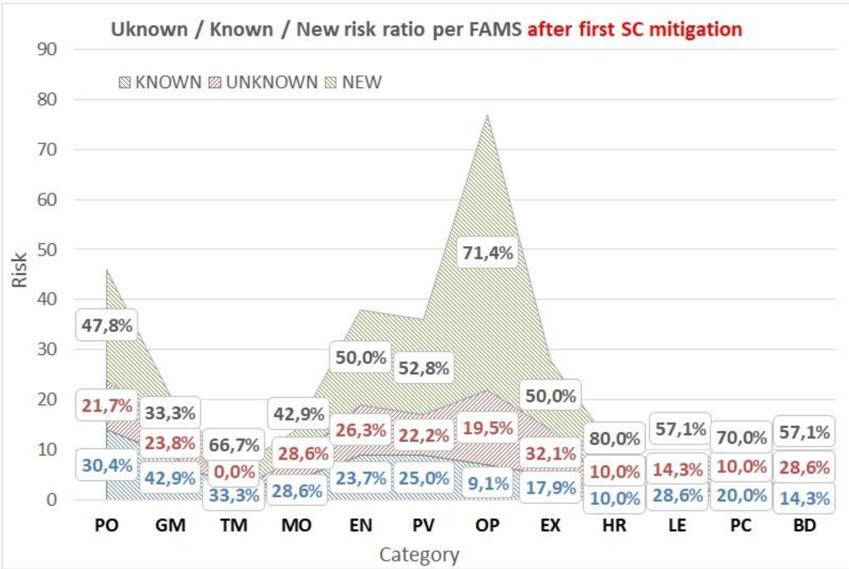
FAMS	UNKNOWN COSTS	UNKNOWN COSTS After Mitigation	Mitigation %
PO	2.456.000,0	1.743.375,0	-29,0%
GM	120.000,0	61.750,0	-48,5%
TM	0,0	0,0	0,0%
MO	340.000,0	157.750,0	-53,6%
EN	1.380.000,0	797.875,0	-42,2%
PV	290.000,0	120.250,0	-58,5%
OP	320.000,0	221.250,0	-30,9%
EX	200.000,0	137.500,0	-31,3%
HR	30.000,0	210.000,0	600,0%
LE	500.000,0	78.750,0	-84,3%
PC	100.000,0	31.250,0	-68,8%
BD	310.000,0	97.750,0	-68,5%
Total	**6.046.000,0**	**3.657.500,0**	**-39,5%**

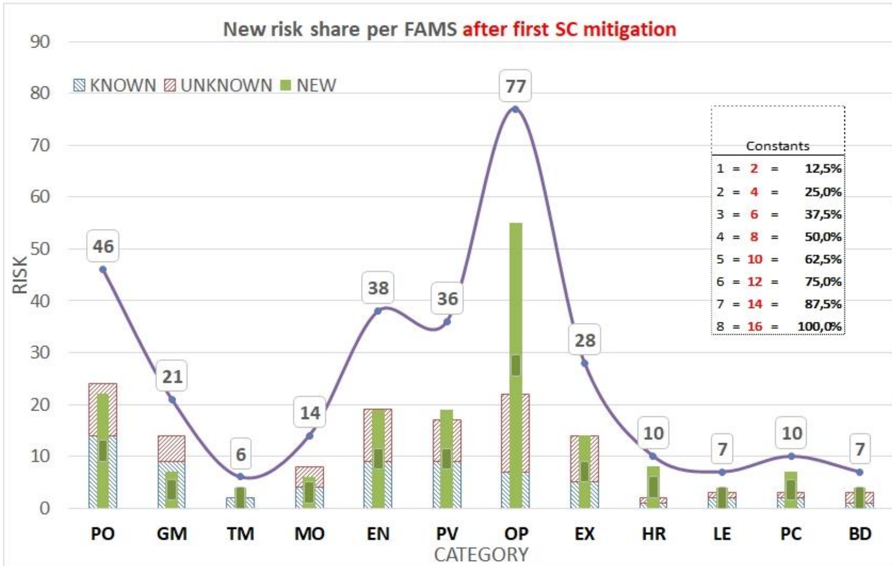


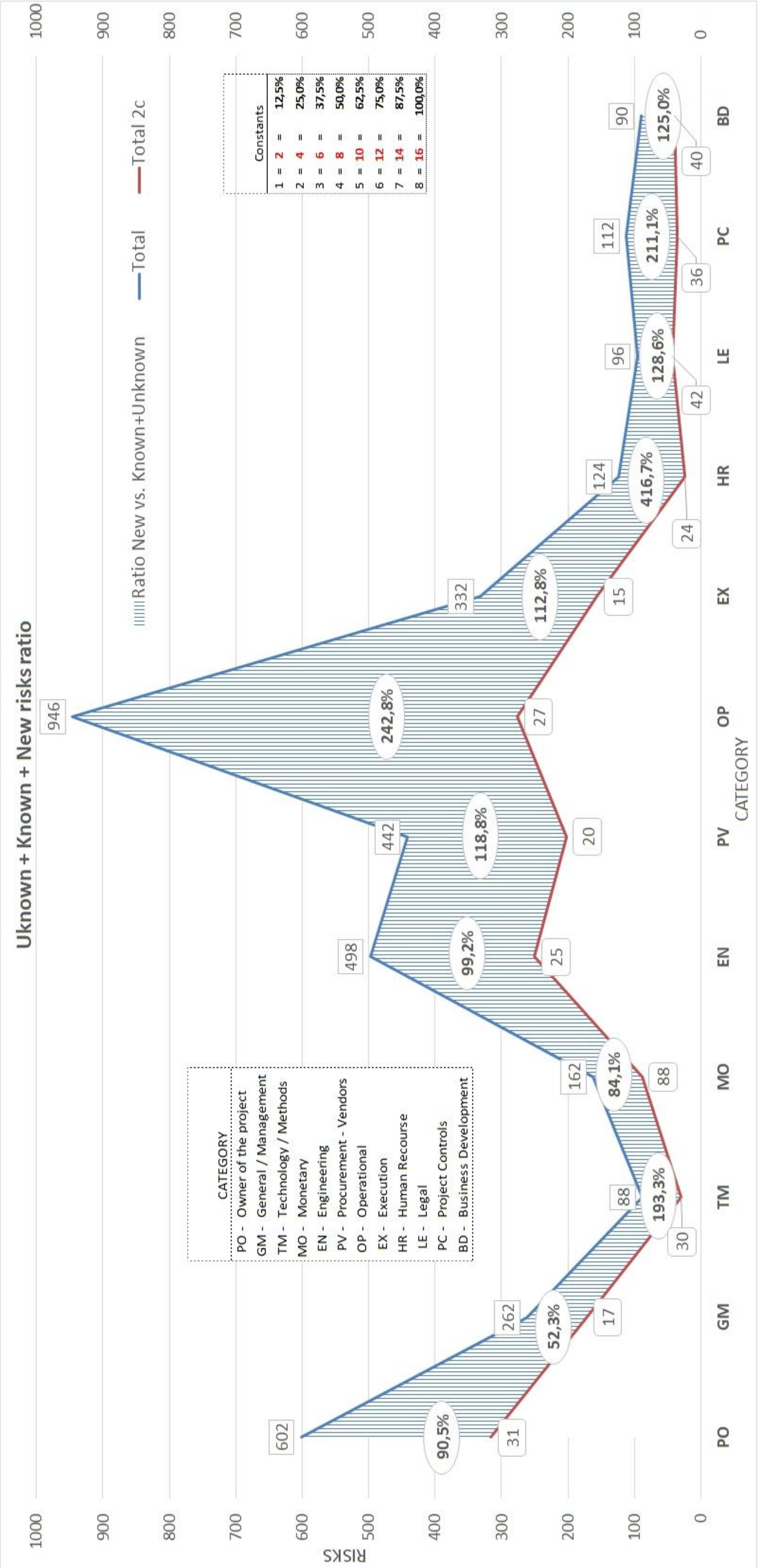
Model results of the Stage Gate III – Project No.1

Basis report stage gate III

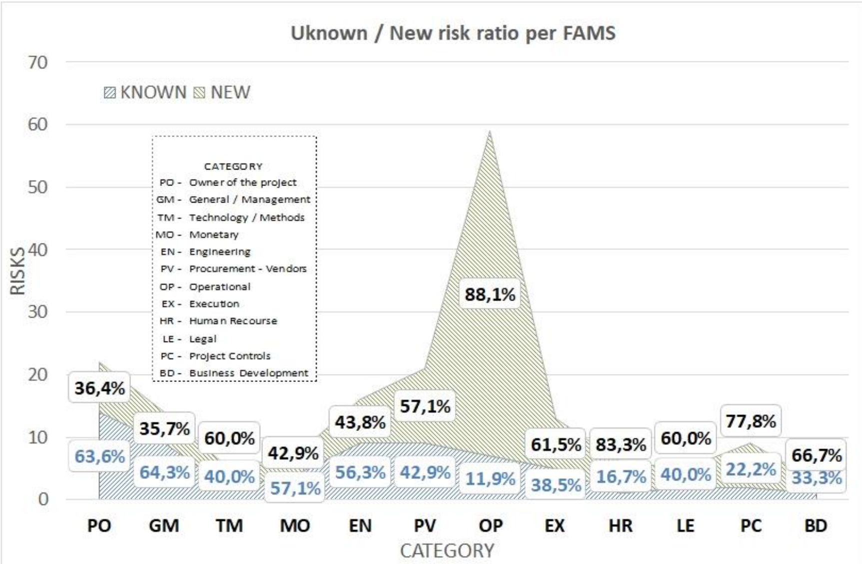
FAMS	RISKS	KNOWN	UNKNOWN	NEW	% Known	% Unknown	% New	High / High	High	High / Medium	Medium	Medium / Medium	Medium / Low	Low	Low / Low	Total	Total 2c	%
PO	46	14	10	22	30,4%	21,7%	47,8%	176	168	168	90	0	0	0	0	602	316	90,5%
GM	21	9	5	7	42,9%	23,8%	33,3%	32	112	84	30	0	0	4	0	262	172	52,3%
TM	6	2	0	4	33,3%	0,0%	66,7%	48	28	12	0	0	0	0	0	88	30	193,3%
MO	14	4	4	6	28,6%	28,6%	42,9%	32	14	60	40	16	0	0	0	162	88	84,1%
EN	38	9	10	19	23,7%	26,3%	50,0%	80	210	168	40	0	0	0	0	498	250	99,2%
PV	36	9	8	19	25,0%	22,2%	52,8%	32	168	168	50	24	0	0	0	442	202	118,8%
OP	77	7	15	55	9,1%	19,5%	71,4%	224	266	252	100	104	0	0	0	946	276	242,8%
EX	28	5	9	14	17,9%	32,1%	50,0%	32	112	72	100	16	0	0	0	332	156	112,8%
HR	10	1	1	8	10,0%	10,0%	80,0%	16	28	60	20	0	0	0	0	124	24	416,7%
LE	7	2	1	4	28,6%	14,3%	57,1%	0	84	12	0	0	0	0	0	96	42	128,6%
PC	10	2	1	7	20,0%	10,0%	70,0%	0	28	48	20	16	0	0	0	112	36	211,1%
BD	7	1	2	4	14,3%	28,6%	57,1%	32	14	24	20	0	0	0	0	90	40	125,0%
Total	300	65	66	169	21,7%	22,0%	56,3%	704	1232	1128	510	176	0	4	0			

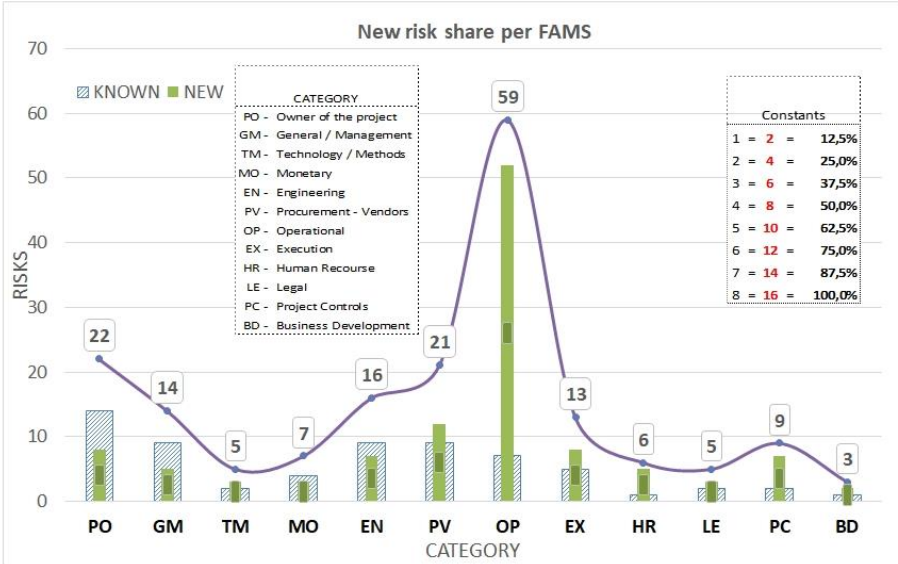




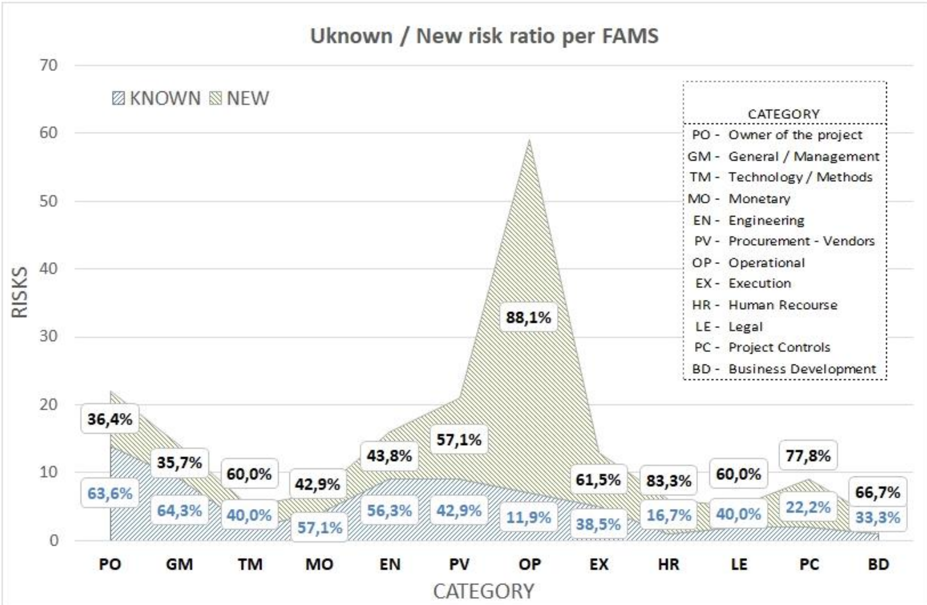

Uknown + Known + New risks ratio
Ratio New vs. Known+Unknown
Total
Total 2c
RISKS
CATEGORY
PO GM TM MO EN PV OP EX HR LE PC BD
602 262 88 162 498 442 946 332 124 96 112 90
31 17 30 88 25 20 27 15 24 42 36 40
90,5% 52,3% 193,3% 84,1% 99,2% 118,8% 242,8% 112,8% 416,7% 128,6% 211,1% 125,0%
CATEGORY
PO - Owner of the project
GM - General / Management
TM - Technology / Methods
MO - Monetary
EN - Engineering
PV - Procurement - Vendors
OP - Operational
EX - Execution
HR - Human Recourse
LE - Legal
PC - Project Controls
BD - Business Development
Constants
1 = 2 = 12,5%
2 = 4 = 25,0%
3 = 6 = 37,5%
4 = 8 = 50,0%
5 = 10 = 62,5%
6 = 12 = 75,0%
7 = 14 = 87,5%
8 = 16 = 100,0%

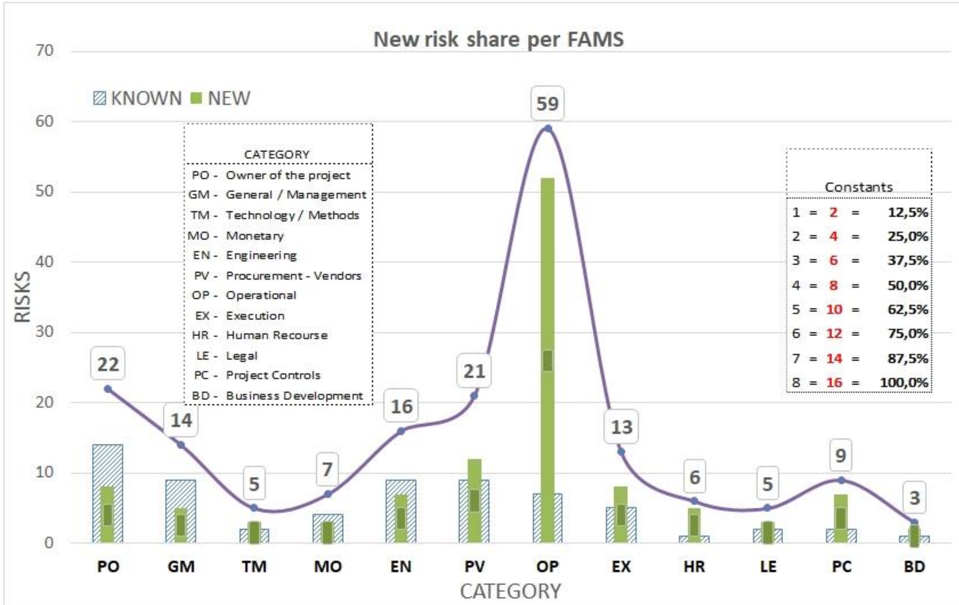
FAMS	KNOWN RISKS	KNOWN	UNKNOWN	NEW	% Known	% Unknown	% New	High / High	High	High / Medium	Medium	Medium / Medium	Medium / Low	Low	Low / Low	Total 17	Total Known 8	%
PO	22	14	0	8	63,6%	0,0%	36,4%	0	0	0	50	48	18	0	0	116	184	-37,0%
GM	14	9	0	5	64,3%	0,0%	35,7%	0	0	24	20	8	12	8	0	72	120	-40,0%
TM	5	2	0	3	40,0%	0,0%	60,0%	0	0	0	0	16	0	0	0	16	30	-46,7%
MO	7	4	0	3	57,1%	0,0%	42,9%	0	0	0	0	16	0	8	0	24	46	-47,8%
EN	16	9	0	7	56,3%	0,0%	43,8%	0	0	12	10	24	24	0	0	70	118	-40,7%
PV	21	9	0	12	42,9%	0,0%	57,1%	0	0	0	0	48	6	8	0	62	100	-38,0%
OP	59	7	0	52	11,9%	0,0%	88,1%	0	0	0	10	0	0	24	0	34	80	-57,5%
EX	13	5	0	8	38,5%	0,0%	61,5%	0	0	0	0	8	24	0	0	32	54	-40,7%
HR	6	1	0	5	16,7%	0,0%	83,3%	0	0	0	0	0	6	0	0	6	10	-40,0%
LE	5	2	0	3	40,0%	0,0%	60,0%	0	0	0	20	0	0	0	0	20	28	-28,6%
PC	9	2	0	7	22,2%	0,0%	77,8%	0	0	0	0	0	12	0	0	12	26	-53,8%
BD	3	1	0	2	33,3%	0,0%	66,7%	0	0	0	10	0	0	0	0	10	12	-16,7%
Total	180	65	0	115	36,1%	0,0%	63,9%	0	0	36	120	168	102	48	0			



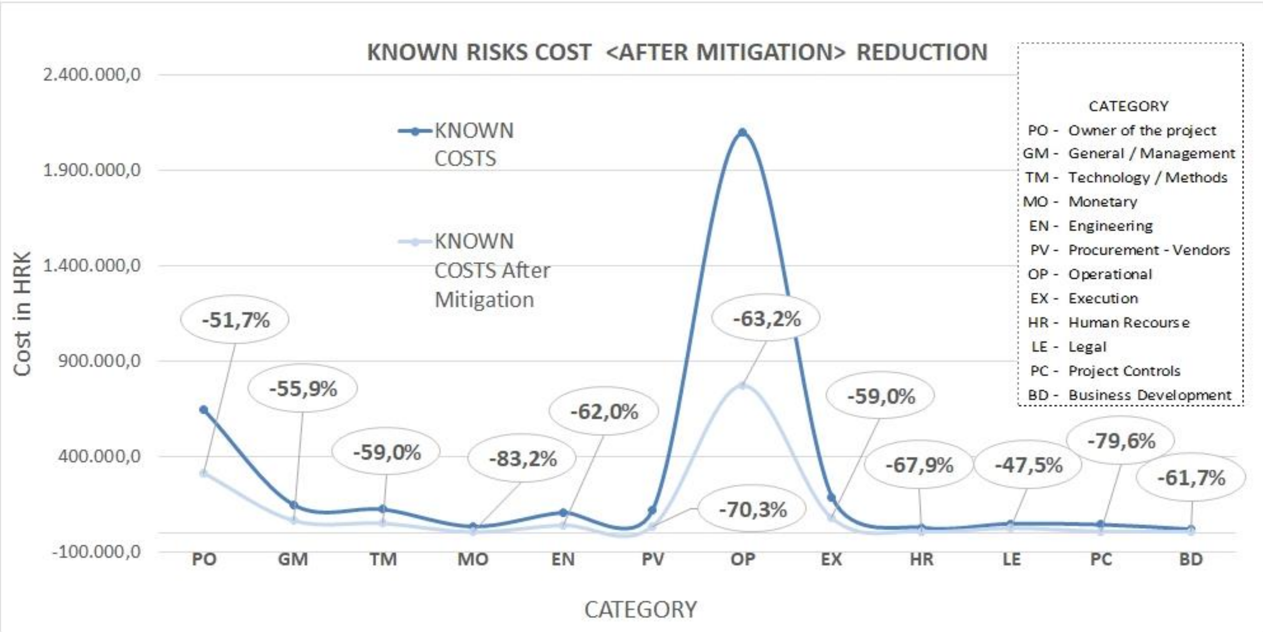


FAMS	KNOWN RISKS	KNOWN	UNKNOWN	NEW	% Known	% Unknown	% New	High / High	High	High / Medium	Medium	Medium / Medium	Medium / Low	Low	Low / Low	Total
PO	22	14	0	8	63,6%	0,0%	36,4%	0	0	12	70	72	18	8	0	180
GM	14	9	0	5	64,3%	0,0%	35,7%	0	0	24	30	8	36	8	0	106
TM	5	2	0	3	40,0%	0,0%	60,0%	0	0	12	10	24	0	0	0	46
MO	7	4	0	3	57,1%	0,0%	42,9%	0	0	0	0	16	0	16	2	34
EN	16	9	0	7	56,3%	0,0%	43,8%	0	0	24	30	40	36	0	0	130
PV	21	9	0	12	42,9%	0,0%	57,1%	0	0	0	10	128	6	12	0	156
OP	59	7	0	52	11,9%	0,0%	88,1%	0	0	0	200	72	48	88	0	408
EX	13	5	0	8	38,5%	0,0%	61,5%	0	0	0	40	40	24	0	0	104
HR	6	1	0	5	16,7%	0,0%	83,3%	0	0	0	10	0	30	0	0	40
LE	5	2	0	3	40,0%	0,0%	60,0%	0	0	0	50	0	0	0	0	50
PC	9	2	0	7	22,2%	0,0%	77,8%	0	0	0	0	0	36	12	0	48
BD	3	1	0	2	33,3%	0,0%	66,7%	0	0	0	10	16	0	0	0	26
Total	180	65	0	115	36,1%	0,0%	63,9%	0	0	72	460	416	234	144	2	

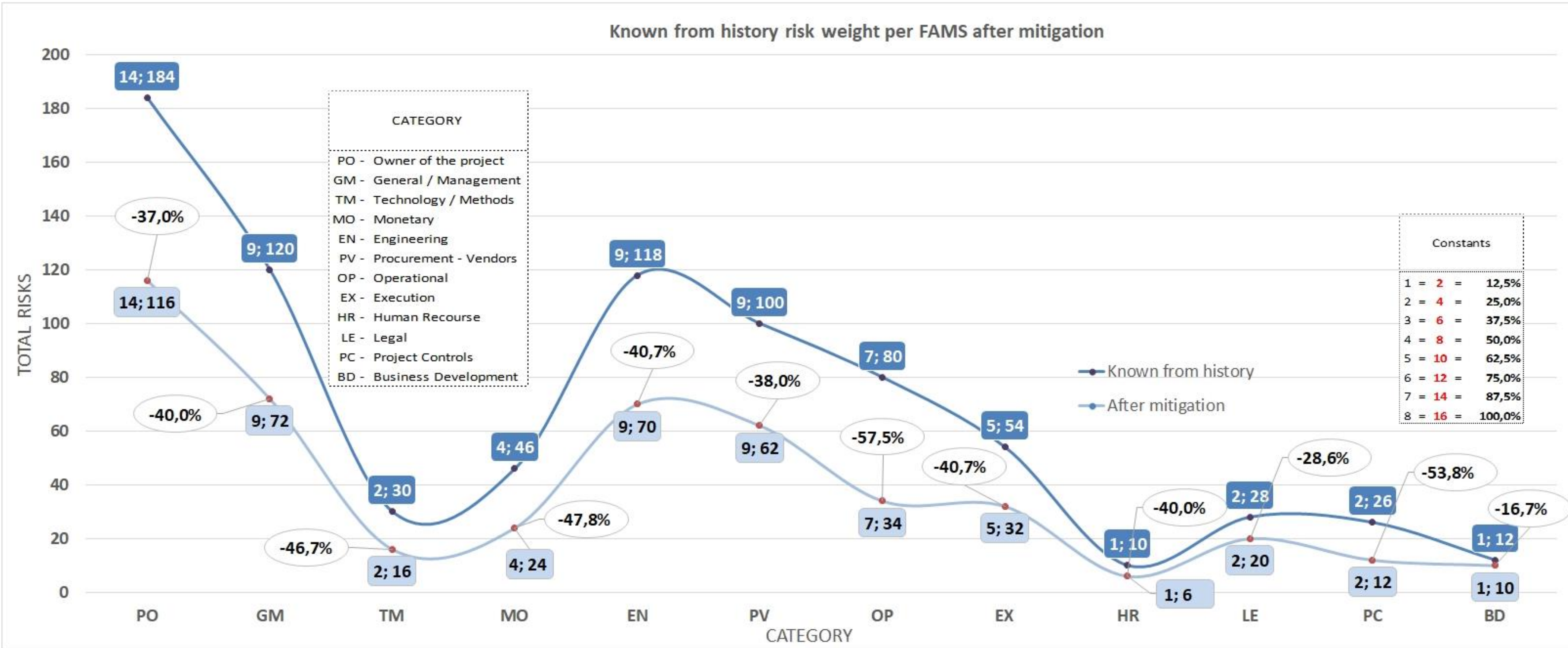




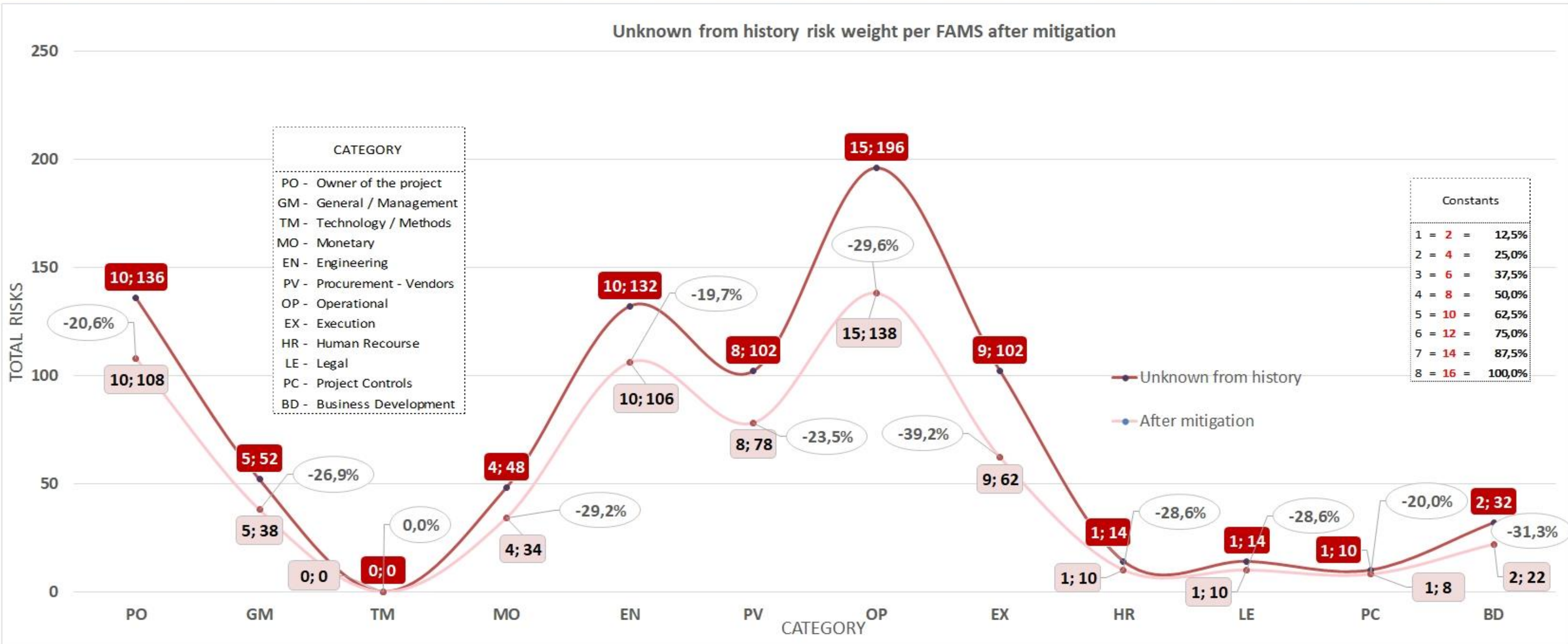
FAMS	KNOWN COSTS	KNOWN COSTS After Mitigation	Mitigation %
PO	649.500,0	313.956,3	-51,7%
GM	150.000,0	66.125,0	-55,9%
TM	125.000,0	51.250,0	-59,0%
MO	35.000,0	5.875,0	-83,2%
EN	109.000,0	41.400,0	-62,0%
PV	120.000,0	35.687,5	-70,3%
OP	2.099.000,0	772.125,0	-63,2%
EX	190.000,0	77.937,5	-59,0%
HR	30.000,0	9.625,0	-67,9%
LE	50.000,0	26.250,0	-47,5%
PC	45.000,0	9.187,5	-79,6%
BD	21.000,0	8.050,0	-61,7%
Total	**3.623.500,0**	**1.417.468,8**	**-60,9%**



FAMS	KNOWN	KNOWN After SC	High / High	After SC	High	After SC	High / Medium	After SC	Medium	After SC	Medium / Medium	After SC	Medium / Low	After SC	Low	After SC	Low / Low	After SC	Total	After SC	Mitigation %
PO	14	14	64	0	42	0	48	0	30	50	0	48	0	18	0	0	0	0	184	116	-37,0%
GM	9	9	32	0	56	0	12	24	20	20	0	8	0	12	0	8	0	0	120	72	-40,0%
TM	2	2	16	0	14	0	0	0	0	0	0	16	0	0	0	0	0	0	30	16	-46,7%
MO	4	4	16	0	0	0	12	0	10	0	8	16	0	0	0	8	0	0	46	24	-47,8%
EN	9	9	32	0	28	0	48	12	10	10	0	24	0	24	0	0	0	0	118	70	-40,7%
PV	9	9	0	0	28	0	36	0	20	0	16	48	0	6	0	8	0	0	100	62	-38,0%
OP	7	7	0	0	28	0	12	0	40	10	0	0	0	0	0	24	0	0	80	34	-57,5%
EX	5	5	0	0	0	0	24	0	30	0	0	8	0	24	0	0	0	0	54	32	-40,7%
HR	1	1	0	0	0	0	0	0	10	0	0	0	0	6	0	0	0	0	10	6	-40,0%
LE	2	2	0	0	28	0	0	0	0	20	0	0	0	0	0	0	0	0	28	20	-28,6%
PC	2	2	0	0	14	0	12	0	0	0	0	0	0	12	0	0	0	0	26	12	-53,8%
BD	1	1	0	0	0	0	12	0	0	10	0	0	0	0	0	0	0	0	12	10	-16,7%
Total	65	65	160	0	238	0	216	36	170	120	24	168	0	102	0	48	0	0			



FAMS	UNKNOWN	UNKNOWN After SC	High / High	After SC	High	After SC	High / Medium	After SC	Medium	After SC	Medium / Medium	After SC	Medium / Low	After SC	Low	After SC	Low / Low	After SC	Total	After SC	Mitigation %
PO	10	10	32	0	84	0	0	60	20	40	0	8	0	0	0	0	0	0	136	108	-20,6%
GM	5	5	0	0	14	0	24	0	10	10	0	24	0	0	4	4	0	0	52	38	-26,9%
TM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0%
MO	4	4	16	0	0	0	24	12	0	0	8	16	0	6	0	0	0	0	48	34	-29,2%
EN	10	10	32	0	56	14	24	48	20	30	0	8	0	6	0	0	0	0	132	106	-19,7%
PV	8	8	0	0	42	0	60	0	0	70	0	8	0	0	0	0	0	0	102	78	-23,5%
OP	15	15	32	0	70	14	84	12	10	50	0	56	0	6	0	0	0	0	196	138	-29,6%
EX	9	9	16	0	28	0	12	0	30	30	16	8	0	12	0	12	0	0	102	62	-39,2%
HR	1	1	0	0	14	0	0	0	0	10	0	0	0	0	0	0	0	0	14	10	-28,6%
LE	1	1	0	0	14	0	0	0	0	10	0	0	0	0	0	0	0	0	14	10	-28,6%
PC	1	1	0	0	0	0	0	0	10	0	0	8	0	0	0	0	0	0	10	8	-20,0%
BD	2	2	32	0	0	0	0	12	0	10	0	0	0	0	0	0	0	0	32	22	-31,3%
Total	66	66	160	0	322	28	228	144	100	260	24	136	0	30	4	16	0	0			



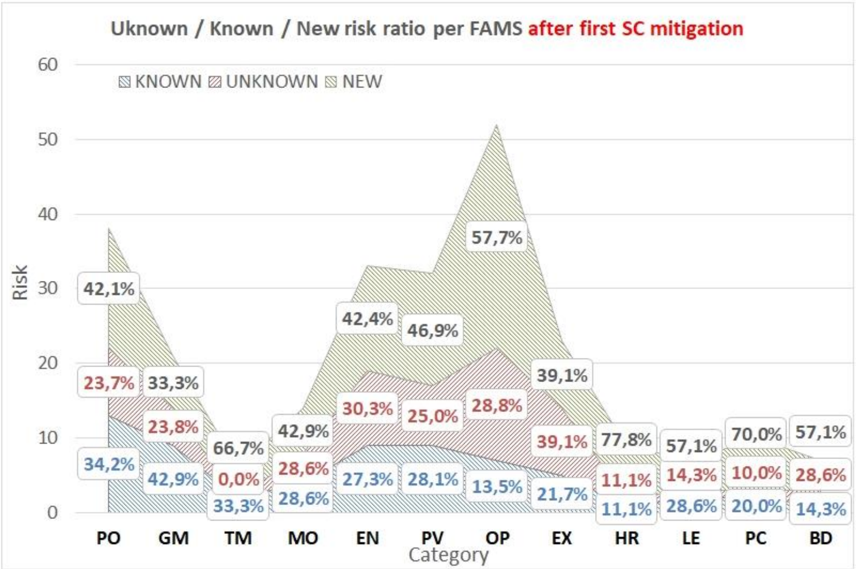
FAMS	Unknown 13a	Unknown Cost 13a	Unknown NEW 13a	Unknown NEW Cost 13a	Known 17a	Known Cost 17a	Known NEW 17a	Known NEW Cost 17a	Unknown 18	Unknown Cost 18	Known 18	Known Cost 18	New 18	New Cost 18	TEST WEIGHT	TEST COST
PO	108	489.875,0	144	1.468.625,0	116	251.581,3	64	62.375,0	108	489.875,0	116	251.581,3	208	1.531.000,0	OK	OK
GM	38	25.250,0	24	12.000,0	72	48.187,5	34	17.937,5	38	25.250,0	72	48.187,5	58	29.937,5	OK	OK
TM	0	0,0	12	30.000,0	16	21.250,0	30	30.000,0	0	0,0	16	21.250,0	42	60.000,0	OK	OK
MO	34	15.625,0	30	46.250,0	24	4.500,0	10	1.375,0	34	15.625,0	24	4.500,0	40	47.625,0	OK	OK
EN	106	99.000,0	130	574.625,0	70	14.500,0	60	26.900,0	106	99.000,0	70	14.500,0	190	601.525,0	OK	OK
PV	78	84.500,0	80	97.375,0	62	12.375,0	94	23.312,5	78	84.500,0	62	12.375,0	174	120.687,5	OK	OK
OP	138	152.500,0	34	50.625,0	34	7.750,0	374	764.375,0	138	152.500,0	34	7.750,0	408	815.000,0	OK	OK
EX	62	41.875,0	70	256.750,0	32	6.375,0	72	71.562,5	62	41.875,0	32	6.375,0	142	328.312,5	OK	OK
HR	10	5.625,0	32	16.750,0	6	1.500,0	34	8.125,0	10	5.625,0	6	1.500,0	66	24.875,0	OK	OK
LE	10	16.875,0	10	250.000,0	20	10.625,0	30	15.625,0	10	16.875,0	20	10.625,0	40	265.625,0	OK	OK
PC	8	25.000,0	0	0,0	12	2.250,0	36	6.937,5	8	25.000,0	12	2.250,0	36	6.937,5	OK	OK
BD	22	95.000,0	22	603.750,0	10	3.500,0	16	4.550,0	22	95.000,0	10	3.500,0	38	608.300,0	OK	OK
Total	614	1.051.125,0	588	3.406.750,0	474	384.393,8	854	1.033.075,0	614	1.051.125,0	474	384.393,8	1442	4.439.825,0		

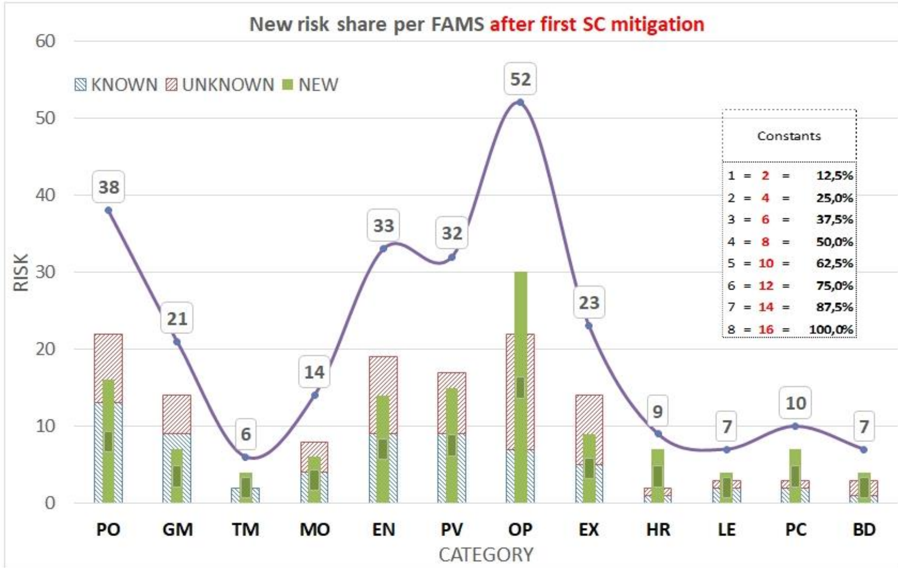
CATEGORY
PO - Owner of the project
GM - General / Management
TM - Technology / Methods
MO - Monetary
EN - Engineering
PV - Procurement - Vendors
OP - Operational
EX - Execution
HR - Human Recourse
LE - Legal
PC - Project Controls
BD - Business Development

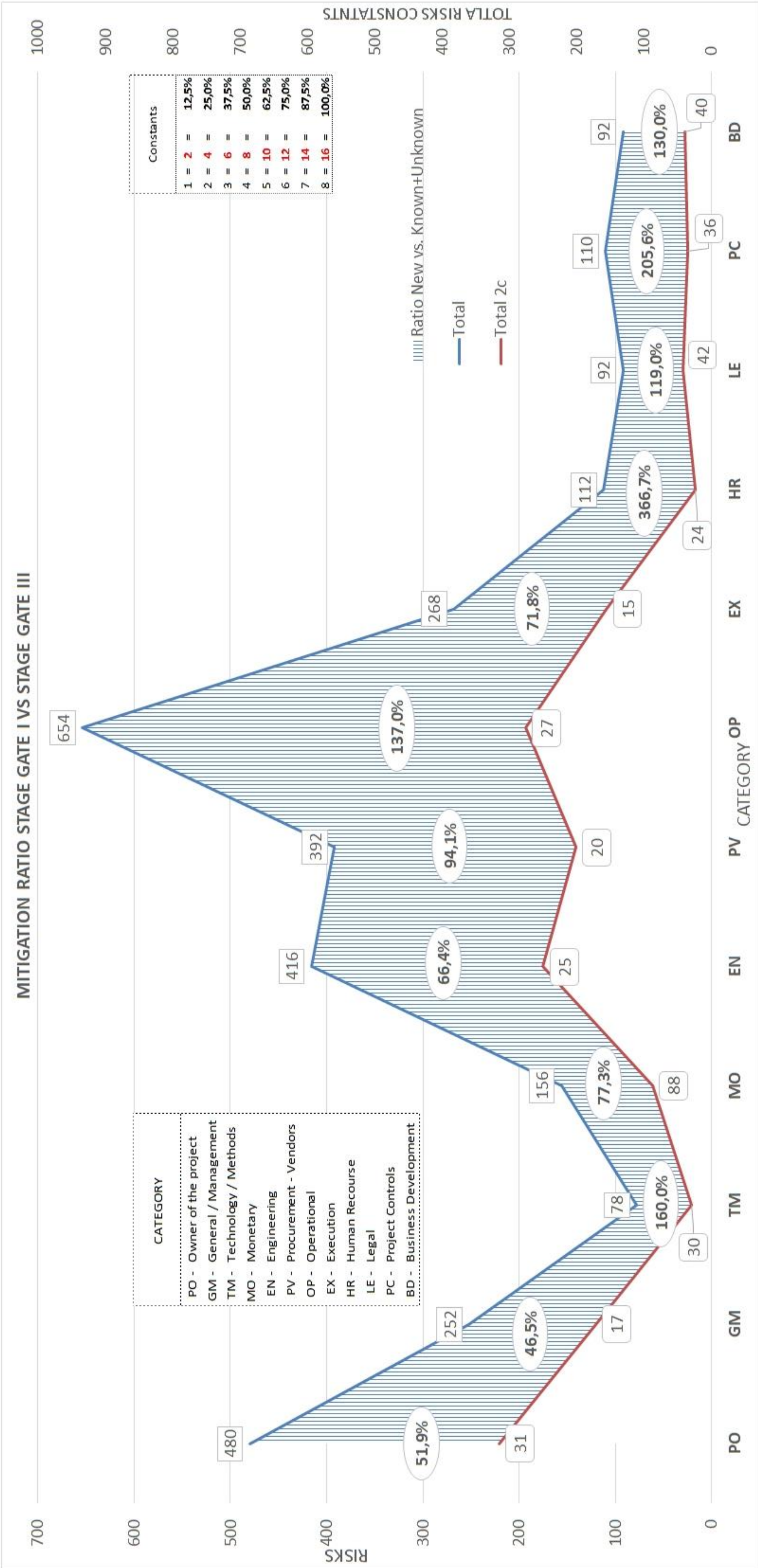
Model results of the Stage Gate III – Project No.2

Basis report stage gate III

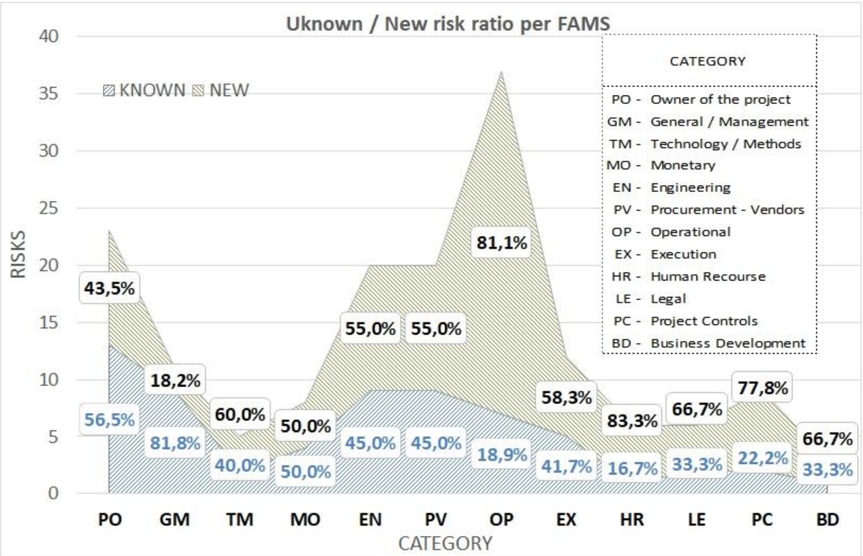
FAMS	RISKS	KNOWN	UNKNOWN	NEW	% Known	% Unknown	% New	High / High	High	High / Medium	Medium	Medium / Medium	Medium / Low	Low	Low / Low	Total	Total 2c	%
PO	38	13	9	16	34,2%	23,7%	42,1%	96	126	168	90	0	0	0	0	480	316	51,9%
GM	21	9	5	7	42,9%	23,8%	33,3%	32	84	72	60	0	0	4	0	252	172	46,5%
TM	6	2	0	4	33,3%	0,0%	66,7%	16	28	24	10	0	0	0	0	78	30	160,0%
MO	14	4	4	6	28,6%	28,6%	42,9%	32	0	72	20	32	0	0	0	156	88	77,3%
EN	33	9	10	14	27,3%	30,3%	42,4%	64	126	180	30	16	0	0	0	416	250	66,4%
PV	32	9	8	15	28,1%	25,0%	46,9%	0	168	168	40	16	0	0	0	392	202	94,1%
OP	52	7	15	30	13,5%	28,8%	57,7%	96	238	216	80	24	0	0	0	654	276	137,0%
EX	23	5	9	9	21,7%	39,1%	39,1%	16	56	120	60	16	0	0	0	268	156	71,8%
HR	9	1	1	7	11,1%	11,1%	77,8%	0	42	60	10	0	0	0	0	112	24	366,7%
LE	7	2	1	4	28,6%	14,3%	57,1%	0	56	36	0	0	0	0	0	92	42	119,0%
PC	10	2	1	7	20,0%	10,0%	70,0%	0	14	60	20	16	0	0	0	110	36	205,6%
BD	7	1	2	4	14,3%	28,6%	57,1%	48	0	24	20	0	0	0	0	92	40	130,0%
Total	252	64	65	123	25,4%	25,8%	48,8%	400	938	1200	440	120	0	4	0			

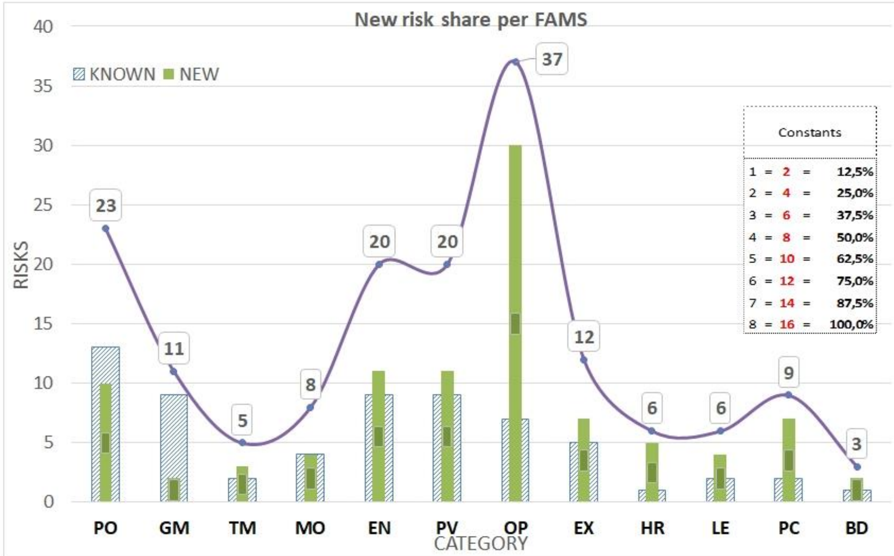




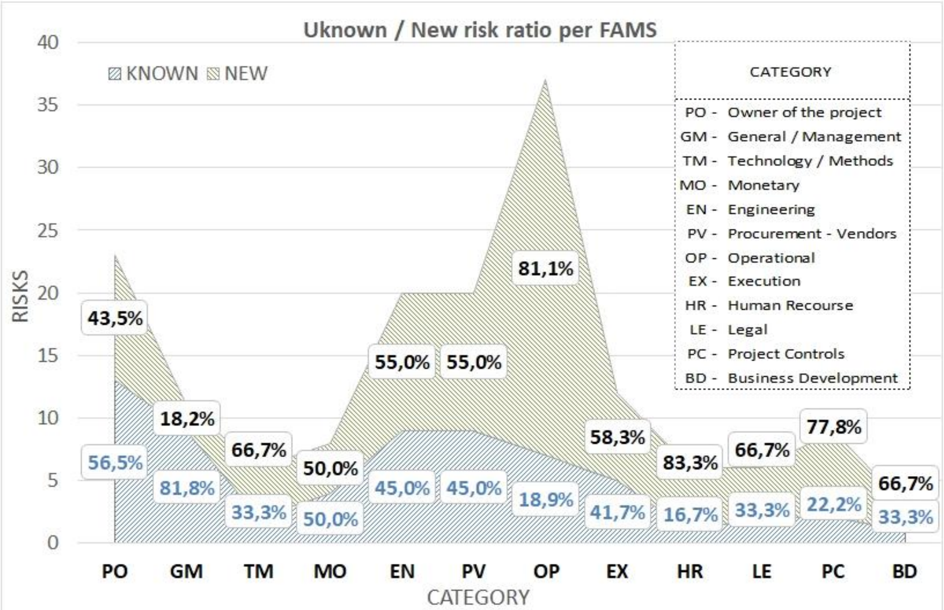

MITIGATION RATIO STAGE GATE I VS STAGE GATE III
RISKS
TOTLA RISKS CONSTATNTS
CATEGORY
PO
GM
TM
MO
EN
PV
OP
EX
HR
LE
PC
BD
480
252
78
156
416
392
654
268
112
92
110
92
31
17
30
88
25
20
27
15
24
42
36
40
51,9%
46,5%
160,0%
77,3%
66,4%
94,1%
137,0%
71,8%
366,7%
119,0%
205,6%
130,0%
Ratio New vs. Known+Unknown
Total
Total 2c
CATEGORY
PO - Owner of the project
GM - General / Management
TM - Technology / Methods
MO - Monetary
EN - Engineering
PV - Procurement - Vendors
OP - Operational
EX - Execution
HR - Human Recourse
LE - Legal
PC - Project Controls
BD - Business Development
Constants
1 = 2 = 12,5%
2 = 4 = 25,0%
3 = 6 = 37,5%
4 = 8 = 50,0%
5 = 10 = 62,5%
6 = 12 = 75,0%
7 = 14 = 87,5%
8 = 16 = 100,0%

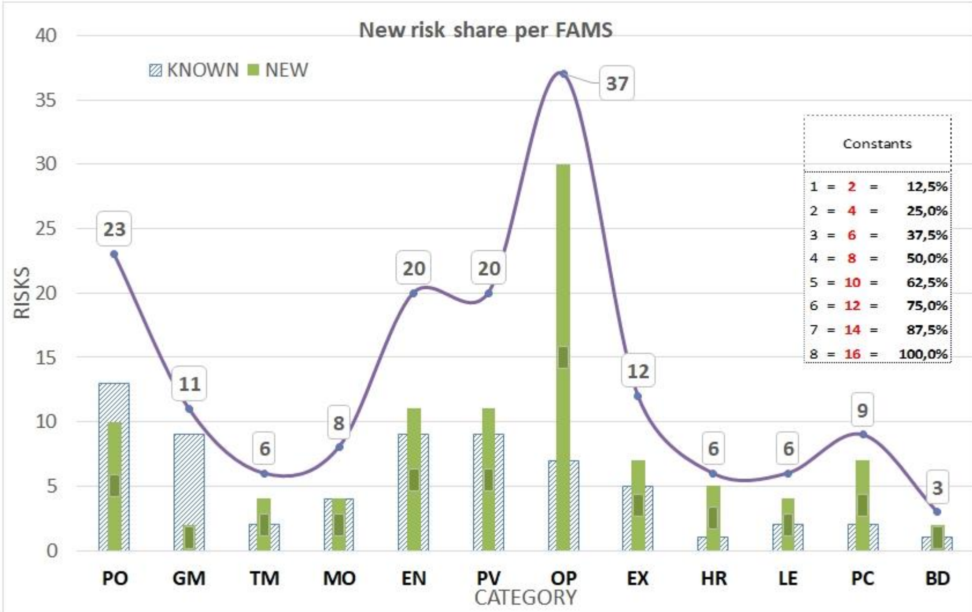
FAMS	KNOWN RISKS	KNOWN	UNKNOWN	NEW	% Known	% Unknown	% New	High / High	High	High / Medium	Medium	Medium / Medium	Medium / Low	Low	Low / Low	Total 17	Total Known 8	%
PO	23	13	0	10	56,5%	0,0%	43,5%	64	42	48	20	0	0	0	0	174	174	0,0%
GM	11	9	0	2	81,8%	0,0%	18,2%	32	56	12	20	0	0	0	0	120	120	0,0%
TM	5	2	0	3	40,0%	0,0%	60,0%	16	14	0	0	0	0	0	0	30	30	0,0%
MO	8	4	0	4	50,0%	0,0%	50,0%	16	0	12	10	8	0	0	0	46	46	0,0%
EN	20	9	0	11	45,0%	0,0%	55,0%	32	28	48	10	0	0	0	0	118	118	0,0%
PV	20	9	0	11	45,0%	0,0%	55,0%	0	28	36	20	16	0	0	0	100	100	0,0%
OP	37	7	0	30	18,9%	0,0%	81,1%	0	0	0	70	0	0	0	0	70	80	-12,5%
EX	12	5	0	7	41,7%	0,0%	58,3%	0	0	0	0	0	0	20	0	20	54	-63,0%
HR	6	1	0	5	16,7%	0,0%	83,3%	0	0	0	10	0	0	0	0	10	10	0,0%
LE	6	2	0	4	33,3%	0,0%	66,7%	0	28	0	0	0	0	0	0	28	28	0,0%
PC	9	2	0	7	22,2%	0,0%	77,8%	0	0	0	20	0	0	0	0	20	26	-23,1%
BD	3	1	0	2	33,3%	0,0%	66,7%	0	0	12	0	0	0	0	0	12	12	0,0%
Total	160	64	0	96	40,0%	0,0%	60,0%	160	196	168	180	24	0	20	0			



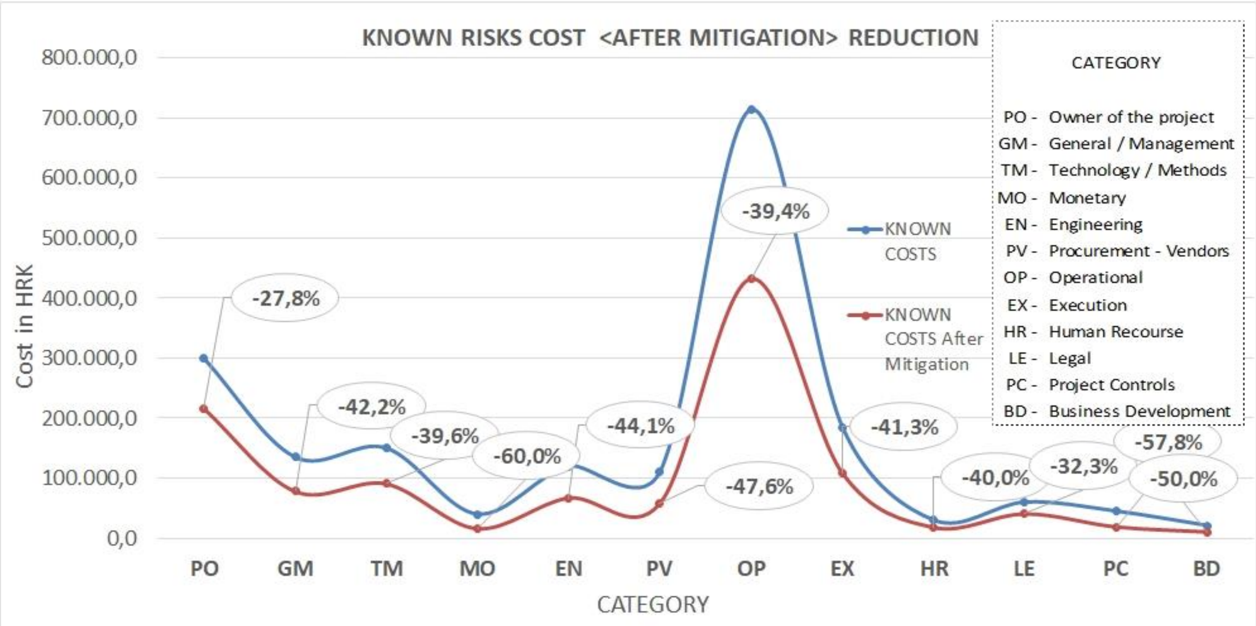


FAMS	KNOWN RISKS	KNOWN	UNKNOWN	NEW	% Known	% Unknown	% New	High / High	High	High / Medium	Medium	Medium / Medium	Medium / Low	Low	Low / Low	Total
PO	23	13	0	10	56,5%	0,0%	43,5%	64	42	120	60	0	0	0	0	286
GM	11	9	0	2	81,8%	0,0%	18,2%	32	56	24	30	0	0	0	0	142
TM	6	2	0	4	33,3%	0,0%	66,7%	16	28	24	10	0	0	0	0	78
MO	8	4	0	4	50,0%	0,0%	50,0%	16	0	24	20	24	0	0	0	84
EN	20	9	0	11	45,0%	0,0%	55,0%	32	70	132	10	8	0	0	0	252
PV	20	9	0	11	45,0%	0,0%	55,0%	0	98	96	30	16	0	0	0	240
OP	37	7	0	30	18,9%	0,0%	81,1%	64	168	132	70	24	0	0	0	458
EX	12	5	0	7	41,7%	0,0%	58,3%	0	14	96	30	0	0	0	0	140
HR	6	1	0	5	16,7%	0,0%	83,3%	0	14	48	10	0	0	0	0	72
LE	6	2	0	4	33,3%	0,0%	66,7%	0	42	36	0	0	0	0	0	78
PC	9	2	0	7	22,2%	0,0%	77,8%	0	14	60	10	16	0	0	0	100
BD	3	1	0	2	33,3%	0,0%	66,7%	0	0	24	10	0	0	0	0	a
Total	161	64	0	97	39,8%	0,0%	60,2%	224	546	816	290	88	0	0	0	

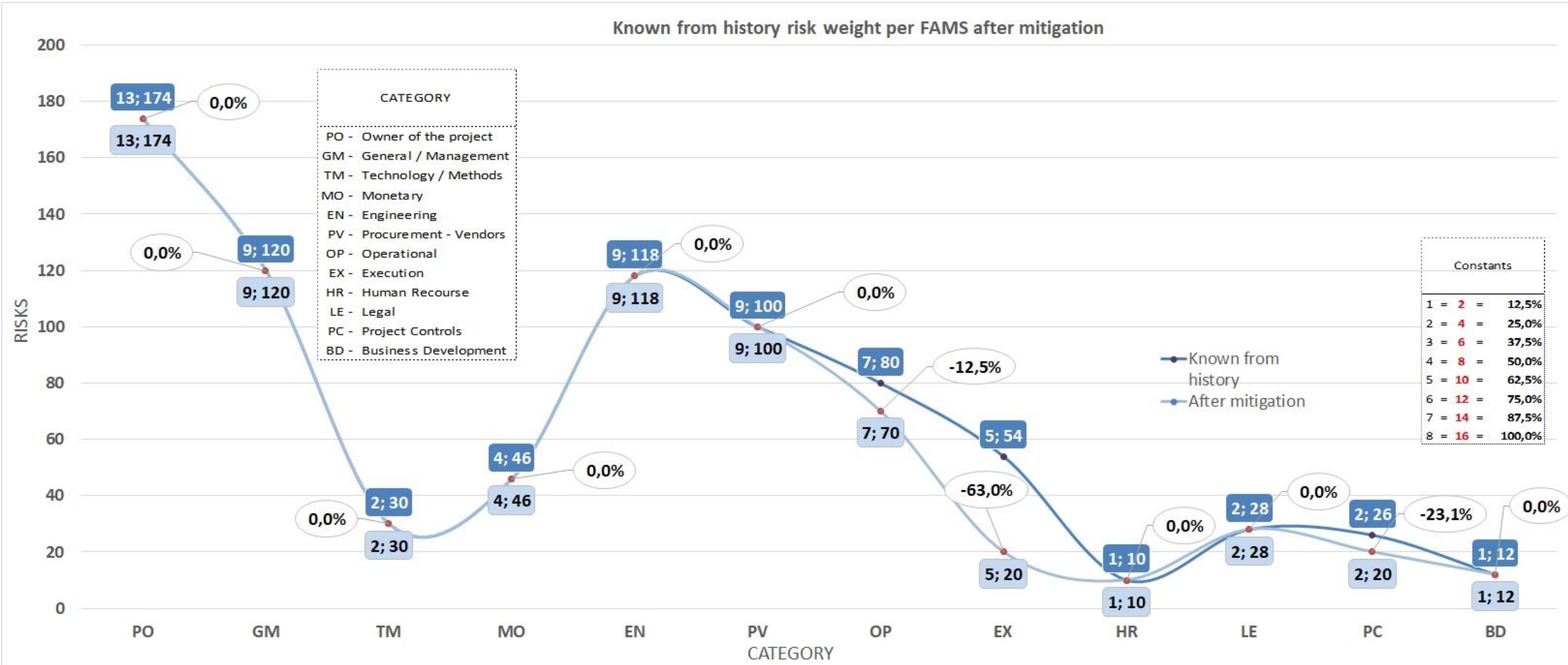




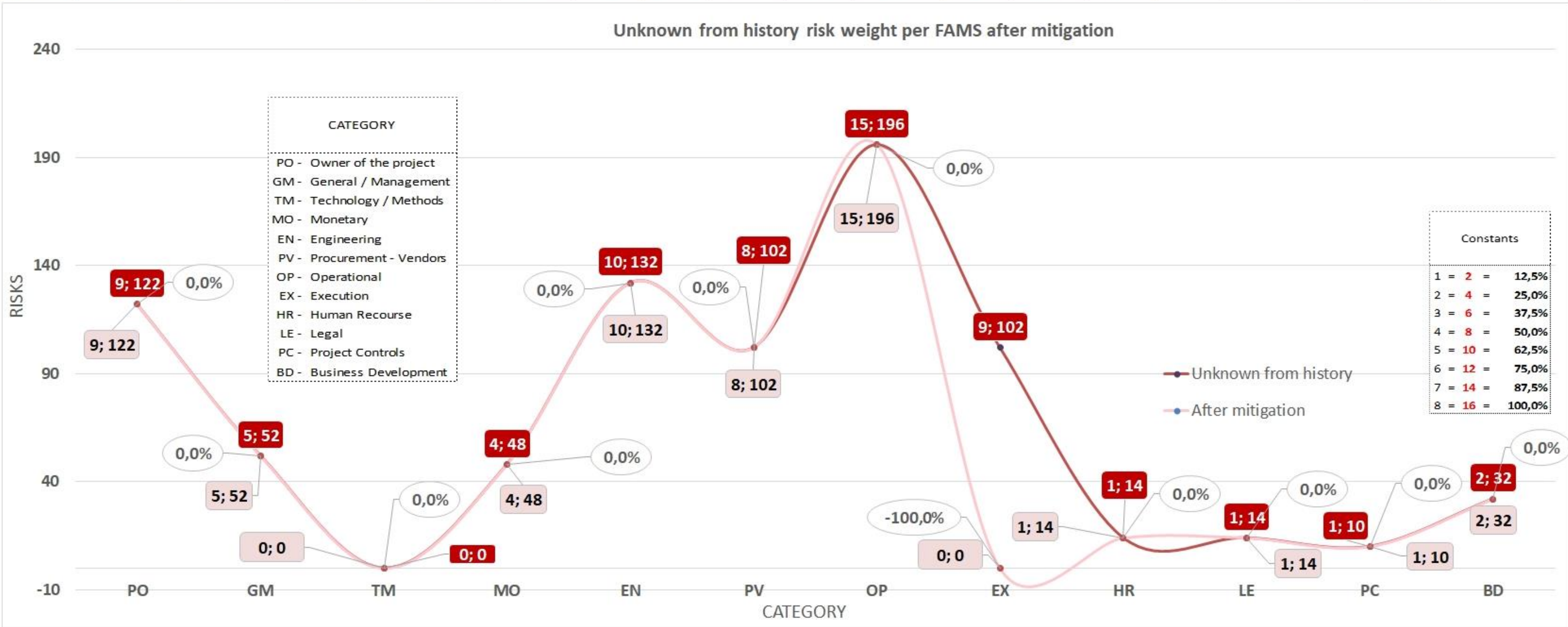
FAMS	KNOWN COSTS	KNOWN COSTS After Mitigation	Mitigation %
PO	300.000,0	216.606,3	-27,8%
GM	135.000,0	78.062,5	-42,2%
TM	150.000,0	90.625,0	-39,6%
MO	40.000,0	16.000,0	-60,0%
EN	120.000,0	67.075,0	-44,1%
PV	110.000,0	57.687,5	-47,6%
OP	714.000,0	432.350,0	-39,4%
EX	185.000,0	108.562,5	-41,3%
HR	30.000,0	18.000,0	-40,0%
LE	60.000,0	40.625,0	-32,3%
PC	45.000,0	19.000,0	-57,8%
BD	21.000,0	10.500,0	-50,0%
Total	**1.910.000,0**	**1.155.093,8**	**-39,5%**



FAMS	KNOWN	KNOWN After SC	High / High	After SC	High	After SC	High / Medium	After SC	Medium	After SC	Medium / Medium	After SC	Medium / Low	After SC	Low	After SC	Low / Low	After SC	Total	After SC	Mitigation %
PO	13	13	64	64	42	42	48	48	20	20	0	0	0	0	0	0	0	0	174	174	0,0%
GM	9	9	32	32	56	56	12	12	20	20	0	0	0	0	0	0	0	0	120	120	0,0%
TM	2	2	16	16	14	14	0	0	0	0	0	0	0	0	0	0	0	0	30	30	0,0%
MO	4	4	16	16	0	0	12	12	10	10	8	8	0	0	0	0	0	0	46	46	0,0%
EN	9	9	32	32	28	28	48	48	10	10	0	0	0	0	0	0	0	0	118	118	0,0%
PV	9	9	0	0	28	28	36	36	20	20	16	16	0	0	0	0	0	0	100	100	0,0%
OP	7	7	0	0	28	0	12	0	40	70	0	0	0	0	0	0	0	0	80	70	-12,5%
EX	5	5	0	0	0	0	24	0	30	0	0	0	0	0	0	20	0	0	54	20	-63,0%
HR	1	1	0	0	0	0	0	0	10	10	0	0	0	0	0	0	0	0	10	10	0,0%
LE	2	2	0	0	28	28	0	0	0	0	0	0	0	0	0	0	0	0	28	28	0,0%
PC	2	2	0	0	14	0	12	0	0	20	0	0	0	0	0	0	0	0	26	20	-23,1%
BD	1	1	0	0	0	0	12	12	0	0	0	0	0	0	0	0	0	0	12	12	0,0%
Total	64	64	160	160	238	196	216	168	160	180	24	24	0	0	0	20	0	0			



FAMS	UNKNOWN	UNKNOWN After SC	High / High	After SC	High	After SC	High / Medium	After SC	Medium	After SC	Medium / Medium	After SC	Medium / Low	After SC	Low	After SC	Low / Low	After SC	Total	After SC	Mitigation %
PO	9	9	32	32	70	70	0	0	20	20	0	0	0	0	0	0	0	0	122	122	0,0%
GM	5	5	0	0	14	14	24	24	10	10	0	0	0	0	4	4	0	0	52	52	0,0%
TM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,0%
MO	4	4	16	16	0	0	24	24	0	0	8	8	0	0	0	0	0	0	48	48	0,0%
EN	10	10	32	32	56	56	24	24	20	20	0	0	0	0	0	0	0	0	132	132	0,0%
PV	8	8	0	0	42	42	60	60	0	0	0	0	0	0	0	0	0	0	102	102	0,0%
OP	15	15	32	32	70	70	84	84	10	10	0	0	0	0	0	0	0	0	196	196	0,0%
EX	9	0	16	0	28	0	12	0	30	0	16	0	0	0	0	0	0	0	102	0	-100,0%
HR	1	1	0	0	14	14	0	0	0	0	0	0	0	0	0	0	0	0	14	14	0,0%
LE	1	1	0	0	14	14	0	0	0	0	0	0	0	0	0	0	0	0	14	14	0,0%
PC	1	1	0	0	0	0	0	0	10	10	0	0	0	0	0	0	0	0	10	10	0,0%
BD	2	2	32	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	32	0,0%
Total	65	56	160	144	308	280	228	216	100	70	24	8	0	0	4	4	0	0			



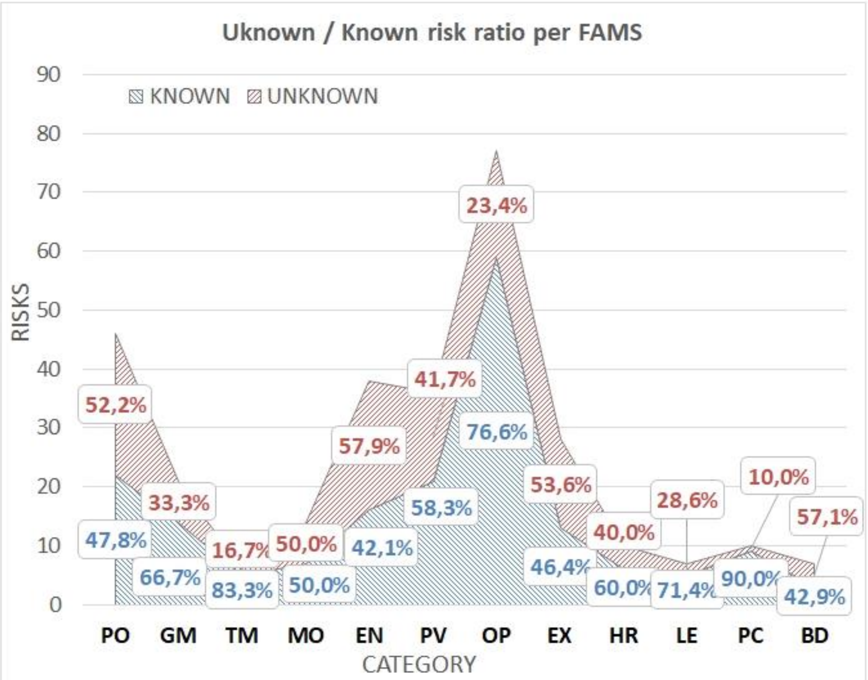
FAMS	Unknown 13a	Unknown Cost 13a	Unknown NEW 13a	Unknown NEW Cost 13a	Known 17a	Known Cost 17a	Known NEW 17a	Known NEW Cost 17a	Unknown 18	Unknown Cost 18	Known 18	Known Cost 18	New 18	New Cost 18	TEST WEIGHT	TEST COST
PO	122	1.379.375,0	72	364.000,0	174	199.593,8	112	17.012,5	122	1.379.375,0	174	199.593,8	184	381.012,5	OK	OK
GM	52	34.625,0	58	27.125,0	120	62.562,5	22	15.500,0	52	34.625,0	120	62.562,5	80	42.625,0	OK	OK
TM	0	0,0	0	0,0	30	40.000,0	48	50.625,0	0	0,0	30	40.000,0	48	50.625,0	OK	OK
MO	48	63.250,0	24	94.500,0	46	8.750,0	38	7.250,0	48	63.250,0	46	8.750,0	62	101.750,0	OK	OK
EN	132	725.125,0	36	72.750,0	118	22.012,5	134	45.062,5	132	725.125,0	118	22.012,5	170	117.812,5	OK	OK
PV	102	71.000,0	50	49.250,0	100	18.562,5	140	39.125,0	102	71.000,0	100	18.562,5	190	88.375,0	OK	OK
OP	196	221.250,0	0	0,0	80	95.000,0	378	337.350,0	196	221.250,0	80	95.000,0	378	337.350,0	OK	OK
EX	0	0,0	26	137.500,0	54	10.687,5	86	97.875,0	0	0,0	54	10.687,5	112	235.375,0	OK	OK
HR	14	78.750,0	26	131.250,0	10	2.500,0	62	15.500,0	14	78.750,0	10	2.500,0	88	146.750,0	OK	OK
LE	14	78.750,0	0	0,0	28	14.875,0	50	25.750,0	14	78.750,0	28	14.875,0	50	25.750,0	OK	OK
PC	10	31.250,0	0	0,0	26	4.875,0	74	14.125,0	10	31.250,0	26	4.875,0	74	14.125,0	OK	OK
BD	32	14.000,0	26	83.750,0	12	4.200,0	22	6.300,0	32	14.000,0	12	4.200,0	48	90.050,0	OK	OK
Total	722	2.697.375,0	318	960.125,0	798	483.618,8	1166	671.475,0	722	2.697.375,0	798	483.618,8	1484	1.631.600,0		

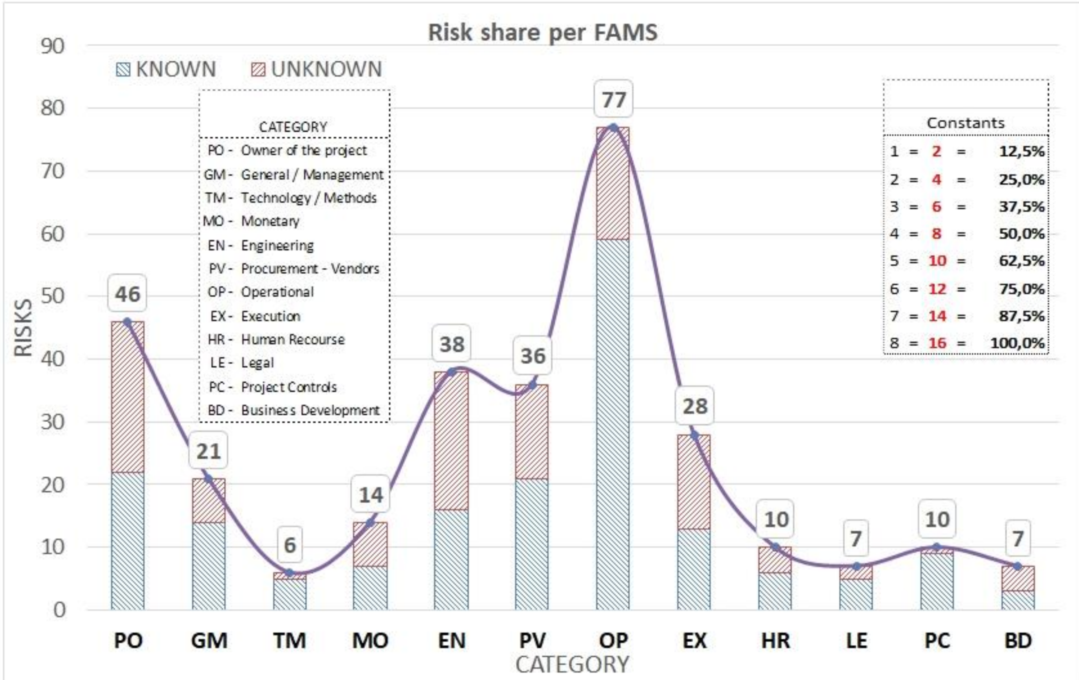
CATEGORY
PO - Owner of the project
GM - General / Management
TM - Technology / Methods
MO - Monetary
EN - Engineering
PV - Procurement - Vendors
OP - Operational
EX - Execution
HR - Human Recourse
LE - Legal
PC - Project Controls
BD - Business Development

Model results of the Stage Gate IV – Project No.1

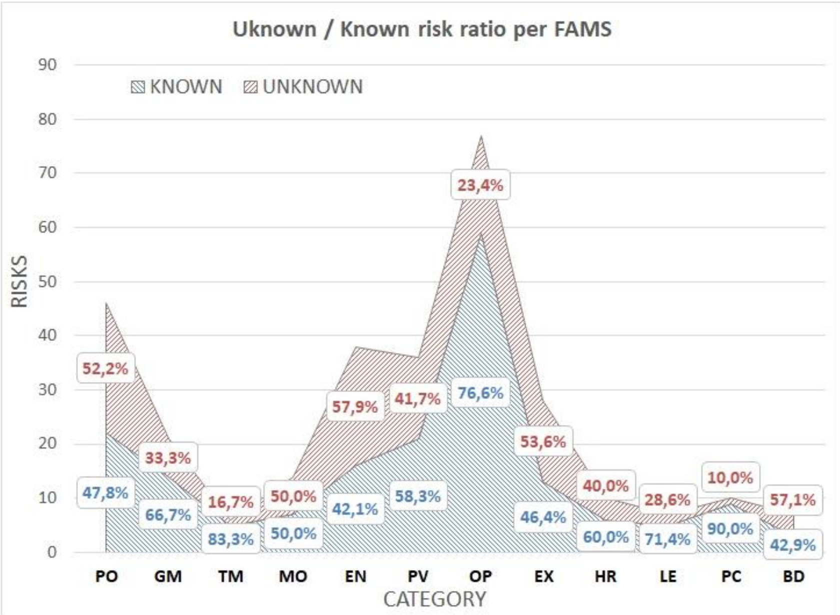
Basis report stage gate IV

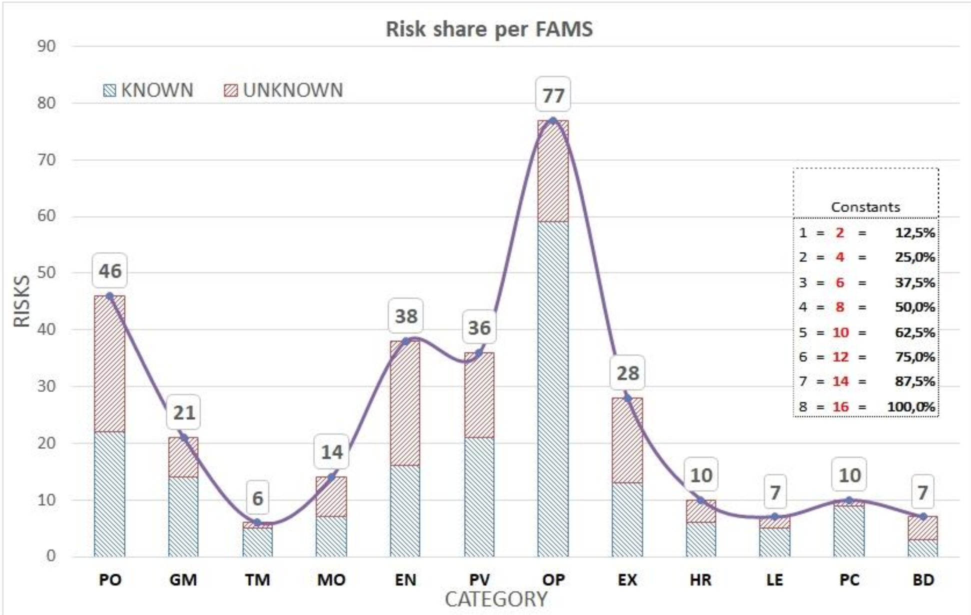
FAMS	RISKS	KNOWN	UNKNOWN	% Known	% Unknown	High / High	High	High / Medium	Medium	Medium / Medium	Medium / Low	Low	Low / Low	Total
PO	46	22	24	47,8%	52,2%	0	0	132	180	88	24	8	0	432
GM	21	14	7	66,7%	33,3%	0	0	48	40	32	36	12	0	168
TM	6	5	1	83,3%	16,7%	0	0	24	10	24	0	0	0	58
MO	14	7	7	50,0%	50,0%	0	0	12	30	32	6	16	2	98
EN	38	16	22	42,1%	57,9%	0	14	144	110	56	42	0	0	366
PV	36	21	15	58,3%	41,7%	0	0	60	100	136	6	12	0	314
OP	77	59	18	76,6%	23,4%	0	28	12	270	128	54	88	0	580
EX	28	13	15	46,4%	53,6%	0	0	60	80	48	36	12	0	236
HR	10	6	4	60,0%	40,0%	0	0	12	40	0	30	0	0	82
LE	7	5	2	71,4%	28,6%	0	0	0	70	0	0	0	0	70
PC	10	9	1	90,0%	10,0%	0	0	0	0	8	36	12	0	56
BD	7	3	4	42,9%	57,1%	0	0	24	30	16	0	0	0	70
Total	300	180	120	60,0%	40,0%	0	42	528	960	568	270	160	2	

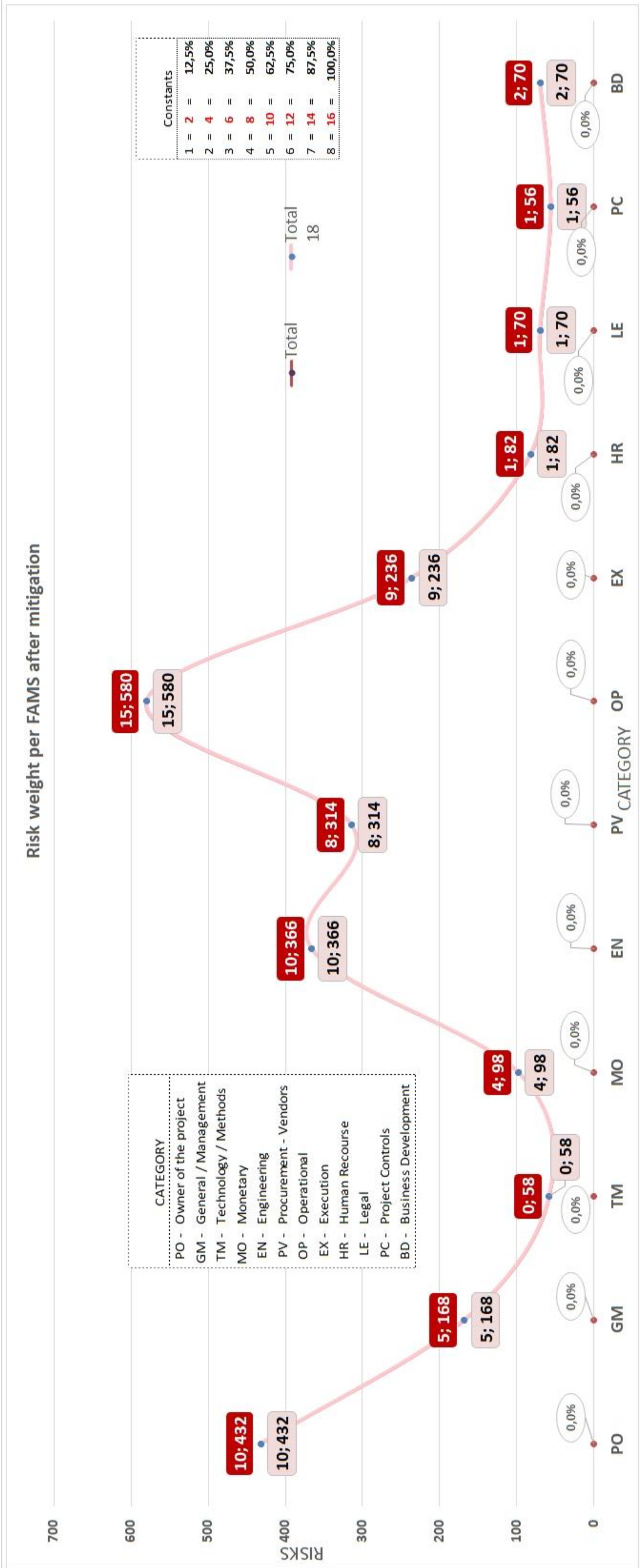




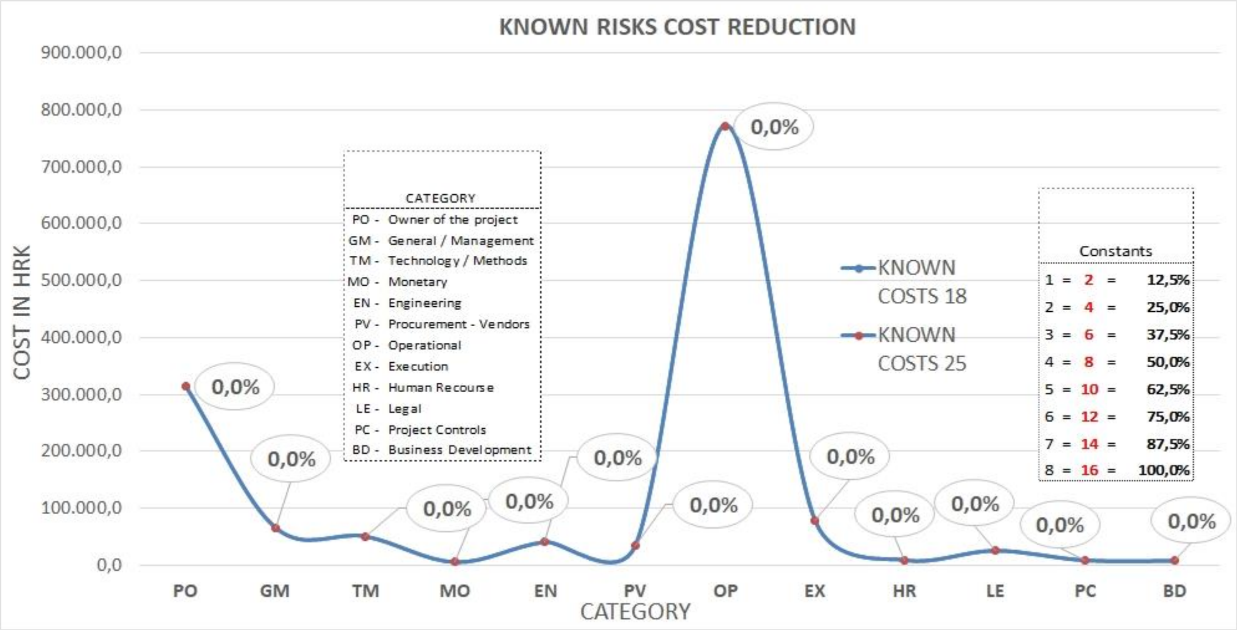
FAMS	RISKS	KNOWN	UNKNOWN	% Known	% Unknown	High / High	High	High / Medium	Medium	Medium / Medium	Medium / Low	Low	Low / Low	Total	Total 18	%
PO	46	22	24	47,8%	52,2%	0	0	132	180	88	24	8	0	432	432	0,0%
GM	21	14	7	66,7%	33,3%	0	0	48	40	32	36	12	0	168	168	0,0%
TM	6	5	1	83,3%	16,7%	0	0	24	10	24	0	0	0	58	58	0,0%
MO	14	7	7	50,0%	50,0%	0	0	12	30	32	6	16	2	98	98	0,0%
EN	38	16	22	42,1%	57,9%	0	14	144	110	56	42	0	0	366	366	0,0%
PV	36	21	15	58,3%	41,7%	0	0	60	100	136	6	12	0	314	314	0,0%
OP	77	59	18	76,6%	23,4%	0	28	12	270	128	54	88	0	580	580	0,0%
EX	28	13	15	46,4%	53,6%	0	0	60	80	48	36	12	0	236	236	0,0%
HR	10	6	4	60,0%	40,0%	0	0	12	40	0	30	0	0	82	82	0,0%
LE	7	5	2	71,4%	28,6%	0	0	0	70	0	0	0	0	70	70	0,0%
PC	10	9	1	90,0%	10,0%	0	0	0	0	8	36	12	0	56	56	0,0%
BD	7	3	4	42,9%	57,1%	0	0	24	30	16	0	0	0	70	70	0,0%
Total	300	180	120	60,0%	40,0%	0	42	528	960	568	270	160	2			

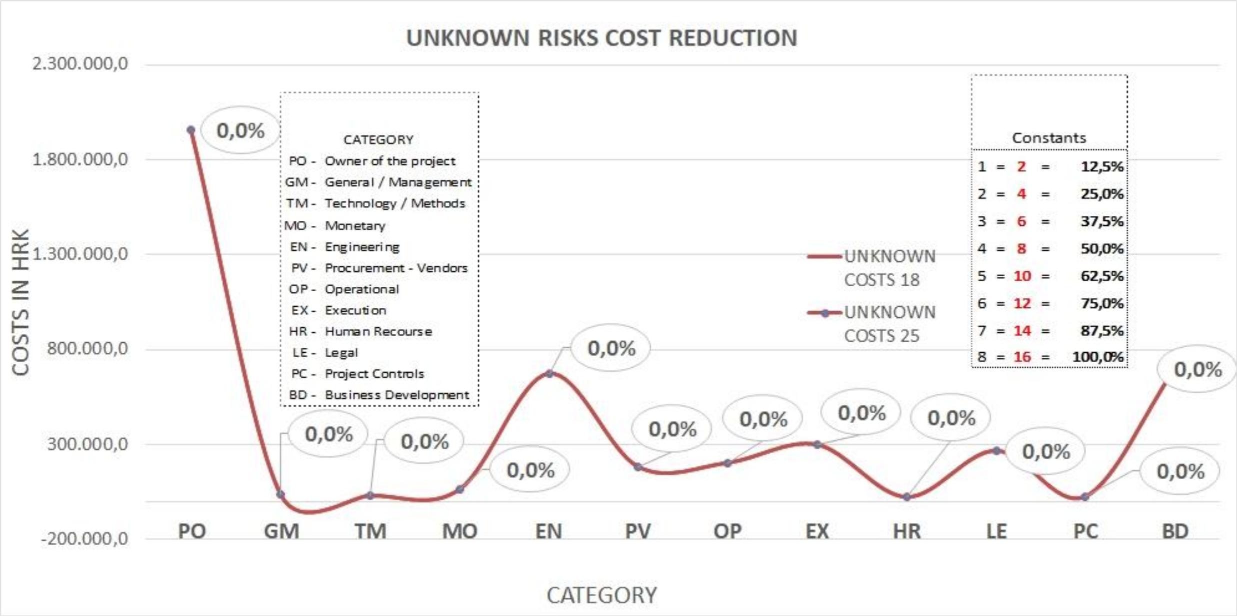




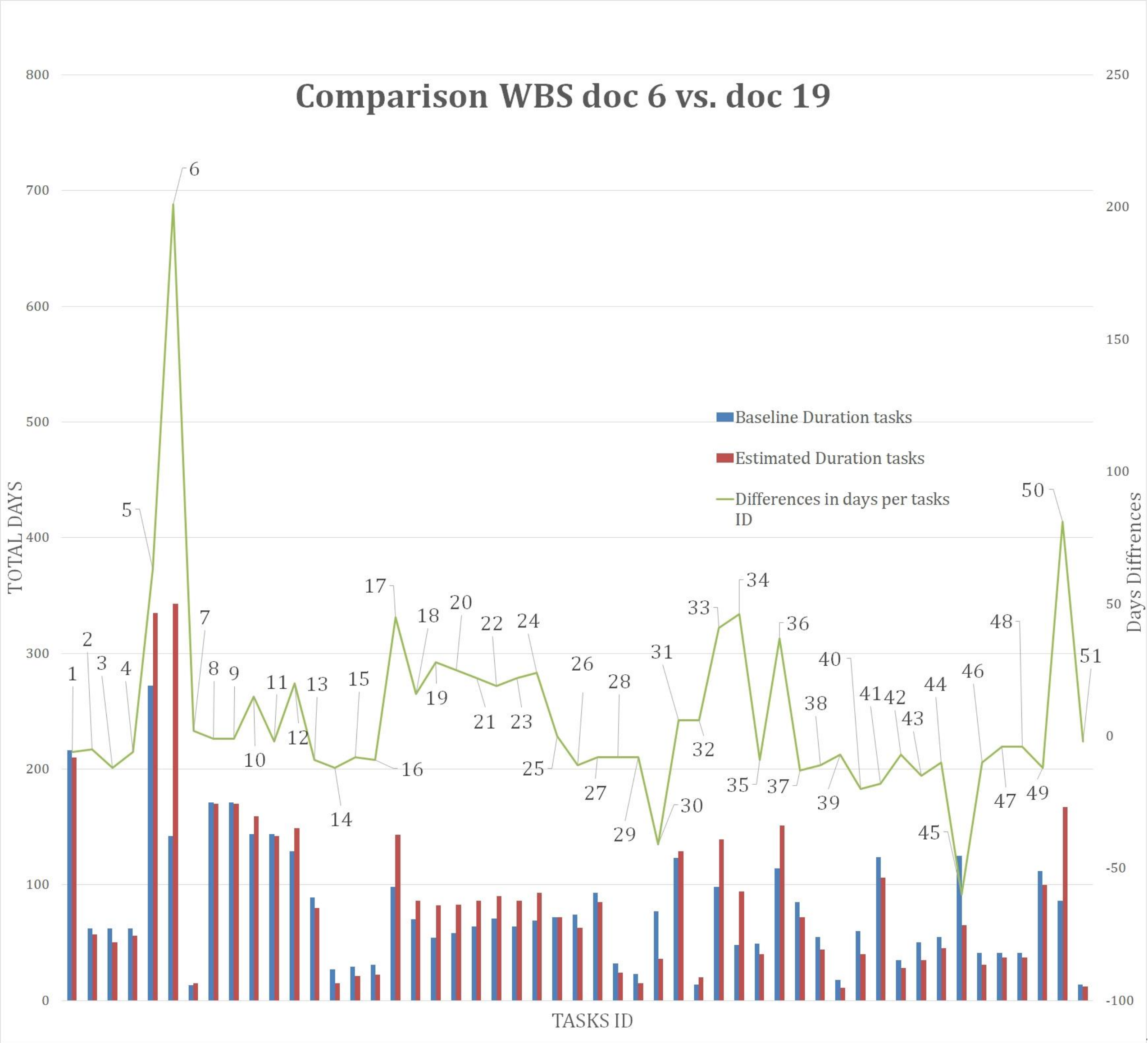

Risk weight per FAMS after mitigation
RISKS
CATEGORY
0
100
200
300
400
500
600
700
PO
GM
TM
MO
EN
PV
OP
EX
HR
LE
PC
BD
10; 432
5; 168
0; 58
4; 98
10; 366
8; 314
15; 580
9; 236
1; 82
1; 70
1; 56
2; 70
0,0%
Total
Total
18
CATEGORY
PO - Owner of the project
GM - General / Management
TM - Technology / Methods
MO - Monetary
EN - Engineering
PV - Procurement - Vendors
OP - Operational
EX - Execution
HR - Human Recourse
LE - Legal
PC - Project Controls
BD - Business Development
Constants
1 = 2 = 12,5%
2 = 4 = 25,0%
3 = 6 = 37,5%
4 = 8 = 50,0%
5 = 10 = 62,5%
6 = 12 = 75,0%
7 = 14 = 87,5%
8 = 16 = 100,0%

FAMS	KNOWN COSTS 18	UNKNOWN COSTS 18	KNOWN COSTS 25	UNKNOWN COSTS 25	KNOWN Mitigation %	UNKNOWN Mitigation %
PO	313.956,3	1.958.500,0	313.956,3	1.958.500,0	0,0%	0,0%
GM	66.125,0	37.250,0	66.125,0	37.250,0	0,0%	0,0%
TM	51.250,0	30.000,0	51.250,0	30.000,0	0,0%	0,0%
MO	5.875,0	61.875,0	5.875,0	61.875,0	0,0%	0,0%
EN	41.400,0	673.625,0	41.400,0	673.625,0	0,0%	0,0%
PV	35.687,5	181.875,0	35.687,5	181.875,0	0,0%	0,0%
OP	772.125,0	203.125,0	772.125,0	203.125,0	0,0%	0,0%
EX	77.937,5	298.625,0	77.937,5	298.625,0	0,0%	0,0%
HR	9.625,0	22.375,0	9.625,0	22.375,0	0,0%	0,0%
LE	26.250,0	266.875,0	26.250,0	266.875,0	0,0%	0,0%
PC	9.187,5	25.000,0	9.187,5	25.000,0	0,0%	0,0%
BD	8.050,0	698.750,0	8.050,0	698.750,0	0,0%	0,0%
Total	**1.417.468,8**	**4.457.875,0**	**1.417.468,8**	**4.457.875,0**	**0,0%**	**0,0%**





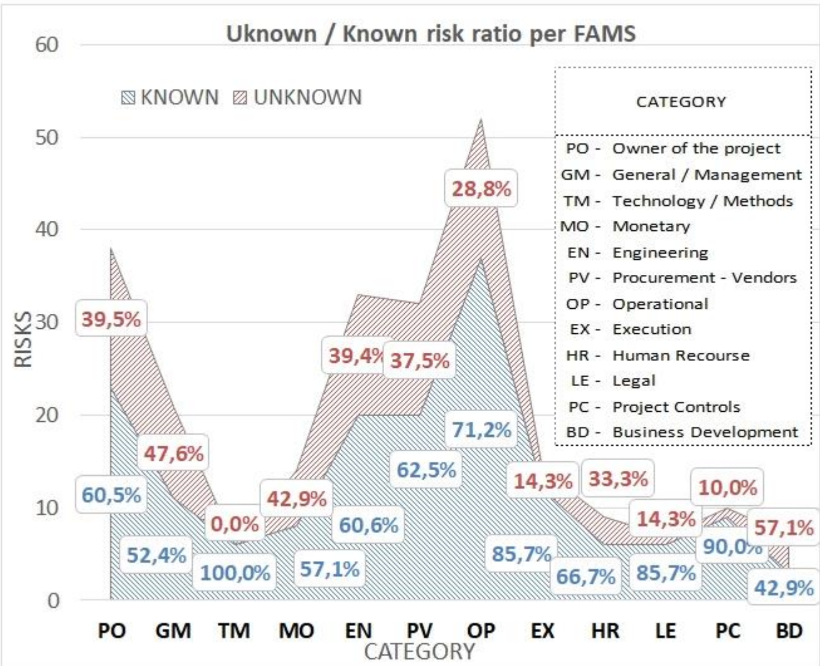
Task ID	Task	Baseline Duration tasks	Estimated Duration tasks	Differences in days per tasks ID
1	STSI - painting specialist consultant	216	210	-6
2	Painting specialist consulting in work breakdown - ongoing activity with intermetent meetings and consulting - Phase1	62	57	-5
3	Painting specialist consulting in work breakdown - ongoing activity with intermetent meetings and consulting - Phase 2	62	50	-12
4	Painting specialist consulting in work breakdown - ongoing activity with intermetent meetings and consulting - Phase 3	62	56	-6
5	**Procurement LLI**	272	335	63
6	**Procurement Other**	142	343	201
7	Project Team - mobilization	13	15	2
8	**LEGS SCOPES OF WORK (Detailed Schedule)**	171	170	-1
9	**Leg #3**	171	170	-1
10	**Leg #2**	144	159	15
11	**Leg #1**	144	142	-2
12	**LAB-HSO-004 Main Deck - steel renewal**	129	149	20
13	**Removal of wasted areas and welding of new steel as per refurbishment plan**	89	80	-9
14	Removal of wasted areas and welding of new steel as per refurbishment plan PHASE 1	27	15	-12
15	Removal of wasted areas and welding of new steel as per refurbishment plan PHASE 2	29	21	-8
16	Removal of wasted areas and welding of new steel as per refurbishment plan PHASE 3	31	22	-9
17	**LAB-HSO-002/003 PRELOAD TANKS**	98	143	45
18	**BOW**	70	86	16
19	**TANK #1**	54	82	28
20	**TANK #2**	58	83	25
21	**TANK #3**	64	86	22
22	**STBD**	71	90	19
23	**TANK #13**	64	86	22
24	**TANK #17**	69	93	24
25	**TANK #12**	72	72	0
26	**TANK #14**	74	63	-11
27	**LAB-HSO-023 Cable Trays & Supports - renewal**	93	85	-8
28	Refurbishment of cable trays and supports - phase 2	32	24	-8
29	Refurbishment of cable trays and supports - phase 3	23	15	-8
30	**Helideck installation**	77	36	-41
31	**MARINE EQUIPMENT & SYSTEMS**	123	129	6
32	LAB-MES-002 Jacking system	14	20	6
33	**LAB-MES-008 Preload System - piping & dump vaves repair/replacement**	98	139	41
34	Preload System - piping & dump vaves repair/replacement - PHASE 1	48	94	46
35	Preload System - piping & dump vaves repair/replacement - PHASE 2	49	40	-9
36	**DRILLING EQUIPMENT & SYSTEMS**	114	151	37
37	**LAB-DES-004 Top Drive - overhaul**	85	72	-13
38	LAB-DES-003 Top Drive Trolley Beams - guide track alignement/replacement	55	44	-11
39	LAB-DES-008 Well Testing Lines - repair / replacement	18	11	-7
40	LAB-DES-013 Mud Pumps - overhaul	60	40	-20
41	**SAFETY EQUIPMENT & SYSTEMS**	124	106	-18
42	LAB-SES-004 Fast Rescue Boat - refurbishment	35	28	-7
43	LAB-SES-003 Installation of new davits and life boat stations 3 & 4	50	35	-15
44	LAB-SES-006/007 Fire Alarm System (AUTRONICA) - upgrade	55	45	-10
45	**LAB-LAG-002 Deck Cranes**	125	65	-60
46	STBD CRANE	41	31	-10
47	AFT CRANE	41	37	-4
48	PORT CRANE	41	37	-4
49	**LAB-EPS-001 MCC - upgrade**	112	100	-12
50	**COMMUNICATIONS & DATA PROCESSING**	86	167	81
51	LAB-CDP-004 TV system - recievers replacment	14	12	-2

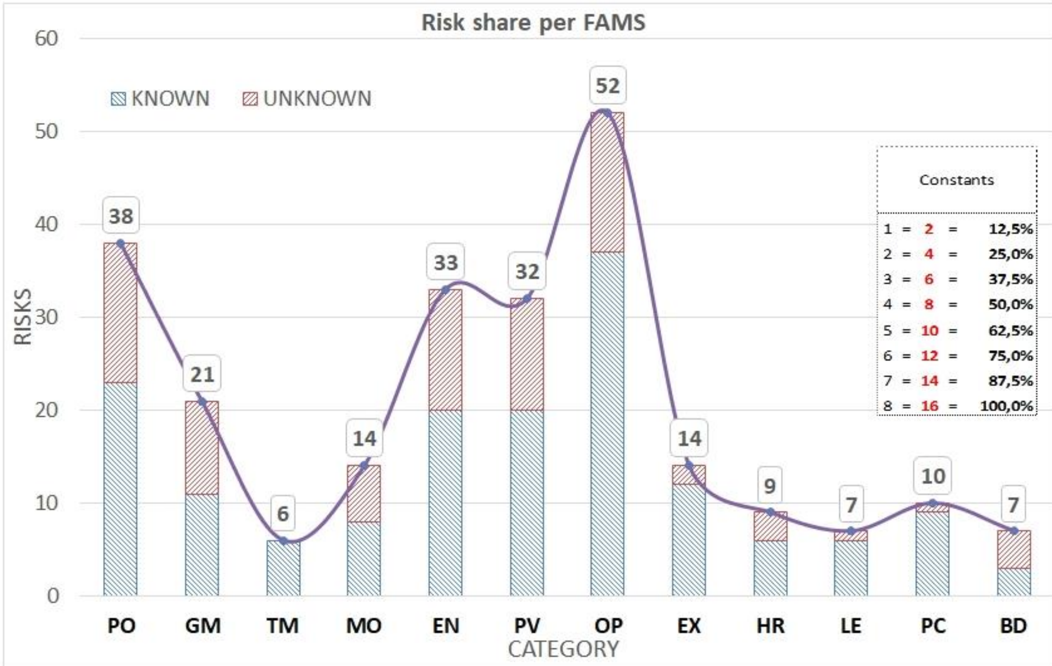

Comparison WBS doc 6 vs. doc 19
TOTAL DAYS
TASKS ID
Days Diffrences
Baseline Duration tasks
Estimated Duration tasks
Differences in days per tasks ID
0
100
200
300
400
500
600
700
800
-100
-50
0
50
100
150
200
250

Model results of the Stage Gate IV – Project No.2

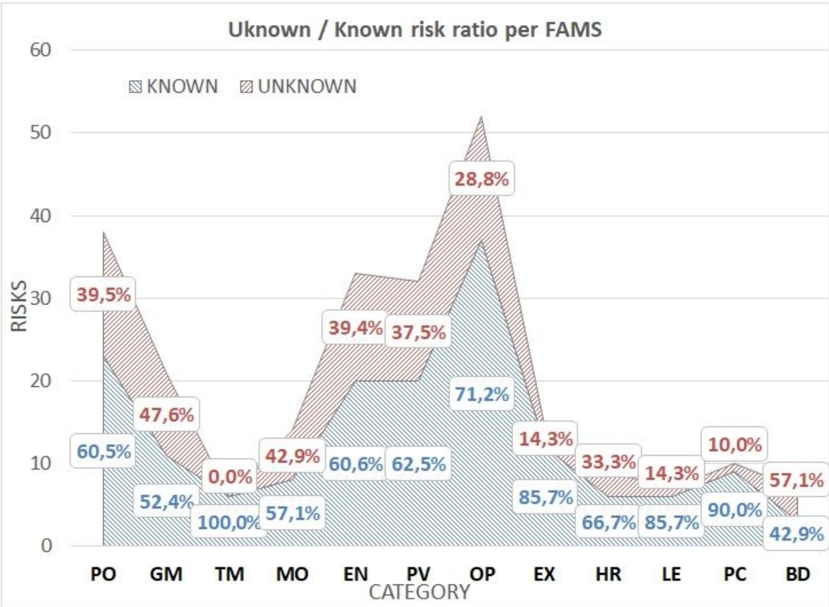
Basis report stage gate IV

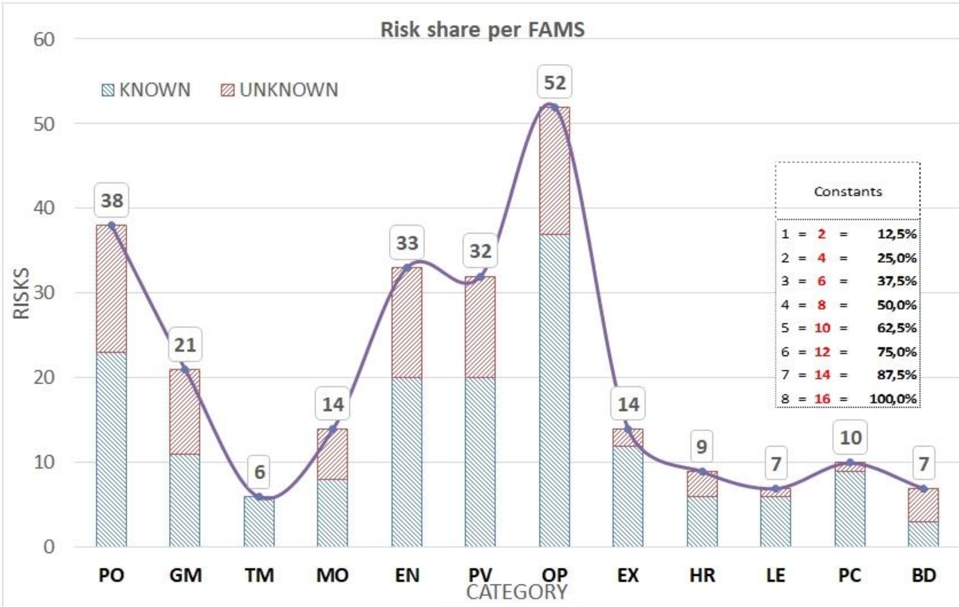
FAMS	RISKS	KNOWN	UNKNOWN	% Known	% Unknown	High / High	High	High / Medium	Medium	Medium / Medium	Medium / Low	Low	Low / Low	Total
PO	38	23	15	60,5%	39,5%	96	126	168	90	0	0	0	0	480
GM	21	11	10	52,4%	47,6%	32	84	72	60	0	0	4	0	252
TM	6	6	0	100,0%	0,0%	16	28	24	10	0	0	0	0	78
MO	14	8	6	57,1%	42,9%	32	0	72	20	32	0	0	0	156
EN	33	20	13	60,6%	39,4%	64	126	192	30	8	0	0	0	420
PV	32	20	12	62,5%	37,5%	0	168	168	40	16	0	0	0	392
OP	52	37	15	71,2%	28,8%	96	238	216	80	24	0	0	0	654
EX	14	12	2	85,7%	14,3%	16	56	120	60	16	0	0	0	268
HR	9	6	3	66,7%	33,3%	0	42	60	10	0	0	0	0	112
LE	7	6	1	85,7%	14,3%	0	56	36	0	0	0	0	0	92
PC	10	9	1	90,0%	10,0%	0	14	60	20	16	0	0	0	110
BD	7	3	4	42,9%	57,1%	48	0	24	20	0	0	0	0	92
Total	243	161	82	66,3%	33,7%	400	938	1212	440	112	0	4	0	





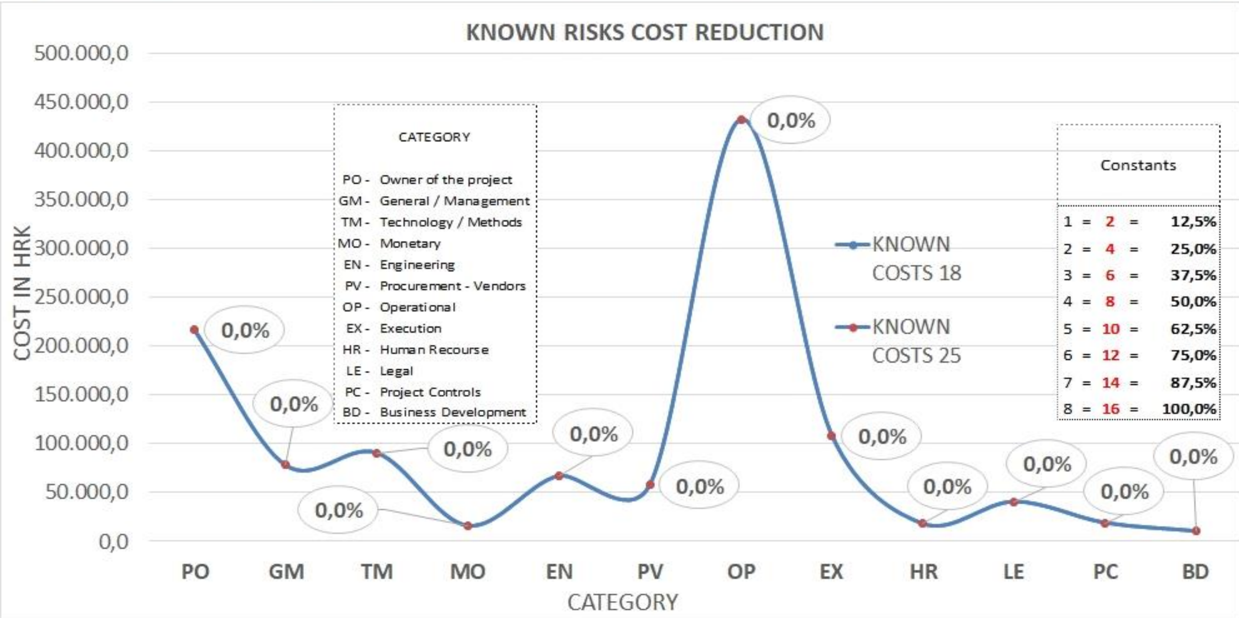
FAMS	RISKS	KNOWN	UNKNOWN	% Known	% Unknown	High / High	High	High / Medium	Medium	Medium / Medium	Medium / Low	Low	Low / Low	Total	Total 18	%
PO	38	23	15	60,5%	39,5%	96	126	168	90	0	0	0	0	480	480	0,0%
GM	21	11	10	52,4%	47,6%	32	84	72	60	0	0	4	0	252	252	0,0%
TM	6	6	0	100,0%	0,0%	16	28	24	10	0	0	0	0	78	78	0,0%
MO	14	8	6	57,1%	42,9%	32	0	72	20	32	0	0	0	156	156	0,0%
EN	33	20	13	60,6%	39,4%	64	126	192	30	8	0	0	0	420	420	0,0%
PV	32	20	12	62,5%	37,5%	0	168	168	40	16	0	0	0	392	392	0,0%
OP	52	37	15	71,2%	28,8%	96	238	216	80	24	0	0	0	654	654	0,0%
EX	14	12	2	85,7%	14,3%	16	56	120	60	16	0	0	0	268	268	0,0%
HR	9	6	3	66,7%	33,3%	0	42	60	10	0	0	0	0	112	112	0,0%
LE	7	6	1	85,7%	14,3%	0	56	36	0	0	0	0	0	92	92	0,0%
PC	10	9	1	90,0%	10,0%	0	14	60	20	16	0	0	0	110	110	0,0%
BD	7	3	4	42,9%	57,1%	48	0	24	20	0	0	0	0	92	92	0,0%
Total	243	161	82	66,3%	33,7%	400	938	1212	440	112	0	4	0			

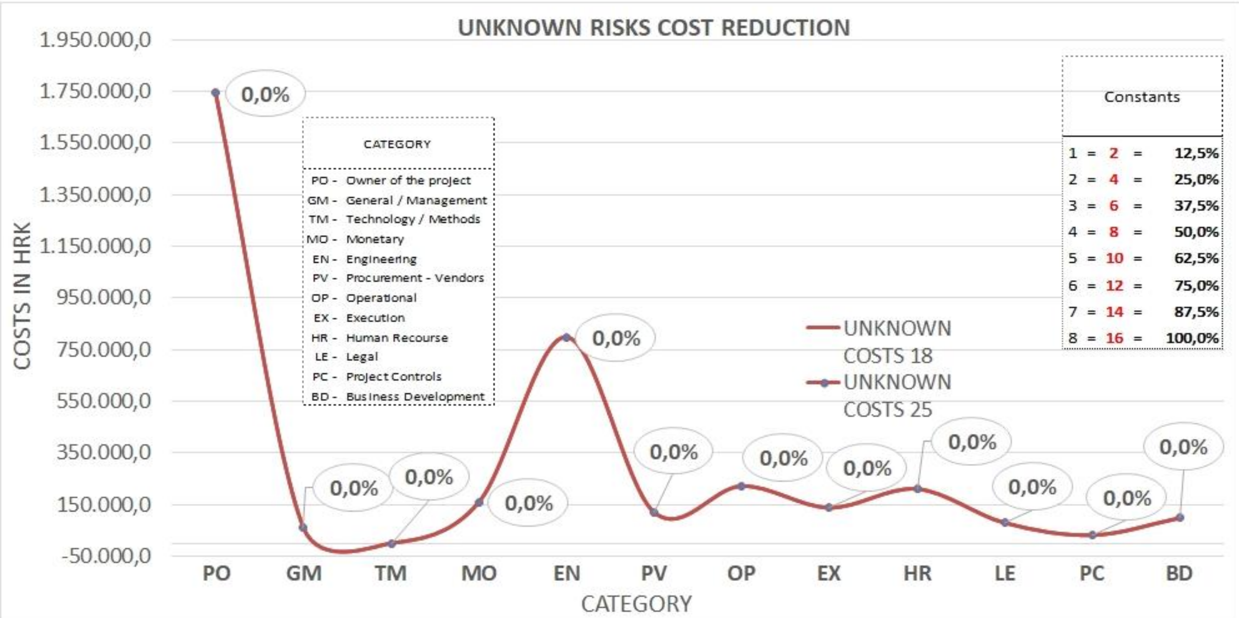




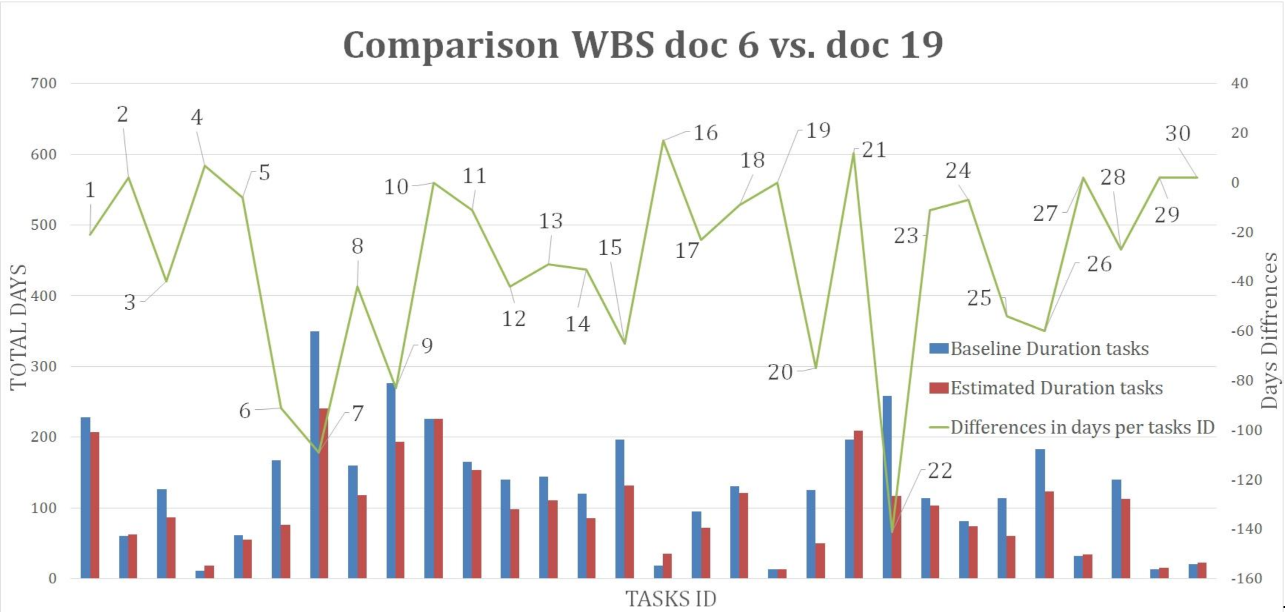

Risk weight per FAMS after mitigation
TOTAL RISKS CONSTANTS
0
100
200
300
400
500
600
700
CATEGORY
PO
GM
TM
MO
EN
PV
OP
EX
HR
LE
PC
BD
10; 480
5; 252
0; 78
4; 156
10; 420
8; 392
15; 654
9; 268
1; 112
1; 92
1; 110
2; 92
0,0%
CATEGORY
PO - Owner of the project
GM - General / Management
TM - Technology / Methods
MO - Monetary
EN - Engineering
PV - Procurement - Vendors
OP - Operational
EX - Execution
HR - Human Recourse
LE - Legal
PC - Project Controls
BD - Business Development
Total
Total 18
Constants
1 = 2 = 12,5%
2 = 4 = 25,0%
3 = 6 = 37,5%
4 = 8 = 50,0%
5 = 10 = 62,5%
6 = 12 = 75,0%
7 = 14 = 87,5%
8 = 16 = 100,0%

FAMS	KNOWN COSTS 18	UNKNOWN COSTS 18	KNOWN COSTS 25	UNKNOWN COSTS 25	KNOWN Mitigation %	UNKNOWN Mitigation %
PO	216.606,3	1.743.375,0	216.606,3	1.743.375,0	0,0%	0,0%
GM	78.062,5	61.750,0	78.062,5	61.750,0	0,0%	0,0%
TM	90.625,0	0,0	90.625,0	0,0	0,0%	0,0%
MO	16.000,0	157.750,0	16.000,0	157.750,0	0,0%	0,0%
EN	67.075,0	797.875,0	67.075,0	797.875,0	0,0%	0,0%
PV	57.687,5	120.250,0	57.687,5	120.250,0	0,0%	0,0%
OP	432.350,0	221.250,0	432.350,0	221.250,0	0,0%	0,0%
EX	108.562,5	137.500,0	108.562,5	137.500,0	0,0%	0,0%
HR	18.000,0	210.000,0	18.000,0	210.000,0	0,0%	0,0%
LE	40.625,0	78.750,0	40.625,0	78.750,0	0,0%	0,0%
PC	19.000,0	31.250,0	19.000,0	31.250,0	0,0%	0,0%
BD	10.500,0	97.750,0	10.500,0	97.750,0	0,0%	0,0%
Total	**1.155.093,8**	**3.657.500,0**	**1.155.093,8**	**3.657.500,0**	**0,0%**	**0,0%**





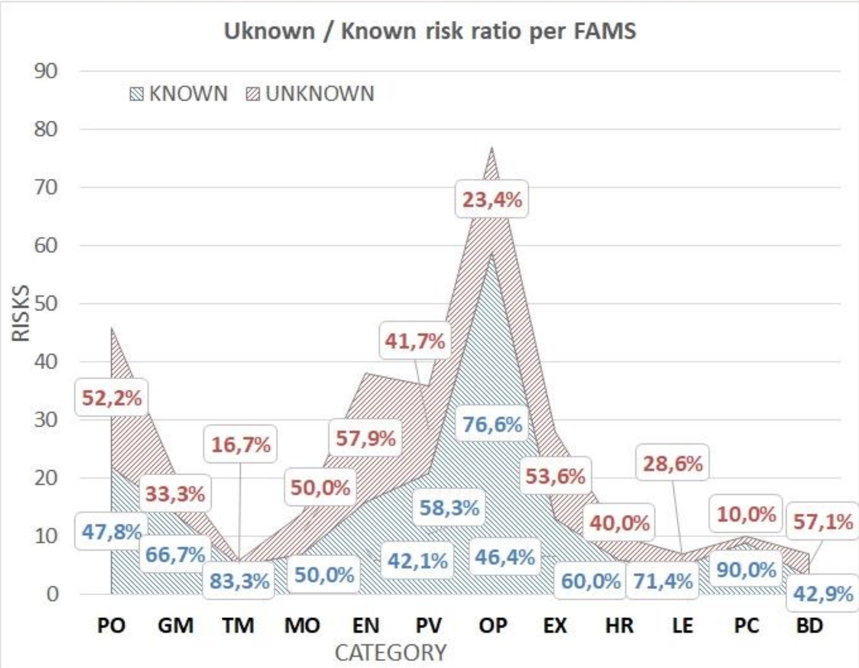
Task ID	Task	Baseline Duration tasks	Estimated Duration tasks	Differences in days per tasks ID
1	Project preparation phase	228	207	-21
2	Wind-wall	60	62	2
3	Triplex pumps	126	86	-40
4	Third party inspections, acceptances	11	18	7
5	**Substructure**	61	55	-6
6	**R/U electrical power supply. (as per electrical power plan)**	167	76	-91
7	Procurement of ZJ40 rig and main aux.equipment	350	241	-109
8	**Procurement of Solids Control Equipments**	160	118	-42
9	**Procurement of BOP control unit**	276	193	-83
10	**Procurement of BHA elements**	226	226	0
11	**Outdoor high voltage and lighting system execution works**	165	154	-11
12	**Nested water tank manufacturing**	140	98	-42
13	**MCC container manufacturing**	144	111	-33
14	Mast and substructure finalizing jobs	120	85	-35
15	Manufacturing of mudtank system	197	132	-65
16	Low Pressure mud system	18	35	17
17	**Instrumentation system**	95	72	-23
18	**Instrumentation and data system**	130	121	-9
19	**Install the HP lines & H.mannifold.**	13	13	0
20	**Hydraulic system modification**	125	50	-75
21	**High Pressure mud system manufacturing**	197	209	12
22	**Fuel tank system manufacturing**	258	117	-141
23	**Foldable mobile hause manufacturing**	114	103	-11
24	**Finalize Social & office containers.**	81	74	-7
25	**Diesel supply system**	114	60	-54
26	**Caravan manufacturing**	183	123	-60
27	**BOP transport and testing skid**	32	34	2
28	Air supply unit manufacturing	140	113	-27
29	Works prior to mast erection	13	15	2
30	**Mast erection partial jobs**	20	22	2

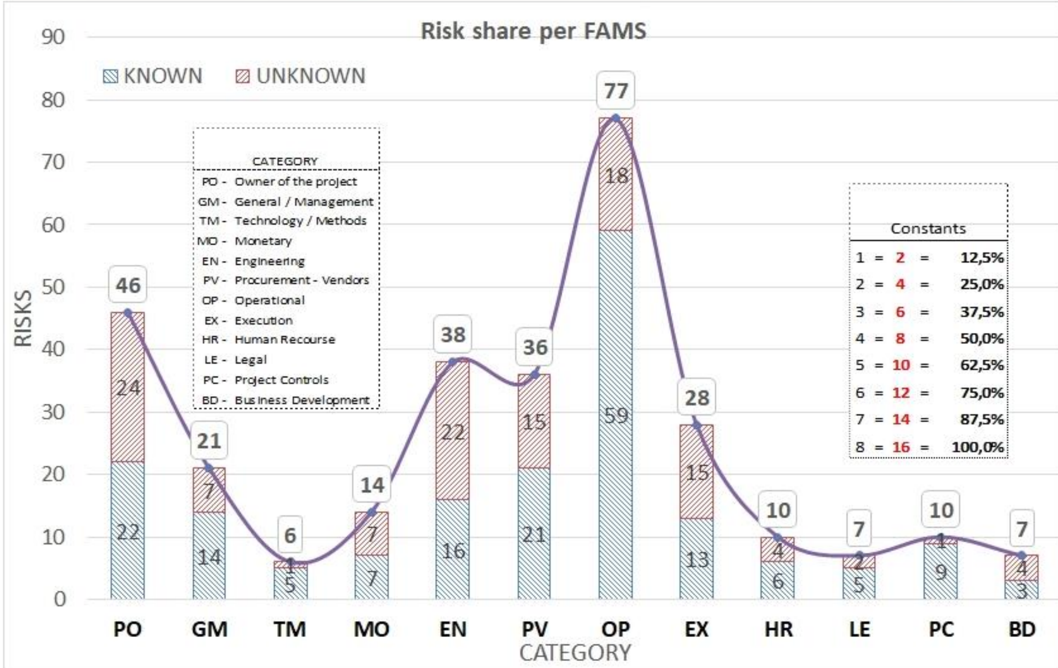


Model results of the Stage Gate V – Project No.1

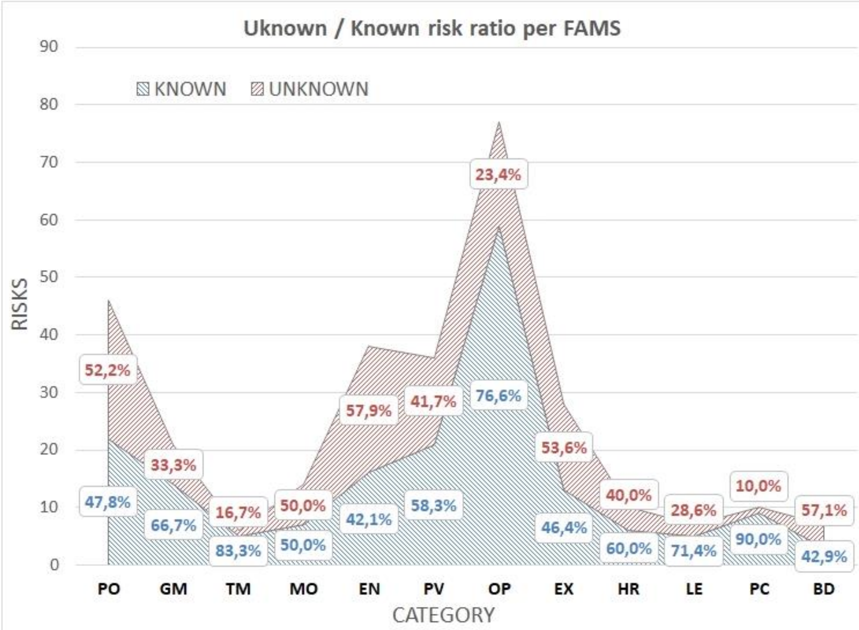
Basis report stage gate V

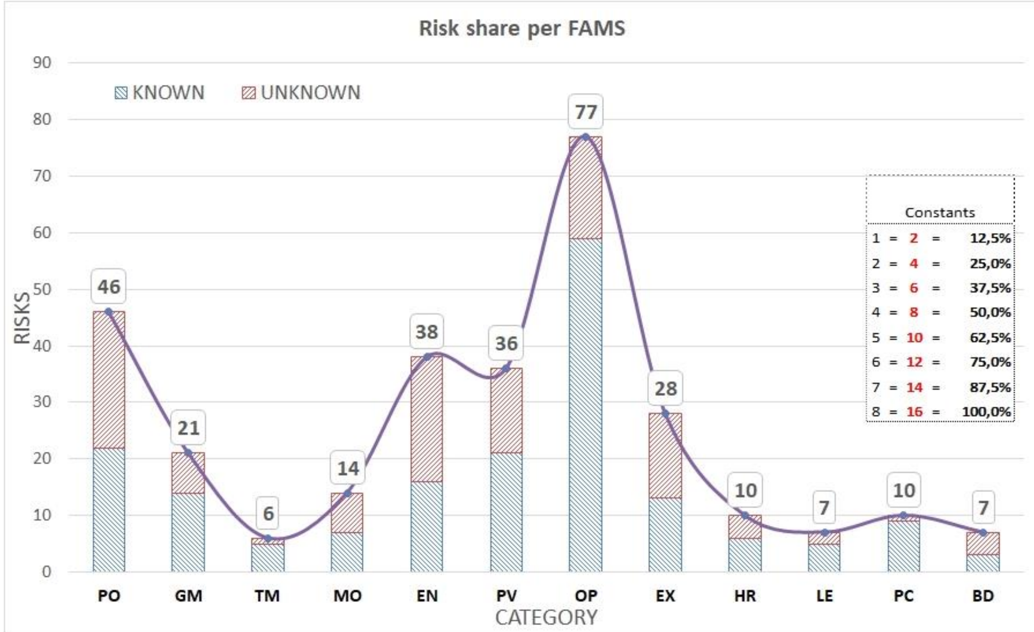
FAMS	RISKS	KNOWN	UNKNOWN	% Known	% Unknown	High / High	High	High / Medium	Medium	Medium / Medium	Medium / Low	Low	Low / Low	Total
PO	46	22	24	47,8%	52,2%	0	0	132	180	88	24	8	0	432
GM	21	14	7	66,7%	33,3%	0	0	48	40	32	36	12	0	168
TM	6	5	1	83,3%	16,7%	0	0	24	10	24	0	0	0	58
MO	14	7	7	50,0%	50,0%	0	0	12	30	32	6	16	2	98
EN	38	16	22	42,1%	57,9%	0	14	144	110	56	42	0	0	366
PV	36	21	15	58,3%	41,7%	0	0	60	100	136	6	12	0	314
OP	77	59	18	76,6%	23,4%	0	28	12	270	128	54	88	0	580
EX	28	13	15	46,4%	53,6%	0	0	60	80	48	36	12	0	236
HR	10	6	4	60,0%	40,0%	0	0	12	40	0	30	0	0	82
LE	7	5	2	71,4%	28,6%	0	0	0	70	0	0	0	0	70
PC	10	9	1	90,0%	10,0%	0	0	0	0	8	36	12	0	56
BD	7	3	4	42,9%	57,1%	0	0	24	30	16	0	0	0	70
Total	300	180	120	60,0%	40,0%	0	42	528	960	568	270	160	2	

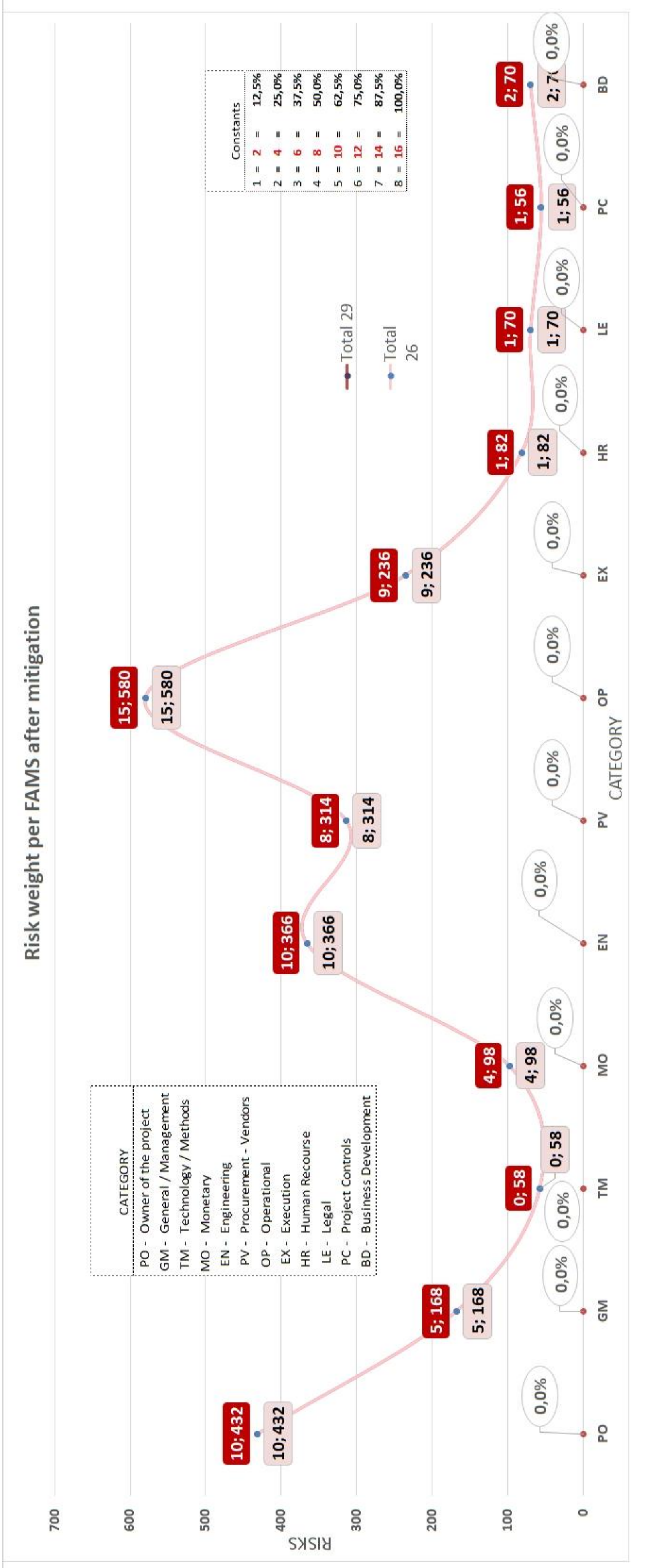




FAMS	RISKS	KNOWN	UNKNOWN	% Known	% Unknown	High / High	High	High / Medium	Medium	Medium / Medium	Medium / Low	Low	Low / Low	Total 29	Total 26	%
PO	46	22	24	47,8%	52,2%	0	0	132	180	88	24	8	0	432	432	0,0%
GM	21	14	7	66,7%	33,3%	0	0	48	40	32	36	12	0	168	168	0,0%
TM	6	5	1	83,3%	16,7%	0	0	24	10	24	0	0	0	58	58	0,0%
MO	14	7	7	50,0%	50,0%	0	0	12	30	32	6	16	2	98	98	0,0%
EN	38	16	22	42,1%	57,9%	0	14	144	110	56	42	0	0	366	366	0,0%
PV	36	21	15	58,3%	41,7%	0	0	60	100	136	6	12	0	314	314	0,0%
OP	77	59	18	76,6%	23,4%	0	28	12	270	128	54	88	0	580	580	0,0%
EX	28	13	15	46,4%	53,6%	0	0	60	80	48	36	12	0	236	236	0,0%
HR	10	6	4	60,0%	40,0%	0	0	12	40	0	30	0	0	82	82	0,0%
LE	7	5	2	71,4%	28,6%	0	0	0	70	0	0	0	0	70	70	0,0%
PC	10	9	1	90,0%	10,0%	0	0	0	0	8	36	12	0	56	56	0,0%
BD	7	3	4	42,9%	57,1%	0	0	24	30	16	0	0	0	70	70	0,0%
Total	300	180	120	60,0%	40,0%	0	42	528	960	568	270	160	2			

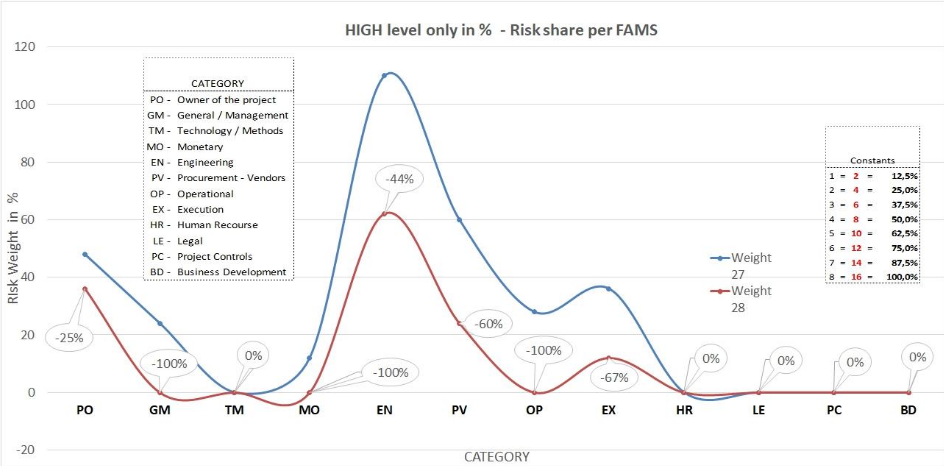


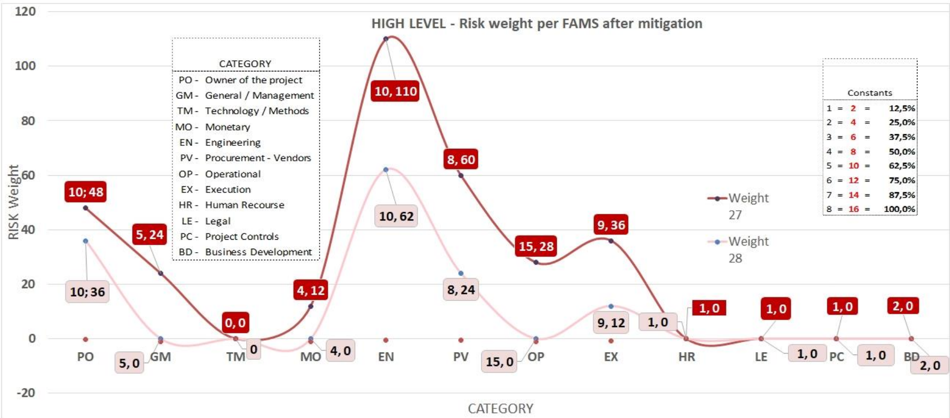




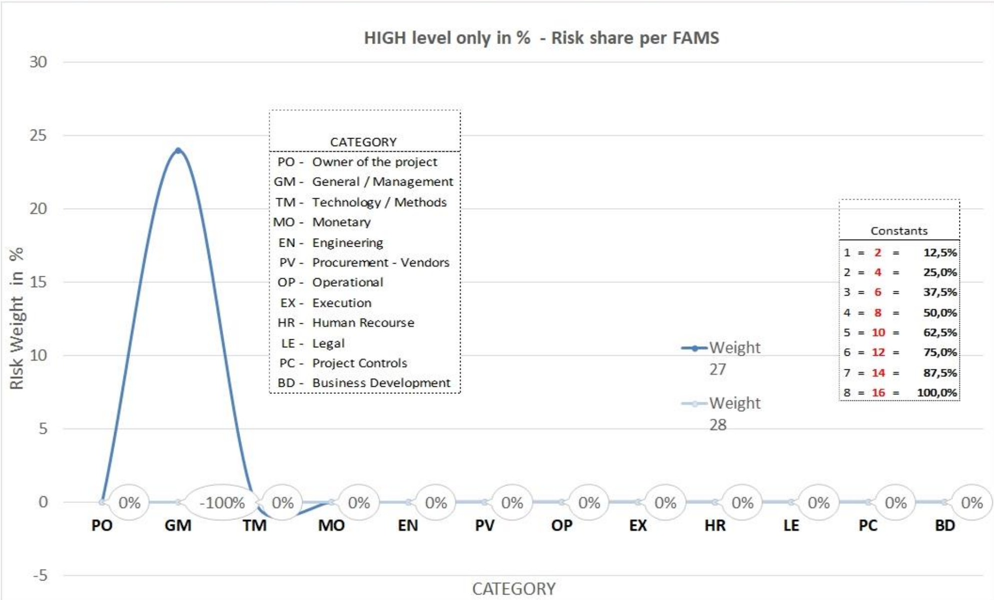
Risk weight per FAMS after mitigation
RISKS
700
600
500
400
300
200
100
0
CATEGORY
PO
GM
TM
MO
EN
PV
OP
EX
HR
LE
PC
BD
10;432
5; 168
0; 58
4; 98
10;366
8; 314
15;580
9; 236
1; 82
1; 70
1; 56
2; 70
0,0%
CATEGORY
PO - Owner of the project
GM - General / Management
TM - Technology / Methods
MO - Monetary
EN - Engineering
PV - Procurement - Vendors
OP - Operational
EX - Execution
HR - Human Recourse
LE - Legal
PC - Project Controls
BD - Business Development
Total 29
Total 26
Constants
1 = 2 = 12,5%
2 = 4 = 25,0%
3 = 6 = 37,5%
4 = 8 = 50,0%
5 = 10 = 62,5%
6 = 12 = 75,0%
7 = 14 = 87,5%
8 = 16 = 100,0%

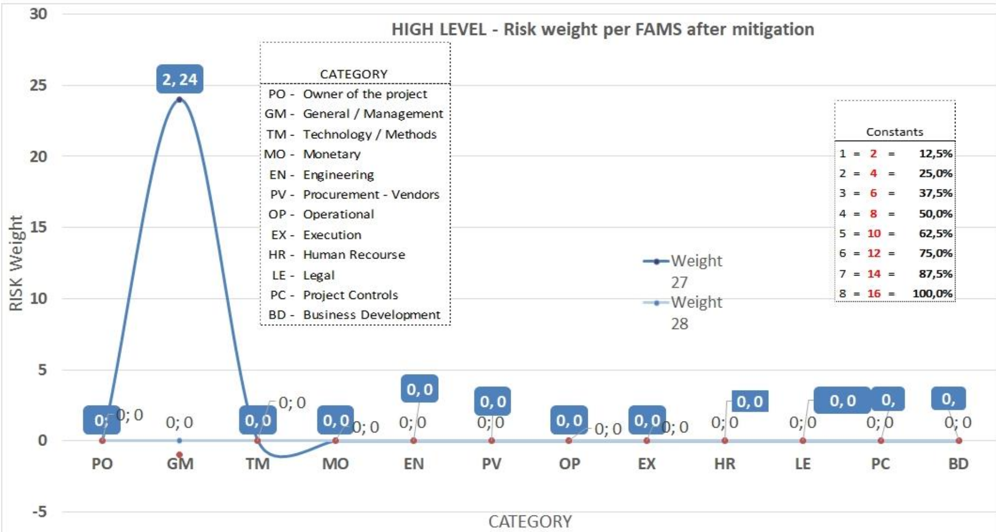
FAMS	RISKS 27	RISK 28	KNOWN 27	KNOWN 28	UNKNOWN 27	UNKNOWN 28	High / High	High	High / Medium	High / High	High	High / Medium	Weight 27	Weight 28	% DIFF
PO	4	3	0	0	4	3	0	0	48	0	0	36	48	36	-25%
GM	2	0	2	0	0	0	0	0	24	0	0	0	24	0	-100%
TM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
MO	1	0	0	0	1	0	0	0	12	0	0	0	12	0	-100%
EN	9	5	0	0	9	5	0	14	96	0	14	48	110	62	-44%
PV	5	2	0	0	5	2	0	0	60	0	0	24	60	24	-60%
OP	2	0	0	0	2	0	0	28	0	0	0	0	28	0	-100%
EX	3	1	0	0	3	1	0	0	36	0	0	12	36	12	-67%
HR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
LE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
PC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
BD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
Total	26	11	2	0	24	11	0	42	276	0	14	120	318	134	-495,30%



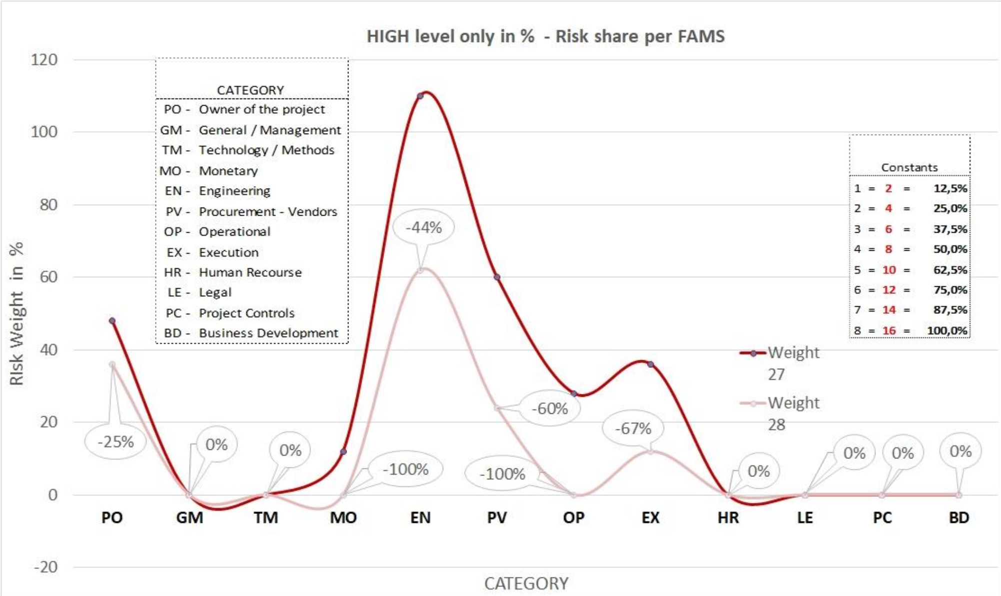


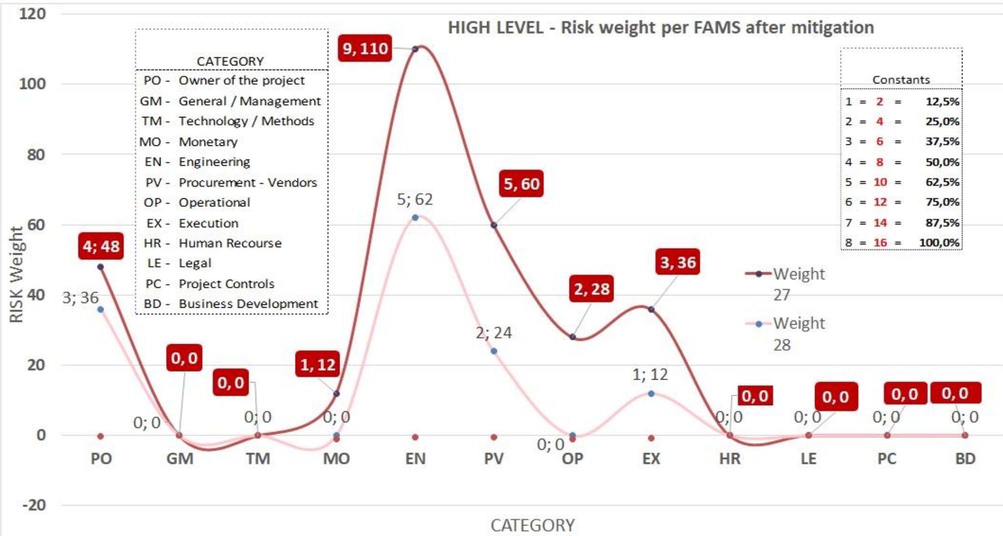
FAMS	KNOWN 27	KNOWN 28	High / High	High	High / Medium	High / High	High	High / Medium	Weight 27	Weight 28	% DIFF
PO	0	0	0	0	0	0	0	0	0	0	0%
GM	2	0	0	0	24	0	0	0	24	0	-100%
TM	0	0	0	0	0	0	0	0	0	0	0%
MO	0	0	0	0	0	0	0	0	0	0	0%
EN	0	0	0	0	0	0	0	0	0	0	0%
PV	0	0	0	0	0	0	0	0	0	0	0%
OP	0	0	0	0	0	0	0	0	0	0	0%
EX	0	0	0	0	0	0	0	0	0	0	0%
HR	0	0	0	0	0	0	0	0	0	0	0%
LE	0	0	0	0	0	0	0	0	0	0	0%
PC	0	0	0	0	0	0	0	0	0	0	0%
BD	0	0	0	0	0	0	0	0	0	0	0%
Total	2	0	0	0	24	0	0	0	24	0	-1



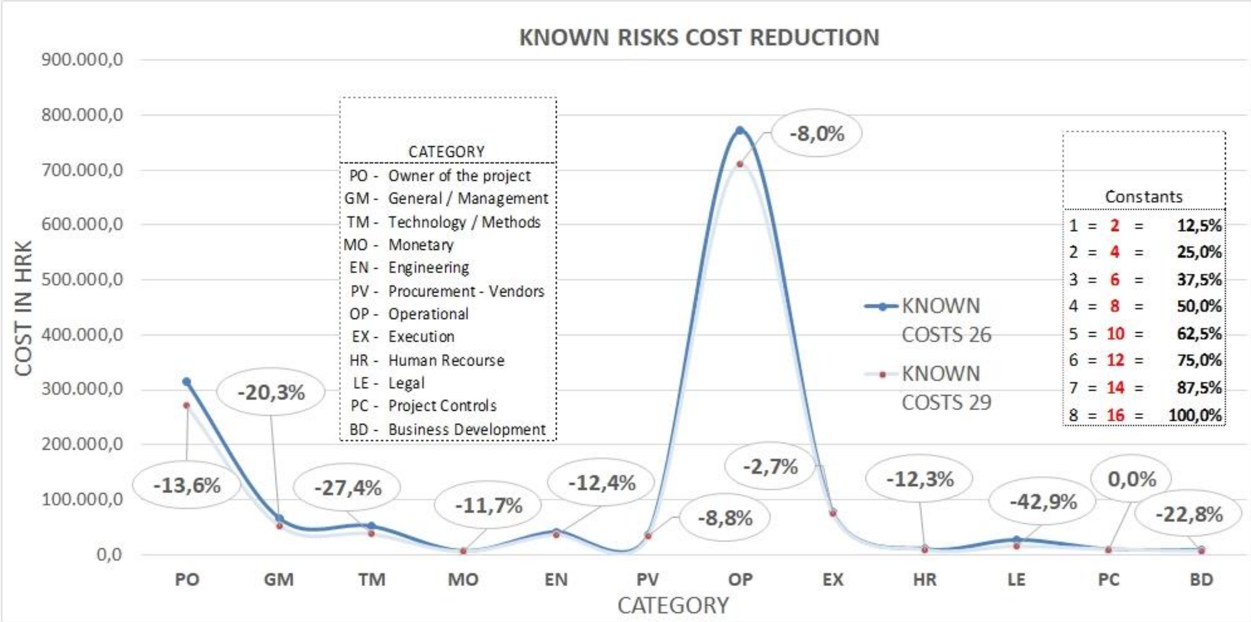


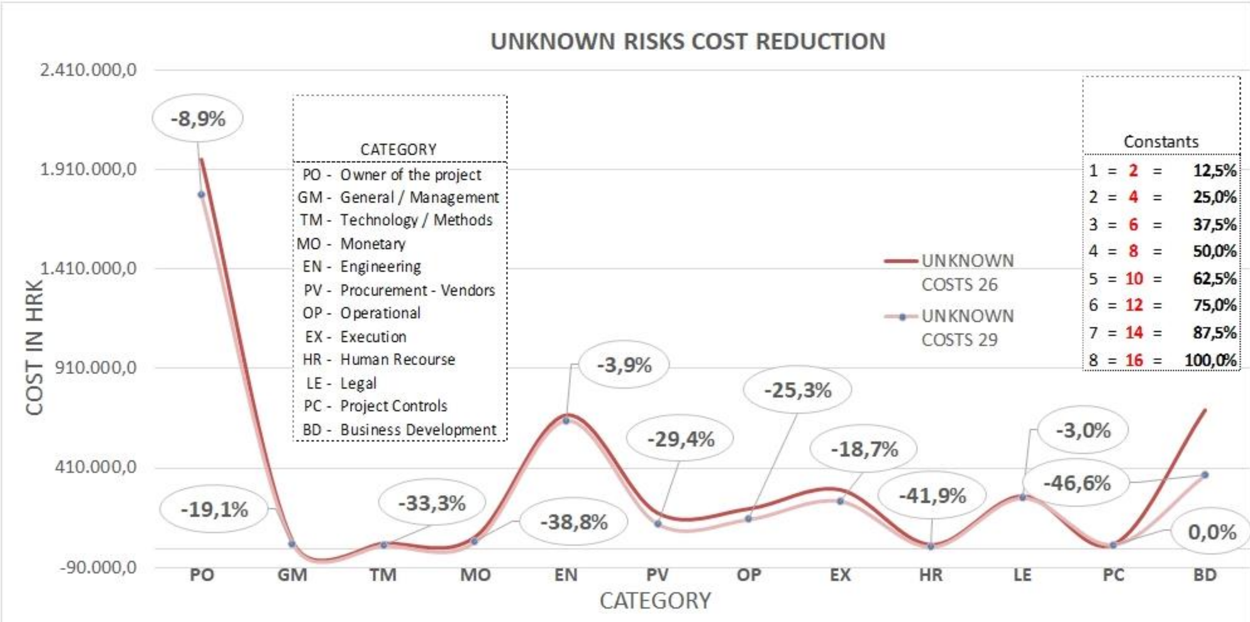
FAMS	UNKNOWN	UNKNOWN	High / High	High	High / Medium	High / High	High	High / Medium	Weight 27	Weight 28	% DIFF
PO	4	3	0	0	48	0	0	36	48	36	-25%
GM	0	0	0	0	0	0	0	0	0	0	0%
TM	0	0	0	0	0	0	0	0	0	0	0%
MO	1	0	0	0	12	0	0	0	12	0	-100%
EN	9	5	0	14	96	0	14	48	110	62	-44%
PV	5	2	0	0	60	0	0	24	60	24	-60%
OP	2	0	0	28	0	0	0	0	28	0	-100%
EX	3	1	0	0	36	0	0	12	36	12	-67%
HR	0	0	0	0	0	0	0	0	0	0	0%
LE	0	0	0	0	0	0	0	0	0	0	0%
PC	0	0	0	0	0	0	0	0	0	0	0%
BD	0	0	0	0	0	0	0	0	0	0	0%
Total	24	11	0	42	252	0	14	120	294	134	-3,953030303





FAMS	KNOWN COSTS 26	UNKNOWN COSTS 26	KNOWN COSTS 29	UNKNOWN COSTS 29	KNOWN Mitigation %	UNKNOWN Mitigation %
PO	313.956,3	1.958.500,0	271.287,5	1.783.300,0	-13,6%	-8,9%
GM	66.125,0	37.250,0	52.687,5	30.125,0	-20,3%	-19,1%
TM	51.250,0	30.000,0	37.187,5	20.000,0	-27,4%	-33,3%
MO	5.875,0	61.875,0	5.187,5	37.875,0	-11,7%	-38,8%
EN	41.400,0	673.625,0	36.275,0	647.375,0	-12,4%	-3,9%
PV	35.687,5	181.875,0	32.562,5	128.375,0	-8,8%	-29,4%
OP	772.125,0	203.125,0	710.625,0	151.750,0	-8,0%	-25,3%
EX	77.937,5	298.625,0	75.812,5	242.750,0	-2,7%	-18,7%
HR	9.625,0	22.375,0	8.437,5	13.000,0	-12,3%	-41,9%
LE	26.250,0	266.875,0	15.000,0	259.000,0	-42,9%	-3,0%
PC	9.187,5	25.000,0	9.187,5	25.000,0	0,0%	0,0%
BD	8.050,0	698.750,0	6.212,5	373.000,0	-22,8%	-46,6%
Total	**1.417.468,8**	**4.457.875,0**	**1.260.462,5**	**3.711.550,0**	**-11,1%**	**-16,7%**

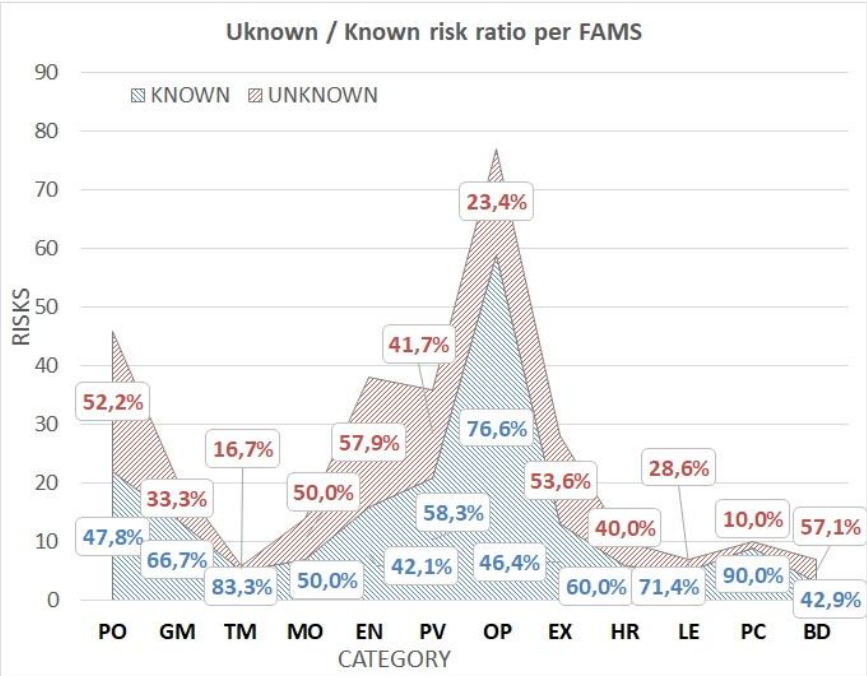


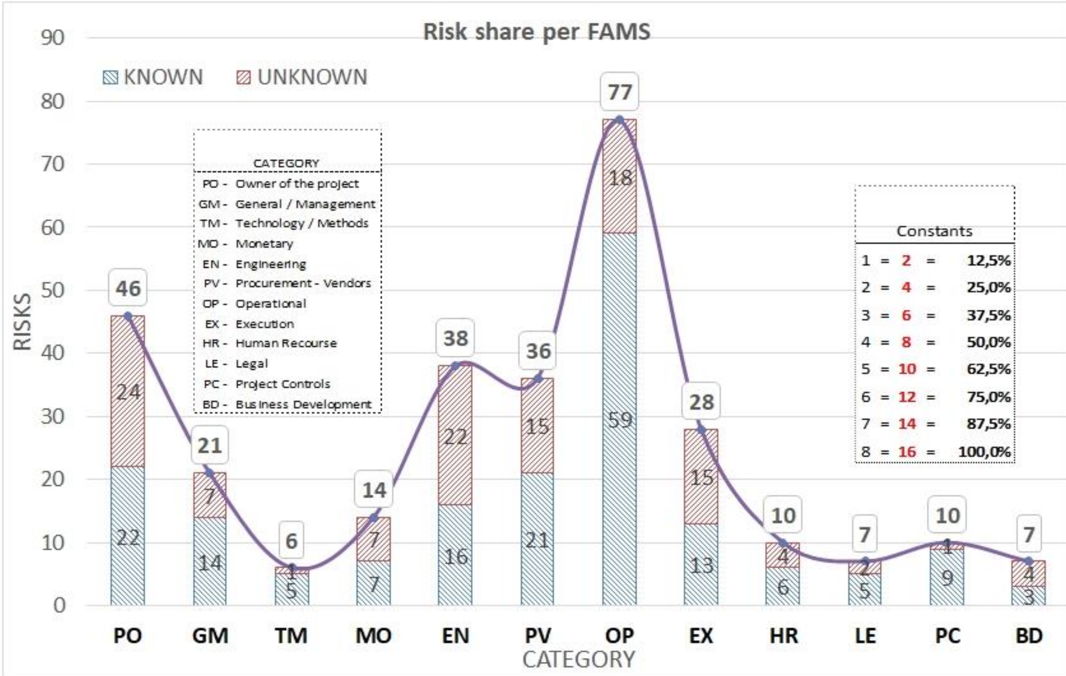


Model results of the Stage Gate V – Project No.2

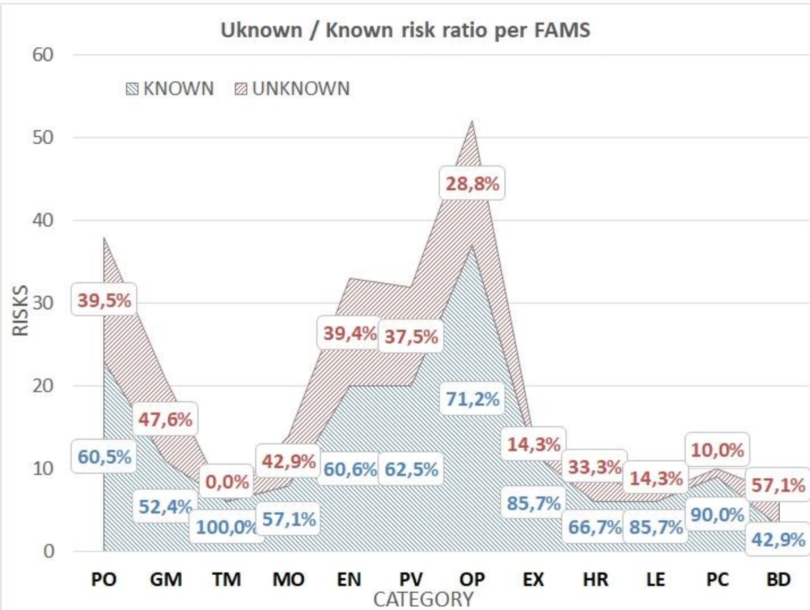
Basis report stage gate V

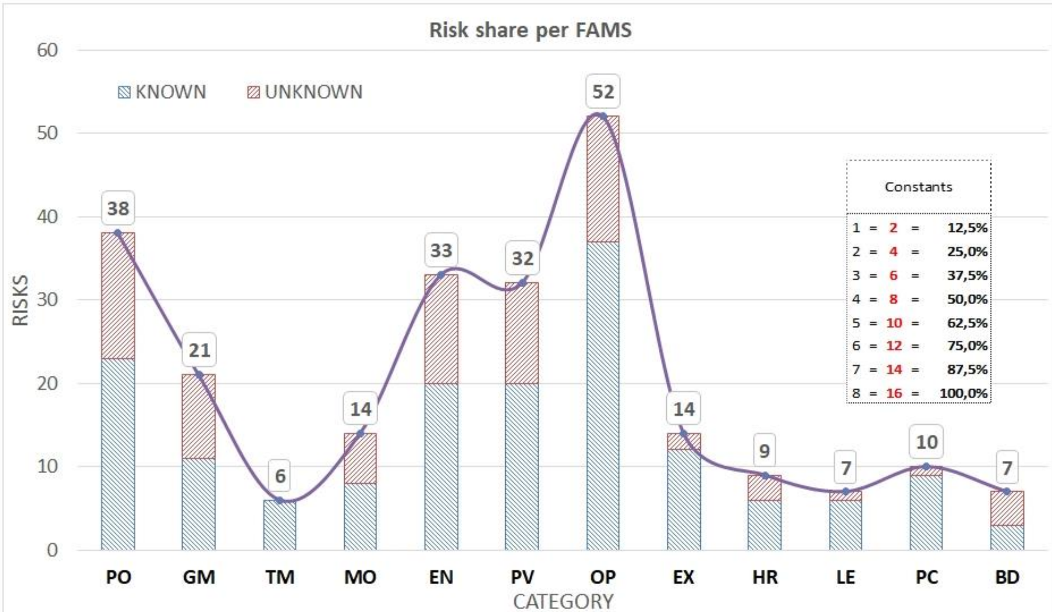
FAMS	RISKS	KNOWN	UNKNOWN	% Known	% Unknown	High / High	High	High / Medium	Medium	Medium / Medium	Medium / Low	Low	Low / Low	Total
PO	46	22	24	47,8%	52,2%	0	0	132	180	88	24	8	0	432
GM	21	14	7	66,7%	33,3%	0	0	48	40	32	36	12	0	168
TM	6	5	1	83,3%	16,7%	0	0	24	10	24	0	0	0	58
MO	14	7	7	50,0%	50,0%	0	0	12	30	32	6	16	2	98
EN	38	16	22	42,1%	57,9%	0	14	144	110	56	42	0	0	366
PV	36	21	15	58,3%	41,7%	0	0	60	100	136	6	12	0	314
OP	77	59	18	76,6%	23,4%	0	28	12	270	128	54	88	0	580
EX	28	13	15	46,4%	53,6%	0	0	60	80	48	36	12	0	236
HR	10	6	4	60,0%	40,0%	0	0	12	40	0	30	0	0	82
LE	7	5	2	71,4%	28,6%	0	0	0	70	0	0	0	0	70
PC	10	9	1	90,0%	10,0%	0	0	0	0	8	36	12	0	56
BD	7	3	4	42,9%	57,1%	0	0	24	30	16	0	0	0	70
Total	300	180	120	60,0%	40,0%	0	42	528	960	568	270	160	2	

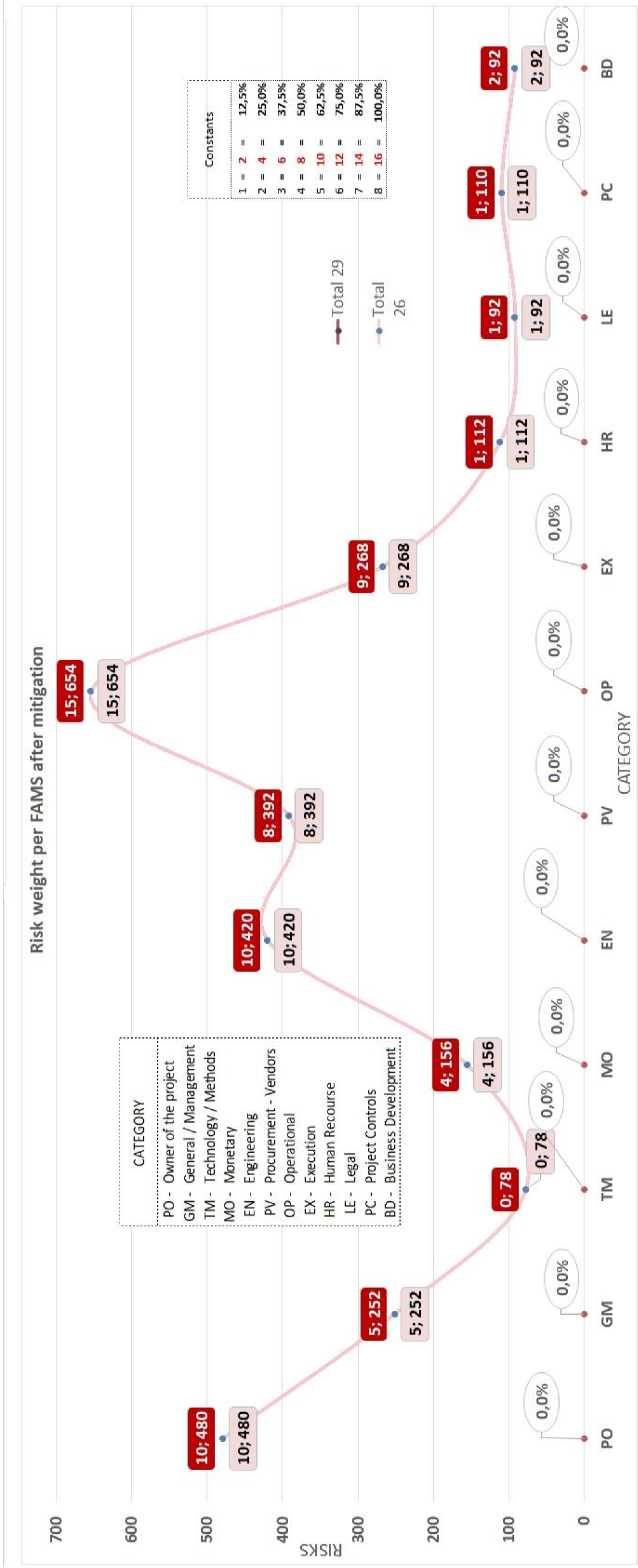




FAMS	RISKS	KNOWN	UNKNOWN	% Known	% Unknown	High / High	High	High / Medium	Medium	Medium / Medium	Medium / Low	Low	Low / Low	Total 29	Total 26	%
PO	38	23	15	60,5%	39,5%	96	126	168	90	0	0	0	0	480	480	0,0%
GM	21	11	10	52,4%	47,6%	32	84	72	60	0	0	4	0	252	252	0,0%
TM	6	6	0	100,0%	0,0%	16	28	24	10	0	0	0	0	78	78	0,0%
MO	14	8	6	57,1%	42,9%	32	0	72	20	32	0	0	0	156	156	0,0%
EN	33	20	13	60,6%	39,4%	64	126	192	30	8	0	0	0	420	420	0,0%
PV	32	20	12	62,5%	37,5%	0	168	168	40	16	0	0	0	392	392	0,0%
OP	52	37	15	71,2%	28,8%	96	238	216	80	24	0	0	0	654	654	0,0%
EX	14	12	2	85,7%	14,3%	16	56	120	60	16	0	0	0	268	268	0,0%
HR	9	6	3	66,7%	33,3%	0	42	60	10	0	0	0	0	112	112	0,0%
LE	7	6	1	85,7%	14,3%	0	56	36	0	0	0	0	0	92	92	0,0%
PC	10	9	1	90,0%	10,0%	0	14	60	20	16	0	0	0	110	110	0,0%
BD	7	3	4	42,9%	57,1%	48	0	24	20	0	0	0	0	92	92	0,0%
Total	243	161	82	66,3%	33,7%	400	938	1212	440	112	0	4	0			

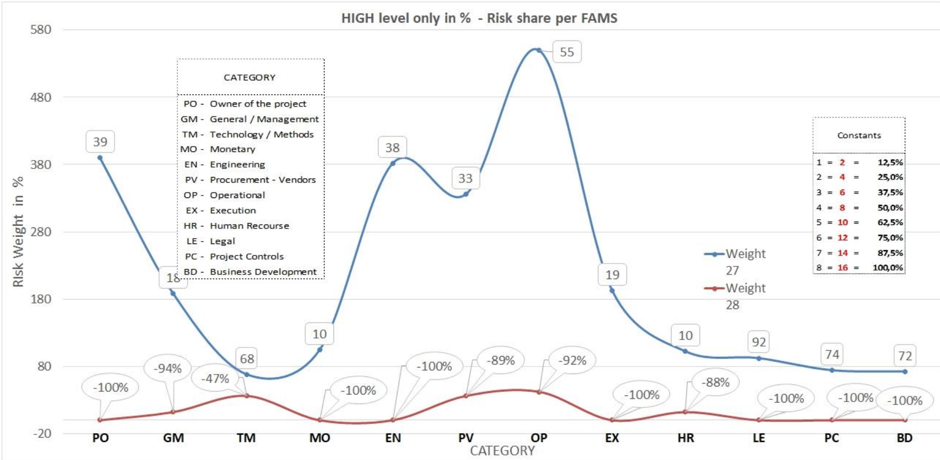




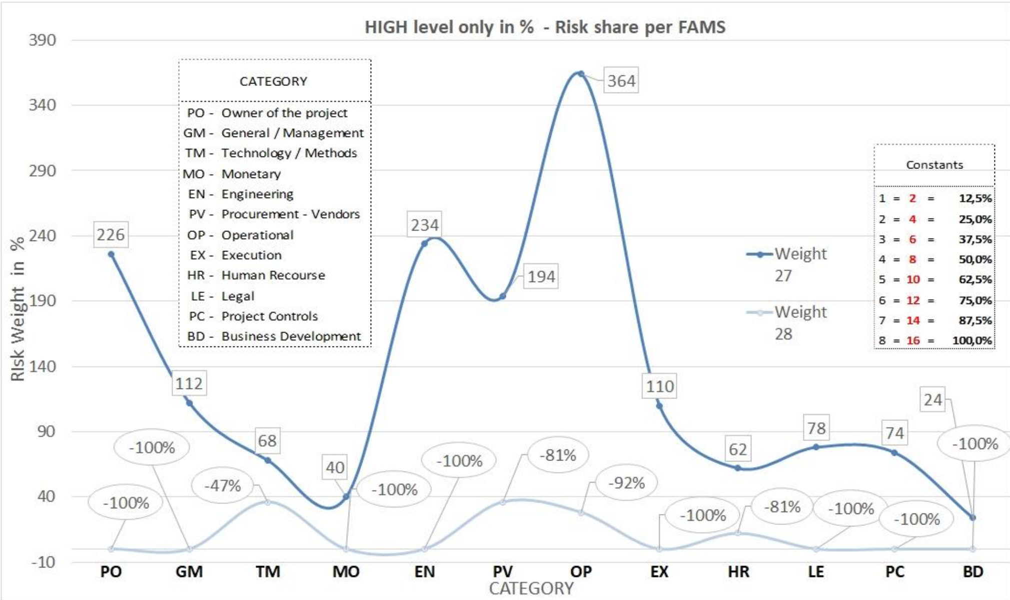


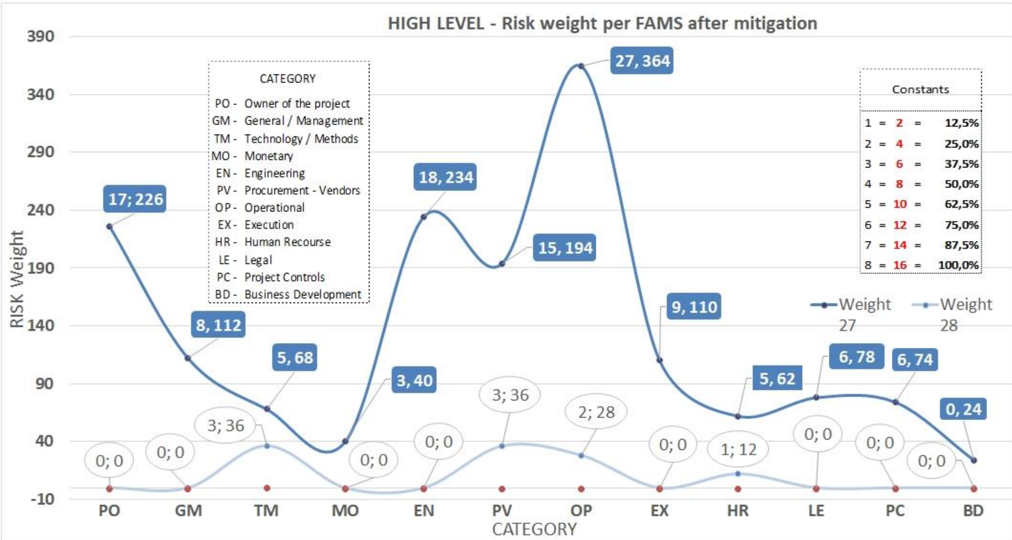
Risk weight per FAMS after mitigation
RISKS
CATEGORY
700
600
500
400
300
200
100
0
PO
GM
TM
MO
EN
PV
OP
EX
HR
LE
PC
BD
10; 480
5; 252
0; 78
4; 156
10; 420
8; 392
15; 654
9; 268
1; 112
1; 92
1; 110
2; 92
0,0%
Total 29
Total 26
CATEGORY
PO - Owner of the project
GM - General / Management
TM - Technology / Methods
MO - Monetary
EN - Engineering
PV - Procurement - Vendors
OP - Operational
EX - Execution
HR - Human Recourse
LE - Legal
PC - Project Controls
BD - Business Development
Constants
1 = 2 = 12,5%
2 = 4 = 25,0%
3 = 6 = 37,5%
4 = 8 = 50,0%
5 = 10 = 62,5%
6 = 12 = 75,0%
7 = 14 = 87,5%
8 = 16 = 100,0%

FAMS	RISKS 27	RISK 28	KNOWN 27	KNOWN 28	UNKNOWN 27	UNKNOWN 28	High / High	High	High / Medium	High / High	High	High / Medium	Weight 27	Weight 28	% DIFF
PO	29	0	17	0	12	0	96	126	168	0	0	0	390	0	-100%
GM	14	1	8	0	6	1	32	84	72	0	0	12	188	12	-94%
TM	5	3	5	3	0	0	16	28	24	0	0	36	68	36	-47%
MO	8	0	3	0	5	0	32	0	72	0	0	0	104	0	-100%
EN	29	0	18	0	11	0	64	126	192	0	0	0	382	0	-100%
PV	26	3	15	3	11	0	0	168	168	0	0	36	336	36	-89%
OP	41	3	27	2	14	1	96	238	216	0	42	0	550	42	-92%
EX	11	0	9	0	2	0	16	56	120	0	0	0	192	0	-100%
HR	8	1	5	1	3	0	0	42	60	0	0	12	102	12	-88%
LE	7	0	6	0	1	0	0	56	36	0	0	0	92	0	-100%
PC	6	0	6	0	0	0	0	14	60	0	0	0	74	0	-100%
BD	0	0	0	0	0	0	48	0	24	0	0	0	72	0	-100%
Total	184	11	119	9	65	2	400	938	1212	0	42	96	2550	138	-92,55%

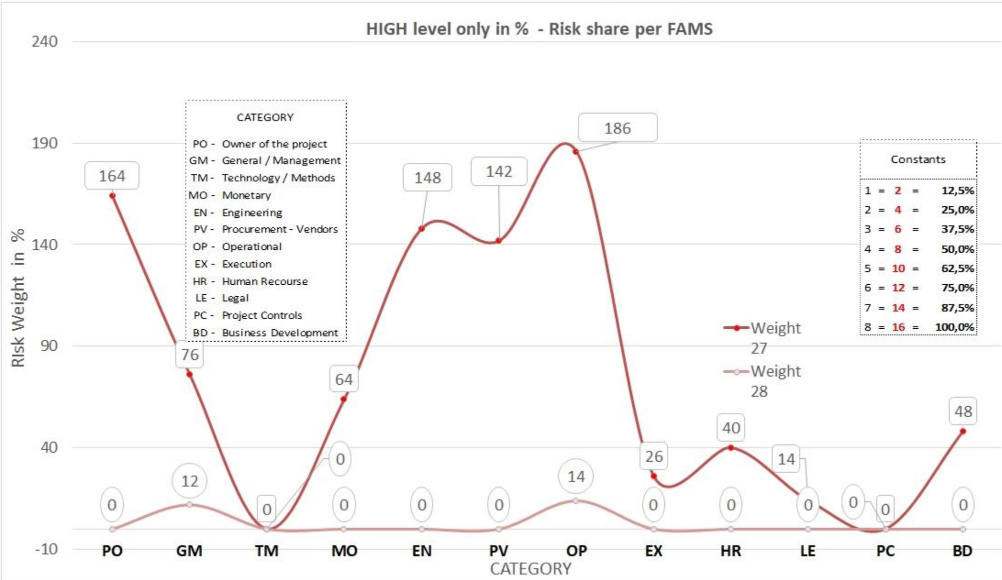


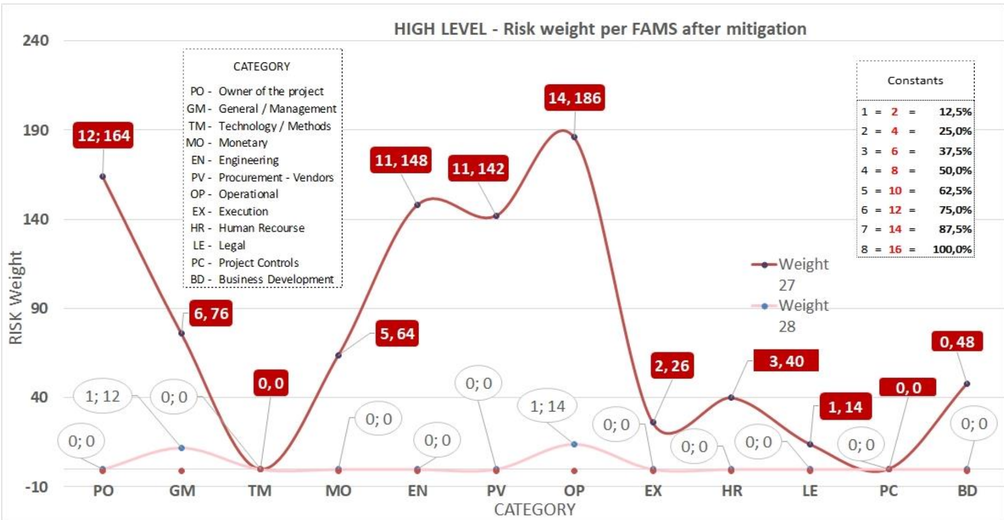
FAMS	KNOWN 27	KNOWN 28	High / High	High	High / Medium	High / High	High	High / Medium	Weight 27	Weight 28	% DIFF
PO	17	0	64	42	120	0	0	0	226	0	-100%
GM	8	0	32	56	24	0	0	0	112	0	-100%
TM	5	3	16	28	24	0	0	36	68	36	-47%
MO	3	0	16	0	24	0	0	0	40	0	-100%
EN	18	0	32	70	132	0	0	0	234	0	-100%
PV	15	3	0	98	96	0	0	36	194	36	-81%
OP	27	2	64	168	132	0	28	0	364	28	-92%
EX	9	0	0	14	96	0	0	0	110	0	-100%
HR	5	1	0	14	48	0	0	12	62	12	-81%
LE	6	0	0	42	36	0	0	0	78	0	-100%
PC	6	0	0	14	60	0	0	0	74	0	-100%
BD	0	0	0	0	24	0	0	0	24	0	-100%
Total	119	9	224	546	816	0	28	84	1586	112	-11,01454976



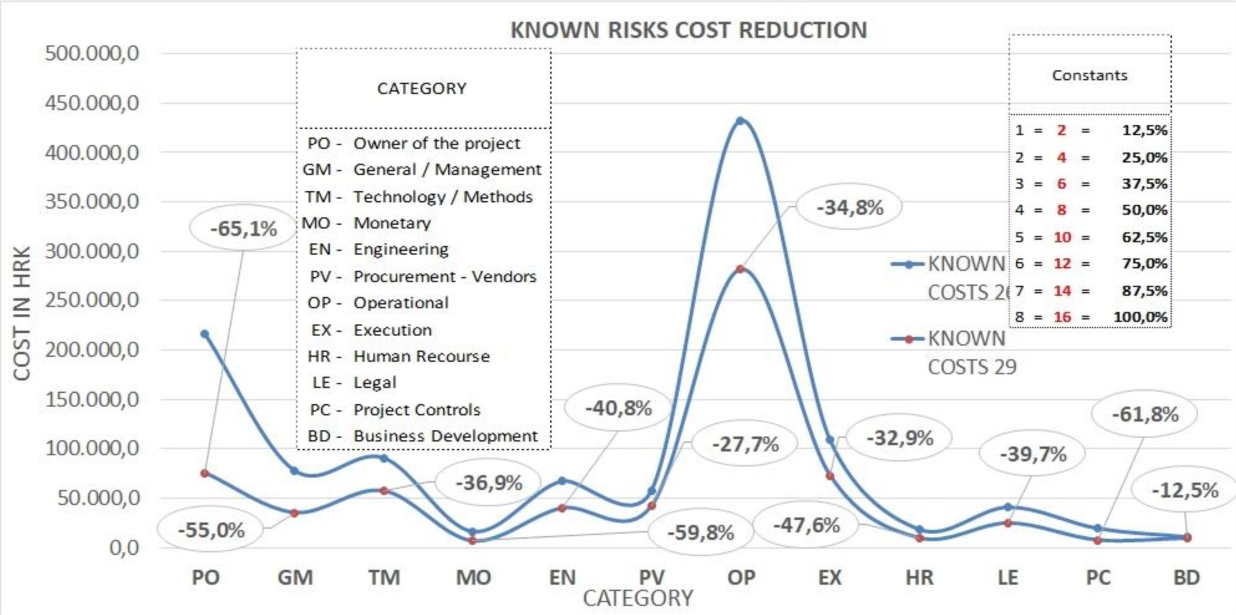


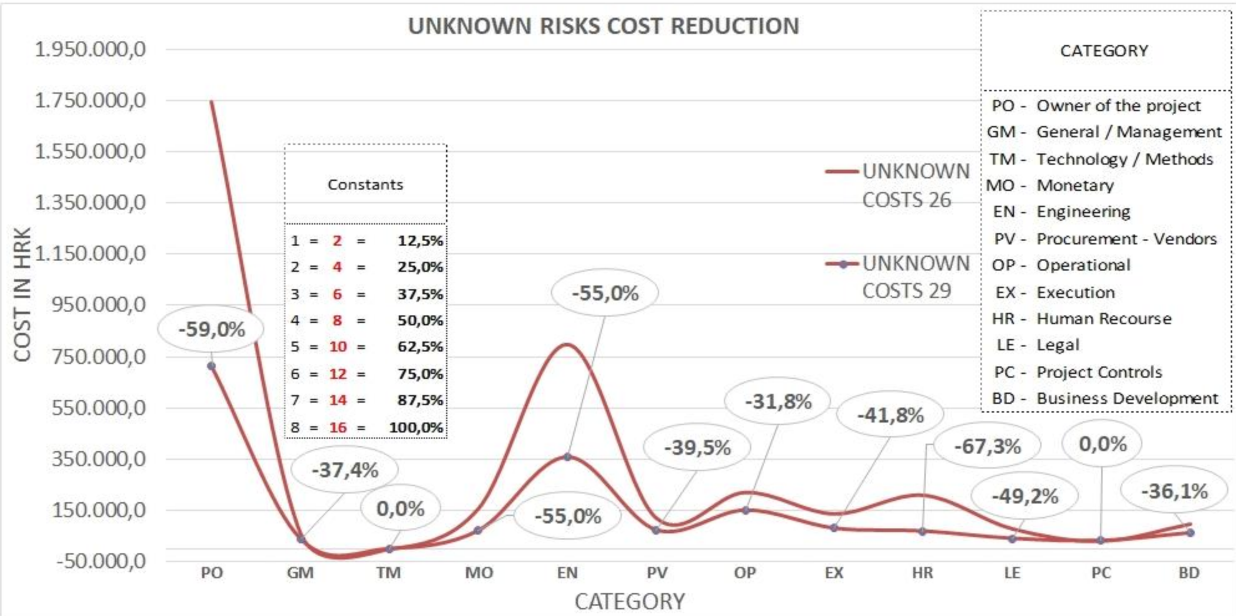
FAMS	UNKNOWN 27	UNKNOWN 28	High / High	High	High / Medium	High / High	High	High / Medium	Weight 27	Weight 28	% DIFF
PO	12	0	32	84	48	0	0	0	164	0	-100%
GM	6	1	0	28	48	0	0	12	76	12	-84%
TM	0	0	0	0	0	0	0	0	0	0	0%
MO	5	0	16	0	48	0	0	0	64	0	-100%
EN	11	0	32	56	60	0	0	0	148	0	-100%
PV	11	0	0	70	72	0	0	0	142	0	-100%
OP	14	1	32	70	84	0	14	0	186	14	-92%
EX	2	0	0	14	12	0	0	0	26	0	-100%
HR	3	0	0	28	12	0	0	0	40	0	-100%
LE	1	0	0	14	0	0	0	0	14	0	-100%
PC	0	0	0	0	0	0	0	0	0	0	0%
BD	0	0	48	0	0	0	0	0	48	0	-100%
Total	65	2	160	364	384	0	14	12	908	26	-81,39%





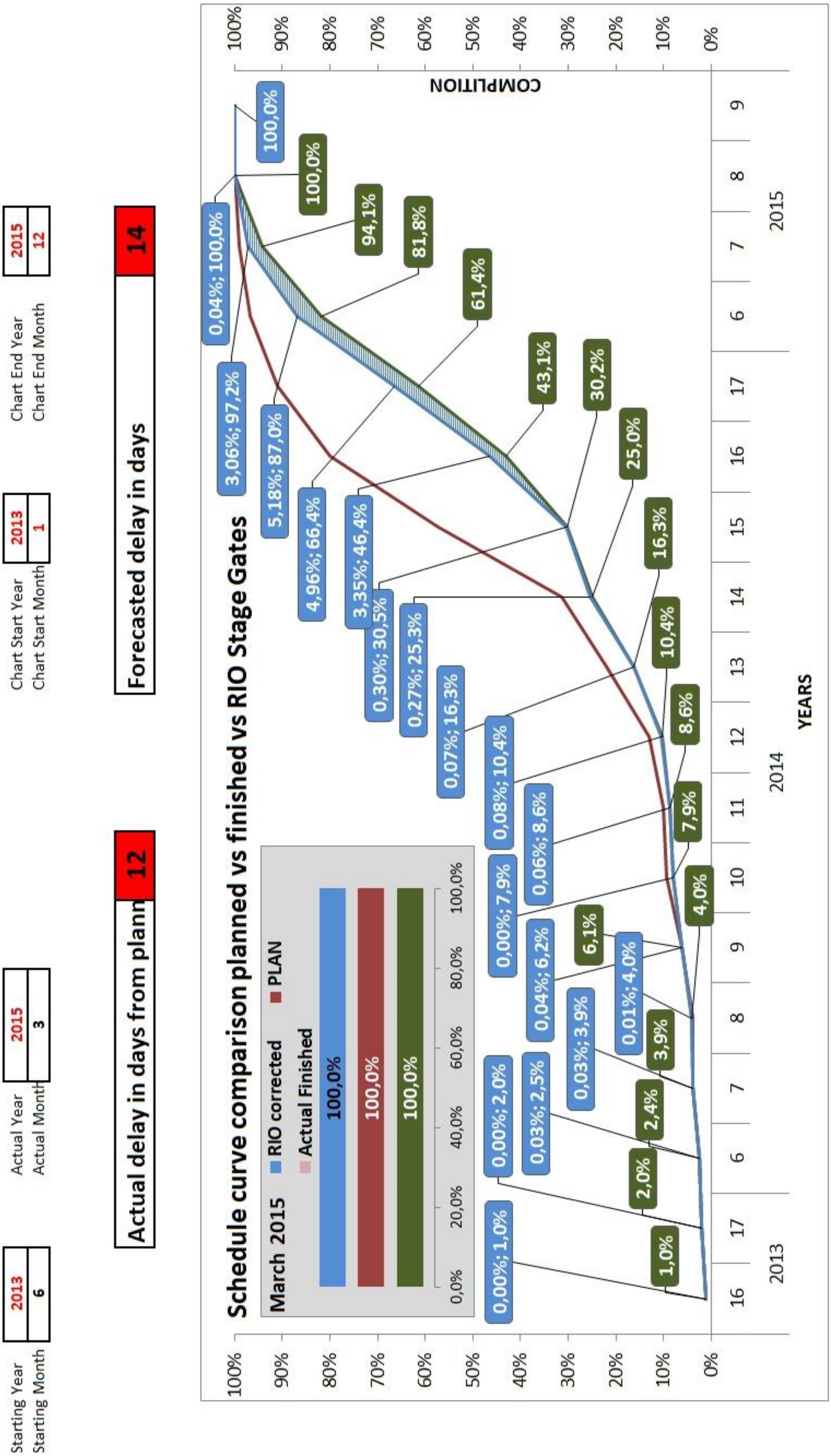
FAMS	KNOWN COSTS 26	UNKNOWN COSTS 26	KNOWN COSTS 29	UNKNOWN COSTS 29	KNOWN Mitigation %	UNKNOWN Mitigation %
PO	216.606,3	1.743.375,0	75.581,3	715.400,0	-65,1%	-59,0%
GM	78.062,5	61.750,0	35.125,0	38.625,0	-55,0%	-37,4%
TM	90.625,0	0,0	57.187,5	0,0	-36,9%	0,0%
MO	16.000,0	157.750,0	6.437,5	71.000,0	-59,8%	-55,0%
EN	67.075,0	797.875,0	39.737,5	359.250,0	-40,8%	-55,0%
PV	57.687,5	120.250,0	41.687,5	72.750,0	-27,7%	-39,5%
OP	432.350,0	221.250,0	281.737,5	150.875,0	-34,8%	-31,8%
EX	108.562,5	137.500,0	72.812,5	80.000,0	-32,9%	-41,8%
HR	18.000,0	210.000,0	9.437,5	68.750,0	-47,6%	-67,3%
LE	40.625,0	78.750,0	24.500,0	40.000,0	-39,7%	-49,2%
PC	19.000,0	31.250,0	7.250,0	31.250,0	-61,8%	0,0%
BD	10.500,0	97.750,0	9.187,5	62.500,0	-12,5%	-36,1%
Total	**1.155.093,8**	**3.657.500,0**	**660.681,3**	**1.690.400,0**	**-42,8%**	**-53,8%**

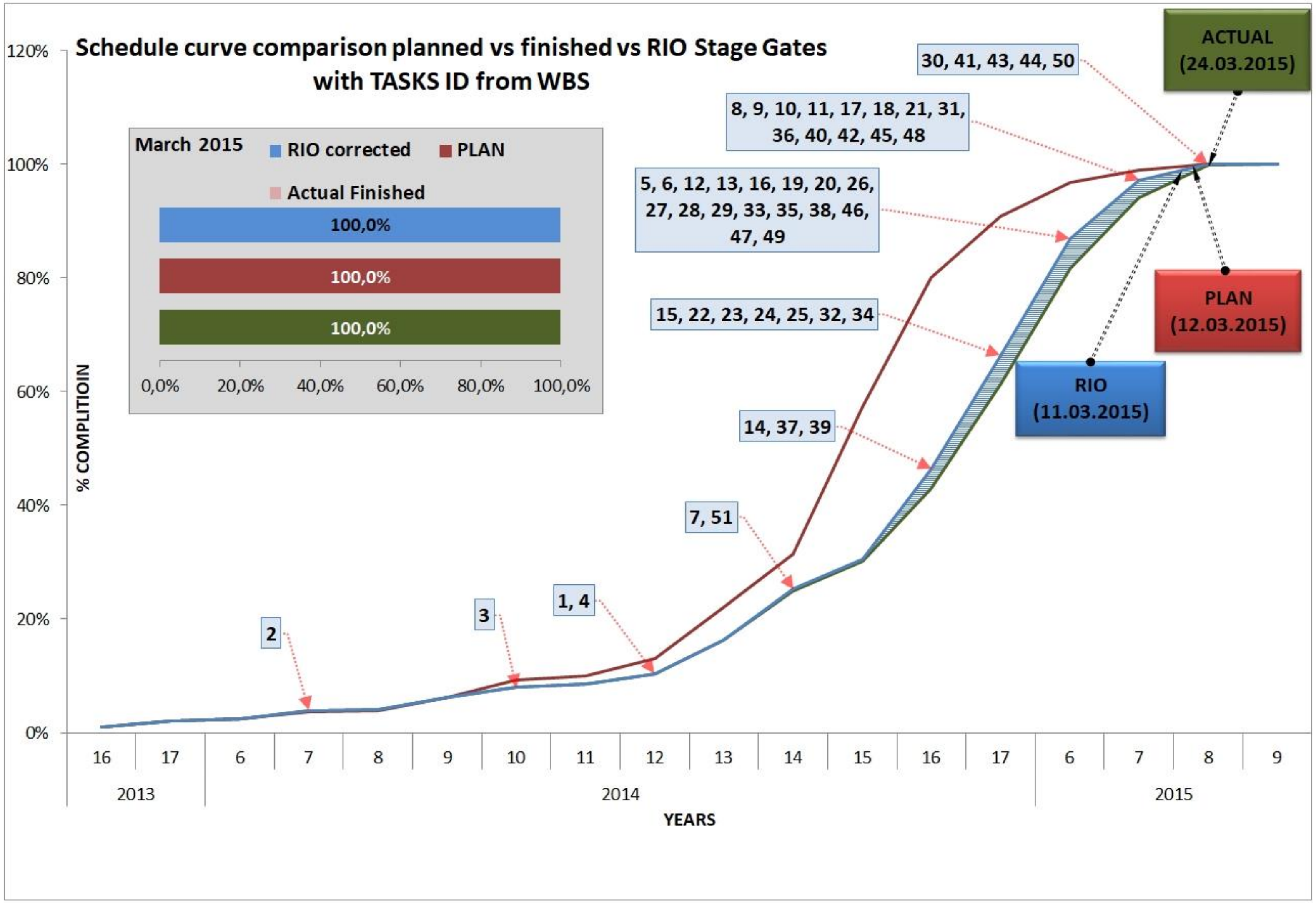




Model results of the Stage Gate VI – Project No.1

Basis report stage gate VI


Starting Year 2013
Starting Month 6
Actual Year 2015
Actual Month 3
Chart Start Year 2013
Chart Start Month 1
Chart End Year 2015
Chart End Month 12
Actual delay in days from plan 12
Forecasted delay in days 14
Schedule curve comparison planned vs finished vs RIO Stage Gates
March 2015
RIO corrected
PLAN
Actual Finished
100,0%
100,0%
100,0%
COMPLETION
YEARS
2013
2014
2015



WBS LINKS TO SCHEDULE TASKS	
1	35
2	36
3	37
4	38
5	39
6	40
7	41
8	42
9	43
10	44
11	45
12	46
13	47
14	48
15	49
16	50
17	51
18	
19	
20	
21	
22	
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34	

Model results of the Stage Gate VI – Project No.2

Basis report stage gate VI

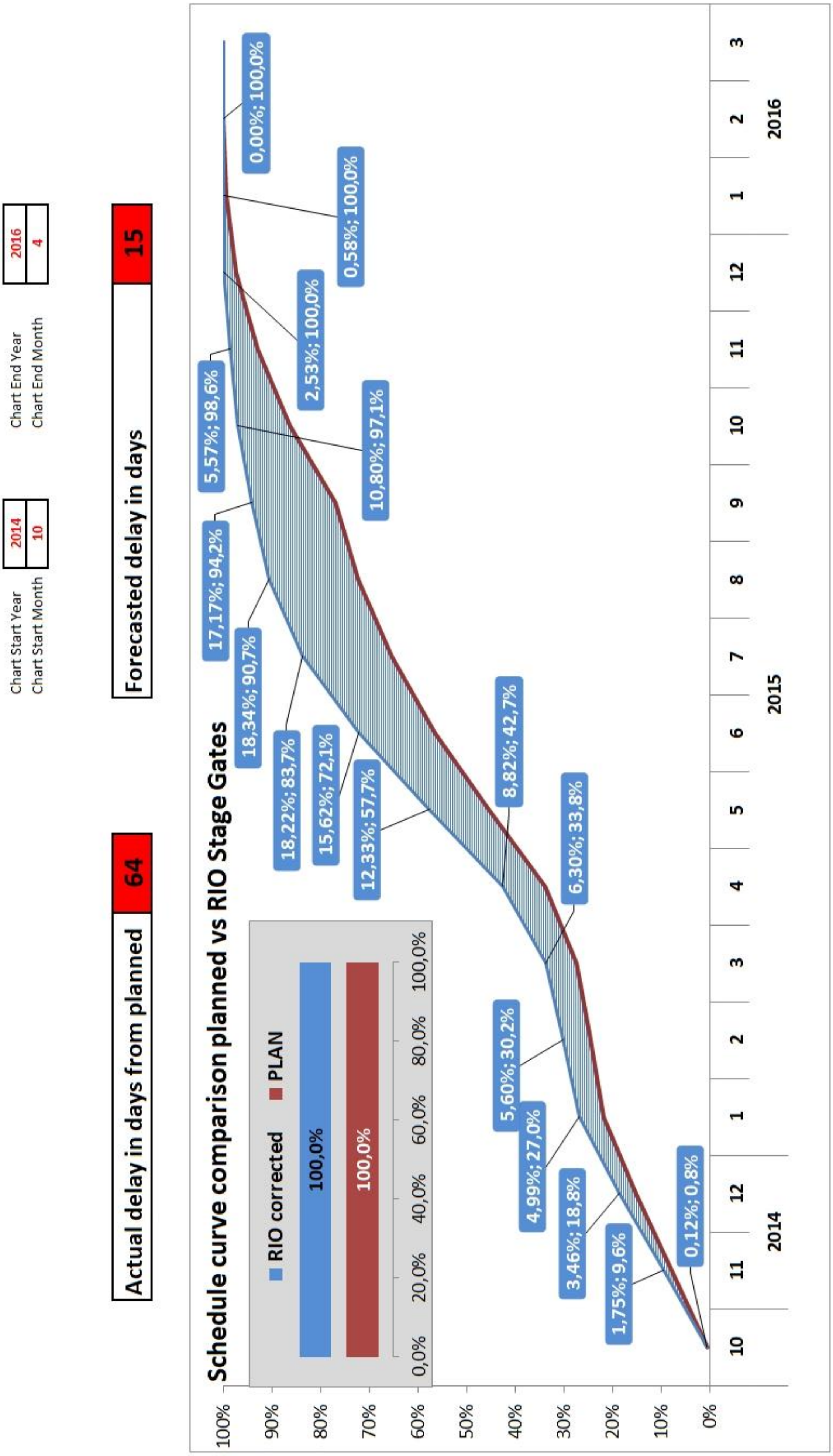
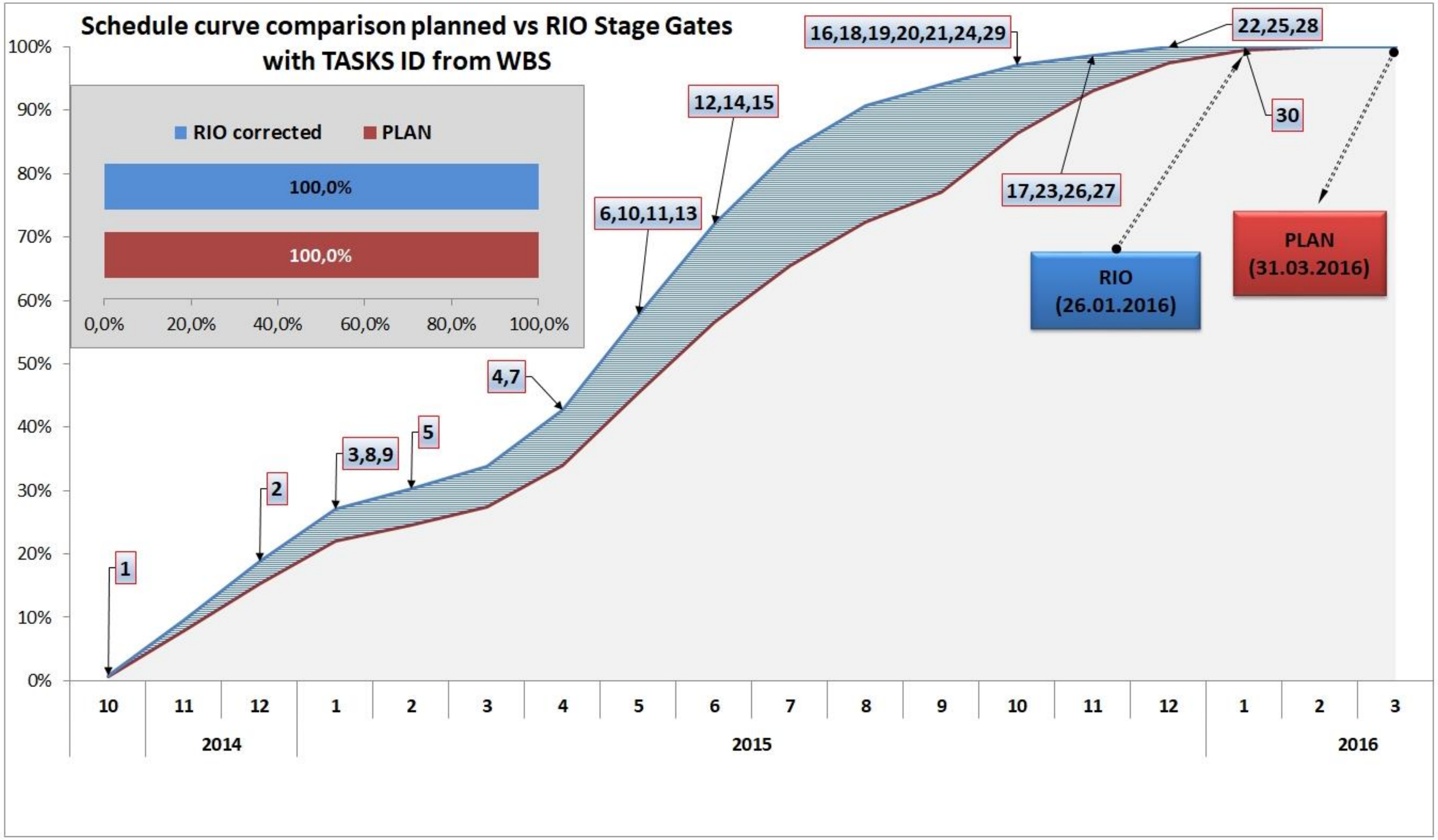


Chart Start Year 2014
Chart Start Month 10
Chart End Year 2016
Chart End Month 4
Actual delay in days from planned 64
Forecasted delay in days 15
Schedule curve comparison planned vs RIO Stage Gates
RIO corrected
PLAN
100,0%
100,0%
0,0% 20,0% 40,0% 60,0% 80,0% 100,0%
0,12%; 0,8%
1,75%; 9,6%
3,46%; 18,8%
4,99%; 27,0%
5,60%; 30,2%
6,30%; 33,8%
8,82%; 42,7%
12,33%; 57,7%
15,62%; 72,1%
18,22%; 83,7%
18,34%; 90,7%
17,17%; 94,2%
5,57%; 98,6%
10,80%; 97,1%
2,53%; 100,0%
0,58%; 100,0%
0,00%; 100,0%
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3
2014 2015 2016



WBS LINKS TO TASKS SCHEDULE	
1	16
2	17
3	18
4	19
5	20
6	21
7	22
8	23
9	24
10	25
11	26
12	27
13	28
14	29
15	30

Model detailed notes per the Stage Gate I through VI

Model detailed notes Stage Gate I through VI

Systematic process approach to risk with established stage-gate criteria

Purpose The purpose of this document is to define the following:

> the process used in the systematic risk assessment

> the stage gates in the process;

> the control/correction points;

> the roles and responsibilities of those involved; and

> the points at which they are involved in the process.

> the measurements steps and the FAMs involvement

> the existing methods of the corrections

> the matrix approach mapping of all risk corrections (RIO)

Scope This matrix mapping model can be applicable to construction and Infrastructure preparation definition projects. The mapping model will be done through the SQL basic and can be merged to the existing reports systems. The aim of the presented model to aligned the systematic approach of the risk awareness and take the opportunity through closing stage gates of identified, mitigate and propose much more systematic and selective approach for the delivery of the good risk assessment tin the preparation and implementation phase .

Documents / reports

The deliverable resulting from this presented mapping model will be much more detailed report in response to future preparation of the project or programmes

Definitions The terms as defined below refer specifically to their use in this procedure.

Risk identification - The initial project scope will be base for the risk identification

Go no go - Any risk opportunity at any stage creates needs for mitigation

Unknown - identification / mitigation

Known - identification / mitigation

Analysis report

Revision History

History Risk Assessment Documents (unknown)

History Risk Assessment Documents (known)

Additional Notes

All risk possible changes (due to the assessment duration) needs to be updated continually throughout the process.

1.0 DEFINE THE RISK OPPORTUNITY

1.1 Ensure that project or possible opportunity is acknowledge for validity in Risk Opportunity Mapping model or any other used system - The Business Development Manager (BDM) will be the owner of the initiation of the project. All available information on project, which generates a initial document will be establish. Once is approved approval information can be entered and tracked.

1.2 Start Risk Assessment Document / works shops and form for pursuits requiring divisional review and above - still at this stage the BDM will create the document of risk using the Risk Assessment Document (attachment 1) and all required and needed FAMs initial acknowledgment reviews.

1.3 Control Point (Initial risk control coordination meeting) - BDM will schedule a decision and coordination meeting with lead FAMs to arrange the initial coordination agreement to move forward with risk assessment

1.3a Assign Risk Manager (operations) - is assigned

1.4 Begin process preparation development based on the scope and related risk documentation BDM will begin development of the Risk documentation regarding risk opportunities to begin building the foundation for the next stage. Also determine the current relationship with the FAMs. Assess initial risk structure and determine what mitigation strategy is needed. Identify capabilities and differentiators per the disciplines , and project risk (e.g. bonds, human capital, material availability issues, etc.).

1.4a Development of the risk strategy.

1.5 Coordinate Risk Assessment Document; Determine requirement for independent third party review. (Key to involve all knowns at this stage). The Risk Assessment Document provides a list of identified potential risk to a project. In this stage all groups has to be involved were coordination with BD, Capture Manager, and select FAMs for development to expand risk element detail. Determine and agree to the requirement for a third party independent risk review if it is needed if yes then in has to be secures third party reviewer.

1.6 Risk draft development plan for preparation phase (w/FAMs). In this case the BDM will draft the risk per the disciplines with the main executive summary. In addition, the BDM will coordinate with all FAMs what type of approach plan should be developed and incorporated into the overall risk strategy. This may consist of a additional support elements or of capabilities or a broader. Other needed plans to far-reaching plan that could include other review forms.

1.7 Develop risk plan for key decision-makers . BDM will structure a call plan for key decision makers and detail who will make the call and on what to schedule as a risks.

1.8 Populate Risk Capture Team. At this stage BDM, working with the Capture Manager and FAM representatives to identify all of the individuals that will form the capture team that will assess further risk assessment preparation. Conduct the first SC and screening.

1.9 Develop risk schedule matrix The risk schedule is an action plan timeline of the developments assigned to the FAMs. The timeline converts to the schedule in the Risk Manager (see 4.4).

1.10 RISK Control Point (approve / disapprove initial risk plan). At this point Risk Manager will request a approval if the opportunity is supported by the all parties involved.

1.11 Assign the known and unknowns number for pre risk matrix . Assign an RISK number of elements and responsible FAMSs involved.

1.12 FAMS validation and approval for all RISK STAGE steps above This control point gives everyone involved in the risk assessment opportunity to ensure that their issues have been addressed.

2.0 ASSESS THE OPPORTUNITY

2.1 Establish risk strategy. Based on the first stage gate it is required from the the Risk Capture Manager and other FAMs, a BDM to complete the template for the risk mitigation strategy and begin formulating the specifics and structure of the mitigation and the approach philosophy that will be used to complete the second stage gate.

2.2 Review risk strategy / open unknowns risk strategy BDM / Risk Capture Manager will review the risk strategy and mitigation strategy.

2.3 Assess work shop risk analysis. BDM and Risk Capture Manager will asses the risks and will continue development of the decision approach documentation regarding the risk opportunity, internal and externa factors to begin building the foundation for the risk strategy mitigation effort. Determine the risk needs and requirements.

2.4 Assess project scope and size BDM and the Risk Capture Manager, will determine the scope of work anticipated to be covered by the upcoming SOW (i.e., types of services, design & construction scope etc. and pertinent business issues associated with accomplishing the scope of work).

2.5 Confirm availability and assignment of RISK team members including Functional Area Manager (FAM). Risk Capture Manager to send notice of risk assessment to each FAMs to determine their ability to provide "staffing for the capture team" to meet the preliminary schedule for the risk project pursuit. The FAMs makes an assignment/commitment to the capture team. Risk Capture Manager shall establish the team and document with assignments, function, and contact information to the risk analysis capture team list.

2.6 Draft ConOps (concept of operations) includes project schedule, Work Break Down Structure (WBS), risk matrix structure. Project Capture Manager shall develop the Concept of Operations (ConOps) with the assistance of each FAM and then distribute to each member of the Risk team. The ConOps focuses on the execution of the work--how it will be done. The document includes the work break down schedule (WBS), organizational structure and project schedule.

2.7 Assess unknown RISK requirements and availability of key known data. Risk Capture Manager to send notice to each FAM to determine their ability to provide the "key project execution risk" per the preliminary ConOps.

2.8 Identify potential UNKNOWN risks (internal external). Working with the Risk Capture Manager and Procurement, etc.... to identify, assess and begin discussion regarding all internal and external risks

2.8a Vet UNKNOWN RISK MATRIX. Confirm the first list of the unknown risk.

2.9 Start contingency process (if needed); mitigation to be applied. This is a lengthy process and needs to be initiated as soon as possible to have all the required early identification an possible mitigation for the discussion and approvals in place before release the next stage gate. At this stage other methodologies review and approvals aren't required.

2.10 Identify legal and business issues (legal contracts, accounting and finance, compliance, tax, entity, HR resourcing.);. update unknown risk matrix Capture Manager to send notice to responsible FAMs to review ConOps and provide any issues from their perspective. Capture Manager shall then document and post to the Risk Assessment document (attachment 1) each issue identified.

2.11 Continue Risk document development. BDM will continuously develop the Risk documentation regarding all aspects of the opportunity to continue building the foundation for the next step in the stage 2.

2.12 Complete first stage Risk Form. BDM is responsible for preparing the risk form that will be presented to the FAMs for approval prior going into next step. BDM will insure all of the information is current and complete and is consistent with the information in Stage gate 1.

2.13 STAGE 1 gate re - Control Point - Mid Point Review (present risk pursuit approval to go to Advance RIO). Risk Capture Manager and a BDM will jointly present the opportunity to a FAMs and lead to gain their approval before going into next step. All of the activities leading up to this decision point should be completed or well along in development to justify continuing the risk assessment. If not, the pursuit will be considered terminated or back again for the evaluation to stage gate 1.

2.14 Develop Risk scenario results for stage 2 approval. Risk Manager and BDM is required to prepare a proposal budget for the contingency. The contingency budget has to be submitted as part of the all other risk project deviations and corresponding data must also be acknowledge by all parties involved.

2.15 Advance RISK approval Bid/No Bid Control Point (approval or advance / additional advance investigation, risk development scenario).

2.16 Assign the final document check list. Once an risk assessment document is approved then final check is needed were correctly entered data in document has to occur.

2.17 FAM validation and approval for all risk stages above. This control point gives everyone involved in the risk assessment to ensure that their issues have been addressed.

3.0 REFINE PURSUIT STRATEGY

3.1 RISK kickoff meeting. Outcome: include known, unknown results and draft unknown known and known unknowns Working with the Risk Capture Manager and Operational Manager, the BDM conducts a coordination meeting that briefs and orients all members of the risk capture team on the current status. The background of the risk assessment, schedule, concept of operations, actions that have been completed and future actions should be discussed and assignments made.

3.2 Continue Development of Review risk strategy / open stage gate 3 risk strategy Risk Manager will continue development of the Risk documentation regarding the all possible risk per the disciplines etc. to continue building the foundation for the next stage gate as well as updates the main document

3.2a Complete risk development of all pursuit information including all updates. All known RISK documentation should be completed by the end of this step in the process.

3.2b Identify capability of RISK shortfalls. Working with the Risk Capture Manager, the BDM should identify any missing information required for a successful mitigation and determine how to gather that information and assure that all items are being identified and results are made available to the all FAMs. ConOps can be updated if there are changes

3.2c Review all known RISK analysis lessons-learned from past projects. Following completion of the risk documents, glitches should be identified in order to overcome any capability shortfalls the analyses have identified.

3.3 Confirm RISK stage gate 3 strategy. Based on the FAMs input and analysis, a Risk Manager finalizes the risk strategy to be presented to the risk team during the kick-off meeting.

3.4 Define risk structure and relationship of all stage gates. Working with the Risk Capture Manager, Legal, Procurement, A&F and pertinent FAMs, the Risk Manager should finalize the business relationship with all of the business partners that will be included in the risk proposal and work to put all of the written agreements in place as soon as possible and well in advance of the release of the stage gate strategy risk document.

3.5 Complete first stage Risk Form. BDM is responsible for preparing the risk form that will be presented to the FAMs for approval prior going into next step. BDM will insure all of the information is current and complete and is consistent with the information in Stage gate 1.

3.6 Update all given results. Risk Manager with the assistance of the FAMs, updates the risk document with new relevant information and distributes to the risk team members.

3.7 Ask/answer all questions and obtain approval for any contingency or high risk agreements.

3.8 FAMs validation and approval for all steps above. This control point gives everyone involved in the risk assessment the opportunity to ensure that their issues have been addressed.

4.0 Refine RISK Pursuit Strategy Issued the report analysis 2

4.1 Make RISK outcome: include known, unknown results, unknown known and known unknowns subsequent to the available data. Risk Proposal Manager distributes the report from the stage gates 1-3 (and subsequent other risk categories) to risk team.
4.2 Prepare detailed risk proposal volume outlines including unknowns + knowns. The Risk Manager develops an outline for each volume of the unknown + known risks, and these outlines are base to the development and review of the known + unknown in stage gates II, III. The outline is based on the requirements listed in the Risk Criteria. The outline is detailed enough to guide risk team as to what to include in their assigned responsibilities/decision sections. Each outline section includes a risk reference requirement(s). .
4.2a Develop Proposal analysis of RISK Matrix mitigations. The Risk Manager develops a base document as the proposal matrix which lists all the requirements in sections (excel document) with space to indicate where in the document is the requirement is responded to. This matrix document serves as a working reference document throughout the risk development process. It has to be noted that the requirements in report section (special excel document called the basic stage gate reports), might be summarized or "rolled up" to a criteria of risk manageable levels such as that unknowns and knows could be further developed into unknowns unknown, and known unknowns if it is needed .
4.3 Conduct alignment meeting with internal and external key factors. Risk Manager, working with key team members (FAMs), conducts an alignment session. This alignment session should include key known, unknown possibilities and reasoning to go or not to go.

4.4 Develop schedule outcome from the risk alignment factors. The proposal schedule is developed and managed by the Project Manager. Changes to the schedule are coordinated between the Project or Owner Manager, Risk Manager, and BDM. The schedule reflects activity and responsible party and includes all stage gates solutions scheduling; stage gate 1, stage gate 2 and stage gate 3 reports.
4.5 Review entire risk unknown in detail (mitigation Review); All review information directed to risk matrix. All FAMs shall make a thorough review of the schedule and detail all concerns, issues, clarifications and requirements of the new schedule (reflecting only on the risk review). Risk manager and project manager receives all comments/forms update them and distribute to the team members.
4.6 Submit review and apply changes if applicable Risk manager is responsible for completing as required.
4.7 Include independent team reviews (ITR). The Risk Manager and Project Manager recommend to include the in depended review team. At this stage it is question to include the in house independent team or third party/independent reviews to be incorporated into review teams per disciplines (i.e., Estimating, subject matter experts). The Risk Manager invites the various team members to participate and directs the arrangements for the reviews.
4.8 3 stage control point. BDM is responsible for preparing and rechecking that process document all updated and there are no glitches
4.9 Update concept of operations & Risk win strategy; Work break down structure , schedule criteria. Risk Manager with the assistance of BDM, Project Controls, Procurement updates the ConOps and other document if it is required based on the previous steps.
4.10 Identify the base line items in scope of work (SOW) related to schedule as a super critical. Risk Manager will include super critical items to be rechecked.
4.11 Include all direct and indirect associated risk external
4.12 Include all Internal / external associated risks. The Risk Manager shall oversee the writing of any requirements per the documentation.
4.13 Perform Independent Contingency Estimate (ICE) The Independent Contingency Risk Estimate (ICE) is an estimate to determine the validate of the in house mitigation. The frame to complete this activity is prior the next stage gate process, RM and BDM leads.
4.14 Plan / discuss risks / possible mitigation strategies (update Risk Breakdown Structure); Based on future independent review and the all stages this steps is connected to the possible mitigation strategies with the reflection on the future outcomes. The Risk Manager works with the Project Manager, Project Controls, and BDM to review the structure of the mitigation proposal as required the future Independent review outcomes. Contingency proposal detailed in the volume outline completed has to be developed and assign responsibility for the various components and FAMs.
4.15 4 Control Point (all 4.99. 4.14) Control Point - Go / No GO The BDM and RM complete and combine all documents with the current information and developments that includes the updated ConOps, Mitigation Strategy, Risk Register, schedule. Any and all concerns from FAMs and others shall be highlighted at this time.
4.16 Update Risk Summary per stage gates. The Risk mitigation and contingency summary document data are finalized. Finalization strategy for the risk assessment and assign responsibilities for its implementation updates is done.
4.17 FAM validation and approval for all stages above This control point gives everyone involved in the pursuit the opportunity to ensure that their issues have been addressed.

5.0 DEVELOP PROPOSAL

5.1 Hold the RISK DATA (gates 1-4). The final stage of the assessment were the Risk Manager sets up a meeting to which all pursuit team members and risk team members are required to attend. At this meeting, the BDM presents information on the all stage gates, including the unknown unknown risk scenarios; the Risk Manager outlines the approach that is taken and other available data information (unknown risk register); were the Project Manager reviews the risk assessment and update schedule (with particular emphasis on new possible impact key deadlines), the writing assignments and the alignment of FAMs. Other topics included for discussion include issues, development of questions for the team, themes and discriminators, assignment of review team members, etc.

5.2 Make RISK outcome: Only the still high, high level. That Includes all known, unknown results, unknown known, known unknowns and unknown unknowns subsequent to the available data. Through the regularly stage gates developments at this stage, the Risk Manager directs FAMs and other team members to re-check the development only of the still high, high levels of the any of the technical and past performance risk volumes and to include all possible changes or recommendations and versions to be assembled if it is applicable at this stage.

5.3 FIRST Team Review (technical/management/past performance) vs. realistic / compliance risk matrix decisions with possibilities of the impacts to the 5.1 and 5.2 The Risk Manager holds the FINAL team review. Reviewers have been pre-briefed and given. All updated document and matrices, and are expected to come to the review with a working knowledge of the risks. At the FINAL meeting team, the Risk Manager assigns FINAL responsibilities to each reviewer, and indicates possible issues.

5.4 RISK Debate Control Point INTERNAL EXTERNAL (evaluation of GO / No go decision) The BDM, RISK Manager, and Project Manager shall present the results of the FINAL Team review to the FAMs including the data from the external or internal third party results.

5.5 Incorporate FAM comments Into proposed list, develop and Introduce versions. The RISK Manager distributes to the team comments of the FAMs, and discusses with them the incorporation of the comments into further drafts of the sections.

5.6 Hold contingency Map to Cost element Volume structure; engage 3rd party reviewer. The Risk Manager, with input from the Project Manager, BDM, Project Controls, Contracts, and third party reviewer will conduct a review of the possible time and cost volume structure (contingency/mitigation). The review focuses on compliance of structure risk element requirements, and internal consistency.

5.7 Analyzed elements When FINAL team has received the response to the 3rd party risk reviewer, they will separate the risk down into two parts. Part One being the unknown technical elements issues and Part Two being the unknown financial / commercial. All Technical Data will be delivered to the Project Manger for evaluation, at the same time the commercial data will be placed into FAMs or BD Manager.

5.8 Select successful mitigations Upon the completion of Section 5.7, the Risk Project Manager, and BDM will determine the path forward with the best value for the risk approach and therefore will be provided with the proper flow downs included.

5.9 Review draft selected mitigation of the final risks. The Risk Manager review the final proposed mitigation strategy

5.10 Review / Argument Risk Register and Run Risk Analysis; update Using the Risk Breakdown Structure as input, review the risk register and run the contingency analysis. The Risk Manager, and BDM will review and approve the proposed contingency.

5.11 Include or exclude Control Point (Go / No GO decision based on 5.10 results). Finalized the risk document and prepare data for the charts. Other functional areas will be contacted as necessary.

5.12 Finalize - complete all risk volumes - The Risk Manager shall assure the all comments and all documents are checked. All elements of mitigation and contingency should have been submitted

6.0 Final stage RIO Activities

6.1 Archive the stage gate data. Risk Manager will revalidate conclusions of previous stage gates, but the focus of this will be to confirm that the final execution strategy is completed, that all outstanding risks have been mitigated. The Risk Manager directs the placement of the finished risk analysis into the risk archives, along with relevant data information. This will be stored on the main server (as a separate project back up and as well the main RISK data base document.).

conducted with the participation of all members of the risk and risk teams and is a review of the process to identify any glitches and recommended process improvements based on the process and its application to the proposal effort. The intent of the analysis is not "fault finding" and it should be conducted in a positive and constructive way. **Upon confirmation, it can be proceed towards the reporting final step.**

6.3 Update RIO and issue the report and charts. The form and format that is used is should be aligned with he Microsoft office project and rechecked outcome of the improvement in the early stage of the definition. The process should carefully examine the feedback we received from the Schedule and be compared to the content of the risk approach model in a methodical and organized manner. The outcome results should be prepared by the Risk team leaders and should be organized by the factors of evaluation for the future projects. For each improvements of correction, conclusions should be provided and corrective actions should be developed, as appropriate, to address the most significant findings.

Model list of the documents Stage Gate I through VI

Model list of the documents Stage Gate I through VI

Systematic process approach to risk with established stage-gate criteria Risk process backup data and supporting documents

ATTACHMENTS

Attachment 1	1. Risk Assessment Document
Attachment 2	1.a Risk Assessment Document
Attachment 3	1.b Risk Assessment Document
Attachment 4	2. Tracking Risk Register Assessment Document
Attachment 5	2.c Tracking Risk Register Assessment Document
Attachment 6	3. History Risk Assessment Documents (known)
Attachment 7	4. History Risk Assessment Documents (unknowns)
Attachment 8	5. Roles and Responsibilities of the Risk Assessment Team
Attachment 9	6. Basic WBS template - with timeline
Attachment 10	7. Include the numbers of the mitigation from the first Sc
Attachment 11	8. Concept of the Execution Document
Attachment 12	Basic Reports Stage Gate I
Attachment 13	8. Initial Risk Strategy report
Attachment 14	8.a Initial Risk Strategy report
Attachment 15	9. Functional Area Manager (FAM) Input Support Document
Attachment 16	10. Template CONOPS English Version
Attachment 17	11. Unknown Risk Process Development Document
Attachment 18	12. Unknown mitigation Risk Process Development Document
Attachment 19	13. Unknown mitigation Risk Contingency Document
Attachment 20	13.a Unknown mitigation Risk Contingency Document
Attachment 21	Basic Reports Stage Gate II
Attachment 22	14. Initial Risk Strategy report from stage gate II
Attachment 23	14a. Initial Risk Strategy report knowns from stage gate I
Attachment 24	15. Functional Area Manager (FAM) Input Support Estimate
Attachment 25	16. Known risk Process Development Document including history
Attachment 26	17. Known mitigation Risk Contingency Document
Attachment 27	17a. Known mitigation Risk Contingency Document
Attachment 28	Basic Reports Stage Gate III
Attachment 29	18. Initial report including the Stage gate II unknown, Stage Gate III known reports and list past history document
Attachment 30	18a.Proposal analysis of the risk mitigation Stage gate II unknown, Stage Gate III known
Attachment 31	18b.Proposal analysis of the risk mitigation Stage gate II unknown, Stage Gate III known
Attachment 32	19. Include the schedule time line impact WBS
Attachment 33	20. 10a Concept of the Execution Document
Attachment 34	21. 19. Time line impact WBS
Attachment 35	22. Schedule
Attachment 36	23. Proposal ICRE based on the document 18b
Attachment 37	24. Proposal ICRE based on the document 23
Attachment 38	25. Final document including the contingency and schedule timeline impact
Attachment 39	Basic Reports Stage Gate IV
Attachment 40	26. Initial report including the Stage gate IV results
Attachment 41	27. Risk outcome of the high high level.
Attachment 42	27. Develop clarifications quantifications exceptions deviations impacts
Attachment 43	28. Risk outcome Tech-commercial based on the document 26-27.
Attachment 44	29. Reference to the all probabilities
Attachment 45	30. Risk Assessment Document
Attachment 46	Basic Reports Stage Gate V
Attachment 47	Basic Reports Stage Gate VI

THE END OF DISSERTATION